# KONGU ENGINEERING COLLEGE

**(Autonomous Institution Affiliated to Anna University, Chennai)**

**PERUNDURAI ERODE – 638 060**

**TAMILNADU INDIA**

Estd : 1984

# REGULATIONS, CURRICULUM & SYLLABI – 2022

**(CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION)**

**(For the students admitted during 2022 - 2023 and onwards)**

# BACHELOR OF ENGINEERING DEGREE IN COMPUTER SCIENCE AND ENGINEERING

# DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

KONGU

Assuring the Best

**KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638060**

**(Autonomous)**

**REGULATIONS 2022**

**CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION**

**BACHELOR OF ENGINEERING (BE) / BACHELOR OF TECHNOLOGY (BTech) DEGREE PROGRAMMES**

**These regulations are applicable to all candidates admitted into BE/BTech Degree programmes from the academic year 2022 – 2023 onwards.**

## 1. DEFINITIONS AND NOMENCLATURE

In these Regulations, unless otherwise specified:

i. “University” means ANNA UNIVERSITY, Chennai.

ii. “College” means KONGU ENGINEERING COLLEGE.

iii. “Programme” means Bachelor of Engineering (BE) / Bachelor of Technology (BTech) Degree programme

iv. “Branch” means specialization or discipline of BE/BTech Degree programme, like Civil Engineering, Information Technology, etc.

v. “Course” means a Theory / Theory cum Practical / Practical course that is normally studied in a semester like Mathematics, Physics etc.

vi. “Credit” means a numerical value allocated to each course to describe the candidate’s workload required per week.

vii. “Grade” means the letter grade assigned to each course based on the marks range specified.

viii. “Grade point” means a numerical value (0 to 10) allocated based on the grade assigned to each course.

ix. “Principal” means Chairman, Academic Council of the College.

x. “Controller of Examinations (COE)” means authorized person who is responsible for all examination related activities of the College.

xi. “Head of the Department (HOD)” means Head of the Department concerned.

## 2. PROGRAMMES AND BRANCHES OF STUDY

The following programmes and branches of study approved by Anna University, Chennai and All India Council for Technical Education, New Delhi are offered by the College.

| Programme | Branch |
|---|---|
| BE | Civil Engineering |
| | Mechanical Engineering |
| | Electronics and Communication Engineering |
| | Computer Science and Engineering |
| | Electrical and Electronics Engineering |
| | Electronics and Instrumentation Engineering |
| | Mechatronics Engineering |
| | Automobile Engineering |
| | Computer Science and Design |
| BTech | Chemical Engineering |
| | Information Technology |
| | Food Technology |
| | Artificial Intelligence and Data Science |
| | Artificial Intelligence and Machine Learning |

## 3. ADMISSION REQUIREMENTS

### 3.1 First Semester Admission

The candidates seeking admission to the first semester of the eight semester BE / BTech Degree Programme:

Should have passed the Higher Secondary Examination (10 + 2) in the academic stream with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III subjects of the study conducted by the Government of Tamil Nadu or any examination of any other University or authority accepted by the Anna University, Chennai as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

They should also satisfy other eligibility conditions as prescribed by the Anna University, Chennai and Directorate of Technical Education, Chennai from time to time.

### 3.2 Lateral Entry Admission

The candidates who hold a Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamilnadu or its equivalent are eligible to apply for

Lateral entry admission to the third semester of BE / BTech.

(OR)

The candidates who hold a BSc degree in Science(10+2+3 stream) with mathematics as one of the subjects at the BSc level from a recognised University are eligible to apply for Lateral entry admission to the third semester of BE / BTech. Such candidates shall undergo two additional Engineering course(s) in the third and fourth semesters as prescribed by the College.

They should also satisfy other eligibility conditions prescribed by the Anna University, Chennai and Directorate of Technical Education, Chennai from time to time.

## 4. STRUCTURE OF PROGRAMMES

### 4.1 Categorisation of Courses

The BE / BTech programme shall have a curriculum with syllabi comprising of theory, theory cum practical, practical courses in each semester, professional skills training/industrial training, project work, internship, etc that have been approved by the respective Board of Studies and Academic Council of the College. All the programmes have well defined Programme Outcomes (PO), Programme Specific Outcomes (PSO) and Programme Educational Objectives (PEOs) as per Outcome Based Education (OBE). The content of each course is designed based on the Course Outcomes (CO). The courses shall be categorized as follows:

i. Humanities and Social Sciences (HS) including Management Courses, English Communication Skills, Universal Human Values and Yoga & Values for Holistic Development.

ii. Basic Science (BS) Courses

iii. Engineering Science (ES) Courses

iv. Professional Core (PC) Courses

v. Professional Elective (PE) Courses

vi. Open Elective (OE) Courses

vii. Employability Enhancement Courses (EC) like Project work, Professional Skills/Industrial Training, Comprehensive Test & Viva, Entrepreneurships/Start ups and Internship / In-plant Training in Industry or elsewhere

viii. Audit Courses (AC)

ix. Mandatory Courses (MC) like Student Induction Program and Environmental Science.

x. Honours Degree Courses (HC)

### 4.2 Credit Assignment and Honours Degree

#### 4.2.1. Credit Assignment

Each course is assigned certain number of credits as follows:

| Contact period per week | Credits |
|---|---|
| 1 Lecture / Tutorial Period | 1 |
| 2 Practical Periods | 1 |
| 2 Project Work Periods | 1 |
| 40 Training / Internship Periods | 1 |

The minimum number of credits to complete the BE/BTech programme is 168.

### 4.2.2 Honours Degree

If a candidate earns 18 to 20 additional credits in an emerging area, then he/she can be awarded with Honours degree mentioning that emerging area as his/her specialization. The respective board of studies shall recommend the specializations for honours degree and appropriate additional courses to be studied by the candidate which shall get approval from Academic Council of the institution. A candidate shall have not less than 7.5 CGPA and no history of arrears to opt for the honours degree and has to maintain the same during the entire programme.

Various specializations for various branches recommended by the respective boards of studies are given below:

| SNo | Specializations for Honours degree in emerging areas | To be offered as Honours, Only for the following branches mentioned against the specialization |
|---|---|---|
| 1. | Construction Technology | BE – Civil Engineering |
| 2. | Smart Cities | BE – Civil Engineering |
| 3. | Smart Manufacturing * | BE – Mechanical Engineering |
| 4. | Computational Product Design * | BE – Mechanical Engineering |
| 5. | Intelligent Autonomous Systems * | BE – Mechatronics Engineering |
| 6. | E-Mobility * | BE – Automobile Engineering |
| 7. | Artificial Intelligence and Machine Learning | BE – Electronics and Communication Engineering |
| 8. | System on Chip Design * | BE – Electronics and Communication Engineering |
| 9. | Electric Vehicles | BE – Electrical and Electronics Engineering |
| 10. | Microgrid Technologies | BE – Electrical and Electronics Engineering |
| 11. | Intelligent Sensors Technology * | BE – Electronics and Instrumentation Engineering |
| 12. | Smart Industrial Automation * | BE – Electronics and Instrumentation Engineering |
| 13. | Data Science | BE – Computer Science and Engineering |
| 14. | Cyber Security | BE – Computer Science and Engineering |
| 15. | Data Science | BTech – Information Technology |
| 16. | Cyber Security | BTech – Information Technology |
| 17. | Petroleum and Petrochemical Engineering * | BTech – Chemical Engineering |
| 18. | Waste Technology * | BTech – Chemical Engineering |
| 19. | Food Processing and Management * | BTech – Food Technology |
| 20. | Virtual and Augumented Reality | BE- Computer Science and Design |
| 21. | Data Science | BE- Computer Science and Design |
| 22. | Internet of Things (IoT) | BTech – Artificial Intelligence and Data Science |
| 23. | Blockchain | BTech – Artificial Intelligence and Data Science |
| 24. | Internet of Things (IoT) | BTech – Artificial Intelligence and Machine Learning |
| 25. | Blockchain | BTech – Artificial Intelligence and Machine Learning |

*Title by KEC

The courses specified under Honours degree in the emerging area may include theory, theory cum practical, practical, project work, etc. under the particular specialization. A candidate can choose and study these specified courses from fourth semester onwards and he/she shall successfully complete the courses within the stipulated time vide clause 5. Total number of credits earned in each semester may vary from candidate to candidate based on the courses chosen. The registration, assessment & evaluation pattern and classification of grades of these courses shall be the same as that of the courses in the regular curriculum of the programme of the candidate vide clause 6, clause 7 and clause 15 respectively. A candidate can earn Honours degree in only one specialization during the entire duration of the programme.

**4.3 Employability Enhancement Courses**

A candidate shall be offered with the employability enhancement courses like project work, internship, professional skills training/industrial training, comprehensive test & viva, and entrepreneurships/start ups during the programme to gain/exhibit the knowledge/skills.

**4.3.1 Professional Skills Training/ Indsutrial Training/Entrepreneurships/Start Ups/ Inplant Training**

A candidate may be offered with appropriate training courses imparting programming skills, communication skills, problem solving skills, aptitude skills etc. It is offered in two phases as phase I in fourth semester and phase II in fifth semester including vacation periods and each phase can carry two credits.

(OR)

A candidate may be allowed to go for training at research organizations or industries for a required number of hours in fifth semester vacation period. Such candidate can earn two credits for this training course in place of Professional Skills Training course II in fifth semester. He/She shall attend Professional Skills Training Phase I in fourth semester and can earn two credits.

(OR)

A candidate may be allowed to set up a start up and working part-time for the start ups by applying his/her innovations and can become a student entrepreneur during BE/BTech programme. Candidates can set up their start up from fifth semester onwards either inside or outside of the college. Such student entrepreneurs may earn 2 credits in place of Professional Skills Training II. The area in which the candidate wants to initiate a start up may be interdisciplinary or multidisciplinary. The progress of the startup shall be evaluated by a panel of members constituted by the Principal through periodic reviews.

**4.3.2 Comprehensive Test and Viva**

The overall knowledge of the candidate in various courses he/she studied shall be evaluated by (i) conducting comprehensive tests with multiple choice questions generally with pattern similar to GATE and/or (ii) viva-voce examination conducted by a panel of experts assigned by the Head of the department. The members can examine the knowledge of the candidate by asking questions from various domains and the marks will be assigned based on their answers. This course shall carry two credits.

**4.3.3 Full Time Project through Internships**

The curriculum enables a candidate to go for full time project through internship during a part of seventh semester and/or entire final semester and can earn credits vide clause 7.6 and clause 7.11.

A candidate is permitted to go for full time projects through internship in seventh semester with the following condition: The candidate shall complete a part of the seventh semester courses with a total credit of about 50% of the total credits of seventh semester including Project Work-II Phase-I in the first two months from the commencement of the seventh semester under fast track mode. The balance credits required to complete the seventh semester shall be earned by the candidate through either approved One/Two Credit Courses /Online courses / Self Study Courses or Add/Drop courses as per clause 4.4 and clause 4.5 respectively.

A candidate is permitted to go for full time projects through internship during eighth semester. Such candidate shall earn the minimum number of credits required to complete eighth semester other than project through either approved One / Two Credit Courses /Online courses / Self Study Courses or Add/Drop courses as per clause 4.4 and clause 4.5 respectively.

Assessment procedure is to be followed as specified in the guidelines approved by the Academic Council.

**4.3.4** A student shall go for in-plant training for duration of two weeks during the entire programme. It is mandatory for all the students.

## 4.4 One / Two Credit Courses / Online Courses / Self Study Courses

The candidates may optionally undergo One / Two Credit Courses / Online Courses / Self Study Courses as elective courses.

**4.4.1** **One / Two Credit Courses:** One / Two credit courses shall be offered by the college with the prior approval from respective Board of Studies. A candidate can earn a maximum of six credits through one / two credit courses during the entire duration of the programme.

**4.4.2** **Online Courses:** Candidates may be permitted to earn credits for online courses, offered by NPTEL / SWAYAM / a University / Other Agencies, approved by respective Board of Studies.

**4.4.3** **Self Study Courses:** The Department may offer an elective course as a self study course. The syllabus of the course shall be approved by the respective Board of Studies. However, mode of assessment for a self study course will be the same as that used for other courses. The candidates shall study such courses on their own under the guidance of member of the faculty following due approval procedure. Self study course is limited to one per semester.

**4.4.4** The elective courses in the final year may be exempted if a candidate earns the required credits vide clause 4.4.1, 4.4.2 and 4.4.3 by registering the required number of courses in advance.

**4.4.5** A candidate can earn a maximum of 30 credits through all one / two credit courses, online courses and self study courses.

## 4.5 Flexibility to Add or Drop Courses

**4.5.1** A candidate has to earn the total number of credits specified in the curriculum of the respective programme of study in order to be eligible to obtain the degree. However, if the candidate wishes, then the candidate is permitted to earn more than the total number of credits prescribed in the curriculum of the candidate's programme.

**4.5.2** From the first to seventh semesters the candidates have the option of registering for additional elective/Honours courses or dropping of already registered additional elective/Honours courses within two weeks from the start of the semester. Add / Drop is only an option given to the candidates.

**4.6** Maximum number of credits the candidate can enroll in a particular semester cannot exceed 30 credits.

**4.7** The blend of different courses shall be so designed that the candidate at the end of the programme would have been trained not only in his / her relevant professional field but also would have developed to become a socially conscious human being.

**4.8** The medium of instruction, examinations and project report shall be English.

## 5. DURATION OF THE PROGRAMME

**5.1** A candidate is normally expected to complete the BE / BTech Degree programme in 8 consecutive semesters/4 Years (6 semesters/3 Years for lateral entry candidate), but in any case not more than 14 semesters/7 Years (12 semesters/6 Years for lateral entry candidate).

**5.2** Each semester shall consist of a minimum of 90 working days including continuous assessment test period. The Head of the Department shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus for the course being taught.

**5.3** The total duration for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum duration specified in clause 5.1 irrespective of the period of break of study (vide clause 11) or prevention (vide clause 9) in order that the candidate may be eligible for the award of the degree (vide clause 16). Extension beyond the prescribed period shall not be permitted.

## 6. COURSE REGISTRATION FOR THE EXAMINATION

**6.1** Registration for the end semester examination is mandatory for courses in the current semester as well as for the arrear courses failing which the candidate will not be permitted to move on to the higher semester. This will not be applicable for the courses which do not have an end semester examination.

**6.2** The candidates who need to reappear for the courses which have only continuous assessment shall enroll for the same in the subsequent semester, when offered next, and repeat the course. In this case, the candidate shall attend the classes, satisfy the attendance requirements (vide clause 8) and earn continuous assessment marks. This will be considered as an attempt for the purpose of classification.

**6.3** If a candidate is prevented from writing end semester examination of a course due to lack of attendance, the candidate has to attend the classes, when offered next, and fulfill the attendance requirements as per clause 8 and earn continuous assessment marks. If the course, in which the candidate has a lack of attendance, is an elective, the candidate may register for the same or any other elective course in the subsequent semesters and that will be considered as an attempt for the purpose of classification.

**6.4** A candidate shall register for the chosen courses as well as arrear courses (if any vide clause 6.2 and 6.3) from the list of courses specified under Honours degree.

## 7. ASSESSMENT AND EXAMINATION PROCEDURE FOR AWARDING MARKS

**7.1** The BE/BTech programmes consist of Theory Courses, Theory cum Practical courses, Practical courses, Comprehensive Test and Viva, Project Work, Industrial Training /Professional Skills Training, Internship/In-plant Training and Entrepreneurships/ Start ups. Performance in each course of study shall be evaluated based on (i) Continuous Assessments (CA) throughout the semester and (ii) End Semester Examination (ESE) at the end of the semester except for the courses which are evaluated based on continuous assessment only. Each course shall be evaluated for a maximum of 100 marks as shown below:

<table>
<tr><th>Sl. No.</th><th>Category of Course</th><th>Continuous Assessment Marks</th><th>End Semester Examination Marks</th></tr>
<tr><td>1.</td><td>Theory</td><td>40</td><td>60</td></tr>
<tr><td>2.</td><td>Theory cum Practical (The distribution of marks shall be decided based on the credit weightage assigned to theory and practical components.)</td><td>50</td><td>50</td></tr>
<tr><td>3.</td><td>Practical</td><td>60</td><td>40</td></tr>
<tr><td>4.</td><td>Professional Skills Training / Comprehensive Test & Viva / Entrepreneurships / Start ups / Project Work I / Mandatory Course/Industrial Training/ Universal Human Values / Yoga and Values for Holistic Development</td><td>100</td><td>---</td></tr>
<tr><td>5.</td><td>Project Work II Phase I / Project Work II Phase II / Internships</td><td>50</td><td>50</td></tr>
<tr><td>6.</td><td>One / Two credit Course</td><td rowspan="2">The distribution of marks shall be decided based on the credit weightage assigned</td><td rowspan="2">---</td></tr>
<tr><td>7.</td><td>All other Courses</td></tr>
</table>

**7.2** Examiners for setting end semester examination question papers for theory courses, theory cum practical courses and practical courses and evaluating end semester examination answer scripts, project works, internships and entrepreneurships/start ups shall be appointed by the Controller of Examinations after obtaining approval from the Principal.

**7.3 Theory Courses**

For all theory courses out of 100 marks, the continuous assessment shall be 40 marks and the end semester examination shall be for 60 marks. However, the end semester examinations shall be conducted for 100 marks and the marks obtained shall be reduced to 60. The continuous assessment tests shall be conducted as per the schedule laid down in the academic schedule. The total of the continuous assessment marks and the end semester examination marks shall be rounded off to the nearest integer.

**7.3.1** The assessment pattern for awarding continuous assessment marks shall be as follows:

| Sl. No. | Type | Max. Marks | Remarks |
|---|---|---|---|
| 1. | Test - I | 20 | Average of best 2 tests (20 marks) |
| | Test - II | 20 | |
| | Test - III | 20 | |
| 2. | Tutorial:<br>(Tutorial/Problem Solving (or)<br>Simulation (or)<br>Simulation & Mini Project (or)<br>Mini Project (or)<br>Case Studies (or)<br>Any other relevant to the course ) | 15 | Type of assessment is to be chosen based on the nature of the course and to be approved by Principal |
| 3. | Others: Assignment / Paper Presentation in Conference / Seminar / Comprehension / Activity based learning / Class notes | 05 | To be assessed by the Course Teacher based on any one type. |
| | Total | 40 | Rounded off to the one decimal place |

However, the assessment pattern for awarding the continuous assessment marks may be changed based on the nature of the course and is to be approved by the Principal.

**7.3.2** A reassessment test or tutorial covering the respective test or tutorial portions may be conducted for those candidates who were absent with valid reasons (Sports or any other reason approved by the Principal).

**7.3.3** The end semester examination for theory courses shall be for a duration of three hours and shall be conducted between November and January during odd semesters and between April and June during even semesters of every year.

**7.4 Theory cum Practical Courses**

For courses involving theory and practical components, the evaluation pattern as per the clause 7.1 shall be followed. Depending on the nature of the course, the end semester examination shall be conducted for theory and the practical components. The apportionment of continuous assessment and end semester examination marks shall be decided based on the credit weightage assigned to theory and practical components approved by Principal.

### 7.5 Practical Courses

For all practical courses out of 100 marks, the continuous assessment shall be for 60 marks and the end semester examination shall be for 40 marks. Every exercise / experiment shall be evaluated based on the candidate’s performance during the practical class and the candidates’ records shall be maintained.

**7.5.1** The assessment pattern for awarding continuous assessment marks for each course shall be decided by the course coordinator based on rubrics of that particular course, and shall be based on rubrics for each experiment.

**7.5.2** The end semester examination shall be conducted for a maximum of 100 marks for duration of 3 hours and reduced to 40 marks. The appointment of examiners and the schedule shall be decided by chairman of Board of Study of the relevant board.

### 7.6 Project Work II Phase I / Project Work II Phase II

**7.6.1** Project work shall be assigned to a single candidate or to a group of candidates not exceeding 4 candidates in a group. The project work is mandatory for all the candidates.

**7.6.2** The Head of the Department shall constitute review committee for project work. There shall be two assessments by the review committee during the semester. The candidate shall make presentation on the progress made by him/her before the committee.

**7.6.3** The continuous assessment and end semester examination marks for Project Work II Phase I /Project Work II Phase II and the Viva-Voce Examination shall be distributed as below.

| Continuous Assessment (Max. 50 Marks) | | | | | | End Semester Examination (Max. 50 Marks) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Zeroth Review | | Review I (Max.. 20 Marks) | | Review II (Max. 30 Marks) | | Report Evaluation (Max. 20 Marks) | Viva - Voce (Max. 30 Marks) | | |
| Rv. Com | Super visor | Review Committee (excluding supervisor ) | Super visor | Review Committee (excluding supervisor) | Super visor | Ext. Exr. | Super visor | Exr.1 | Exr.2 |
| 0 | 0 | 10 | 10 | 15 | 15 | 20 | 10 | 10 | 10 |

**7.6.4** The Project Report prepared according to approved guidelines and duly signed by the Supervisor shall be submitted to Head of the Department. The candidate(s) must submit the project report within the specified date as per the academic schedule of the semester. If the project report is not submitted within the specified date then the candidate is deemed to have failed in the Project Work and redo it in the subsequent semester.

**7.6.5** If a candidate fails to secure 50% of the continuous assessment marks in the project work, he / she shall not be permitted to submit the report for that particular semester and shall have to redo it in the subsequent semester and satisfy attendance requirements.

**7.6.6** The end semester examination of the project work shall be evaluated based on the project report submitted by the candidate in the respective semester and viva-voce examination by a committee consisting of two examiners and supervisor of the project work.

**7.6.7** If a candidate fails to secure 50 % of the end semester examination marks in the project work, he / she shall be required to resubmit the project report within 30 days from the date of declaration of the results and a fresh viva-voce examination shall be conducted as per clause 7.6.6.

**7.6.8** A copy of the approved project report after the successful completion of viva-voce examination shall be kept in the department library.

## 7.7 Project Work I / Industrial Training

The evaluation method shall be same as that of the Project Work II as per clause 7.6 excluding 7.6.3, 7.6.5, 7.6.6 and 7.6.7. The marks distribution is given below.

<table>
<tr><td colspan="9">Continuous Assessment<br>(Max. 100 Marks)</td></tr>
<tr><td colspan="2" rowspan="2">Zeroth Review</td><td colspan="2" rowspan="2">Review I<br>(Max.. 20 Marks)</td><td colspan="2" rowspan="2">Review II<br>Max.. 30 Marks)</td><td colspan="3">Review III<br>(Max. 50 Marks)</td></tr>
<tr><td>Report Evaluation<br>(Max. 20 Marks)</td><td colspan="2">Viva - Voce<br>(Max. 30 Marks)</td></tr>
<tr><td>Review Commi ttee</td><td>Super visor</td><td>Review Committee (excluding supervisor)</td><td>Super visor</td><td>Review Committee (excluding supervisor)</td><td>Super visor</td><td>Review Committee</td><td>Super visor</td><td>Review Committee</td></tr>
<tr><td>0</td><td>0</td><td>10</td><td>10</td><td>15</td><td>15</td><td>20</td><td>10</td><td>20</td></tr>
</table>

If a candidate fails to secure 50 % of the continuous assessment marks in this course, he / she shall be required to resubmit the project report within 30 days from the date of declaration of the results and a fresh viva-voce examination shall be conducted.

## 7.8 Professional Skills Training

Phase I training shall be conducted for minimum of 80 hours in 3$^{rd}$ semester vacation and during 4$^{th}$ semester. Phase II training shall be conducted for minimum of 80 hours in 4$^{th}$ semester vacation and during 5$^{th}$ semester. The evaluation procedure shall be approved by the board of the offering department and Principal.

**7.9 Comprehensive Test and Viva**

A candidate can earn 2 credits by successfully completing this course. The evaluation procedures shall be approved by the Principal.

**7.10 Entrepreneurships/ Start ups**

A start up/business model may be started by a candidate individually or by a group of maximum of three candidates during the programme vide clause 4.3.1. The head of the department concerned shall assign a faculty member as a mentor for each start up.

A review committee shall be formed by the Principal for reviewing the progress of the Start ups / Business models, innovativeness, etc. The review committee can recommend the appropriate grades for academic performance for the candidate(s) involved in the start ups. This course shall carry a maximum of two credits in fifth semester and shall be evaluated through continuous assessments for a maximum of 100 marks vide clause 7.1. A report about the start ups is to be submitted to the review committee for evaluation for each start up and the marks will be given to Controller of Examinations after getting approval from Principal.

**7.11 In-Plant Training**

Each candidate shall go for In-Plant training for a duration of minimum of two weeks during the entire programme of study and submit a brief report about the training undergone and a certificate issued from the organization concerned.

**7.12 One / Twe Credit Courses**

For all one/ two credit courses out of 100 marks, the continuous assessment shall be 50 marks and the model examination shall be for 50 marks. Minimum of two continuous assessments tests shall be conducted during the one / two credit course duration by the offering department concerned. Model examination shall be conducted at the end of the course.

**7.13 Online Course**

The Board of Studies will provide methodology for the evaluation of the online courses. The Board can decide whether to evaluate the online courses through continuous assessment and end semester examination or through end semester examination only. In case of credits earned through online mode from NPTEL / SWAYAM / a University / Other Agencies approved by Chairman, Academic Council, the credits may be transferred and grades shall be assigned accordingly.

**7.14 Self Study Course**

The member of faculty approved by the Head of the Department shall be responsible for periodic monitoring and evaluation of the course. The course shall be evaluated through continuous assessment and end semester examination. The evaluation methodology shall be the same as that of a theory course.

**7.15 Audit Course**

A candidate may be permitted to register for specific course not listed in his/her programme curriculum and without undergoing the rigors of getting a 'good' grade, as an Audit course, subject to the following conditions.

The candidate can register only one Audit course in a semester starting from second semester subject to a maximum of two courses during the entire programme of study. Such courses shall be indicated as 'Audit' during the time of registration itself. Only courses currently offered for credit to the candidates of other branches can be audited.

A course appearing in the curriculum of a candidate cannot be considered as an audit course. However, if a candidate has already met the Professional Elective and Open Elective credit requirements as stipulated in the curriculum, then, a Professional Elective or an Open Elective course listed in the curriculum and not taken by the candidate for credit can be considered as an audit course.

Candidates registering for an audit course shall meet all the assessment and examination requirements (vide clause 7.3) applicable for a credit candidate of that course. Only if the candidate obtains a performance grade, the course will be listed in the semester Grade Sheet and in the Consolidated Grade Sheet along with the grade SC (Successfully Completed). Performance grade will not be shown for the audit course.

Since an audit course has no grade points assigned, it will not be counted for the purpose of GPA and CGPA calculations.

### 7.16 Mandatory Courses

A candidate joined in first semester shall attend and complete a mandatory course namely Student Induction Program of duration three weeks at the beginning of first semester. The candidates studying in second year shall attend and complete another one mandatory course namely Environmental Science. No credits shall be given for mandatory courses and shall be evaluated through continuous assessment tests only vide clause 7.1 for a maximum of 100 marks each. Upon the successful completion, these courses will be listed in the semester grade sheet and in the consolidated grade sheet with the grade "SC" (Successfully Completed). Since no grade points are assigned, these courses will not be counted for the purpose of GPA and CGPA calculations.

### 7.17 Universal Human Values (UHV) and Yoga and Values for Holistic Development (YVHD)

Courses YVHD shall be offered to all first year candidates of all BE/ BTech programmes to impart knowledge on yoga and human values. Course UHV shall be offered to all the second year BE/ BTech students. These courses shall carry a maximum of 100 marks each and shall be evaluated through continuous assessment tests only vide clause 7.1. The candidate(s) can earn 2 credits for UHV and 1 credit for YVHD by successfully completing these courses. Two continuous assessment tests will be conducted and the average marks will be taken for the calculation of grades.

## 8. REQUIREMENTS FOR COMPLETION OF A SEMESTER

**8.1** A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester and permitted to appear for the examinations of that semester.

**8.1.1** Ideally, every candidate is expected to attend all classes and secure 100 % attendance. However, a candidate shall secure not less than 80 % (after rounding off to the nearest integer) of the overall attendance taking into account the total number of working days in a semester.

**8.1.2** A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to medical reasons (hospitalization / accident / specific illness) but has secured not less than 70 % in the current semester may be permitted to appear for the current semester examinations with the approval of the Principal on payment of a condonation fee as may be fixed by the authorities from time to time. The medical certificate needs to be submitted along with the leave application. A candidate can avail this provision only twice during the entire duration of the degree programme.

A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to his/her entrepreneurships/ start ups activities, but has secured not less than 60 % in the current semester can be permitted to appear for the current semester examinations with the recommendation of review committee and approval from the Principal.

**8.1.3** In addition to clause 8.1.1 or 8.1.2, a candidate shall secure not less than 60 % attendance in each course.

**8.1.4** A candidate shall be deemed to have completed the requirements of study of any semester only if he/she has satisfied the attendance requirements (vide clause 8.1.1 to 8.1.3) and has registered for examination by paying the prescribed fee.

**8.1.5** Candidate's progress is satisfactory.

**8.1.6** Candidate's conduct is satisfactory and he/she was not involved in any indisciplined activities in the current semester.

**8.2.** The candidates who do not complete the semester as per clauses from 8.1.1 to 8.1.6 except 8.1.3 shall not be permitted to appear for the examinations at the end of the semester and not be permitted to go to the next semester. They have to repeat the incomplete semester in next academic year.

**8.3** The candidates who satisfy the clause 8.1.1 or 8.1.2 but do not complete the course as per clause 8.1.3 shall not be permitted to appear for the end semester examination of that course alone. They have to repeat the incomplete course in the subsequent semester when it is offered next.

## 9. REQUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATION

**9.1** A candidate shall normally be permitted to appear for end semester examination of the current semester if he/she has satisfied the semester completion requirements as per clause 8, and has registered for examination in all courses of that semester. Registration is mandatory for current semester examinations as well as for arrear examinations failing which the candidate shall not be permitted to move on to the higher semester.

**9.2** When a candidate is deputed for a National / International Sports event during End Semester examination period, supplementary examination shall be conducted for such a candidate on return after participating in the event within a reasonable period of time. Such appearance shall be considered as first appearance.

**9.3** A candidate who has already appeared for a course in a semester and passed the examination is not entitled to reappear in the same course for improvement of letter grades / marks.

## 10. PROVISION FOR WITHDRAWAL FROM EXAMINATIONS

**10.1** A candidate may, for valid reasons, be granted permission to withdraw from appearing for the examination in any regular course or all regular courses registered in a particular semester. Application for withdrawal is permitted only once during the entire duration of the degree programme.

**10.2** The withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination (vide clause 9) and has applied to the Principal for permission prior to the last examination of that semester after duly recommended by the Head of the Department.

**10.3** The withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction/First Class.

**10.4** If a candidate withdraws a course or courses from writing end semester examinations, he/she shall register the same in the subsequent semester and write the end semester examinations. A final semester candidate who has withdrawn shall be permitted to appear for supplementary examination to be conducted within reasonable time as per clause 14.

**10.5** The final semester candidate who has withdrawn from appearing for project viva-voce for genuine reasons shall be permitted to appear for supplementary viva-voce examination within reasonable time with proper application to Controller of Examinations and on payment of prescribed fee.

## 11. PROVISION FOR BREAK OF STUDY

**11.1** A candidate is normally permitted to avail the authorised break of study under valid reasons (such as accident or hospitalization due to prolonged ill health or any other valid reasons) and to rejoin the programme in a later semester. He/She shall apply in advance to the Principal, through the Head of the Department, stating the reasons therefore, in any case, not later than the last date for registering for that semester examination. A candidate is permitted to avail the authorised break of study only once during the entire period of study for a maximum period of one year. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for the break of study.

**11.2** The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance shall be governed by the rules and regulations in force at the time of rejoining.

**11.3** The candidates rejoining in new Regulations shall apply to the Principal in the prescribed format through Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.

**11.4** The total period of completion of the programme reckoned from the commencement of the semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5 irrespective of the period of break of study in order to qualify for the award of the degree.

**11.5** If any candidate is prevented for want of required attendance, the period of prevention shall not be considered as authorized break of study.

11.6 If a candidate has not reported to the college for a period of two consecutive semesters without any intimation, the name of the candidate shall be deleted permanently from the college enrollment. Such candidates are not entitled to seek readmission under any circumstances.

## 12. PASSING REQUIREMENTS

**12.1** A candidate who secures not less than 50 % of total marks (continuous assessment and end semester examination put together) prescribed for the course with a minimum of 45 % of the marks prescribed for the end semester examination in all category of courses vide clause 7.1 except for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course in the examination.

**12.2** A candidate who secures not less than 50 % in continuous assessment marks prescribed for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course. If a candidate secures less than 50% in the continuous assessment marks, he / she shall have to re-enroll for the same in the subsequent semester and satisfy the attendance requirements.

**12.3** For a candidate who does not satisfy the clause 12.1, the continuous assessment marks secured by the candidate in the first attempt shall be retained and considered valid for subsequent attempts. However, from the fourth attempt onwards the marks scored in the end semester examinations alone shall be considered, in which case the candidate shall secure minimum 50 % marks in the end semester examinations to satisfy the passing requirements.

## 13. REVALUATION OF ANSWER SCRIPTS

A candidate shall apply for a photocopy of his / her semester examination answer script within a reasonable time from the declaration of results, on payment of a prescribed fee by submitting the proper application to the Controller of Examinations. The answer script shall be pursued and justified jointly by a faculty member who has handled the course and the course coordinator and recommended for revaluation. Based on the recommendation, the candidate can register for revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for revaluation and the results will be intimated to the candidate concerned. Revaluation is permitted only for Theory courses and Theory cum Practical courses where end semester examination is involved.

## 14. SUPPLEMENTARY EXAMINATION

If a candidate fails to clear all courses in the final semester after the announcement of final end semester examination results, he/she shall be allowed to take up supplementary examinations to be conducted within a reasonable time for the courses of final semester alone, so that he/she gets a chance to complete the programme.

## 15. AWARD OF LETTER GRADES:

For all the passed candidates, the relative grading principle is applied to assign the letter grades.

| Marks / Examination Status | Letter Grade | Grade Point |
|---|---|---|
| Based on the relative grading | O (Outstanding) | 10 |
| | A+ (Excellent) | 9 |
| | A (Very Good) | 8 |
| | B+ (Good) | 7 |
| | B (Average) | 6 |
| | C (Satisfactory) | 5 |
| Less than 50 | U (Reappearance) | 0 |
| Successfully Completed | SC | 0 |
| Withdrawal | W | - |
| Absent | AB | - |
| Shortage of Attendance in a course | SA | - |

The Grade Point Average (GPA) is calculated using the formula:

$$\text{GPA} = \frac{\sum[(\text{course credits}) \times (\text{grade points})] \text{ for all courses in the specific semester}}{\sum(\text{course credits}) \text{ for all courses in the specific semester}}$$

The Cumulative Grade Point Average (CGPA) is calculated from first semester (third semester for lateral entry candidates) to final semester using the formula

$$\text{CGPA} = \frac{\sum[(\text{course credits}) \times (\text{grade points})] \text{ for all courses in all the semesters so far}}{\sum(\text{course credits}) \text{ for all courses in all the semesters so far}}$$

The GPA and CGPA are computed only for the candidates with a pass in all the courses.

The GPA and CGPA indicate the academic performance of a candidate at the end of a semester and at the end of successive semesters respectively.

A grade sheet for each semester shall be issued containing Grade obtained in each course, GPA and CGPA.

A duplicate copy, if required can be obtained on payment of a prescribed fee and satisfying other procedure requirements.

Withholding of Grades: The grades of a candidate may be withheld if he/she has not cleared his/her dues or if there is a disciplinary case pending against him/her or for any other reason.

## 16. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be declared to be eligible for the award of the BE / BTech Degree provided the candidate has

i. Successfully completed all the courses under the different categories, as specified in the regulations.
ii. Successfully gained the required number of total credits as specified in the curriculum corresponding to the candidate's programme within the stipulated time (vide clause 5).
iii. Successfully passed any additional courses prescribed by the respective Board of Studies whenever readmitted under regulations other than R-2022 (vide clause 11.3)
iv. No disciplinary action pending against him / her.

## 17. CLASSIFICATION OF THE DEGREE AWARDED

### 17.1 First Class with Distinction:

**17.1.1.** A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the **First Appearance** within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 8.50

(OR)

**17.1.2** A candidate who joins from other institutions on transfer or a candidate who gets readmitted and has to move from one regulations to another regulations and who qualifies for the award of the degree (vide clause 16) and satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the **First Appearance** within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
- Submission of equivalent course list approved by the respective Board of studies.
- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 9.00

### 17.2 First Class:

A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First class:

- Should have passed the examination in all the courses of all eight semesters (six semesters for lateral entry candidates) within ten consecutive semesters (eight consecutive semesters for lateral entry candidates) excluding authorized break of study (vide clause 11) after the commencement of his / her study.
- Withdrawal from the examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 6.50

**17.3 Second Class:**

All other candidates (not covered in clauses 17.1 and 17.2) who qualify for the award of the degree (vide clause 16) shall be declared to have passed the examination in Second Class.

**17.4** A candidate who is absent for end semester examination in a course / project work after having registered for the same shall be considered to have appeared for that examination for the purpose of classification.

**17.5 Honors Degree:**

A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have earned the BE/BTech degree with Honours (vide clause 16 and clause 4.2.2):

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the **First Appearance** within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 7.50

## 18. MALPRACTICES IN TESTS AND EXAMINATIONS

If a candidate indulges in malpractice in any of the tests or end semester examinations, he/she shall be liable for punitive action as per the examination rules prescribed by the college from time to time.

## 19. AMENDMENTS

Notwithstanding anything contained in this manual, the Kongu Engineering College through the Academic council of the College, reserves the right to modify/amend without notice, the Regulations, Curricula, Syllabi, Scheme of Examinations, procedures, requirements, and rules pertaining to its BE / BTech programme.

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| CURRICULUM BREAKDOWN STRUCTURE – R2022 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Summary of Credit Distribution** | | | | | | | | | | |
| **Category** | **Semester** | | | | | | | | **Total number of credits** | **Curriculum Content (% of total number of credits of the program)** |
| | **I** | **II** | **III** | **IV** | **V** | **VI** | **VII** | **VIII** | | |
| **HS** | 3 | 5 | 3 | 1 | | | 3 | | 15 | 8.93 |
| **BS** | 8 | 8 | 4 | | | | | | 20 | 11.90 |
| **ES** | 8 | 9 | 4 | 4 | | | | | 25 | 14.89 |
| **PC** | 4 | 3 | 11 | 15 | 16 | 8 | | | 57 | 33.93 |
| **PE** | | | | | 3 | 3 | 9 | 3 | 18 | 10.71 |
| **OE** | | | | | 4 | 4 | 3 | 3 | 14 | 8.33 |
| **EC** | | | | 2 | 2 | 6 | 5 | 4 | 19 | 11.31 |
| **MC** | 0 | | | | | 0 | | | 0 | 0 |
| **Semester wise Total** | 23 | 25 | 22 | 22 | 25 | 21 | 17 | 10 | 168 | 100.00 |

| Category | Abbreviation |
|---|---|
| Lecture hours per week | **L** |
| Tutorial hours per week | **T** |
| Practical, Project work, Internship, Professional Skill Training, Industrial Training hours per week | **P** |
| Credits | **C** |

| CATEGORISATION OF COURSES | | | | | | | |
|---|---|---|---|---|---|---|---|
| **HUMANITIES AND SOCIAL SCIENCE INCLUDING MANAGEMENT (HS)** | | | | | | | |
| **S. No.** | **Course Code** | **Course Name** | **L** | **T** | **P** | **C** | **Sem** |
| 1. | 22EGT11 | Communication Skills I | 3 | 0 | 0 | 3 | I |
| 2. | 22EGT21 | Communication Skills II | 3 | 0 | 0 | 3 | II |
| 3. | 22VEC11 | Yoga and Values for Holistic Education | 1 | 0 | 1 | 1 | II |
| 4, | 22TAM01 | Heritage of Tamil | 1 | 0 | 0 | 1 | II |
| 5. | 22TAM02 | Tamils and Technology | 1 | 0 | 0 | 1 | III |
| 6. | 22GCT31 | Universal Human Values | 2 | 0 | 0 | 2 | III |
| 7. | 22EGL31 | Communication Skills Development Laboratory | 0 | 0 | 2 | 1 | IV |
| 8. | 22GCT71 | Engineering Economics and Management | 3 | 0 | 0 | 3 | VII |
| **Total Credits to be earned** | | | | | | **15** | |

| BASIC SCIENCE (BS) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No.** | **Course Code** | **Course Name** | **L** | **T** | **P** | **C** | **Sem** |
| 1. | 22MAC11 | Matrices and Ordinary Differential Equations | 3 | 1* | 2* | 4 | I |
| 2. | 22CYT12 | Chemistry for Computer Systems | 3 | 0 | 0 | 3 | I |
| 3. | 22CYL12 | Chemistry Laboratory for Computer Systems | 0 | 0 | 2 | 1 | I |
| 4. | 22MAC23 | Probability and Statistics | 3 | 1* | 2* | 4 | II |
| 5. | 22PHT22 | Physics for Computer Systems | 3 | 0 | 0 | 3 | II |
| 6. | 22PSL22 | Physics for Computer Systems Laboratory | 0 | 0 | 2 | 1 | II |
| 7. | 22MAT35 | Discrete Mathematical Structures | 3 | 1 | 0 | 4 | III |
| **Total Credits to be earned** | | | | | | **20** | |

| ENGINEERING SCIENCE (ES) | | | | | | | |
|---|---|---|---|---|---|---|---|
| S. No. | Course Code | Course Name | L | T | P | C | Sem |
| 1. | 22CSC12 | Programming in C | 3 | 0 | 2 | 4 | I |
| 2. | 22EEC11 | Basics of Electrical and Electronics Engineering | 3 | 0 | 2 | 4 | I |
| 3. | 22CST21 | Programming and Linear Data Structures | 3 | 0 | 0 | 3 | II |
| 4. | 22CSL21 | Programming and Linear Data Structures Laboratory | 0 | 0 | 2 | 1 | II |
| 5. | 22CSC23 | Object Oriented Programming using C++ | 3 | 0 | 2 | 4 | II |
| 6. | 22MEL11 | Engineering Practices Laboratory | 0 | 0 | 2 | 1 | II |
| 7. | 22CSC31 | Digital Principles and Design | 3 | 0 | 2 | 4 | III |
| 8. | 22CSC41 | Python Programming and Frameworks | 3 | 0 | 2 | 4 | IV |
| **Total Credits to be earned** | | | | | | **25** | |

| PROFESSIONAL CORE (PC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| S. No. | Course Code | Course Name | L | T | P | C | Sem | Domain/ Stream |
| 1. | 22CST11 | Problem Solving and Design | 3 | 0 | 0 | 3 | I | SD |
| 2. | 22CSL11 | Problem Solving and Design Laboratory | 0 | 0 | 2 | 1 | 1 | SD |
| 3. | 22CDT21 | Design Thinking | 3 | 0 | 0 | 3 | II | SD |
| 4. | 22CST31 | Java Programming | 3 | 0 | 0 | 3 | III | SD |
| 5. | 22CST32 | Data Structures | 3 | 0 | 0 | 3 | III | SD |
| 6. | 22CST33 | Computer Organization | 3 | 0 | 0 | 3 | III | SD |
| 7. | 22CSL31 | Java Programming Laboratory | 0 | 0 | 2 | 1 | III | SD |
| 8. | 22CSL32 | Data Structures Laboratory | 0 | 0 | 2 | 1 | III | SD |
| 9. | 22CST41 | Database Management Systems | 3 | 0 | 0 | 3 | IV | SD |
| 10. | 22CST42 | Web Technology | 3 | 0 | 0 | 3 | IV | SDE |
| 11. | 22CST43 | Operating Systems | 3 | 0 | 0 | 3 | IV | SD |
| 12. | 22CST44 | Design and Analysis of Algorithm | 3 | 1 | 0 | 4 | IV | SD |
| 13. | 22CSL41 | Database Management Systems Laboratory | 0 | 0 | 2 | 1 | IV | CS |
| 14. | 22CSL42 | Web Technology Laboratory | 0 | 0 | 2 | 1 | IV | CS |
| 15. | 22CST51 | Internet of Things and Cloud Computing | 3 | 0 | 0 | 3 | V | NS |
| 16. | 22CST52 | Computer Networks | 3 | 0 | 0 | 3 | V | NS |
| 17. | 22CST53 | Theory of Computation | 3 | 1 | 0 | 4 | V | FCC |
| 18. | 22CSC51 | Agile Methodologies | 3 | 0 | 2 | 4 | V | SDE |
| 19. | 22CSL51 | Internet of Things and Cloud Computing Laboratory | 0 | 0 | 2 | 1 | V | NS |
| 20. | 22CSL52 | Computer Networks Laboratory | 0 | 0 | 2 | 1 | V | NS |
| 21. | 22CST61 | Compiler Design | 3 | 0 | 0 | 3 | VI | CS |
| 22. | 22CST62 | Machine Learning | 3 | 0 | 0 | 3 | VI | CS |
| 23. | 22CSL61 | Compiler Design Laboratory | 0 | 0 | 2 | 1 | VI | CS |
| 24. | 22CSL62 | Machine Learning Laboratory | 0 | 0 | 2 | 1 | VI | CS |
| **Total Credits to be earned** | | | | | | **57** | | |

AI – Artificial Intelligence, SD-Systems Development, SDE – Software Development and Engineering, NS- Networks and Security, FCS – Formal Courses on Computer Science, GE – General Engineering

| EMPLOYABILITY ENHANCEMENT COURSES (EC) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No.** | **Course Code** | **Course Name** | **L** | **T** | **P** | **C** | **Sem** |
| 1. | 22GCL41 | Professional Skills Training I / Industrial Training I | -- | -- | -- | 2 | IV |
| 2. | 22GCL51 | Professional Skills Training II / Industrial Training II | -- | -- | -- | 2 | V |
| 3. | 22CSP61 | Project Work I | 0 | 0 | 8 | 4 | VI |
| 4. | 22GEP61 | Comprehensive Test and Viva | --- | --- | --- | 2 | VI |
| 5. | 22CSP71 | Project Work II Phase I | 0 | 0 | 10 | 5 | VII |
| 6. | 22CSP81 | Project Work II Phase II | 0 | 0 | 8 | 4 | VIII |
| **Total Credits to be earned** | | | | | | **19** | |

| MANDATORY COURSES (MC) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No.** | **Course Code** | **Course Name** | **L** | **T** | **P** | **C** | **Sem** |
| 1. | 22MNT11 | Student Induction Program | --- | --- | --- | 0 | I |
| 2. | 22MNT31 | Environmental Science | 2 | 0 | 0 | 0 | VI |
| **Total Credits to be earned** | | | | | | **00** | |

# PROFESSIONAL ELECTIVE

| S. No. | Course Code | Course Name | L | T | P | C | Sem | Domain |
|---|---|---|---|---|---|---|---|---|
| | | **Elective 1 – V sem** | | | | | | |
| 1. | 22CSE01 | Mobile Communications | 3 | 0 | 0 | 3 | V | NS |
| 2. | 22CSE02 | Data Science | 3 | 0 | 0 | 3 | V | AI |
| 3. | 22CSE03 | Building Enterprise Applications | 3 | 0 | 0 | 3 | V | SDE |
| 4. | 22CSE04 | Artificial Intelligence | 3 | 0 | 0 | 3 | V | AI |
| 5. | 22CSE05 | C# and .NET Framework | 3 | 0 | 0 | 3 | V | SD |
| 6. | 22CSE06 | Unix Internals | 3 | 0 | 0 | 3 | V | SD |
| 7. | 22CSE07 | Data Warehousing and Data Mining | 3 | 0 | 0 | 3 | V | SDE |
| | | **Elective 2- VI sem** | | | | | | |
| 8. | 22CSE08 | Cryptography and Network Security | 3 | 0 | 0 | 3 | VI | NS |
| 9. | 22CSE09 | Business Intelligence and its Applications | 3 | 0 | 0 | 3 | VI | AI |
| 10. | 22CSE10 | Graph Theory | 3 | 0 | 0 | 3 | VI | SD |
| 11. | 22CSE11 | Distributed Systems | 3 | 0 | 0 | 3 | VI | AI |
| 12. | 22CSE12 | Deep Learning and its Applications | 3 | 0 | 0 | 3 | VI | AI |
| 13. | 22CSE13 | Graphics and Multimedia | 3 | 0 | 0 | 3 | VI | SD |
| | | **Elective 3 VII sem** | | | | | | |
| 14. | 22CSE14 | Blockchain Technologies | 3 | 0 | 0 | 3 | VII | NS |
| 15. | 22GEE02 | Total Quality Management | 3 | 0 | 0 | 3 | VII | GE |
| 16. | 22CSE15 | Decision Support Systems | 3 | 0 | 0 | 3 | VII | AI |
| 17. | 22CSE16 | Social Network Analysis | 3 | 0 | 0 | 3 | VII | SD |
| 18. | 22CSE17 | Human Computer Interface | 3 | 0 | 0 | 3 | VII | SDE |
| 19. | 22CSE18 | Optimization Techniques | 3 | 0 | 0 | 3 | VII | SD |
| 20. | 22CSE19 | Web Mining | 3 | 0 | 0 | 3 | VII | SD |
| | | Elective 4 | | | | | | |
| 21. | 22CSE20 | Wireless and Sensor Networks | 3 | 0 | 0 | 3 | VII | NS |
| 22. | 22CSE21 | Modeling and Simulation | 3 | 0 | 0 | 3 | VII | SD |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 23. | 22CSE22 | Parallel Computing Architecture and Programming | 3 | 0 | 0 | 3 | VII | SD |
| 24. | 22CSE23 | Digital Marketing | 3 | 0 | 0 | 3 | VII | SD |
| 24. | 22CSF01 | Big Data Analytics | 2 | 0 | 2 | 3 | VII | SDE |
| 25. | 22CSE24 | Cross Platform Application Development | 3 | 0 | 0 | 3 | VII | SD |
| 26. | 22CSE25 | Approximation Algorithms | 3 | 0 | 0 | 3 | VII | SD |
| 28. | 22GEE01 | Fundamentals of Research | 3 | 0 | 0 | 3 | VII | GE |
| | | Elective 5 | | | | | | |
| 29. | 22CSE26 | Software Defined Networks | 3 | 0 | 0 | 3 | VII | NS |
| 30. | 22CSE27 | Information Security | 3 | 0 | 0 | 3 | VII | NS |
| 31 | 22CSE28 | Intelligent Systems | 3 | 0 | 0 | 3 | VII | AI |
| 32 | 22CSE29 | Software Project Management | 3 | 0 | 0 | 3 | VII | SDE |
| 33 | 22CSE30 | Data Visualization Techniques | 3 | 0 | 0 | 3 | VII | SDE |
| 34 | 22CSE31 | Information Retrieval | 3 | 0 | 0 | 3 | VII | AI |
| 35 | 22CSE32 | Computer Vision | 3 | 0 | 0 | 3 | VII | SD |
| | | **Elective 6 – VIII sem** | | | | | | |
| 36 | 22CSE33 | Natural Language Processing | 3 | 0 | 0 | 3 | VIII | AI |
| 37 | 22CSE34 | Cyber Forensics | 3 | 0 | 0 | 3 | VIII | NS |
| 38 | 22CSE35 | Predictive Data Analytics | 3 | 0 | 0 | 3 | VIII | AI |
| 39 | 22CSE36 | Software Quality and Testing | 3 | 0 | 0 | 3 | VIII | SDE |
| 40 | 22CSE37 | Randomized Algorithms | 3 | 0 | 0 | 3 | VIII | SD |
| | | **Total credits to be earned** | | | | **18** | | |

***** AI – Artificial Intelligence, SD-Systems Development, SDE – Software Development and Engineering, NS- Networks and Security, ID- Interface Design, GE – General Engineering

| OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No.** | **Course Code** | **Course Name** | **L** | **T** | **P** | **C** | **Sem** |
| 1. | 22CSX01 | Fundamentals of Databases | 3 | 0 | 2 | 4 | 5 |
| 2. | 22CSX02 | Data science for Engineers | 3 | 0 | 2 | 4 | 5 |
| 3. | 22CSX03 | Enterprise Application Development Using Java | 3 | 0 | 2 | 4 | 5 |
| 4. | 22CSO01 | Computational science for Engineers | 3 | 1 | 0 | 4 | 5 |
| 5. | 22CSO02 | Formal Languages and Automata Theory | 3 | 1 | 0 | 4 | 5 |
| 6. | 22CSX04 | Foundations of Machine Learning | 3 | 0 | 2 | 4 | 6 |
| 7. | 22CSX05 | Web Engineering | 3 | 0 | 2 | 4 | 6 |
| 8. | 22CSO04 | Nature Inspired optimization techniques | 3 | 0 | 0 | 3 | 7 |
| 9. | 22CSO05 | Machine Translation | 3 | 0 | 0 | 3 | 8 |
| 10. | 22CSO06 | Fundamentals of Blockchain | 3 | 0 | 0 | 3 | 8 |

# KEC R2022: SCHEDULING OF COURSES – BE (Computer Science and Engineering) Total Credits: 168

| Sem | Course1 | Course2 | Course3 | Course4 | Course5 | Course6 | Course7 | Course8 | Course9 | Course10 | Course11 | CH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | Communication Skills I (3-0-0-3) | Matrices and Ordinary Differential Equations (3-1*-2* -4) | Problem Solving and Design (3-0-0-3) | Chemistry for Computer Systems (3-0-0-3) | Programming in C (3-0-2-4) | Basics of Electrical and Electronics Engineering (3-0-2-4) | Problem Solving and Design Laboratory (0-0-2-1) | Chemistry Laboratory for Computer Systems (0-0-2-1) | Student Induction Program # (-------0) | | | 23 |
| II | Communication Skills II (3-0-0-3) | Probability and Statistics (3-1*-2*-4) | Physics for Computer Systems (3-0-0-3) | Programming and Linear Data Structures (3-0-0-3) | Design Thinking (3-0-0-3) | Object Oriented Programming using C++ (3-0-2-4) | Heritage of Tamis(1-0-0-1) | Programming and Linear Data Structures Laboratory (0-0-2-1) | Physics for Computer Systems Laboratory (0-0-2-1) | Engineering Practices Laboratory (0-0-2-1) | Yoga and Values for Holistic Education (1-0-0-1) | 25 |
| III | Discrete Mathematical Structures (3-1-0-4) | Java Programming (3-0-0-3) | Data Structures (3-0-0-3) | Computer Organization (3-0-0-3) | Digital Principle Design (3-0-2-4) | Tamils and Technology (1-0-0-1) | Java Programming Laboratory (0-0-2-1) | Data Structures Laboratory (0-0-2-1) | Universal Human Values (2-0-0-2) | | | 22 |
| IV | Python Programming and Frameworks (3-0-2-4) | Database Management Systems (3-0-0-3) | Web Technology (3-0-0-3) | Operating Systems (3-0-0-3) | Design and Analysis of Algorithms (3-1-0-4) | Database Management Systems Laboratory (0-0-2-1) | Web Technology Laboratory (0-0-2-1) | Professional Skills Training I / Industrial Training I (-----2) | Communication Skills Development Laboratory (0-0-2-1) | | | 22 |
| V | Internet of Things & Cloud Computing (3-0-0-3) | Computer Networks (3-0-0-3) | Theory of Computation (3-1-0-4) | Agile Methodologies (3-0-2-4) | Professional Elective – I (3-0-0-3) | Open Elective – I (3-0/1-2/0-4) | Internet of Things & Cloud Computing Laboratory (0-0-2-1) | Computer Networks Laboratory | Professional Skills Training II / Industrial Training II (------2) | | | 25 |
| VI | Compiler Design (3-0-0-3) | Machine Learning (3-0-0-3) | Professional Elective – II (3-0-0-3) | Open Elective – II (3-1/0-0/2-4) | Compiler Design Laboratory (0-0-2-1) | Machine Learning Laboratory (0-0-2-1) | Project Work I (0-0-8-4) | Environmental Science (2-0-0-0) | Comprehensive Test and Viva (-----2) | | | 21 |
| VII | Engineering Economics and Management (3-0-0-3) | Professional Elective – III (3-0-0-3) | Professional Elective – IV (3-0-0-3) | Professional Elective – V (3-0-0-3) | Open Elective – III (3-0-0-3) | Project Work II Phase I (0-0-10-5) | | | | | | 20 |
| VIII | Professional Elective – VI (3-0-0-3) | Open Elective – IV (3-0-0-3) | Project Work II Phase II (0-0-8-4) | | | | | | | | | 10 |

## MAPPING OF COURSES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 22EGT11 | Communication Skills I | | | | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | | |
| 1 | 22MAC11 | Matrices and Ordinary Differential Equations | ✓ | ✓ | ✓ | | ✓ | | | | | | | | | |
| 1 | 22CST11 | Problem Solving and Design | ✓ | ✓ | ✓ | | | | | | | | | | ✓ | ✓ |
| 1 | 22CYT12 | Chemistry for Computer Systems | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ |
| 1 | 22CSC12 | Programming in C | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 1 | 22EEC12 | Basics of Electrical and Electronics Engineering | ✓ | ✓ | ✓ | ✓ | | | | | | | | | ✓ | ✓ |
| 1 | 22CSL11 | Problem Solving and Design Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ |
| 1 | 22CYL12 | Chemistry Laboratory for Computer Systems | ✓ | ✓ | ✓ | ✓ | | | | | | | | | ✓ | ✓ |
| 1 | 22MNT11 | Student Induction Program # | | | | | | | | | | | | | | |
| 1 | 22EGT21 | Communication Skills II | | | | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | | |
| 2 | 22MAC23 | Probability and Statistics | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ | |
| 2 | 22PHT22 | Physics for Computer Systems | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 2 | 22CST21 | Programming and Linear Data Structures | ✓ | ✓ | ✓ | ✓ | | | | | | | | | ✓ | ✓ |
| 2 | 22CST22 | Design Thinking | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | ✓ | ✓ |
| 2 | 22CSC23 | Object Oriented Programming using C++ | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | | | ✓ | ✓ | ✓ |
| 2 | 22CSL21 | Programming and Linear Data Structures Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ | ✓ |
| 2 | 22PSL22 | Physics Laboratory | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 2 | 22MEL11 | Engineering Practices Laboratory | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 2 | 22VEC11 | Yoga and Values for Holistic Education | | | | | | ✓ | | ✓ | ✓ | | | | | |
| 3 | 22MAT35 | Discrete Mathematical Structures | ✓ | ✓ | ✓ | | | | | | | | | | ✓ | |
| 3 | 22CST31 | Java Programming | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 3 | 22CST32 | Data Structures | ✓ | ✓ | ✓ | | | | | | | | | | ✓ | ✓ |
| 3 | 22CST33 | Computer Organization | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | | ✓ | ✓ |
| 3 | 22CSC31 | Digital Principles and Design | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | | | ✓ | ✓ |
| 3 | 22CSL31 | Java Programming Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | | | ✓ | ✓ |

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
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| 3 | 22CSL32 | Data Structures Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ | ✓ |
| 3 | 22GET31 | Universal Human Values | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 4 | 22CSC41 | Python Programming and Frameworks | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | | | ✓ | ✓ |
| 4 | 22CST41 | Database Management Systems | ✓ | ✓ | ✓ | | | | | | | | | | ✓ | ✓ |
| 4 | 22CSC42 | Web Technology | ✓ | ✓ | ✓ | ✓ | | | | | | | | | ✓ | ✓ |
| 4 | 22CST43 | Operating Systems | ✓ | ✓ | ✓ | | | | | | | | | | ✓ | ✓ |
| 4 | 22CST44 | Design and Analysis of Algorithms | ✓ | ✓ | ✓ | | | | | | | | | | ✓ | ✓ |
| 4 | 22CSL41 | Database Management Systems Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ | | ✓ | ✓ |
| 4 | 22CSL42 | Web Technology Laboratory | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | | | ✓ | ✓ |
| 4 | 22GEL41 | Professional Skills Training I / Industrial Training I | | | | | | | | | | | | | | |
| 4 | 22EGL31 | Communication Skills Development Laboratory | | | | | | | | | ✓ | ✓ | | ✓ | | |
| 6 | 22MNT31 | Environmental Science | ✓ | ✓ | ✓ | | | | ✓ | | | | | | | |
| 6 | 22GEP61 | Comprehensive Test and Viva | | | | | | | | | | | | | | |

## MAPPING OF COURSES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 22CEX01 | Remote Sensing and its Applications | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ | | | ✓ | | |
| 5 | 22MEX01 | Renewable Energy Sources | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| 5 | 22MTO01 | Design of Mechatronics Systems | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ | | |
| 5 | 22MTX01 | Data Acquisition and Virtual Instrumentation | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ | | |
| 5 | 22MTX02 | Factory Automation | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | | |
| 5 | 22AUX01 | Automotive Engineering | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | ✓ | | ✓ | | |
| 5 | 22ECX01 | Basics of Electronics in Automation Appliances | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | | |
| 5 | 22ECX02 | Image Processing | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | | |
| 5 | 22EEO01 | Solar and Wind Energy Systems | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | | ✓ | | |
| 5 | 22EEO02 | Electrical Wiring and Lighting | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ | | |
| 5 | 22EEO03 | Programmable Logic Controller and SCADA | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ | | | ✓ | | |
| 5 | 22EEO04 | Analog and Digital Electronics | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ | | |
| 5 | 22EEO05 | Power Electronics and Drives | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | |
| 5 | 22EEO06 | Sensors and Actuators | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | | |
| 5 | 22EIO01 | Measurements and Instrumentation | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 5 | 22EIO02 | Biomedical Instrumentation and Applications | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | | | |
| 5 | 22EIO03 | Industrial Automation | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 5 | 22CSX01 | Fundamentals of Databases | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 22CSX02 | Data science for Engineers | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 5 | 22CSX03 | Enterprise Application Development Using Java | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| 5 | 22CSO01 | Computational science for Engineers | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 22CSO02 | Formal Languages and Automata Theory | ✓ | ✓ | ✓ | | | | | | | | | | | |

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
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| 5 | 22ITO01 | Artificial Intelligence | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| 5 | 22ITX01 | Next Generation Databases | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| 5 | 22CDO01 | Fundamentals of User Experience Design | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ | | | |
| 5 | 22ADO01 | Data Warehousing and Data Mining | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 22ALO01 | Business Intelligence | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 22CHO01 | Industrial Enzymology | ✓ | ✓ | ✓ | | | | | | | ✓ | ✓ | ✓ | | |
| 5 | 22CHO02 | Waste to Energy Conversion | ✓ | ✓ | | | | | | | | | | | | |
| 5 | 22CHO03 | Applied Nanotechnology | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | |
| 5 | 22FTX01 | Baking Technology | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | | |
| 5 | 22FTO01 | Food Processing Technology | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | ✓ | | ✓ | | |
| 5 | 22MAO01 | Mathematical Foundations for Machine Learning | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 5 | 22MAO02 | Numerical Computing | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 22MAO03 | Stochastic Processes and Queuing Theory | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 22MAO04 | Statistics for Engineers | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 22PHO01 | Thin Film Technology | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | ✓ | | |
| 5 | 22PHO02 | High Energy Storage Devices | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | ✓ | | |
| 5 | 22PHO03 | Structural and Optical Characterization of Materials | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | ✓ | | |
| 5 | 22CYO01 | Instrumental Methods of Analysis | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 5 | 22CYO02 | Chemistry Concepts for Competitive Examinations | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 22CYO03 | Organic Chemistry for Industry | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 5 | 22MBO01 | Cost Accounting for Engineers | | | | | | | | | | ✓ | ✓ | ✓ | | |
| 6 | 22CEO01 | Disaster Management | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | | ✓ | | |
| 6 | 22MEX02 | Design of Experiments | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | | | | |
| 6 | 22GEO04 | Innovation and Business Model Development | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
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| 6 | 22MTO02 | Robotics | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ | | |
| 6 | 22MTO03 | 3D Printing and Design | ✓ | ✓ | | | ✓ | | | | | | | ✓ | | |
| 6 | 22AUO01 | Automotive Electronics | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ | | |
| 6 | 22ECX03 | PCB Design and Fabrication | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | |
| 6 | 22EEO07 | Energy Conservation and Management | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | | | ✓ | | |
| 6 | 22EEO08 | Microprocessors and Microcontrollers Interfacing | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| 6 | 22EEO09 | Electrical Safety | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | | ✓ | ✓ | | |
| 6 | 22EEO10 | VLSI System Design | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | ✓ | | |
| 6 | 22EEO11 | Automation for Industrial Applications | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | | ✓ | | |
| 6 | 22EIO04 | PLC Programming with High Level Languages | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 6 | 22EIO05 | Virtual Instrumentation | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 6 | 22CSX04 | Foundations of Machine Learning | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 22CSX05 | Web Engineering | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 22ITX02 | Advanced Java Programming | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| 6 | 22ITO02 | Internet of Things | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| 6 | 22ITO03 | Fundamentals of Software Development | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| 6 | 22ITO04 | Mobile Application Development | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| 6 | 22CDX01 | Fundamentals of User Interactive Design | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 6 | 22ADX01 | Data Visualization | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 22ALX01 | Data Exploration and Visualization Techniques | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 22CHO04 | Air Pollution Monitoring and Control | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | | | | |
| 6 | 22CHO05 | Paints and Coatings | ✓ | ✓ | ✓ | | | | ✓ | | | | | | | |
| 6 | 22CHO06 | Powder Technology | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | | ✓ | | |
| 6 | 22FTX02 | Processing of milk and milk products | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | | |

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
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| 6 | 22FTX03 | Processing of Fruits and Vegetables | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | | |
| 6 | 22MAO05 | Graph Theory and its Applications | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 22MAX01 | Data Analytics using R Programming | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 6 | 22MAO06 | Operations Research | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 22MAO07 | Number Theory and Cryptography | ✓ | ✓ | ✓ | | ✓ | | | | | | | | | |
| 6 | 22PHO04 | Synthesis, Characterization and Biological Applications of Nanomaterials | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | ✓ | | |
| 6 | 22PHO05 | Techniques of Crystal Growth | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | ✓ | | |
| 6 | 22CYO04 | Corrosion Science and Engineering | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 6 | 22CYO05 | Chemistry of Cosmetics in Daily Life | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 22CYO06 | Nanocomposite Materials | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 6 | 22MBO02 | Economic Analysis for Decision Making | | | | | ✓ | | | | | ✓ | ✓ | | | |
| 7 | 22CEO02 | Introduction to Smart Cities | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 7 | 22CEO03 | Environmental Health and Safety | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | | | | |
| 7 | 22MEO01 | Fundamentals of Ergonomics | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | | |
| 7 | 22MEO02 | Principles of Management and Industrial Psychology | ✓ | | | | | ✓ | | | | ✓ | ✓ | | | |
| 7 | 22MEO03 | Waste Heat Recovery System and Storage | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | | |
| 7 | 22GEO05 | Entrepreneurship Development | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| 7 | 22MTO04 | Drone System Technology | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ | | |
| 7 | 22AUO02 | Vehicle Maintenance | ✓ | ✓ | | | ✓ | | ✓ | | | | | ✓ | | |
| 7 | 22ECO01 | Wearable Devices | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | |
| 7 | 22ECX04 | Electronic Hardware and Troubleshooting | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | |
| 7 | 22EEO12 | Electric Vehicle | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | | | ✓ | | |
| 7 | 22EEO13 | E-Waste Management | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | ✓ | | |

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
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| 7 | 22EEO14 | Embedded System Design | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| 7 | 22EEO15 | Energy Storage Systems and Controllers | ✓ | ✓ | ✓ | | | ✓ | | | ✓ | | ✓ | ✓ | | |
| 7 | 22EEO16 | AI Techniques for Engineering Applications | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 7 | 22EIO06 | Introduction to Distributed Control Systems | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | | | |
| 7 | 22EIO07 | Instrumentation in Aircraft Navigation and Control | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 7 | 22EIO08 | Industry 4.0 with Industrial IoT | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | |
| 7 | 22EIO09 | Industrial Data Communication | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | |
| 7 | 22EIO10 | Wireless Instrumentation | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | | | | |
| 7 | 22EIO11 | Instrumentation Techniques in Agriculture | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 7 | 22CSO03 | Nature Inspired optimization techniques | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 7 | 22ITO05 | Fundamentals of Cloud Computing | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| 7 | 22ITO06 | Introduction to Ethical Hacking | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| 7 | 22CDO02 | Introduction to Mobile Game Design | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 7 | 22CDO03 | Introduction to Graphics Design | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 7 | 22ADO02 | Neural Networks and Deep Learning | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 7 | 22ALO02 | Industrial Machine Learning | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 7 | 22CHO07 | Hydrogen Energy | ✓ | ✓ | | | | | | | | | | ✓ | | |
| 7 | 22CHO08 | Rubber Technology | ✓ | ✓ | | | | ✓ | ✓ | | | | | ✓ | | |
| 7 | 22FTO02 | Principles of Food safety | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | ✓ | | ✓ | | |
| 7 | 22FTO03 | Fundamentals of Food Packaging and Storage | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | | ✓ | | |
| 7 | 22MAO08 | Non-Linear Optimization | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 7 | 22MAO09 | Optimization for Engineers | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 7 | 22CYO07 | Waste and Hazardous Waste Management | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | | |
| 7 | 22CYO08 | Chemistry in Every day Life | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
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| 7 | 22MBO03 | Marketing Analytics | | | | | | | | | | ✓ | ✓ | ✓ | | |
| 8 | 22CEO04 | Infrastructure Planning and Management | ✓ | ✓ | ✓ | | ✓ | | | | | | | | | |
| 8 | 22CEO05 | Environmental Laws and Policy | ✓ | ✓ | | | ✓ | | | | | | | | | |
| 8 | 22MEO04 | Safety Measures for Engineers | ✓ | | | | | ✓ | ✓ | ✓ | | | | | | |
| 8 | 22MEO05 | Energy Conservation in Thermal Equipments | ✓ | | ✓ | | ✓ | ✓ | ✓ | | | | | ✓ | | |
| 8 | 22MEO06 | Climate Change and New Energy Technology | ✓ | | ✓ | | | ✓ | ✓ | ✓ | | | | | | |
| 8 | 22MTO05 | Micro and Nano Electromechanical Systems | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ | | |
| 8 | 22AUO03 | Public Transport Management | ✓ | ✓ | | | | ✓ | ✓ | ✓ | | | | ✓ | | |
| 8 | 22AUO04 | Autonomous Vehicles | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | | |
| 8 | 22ECO02 | Optical Engineering | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ | | |
| 8 | 22EEO17 | Smart Grid Technologies | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | ✓ | | |
| 8 | 22EEO18 | Biomass Energy Systems | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | ✓ | ✓ | | |
| 8 | 22EIO12 | Environmental Sensors | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | | | | |
| 8 | 22EIO13 | Pollution Control and Management | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | | | |
| 8 | 22CSO04 | Machine Translation | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 8 | 22CSO05 | Fundamentals of Blockchain | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 8 | 22ITO07 | Business Continuity Planning | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| 8 | 22CDX02 | Virtual Reality and Augmented Reality | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 8 | 22ADO03 | Business Analytics | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 8 | 22ALO03 | Machine Learning for Smart Cities | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 8 | 22CHO09 | Industrial Accident Prevention and Management | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| 8 | 22CHO10 | Electrochemical Engineering | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 8 | 22CHO11 | Smart and Functional Materials | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | | ✓ | | |
| 8 | 22FTO04 | Food Ingredients | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | | ✓ | | |
| 8 | 22FTO05 | Food and Nutrition | ✓ | ✓ | ✓ | | | ✓ | | | | ✓ | | ✓ | | |

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 22CYO09 | Chemistry of Nutrition for Women Health | ✓ | ✓ | ✓ | | | | | | | | | | | |
| | | **General Open Elective Courses** | | | | | | | | | | | | | | |
| ALL | 22GEO01 | German Language Level 1 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| ALL | 22GEO02 | Japanese Language Level 1 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 5 | 22GEO03 | Engineers | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 6 | 22GEO04 | Innovation and Business Model Development | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| ALL | 22GEO05 | German Language Level 2 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| ALL | 22GEO06 | German Language Level 3 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| ALL | 22GEO07 | German Language Level 4 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| ALL | 22GEO08 | Japanese Language Level 2 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| ALL | 22GEO09 | Japanese Language Level 3 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| ALL | 22GEO10 | Japanese Language Level 4 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| ALL | 22GEO11 | French Language Level 1 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| ALL | 22GEO12 | French Language Level 2 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| ALL | 22GEO13 | French Language Level 3 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| ALL | 22GEO14 | Spanish Language Level 1 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| ALL | 22GEO15 | Spanish Language Level 2 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| ALL | 22GEO16 | Spanish Language Level 3 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 7 | 22GEO17 | Entrepreneurship Development | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| 5 / 6 | 22GEX01 | NCC Studies (Army Wing) - I | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| 5 / 6 | 22GEX02 | NCC Studies (Air Wing) - 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| 5 | 22MBO01 | Cost Accounting for Engineers | | | | | | | | | | ✓ | ✓ | ✓ | | |
| 6 | 22MBO02 | Economic Analysis for Decision Making | | | | | ✓ | | | | | ✓ | ✓ | | | |
| 7 | 22MBO03 | Marketing Analytics | | | | | | | | | | ✓ | ✓ | ✓ | | |

## B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2022
**(for the students admitted in the academic year 2022-23)**

| SEMESTER – I | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22EGT11 | Communication Skills I | 3 | 0 | 0 | 3 | 40 | 60 | 100 | HS |
| 22MAC11 | Matrices and Ordinary Differential Equations | 3 | 1* | 2* | 4 | 50 | 50 | 100 | BS |
| 22CST11 | Problem Solving and Design | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CYT12 | Chemistry for Computer Systems | 3 | 0 | 0 | 3 | 40 | 60 | 100 | BS |
| 22CSC12 | Programming in C | 3 | 0 | 2 | 4 | 100 | 0 | 100 | ES |
| 22EEC12 | Basics of Electrical and Electronics Engineering | 3 | 0 | 2 | 4 | 50 | 50 | 100 | ES |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSL11 | Problem Solving and Design Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22CYL12 | Chemistry Laboratory for Computer Systems | 0 | 0 | 2 | 1 | 60 | 40 | 100 | BS |
| 22MNT11 | Student Induction Program # | --- | --- | --- | 0 | 100 | 0 | 100 | MC |
| **Total Credits to be earned** | | | | | **23** | | | | |

| SEMESTER – II | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22EGT21 | Communication Skills II | 3 | 0 | 0 | 3 | 40 | 60 | 100 | HS |
| 22MAC23 | Probability and Statistics | 3 | 1* | 2* | 4 | 50 | 50 | 100 | BS |
| 22PHT22 | Physics for Computer Systems | 3 | 0 | 0 | 3 | 40 | 60 | 100 | BS |
| 22CST21 | Programming and Linear Data Structures | 3 | 0 | 0 | 3 | 40 | 60 | 100 | ES |
| 22CSC23 | Object Oriented Programming using C++ | 3 | 0 | 2 | 4 | 100 | 0 | 100 | ES |
| 22CDT21 | Design Thinking | 3 | 0 | 0 | 3 | 100 | 0 | 100 | PC |
| 22TAM01 | Heritage of Tamil | 1 | 0 | 0 | 1 | 100 | 0 | 100 | HS |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSL21 | Programming and Linear Data Structures Laboratory | 0 | 0 | 2 | 1 | 100 | 0 | 100 | ES |
| 22PSL22 | Physics Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | BS |
| 22MEL11 | Engineering Practices Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | ES |
| 22VEC11 | Yoga and Values for Holistic Education | 1 | 0 | 1 | 1 | 100 | 0 | 100 | HS |
| **Total Credits to be earned** | | | | | **25** | | | | |

**B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2022**
**(for the students admitted in the academic year 2022-23)**

| SEMESTER – III | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22MAT32 | Discrete Mathematical Structures | 3 | 1 | 0 | 4 | 40 | 60 | 100 | BS |
| 22CST31 | Java Programming | 3 | 0 | 0 | 3 | 100 | 0 | 100 | PC |
| 22CST32 | Data Structures | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST33 | Computer Organization | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CSC31 | Digital Principles and Design | 3 | 0 | 2 | 4 | 50 | 50 | 100 | ES |
| 22TAM02 | Tamils and Technology | 1 | 0 | 0 | 1 | 100 | 0 | 100 | HS |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSL31 | Java Programming Laboratory | 0 | 0 | 2 | 1 | 100 | 0 | 100 | PC |
| 22CSL32 | Data Structures Laboratory | 0 | 0 | 2 | 1 | 100 | 0 | 100 | PC |
| 22GCT31 | Universal Human Values | 2 | 0 | 0 | 2 | 100 | 0 | 100 | HS |
| **Total Credits to be earned** | | | | | **22** | | | | |

| SEMESTER – IV | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22CSC41 | Python Programming and Frameworks | 3 | 0 | 2 | 4 | 100 | 0 | 100 | ES |
| 22CST41 | Database Management Systems | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST42 | Web Technology | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST43 | Operating Systems | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST44 | Design and Analysis of Algorithm | 3 | 1 | 0 | 4 | 40 | 60 | 100 | PC |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSL41 | Database Management Systems Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22CSL42 | Web Technology Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22GCL41/ 22GCI41 | Professional Skills Training I / Industrial Training I | -- | -- | -- | 2 | 100 | 0 | 100 | EC |
| 22GEL31 | Communication Skills Development Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | HS |
| **Total Credits to be earned** | | | | | **22** | | | | |

**B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2022**
**(for the students admitted in the academic year 2022-23)**

| SEMESTER – V | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22CST51 | Internet of Things and Cloud Computing | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST52 | Computer Networks | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST53 | Theory of Computation | 3 | 1 | 0 | 4 | 40 | 60 | 100 | PC |
| 22CSC51 | Agile Methodologies | 3 | 0 | 2 | 4 | 50 | 50 | 100 | PC |
| | Professional Elective – I | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Open Elective – I | 3 | 0/1 | 2/0 | 4 | 40/ 50 | 60/ 50 | 100 | OE |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSL51 | Internet of Things and Cloud Computing Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22CSL52 | Computer Networks Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22GCL51 / 22GCI51 | Professional Skills Training II / Industrial Training II | -- | -- | -- | 2 | 100 | 0 | 100 | EC |
| **Total Credits to be earned** | | | | | **25** | | | | |

| SEMESTER – VI | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22CST61 | Compiler Design | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST62 | Machine Learning | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| | Professional Elective – 2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Open Elective – 2 | 3 | 1/0 | 0/2 | 4 | 40/ 50 | 60/ 50 | 100 | OE |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSL61 | Compiler Design Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22CSL62 | Machine Learning Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22CSP61 | Project Work I | 0 | 0 | 8 | 4 | 100 | 0 | 100 | EC |
| 22MNT31 | Environmental Science | 2 | 0 | 0 | 0 | 100 | 0 | 100 | MC |
| 22GEP61 | Comprehensive Test and Viva | --- | --- | --- | 2 | 100 | 0 | 100 | EC |
| **Total Credits to be earned** | | | | | **21** | | | | |

**B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2022**
**(for the students admitted in the academic year 2022-23)**

| SEMESTER – VII | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22GCT71 | Engineering Economics and Management | 3 | 0 | 0 | 3 | 40 | 60 | 100 | HS |
| | Professional Elective – III | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Professional Elective – IV | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Professional Elective – V | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Open Elective – III | 3 | 0 | 0 | 3 | 40 | 60 | 100 | OE |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSP71 | Project Work II Phase I | 0 | 0 | 10 | 5 | 50 | 50 | 100 | EC |
| | **Total Credits to be earned** | | | | **20** | | | | |

| SEMESTER – VIII | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| | Professional Elective – VI | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Open Elective – IV | 3 | 0 | 0 | 3 | 40 | 60 | 100 | OE |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSP81 | Project Work II Phase II | 0 | 0 | 8 | 4 | 50 | 50 | 100 | EC |
| | **Total Credits to be earned** | | | | **10** | | | | |

**Total Credits : 168**

**B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2022**
**(for the students admitted in the academic year 2022-23)**

## LIST OF PROFESSIONAL ELECTIVE COURSES

| S. No. | Course Code | Course Name | L | T | P | C | Domain |
|---|---|---|---|---|---|---|---|
| | | **Semester V** | | | | | |
| | | **Elective 1** | | | | | |
| 1. | 22CSE01 | Mobile Communications | 3 | 0 | 0 | 3 | NS |
| 2. | 22CSE02 | Data Science | 3 | 0 | 0 | 3 | AI |
| 3. | 22CSE03 | Building Enterprise Applications | 3 | 0 | 0 | 3 | SDE |
| 4. | 22CSE04 | Artificial Intelligence | 3 | 0 | 0 | 3 | AI |
| 5. | 22CSE05 | C# and .NET Framework | 3 | 0 | 0 | 3 | SD |
| 6. | 22CSE06 | Unix Internals | 3 | 0 | 0 | 3 | SD |
| 7. | 22CSE07 | Data Warehousing and Data Mining | 3 | 0 | 0 | 3 | SDE |
| | | **Semester VI** | | | | | |
| | | **Elective 2** | | | | | |
| 8. | 22CSE08 | Cryptography and Network Security | 3 | 0 | 0 | 3 | NS |
| 9. | 22CSE09 | Business Intelligence and its Applications | 3 | 0 | 0 | 3 | AI |
| 10. | 22CSE10 | Graph Theory | 3 | 0 | 0 | 3 | SD |
| 11. | 22CSE11 | Distributed Systems | 3 | 0 | 0 | 3 | AI |
| 12. | 22CSE12 | Deep Learning and its Applications | 3 | 0 | 0 | 3 | AI |
| 13. | 22CSE13 | Graphics and Multimedia | 3 | 0 | 0 | 3 | SD |
| | | **Semester VII** | | | | | |
| | | **Elective 3** | | | | | |
| 14. | 22CSE14 | Blockchain Technologies | 3 | 0 | 0 | 3 | NS |
| 15. | 22GEE02 | Total Quality Management | 3 | 0 | 0 | 3 | GE |
| 16. | 22CSE15 | Decision Support Systems | 3 | 0 | 0 | 3 | AI |
| 17. | 22CSE16 | Social Network Analysis | 3 | 0 | 0 | 3 | SD |
| 18. | 22CSE17 | Human Computer Interface | 3 | 0 | 0 | 3 | SDE |
| 19. | 22CSE18 | Optimization Techniques | 3 | 0 | 0 | 3 | SD |
| 20. | 22CSE19 | Web Mining | 3 | 0 | 0 | 3 | SD |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Elective 4** | | | | | |
| 21. | 22CSE20 | Wireless and Sensor Networks | 3 | 0 | 0 | 3 | NS |
| 22. | 22CSE21 | Modeling and Simulation | 3 | 0 | 0 | 3 | SD |
| 23. | 22CSE22 | Parallel Computing Architecture and Programming | 3 | 0 | 0 | 3 | SD |
| 24. | 22CSE23 | Digital Marketing | 3 | 0 | 0 | 3 | SD |
| 24. | 22CSF01 | Big Data Analytics | 2 | 0 | 2 | 3 | SDE |
| 25. | 22CSE24 | Cross Platform Application Development | 3 | 0 | 0 | 3 | SD |
| 26. | 22CSE25 | Approximation Algorithms | 3 | 0 | 0 | 3 | SD |
| 28. | 22GEE01 | Fundamentals of Research | 3 | 0 | 0 | 3 | GE |
| | | **Elective 5** | | | | | |
| 29. | 22CSE26 | Software Defined Networks | 3 | 0 | 0 | 3 | NS |
| 30. | 22CSE27 | Information Security | 3 | 0 | 0 | 3 | NS |
| 31 | 22CSE28 | Intelligent Systems | 3 | 0 | 0 | 3 | AI |
| 32 | 22CSE29 | Software Project Management | 3 | 0 | 0 | 3 | SDE |
| 33 | 22CSE30 | Data Visualization Techniques | 3 | 0 | 0 | 3 | SDE |
| 34 | 22CSE31 | Information Retrieval | 3 | 0 | 0 | 3 | AI |
| 35 | 22CSE32 | Computer Vision | 3 | 0 | 0 | 3 | SD |
| | | **Semester VIII** | | | | | |
| | | **Elective 6** | | | | | |
| 36 | 22CSE33 | Natural Language Processing | 3 | 0 | 0 | 3 | AI |
| 37 | 22CSE34 | Cyber Forensics | 3 | 0 | 0 | 3 | NS |
| 38 | 22CSE35 | Predictive Data Analytics | 3 | 0 | 0 | 3 | AI |
| 39 | 22CSE36 | Software Quality and Testing | 3 | 0 | 0 | 3 | SDE |
| 40 | 22CSE37 | Randomized Algorithms | 3 | 0 | 0 | 3 | SD |

## B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2022
**(for the students admitted in the academic year 2023-24)**

| SEMESTER – I | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22EGT11 | Communication Skills I | 3 | 0 | 0 | 3 | 40 | 60 | 100 | HS |
| 22MAC11 | Matrices and Ordinary Differential Equations | 3 | 1* | 2* | 4 | 50 | 50 | 100 | BS |
| 22CYT12 | Chemistry for Computer Systems | 3 | 0 | 0 | 3 | 40 | 60 | 100 | BS |
| 22CST11 | Problem Solving and Design | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CSC12 | Programming in C | 3 | 0 | 2 | 4 | 100 | 0 | 100 | ES |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSL11 | Problem Solving and Design Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22CYL12 | Chemistry Laboratory for Computer Systems | 0 | 0 | 2 | 1 | 60 | 40 | 100 | BS |
| 22GCL11 | Foundation Lab – Manufacturing, Design and Robotics | 0 | 0 | 6 | 3 | 100 | 0 | 100 | ES |
| 22TAM01 | Heritage of Tamils | 1 | 0 | 0 | 1 | 100 | 0 | 100 | HS |
| 22MNT11 | Student Induction Program | --- | --- | --- | 0 | 100 | 0 | 100 | MC |
| **Total Credits to be earned** | | | | | **23** | | | | |

| SEMESTER – II | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22EGT21 | Communication Skills II | 3 | 0 | 0 | 3 | 40 | 60 | 100 | HS |
| 22MAC23 | Probability and Statistics | 3 | 1* | 2* | 4 | 50 | 50 | 100 | BS |
| 22PHT22 | Physics for Computer Systems | 3 | 0 | 0 | 3 | 40 | 60 | 100 | BS |
| 22CST21 | Programming and Linear Data Structures | 3 | 0 | 0 | 3 | 40 | 60 | 100 | ES |
| 22CSC24 | Fundamentals of Java Programming | 3 | 0 | 2 | 4 | 100 | 0 | 100 | PC |
| 22TAM02 | Tamils and Technology | 1 | 0 | 0 | 1 | 100 | 0 | 100 | HS |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSL21 | Programming and Linear Data Structures Laboratory | 0 | 0 | 2 | 1 | 100 | 0 | 100 | ES |
| 22PSL22 | Physics Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | BS |
| 22GCL12 | Foundation Laboratory - Electrical, IoT and Web | 0 | 0 | 6 | 3 | 100 | 0 | 100 | ES |
| 22VEC11 | Yoga and Values for Holistic Education | 1 | 0 | 1 | 1 | 100 | 0 | 100 | HS |
| **Total Credits to be earned** | | | | | **24** | | | | |

**B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2022**
**(for the students admitted in the academic year 2023-24)**

| SEMESTER – III | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22MAT35 | Discrete Mathematical Structures | 3 | 1 | 0 | 4 | 40 | 60 | 100 | BS |
| 22CDT21 | Design Thinking | 3 | 0 | 0 | 3 | 100 | 0 | 100 | PC |
| 22CST32 | Data Structures | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST33 | Computer Organization | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST34 | Digital Principles and Design | 3 | 0 | 0 | 3 | 50 | 50 | 100 | ES |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSL31 | Digital Principles and Design Laboratory | 0 | 0 | 2 | 1 | 100 | 0 | 100 | ES |
| 22CSL32 | Data Structures Laboratory | 0 | 0 | 2 | 1 | 100 | 0 | 100 | PC |
| 22GCT31 | Universal Human Values | 2 | 0 | 0 | 2 | 100 | 0 | 100 | HS |
| **Total Credits to be earned** | | | | | **20** | | | | |

| SEMESTER – IV | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22CSC41 | Python Programming and Frameworks | 3 | 0 | 2 | 4 | 100 | 0 | 100 | ES |
| 22CST41 | Database Management Systems | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST42 | Web Technology | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST43 | Operating Systems | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST44 | Design and Analysis of Algorithm | 3 | 1 | 0 | 4 | 40 | 60 | 100 | PC |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSL41 | Database Management Systems Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22CSL42 | Web Technology Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22GCL41/ 22GCI41 | Professional Skills Training I / Industrial Training I | -- | -- | -- | 2 | 100 | 0 | 100 | EC |
| 22GEL31 | Communication Skills Development Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | HS |
| **Total Credits to be earned** | | | | | **22** | | | | |

**B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2022**
**(for the students admitted in the academic year 2023-24)**

| SEMESTER – V | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Cate gory** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22CST51 | Internet of Things and Cloud Computing | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST52 | Computer Networks | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST53 | Theory of Computation | 3 | 1 | 0 | 4 | 40 | 60 | 100 | PC |
| 22CSC51 | Agile Methodologies | 3 | 0 | 2 | 4 | 50 | 50 | 100 | PC |
| | Professional Elective – I | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Open Elective – I | 3 | 0/1 | 2/0 | 4 | 40/ 50 | 60/ 50 | 100 | OE |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSL51 | Internet of Things and Cloud Computing Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22CSL52 | Computer Networks Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22GCL51/ 22GCI51 | Professional Skills Training II / Industrial Training II | -- | -- | -- | 2 | 100 | 0 | 100 | EC |
| **Total Credits to be earned** | | | | | **25** | | | | |

| SEMESTER – VI | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Cate gory** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22CST61 | Compiler Design | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 22CST62 | Machine Learning | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| | Professional Elective – 2 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Open Elective – 2 | 3 | 1/0 | 0/2 | 4 | 40/ 50 | 60/ 50 | 100 | OE |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSL61 | Compiler Design Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22CSL62 | Machine Learning Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 22CSP62 | Project Work I | 0 | 0 | 10 | 5 | 50 | 50 | 100 | EC |
| 22MNT31 | Environmental Science | 2 | 0 | 0 | 0 | 100 | 0 | 100 | MC |
| 22GEP61 | Comprehensive Test and Viva | --- | --- | --- | 2 | 100 | 0 | 100 | EC |
| **Total Credits to be earned** | | | | | **22** | | | | |

**B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2022**
**(for the students admitted in the academic year 2023-24)**

| SEMESTER – VII | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| 22GCT71 | Engineering Economics and Management | 3 | 0 | 0 | 3 | 40 | 60 | 100 | HS |
| 22CSC71 | Deep Learning | 3 | 0 | 2 | 4 | 40 | 60 | 100 | PC |
| | Professional Elective – IV | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Professional Elective – III | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Open Elective – III | 3 | 0 | 0 | 3 | 40 | 60 | 100 | OE |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSP72 | Project Work II Phase I | 0 | 0 | 12 | 6 | 50 | 50 | 100 | EC |
| **Total Credits to be earned** | | | | | **22** | | | | |

| SEMESTER – VIII | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | | **Category** |
| | | **L** | **T** | **P** | | **CA** | **ESE** | **Total** | |
| **Theory/Theory with Practical** | | | | | | | | | |
| | Professional Elective – V | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Open Elective – IV | 3 | 0 | 0 | 3 | 40 | 60 | 100 | OE |
| **Practical / Employability Enhancement** | | | | | | | | | |
| 22CSP81 | Project Work II Phase II | 0 | 0 | 8 | 4 | 50 | 50 | 100 | EC |
| **Total Credits to be earned** | | | | | **10** | | | | |

**Total Credits : 168**

**B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2022**
**(for the students admitted in the academic year 2023-24)**

## LIST OF PROFESSIONAL ELECTIVE COURSES

| S. No. | Course Code | Course Name | L | T | P | C | Domain |
|---|---|---|---|---|---|---|---|
| | | **Semester V** | | | | | |
| | | **Elective 1** | | | | | |
| 1. | 22CSE01 | Mobile Communications | 3 | 0 | 0 | 3 | NS |
| 2. | 22CSE02 | Data Science | 3 | 0 | 0 | 3 | AI |
| 3. | 22CSE03 | Building Enterprise Applications | 3 | 0 | 0 | 3 | SDE |
| 4. | 22CSE04 | Artificial Intelligence | 3 | 0 | 0 | 3 | AI |
| 5. | 22CSE05 | C# and .NET Framework | 3 | 0 | 0 | 3 | SD |
| 6. | 22CSE06 | Unix Internals | 3 | 0 | 0 | 3 | SD |
| 7. | 22CSE07 | Data Warehousing and Data Mining | 3 | 0 | 0 | 3 | SDE |
| | | **Semester VI** | | | | | |
| | | **Elective 2** | | | | | |
| 8. | 22CSE08 | Cryptography and Network Security | 3 | 0 | 0 | 3 | NS |
| 9. | 22CSE09 | Business Intelligence and its Applications | 3 | 0 | 0 | 3 | AI |
| 10. | 22CSE10 | Graph Theory | 3 | 0 | 0 | 3 | SD |
| 11. | 22CSE11 | Distributed Systems | 3 | 0 | 0 | 3 | AI |
| 12. | 22CSE12 | Deep Learning and its Applications | 3 | 0 | 0 | 3 | AI |
| 13. | 22CSE13 | Graphics and Multimedia | 3 | 0 | 0 | 3 | SD |
| | | **Semester VII** | | | | | |
| | | **Elective 3** | | | | | |
| 14. | 22CSE14 | Blockchain Technologies | 3 | 0 | 0 | 3 | NS |
| 15. | 22CSE15 | Decision Support Systems | 3 | 0 | 0 | 3 | AI |
| 16. | 22GEE02 | Total Quality Management | 3 | 0 | 0 | 3 | GE |
| 17. | 22CSE16 | Social Network Analysis | 3 | 0 | 0 | 3 | SD |
| 18. | 22CSE17 | Human Computer Interface | 3 | 0 | 0 | 3 | SDE |
| 19. | 22CSE18 | Optimization Techniques | 3 | 0 | 0 | 3 | SD |
| 20. | 22CSE19 | Web Mining | 3 | 0 | 0 | 3 | SD |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Elective 4 | | | | | |
| 21. | 22CSE20 | Wireless and Sensor Networks | 3 | 0 | 0 | 3 | NS |
| 22. | 22CSE21 | Modeling and Simulation | 3 | 0 | 0 | 3 | SD |
| 23. | 22CSE22 | Parallel Computing Architecture and Programming | 3 | 0 | 0 | 3 | SD |
| 24, | 22CSE23 | Digital Marketing | 3 | 0 | 0 | 3 | SD |
| 25. | 22CSF01 | Big Data Analytics | 2 | 0 | 2 | 3 | SDE |
| 26. | 22CSE24 | Cross Platform Application Development | 3 | 0 | 0 | 3 | SD |
| 27. | 22CSE25 | Approximation Algorithms | 3 | 0 | 0 | 3 | SD |
| 28. | 22GEE01 | Fundamentals of Research | 3 | 0 | 0 | 3 | GE |
| 29. | 22CSE26 | Software Defined Networks | 3 | 0 | 0 | 3 | GE |
| 30. | 22CSE27 | Information Security | 3 | 0 | 0 | 3 | NS |
| 31. | 22CSE28 | Intelligent Systems | 3 | 0 | 0 | 3 | NS |
| 32. | 22CSE29 | Software Project Management | 3 | 0 | 0 | 3 | SDE |
| 33. | 22CSE30 | Data Visualization Techniques | 3 | 0 | 0 | 3 | SDE |
| 34. | 22CSE31 | Information Retrieval | 3 | 0 | 0 | 3 | AI |
| 35. | 22CSE32 | Computer Vision | 3 | 0 | 0 | 3 | SD |
| | | **Semester VIII** | | | | | |
| | | **Elective 5** | | | | | |
| 36. | 22CSE33 | Natural Language Processing | 3 | 0 | 0 | 3 | AI |
| 37. | 22CSE34 | Cyber Forensics | 3 | 0 | 0 | 3 | NS |
| 38. | 22CSE35 | Predictive Data Analytics | 3 | 0 | 0 | 3 | AI |
| 39. | 22CSE36 | Software Quality and Testing | 3 | 0 | 0 | 3 | SDE |
| 40. | 22CSE37 | Randomized Algorithms | 3 | 0 | 0 | 3 | SD |

*** AI – Artificial Intelligence, SD-Systems Development, SDE – Software Development and Engineering, NS- Networks and Security, GE – General Engineering**

| OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE) | | | | | | | |
|---|---|---|---|---|---|---|---|
| S. No. | Course Code | Course Name | L | T | P | C | Sem |
| 1. | 22CSX01 | Fundamentals of Database | 3 | 0 | 2 | 4 | 5 |
| 2. | 22CSX02 | Data Science for Engineers | 3 | 0 | 2 | 4 | 5 |
| 3. | 22CSX03 | Enterprise Application Development Using Java | 3 | 0 | 2 | 4 | 5 |
| 4. | 22CSO01 | Computational Science for Engineers | 3 | 1 | 0 | 4 | 5 |
| 5. | 22CSO02 | Formal Languages and Automata Theory | 3 | 1 | 0 | 4 | 5 |
| 6. | 22GEO03 | Design Thinking for Engineers | 3 | 1 | 0 | 4 | 5 |
| 7. | 22CSX04 | Foundations of Machine Learning | 3 | 0 | 2 | 4 | 6 |
| 8. | 22CSX05 | Web Engineering | 3 | 0 | 2 | 4 | 6 |
| 9. | 22CSO03 | Nature Inspired Optimization Techniques | 3 | 0 | 0 | 3 | 7 |
| 10. | 22CSO04 | Machine Translation | 3 | 0 | 0 | 3 | 8 |
| 11. | 22CSO05 | Fundamentals of Blockchain | 3 | 0 | 0 | 3 | 8 |

| OPEN ELECTIVE COURSES OFFERED BY OTHER DEPARTMENTS (OE) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No.** | **Course Code** | **Course Name** | **L** | **T** | **P** | **C** | **OFFERED BY** |
| | | **SEMESTER V** | | | | | |
| 1. | 22CEX01 | Remote Sensing and its Applications | 3 | 0 | 2 | 4 | CIVIL |
| 2. | 22MEX01 | Renewable Energy Sources | 3 | 0 | 2 | 4 | MECH |
| 3. | 22MTO01 | Design of Mechatronics Systems | 3 | 1 | 0 | 4 | MTS |
| 4. | 22MTX01 | Data Acquisition and Virtual Instrumentation | 3 | 0 | 2 | 4 | MTS |
| 5. | 22MTX02 | Factory Automation | 3 | 0 | 2 | 4 | MTS |
| 6. | 22AUX01 | Automotive Engineering | 3 | 0 | 2 | 4 | AUTO |
| 7. | 22ECX01 | Basics of Electronics in Automation Appliances | 3 | 0 | 2 | 4 | ECE |
| 8. | 22ECX02 | Image Processing | 3 | 0 | 2 | 4 | ECE |
| 9. | 22EEO01 | Solar and Wind Energy Systems | 3 | 1 | 0 | 4 | EEE |
| 10. | 22EEO02 | Electrical Wiring and Lighting | 3 | 1 | 0 | 4 | EEE |
| 11. | 22EEO03 | Programmable Logic Controller and SCADA | 3 | 1 | 0 | 4 | EEE |
| 12. | 22EEO04 | Analog and Digital Electronics | 3 | 1 | 0 | 4 | EEE |
| 13. | 22EEO05 | Power Electronics and Drives | 3 | 1 | 0 | 4 | EEE |
| 14. | 22EEO06 | Sensors and Actuators | 3 | 1 | 0 | 4 | EEE |
| 15. | 22EIO01 | Measurements and Instrumentation | 3 | 1 | 0 | 4 | EIE |
| 16. | 22EIO02 | Biomedical Instrumentation and Applications | 3 | 1 | 0 | 4 | EIE |
| 17. | 22EIO03 | Industrial Automation | 3 | 1 | 0 | 4 | EIE |
| 18. | 22CSX01 | Fundamentals of Databases | 3 | 0 | 2 | 4 | CSE |
| 19. | 22CSX02 | Data science for Engineers | 3 | 0 | 2 | 4 | CSE |
| 20. | 22CSX03 | Enterprise Application Development Using Java | 3 | 0 | 2 | 4 | CSE |
| 21. | 22CSO01 | Computational science for Engineers | 3 | 1 | 0 | 4 | CSE |
| 22. | 22CSO02 | Formal Languages and Automata Theory | 3 | 1 | 0 | 4 | CSE |
| 23. | 22ITO01 | Artificial Intelligence | 3 | 1 | 0 | 4 | IT |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24. | 22ITX01 | Next Generation Databases | 3 | 0 | 2 | 4 | IT |
| 25. | 22GEX02 | NCC Studies (Air Wing) - 1 | 3 | 0 | 2 | 4 | IT |
| 26. | 22CDO01 | Fundamentals of User Experience Design | 3 | 1 | 0 | 4 | CSD |
| 27. | 22ADO01 | Data Warehousing and Data Mining | 3 | 1 | 0 | 4 | AIDS |
| 28. | 22ALO01 | Business Intelligence | 3 | 1 | 0 | 4 | AIML |
| 29. | 22CHO01 | Industrial Enzymology | 3 | 1 | 0 | 4 | CHEM |
| 30. | 22CHO02 | Waste to Energy Conversion | 3 | 1 | 0 | 4 | CHEM |
| 31. | 22CHO03 | Applied Nanotechnology | 3 | 1 | 0 | 4 | CHEM |
| 32. | 22FTX01 | Baking Technology | 3 | 0 | 2 | 4 | FT |
| 33. | 22FTO01 | Food Processing Technology | 3 | 1 | 0 | 4 | FT |
| 34. | 22MAO01 | Mathematical Foundations for Machine Learning | 3 | 1 | 0 | 4 | MATHS |
| 35. | 22MAO02 | Numerical Computing | 3 | 1 | 0 | 4 | MATHS |
| 36. | 22MAO03 | Stochastic Processes and Queuing Theory | 3 | 1 | 0 | 4 | MATHS |
| 37. | 22MAO04 | Statistics for Engineers | 3 | 1 | 0 | 4 | MATHS |
| 38. | 22PHO01 | Thin Film Technology | 3 | 1 | 0 | 4 | PHYSICS |
| 39. | 22PHO02 | High Energy Storage Devices | 3 | 1 | 0 | 4 | PHYSICS |
| 40. | 22PHO03 | Structural and Optical Characterization of Materials | 3 | 1 | 0 | 4 | PHYSICS |
| 41. | 22CYO01 | Instrumental Methods of Analysis | 3 | 1 | 0 | 4 | CHEMISTRY |
| 42. | 22CYO02 | Chemistry Concepts for Competitive Examinations | 3 | 1 | 0 | 4 | CHEMISTRY |
| 43. | 22CYO03 | Organic Chemistry for Industry | 3 | 1 | 0 | 4 | CHEMISTRY |
| | | **SEMESTER VI** | | | | | |
| 44. | 22CEO01 | Disaster Management | 3 | 1 | 0 | 4 | CIVIL |
| 45. | 22MEX02 | Design of Experiments | 3 | 0 | 2 | 4 | MECH |
| 46. | 22MTO02 | Robotics | 3 | 1 | 0 | 4 | MTS |
| 47. | 22MTO03 | 3D Printing and Design | 3 | 1 | 0 | 4 | MTS |
| 48. | 22AUO01 | Automotive Electronics | 3 | 1 | 0 | 4 | ECE |
| 49. | 22ECX03 | PCB Design and Fabrication | 3 | 0 | 2 | 4 | ECE |
| 50. | 22EEO07 | Energy Conservation and Management | 3 | 1 | 0 | 4 | EEE |
| 51. | 22EEO08 | Microprocessors and Microcontrollers Interfacing | 3 | 1 | 0 | 4 | EEE |
| 52. | 22EEO09 | Electrical Safety | 3 | 1 | 0 | 4 | EEE |

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|---|---|---|---|---|---|---|---|
| 53. | 22EEO10 | VLSI System Design | 3 | 1 | 0 | 4 | EEE |
| 54. | 22EEO11 | Automation for Industrial Applications | 3 | 1 | 0 | 4 | EEE |
| 55. | 22EIO04 | PLC Programming with High Level Languages | 3 | 1 | 0 | 4 | EIE |
| 56. | 22EIO05 | Virtual Instrumentation | 3 | 1 | 0 | 4 | EIE |
| 57. | 22CSX04 | Foundations of Machine Learning | 3 | 0 | 2 | 4 | CSE |
| 58. | 22CSX05 | Web Engineering | 3 | 0 | 2 | 4 | CSE |
| 59. | 22ITX02 | Advanced Java Programming | 3 | 0 | 2 | 4 | IT |
| 60. | 22ITO02 | Internet of Things | 3 | 1 | 0 | 4 | IT |
| 61. | 22ITO03 | Fundamentals of Software Development | 3 | 1 | 0 | 4 | IT |
| 62. | 22ITO04 | Mobile Application Development | 3 | 1 | 0 | 4 | IT |
| 63. | 22CDX01 | Fundamentals of User Interactive Design | 3 | 0 | 2 | 4 | CSD |
| 64. | 22ADX01 | Data Visualization | 3 | 0 | 2 | 4 | AIDS |
| 65. | 22ALX01 | Data Exploration and Visualization Techniques | 3 | 0 | 2 | 4 | AIML |
| 66. | 22CHO04 | Air Pollution Monitoring and Control | 3 | 1 | 0 | 4 | CHEM |
| 67. | 22CHO05 | Paints and Coatings | 3 | 1 | 0 | 4 | CHEM |
| 68. | 22CHO06 | Powder Technology | 3 | 1 | 0 | 4 | CHEM |
| | 22FTX02 | Processing of milk and milk products | 3 | 0 | 2 | 4 | FT |
| | 22FTX03 | Processing of Fruits and Vegetables | 3 | 0 | 2 | 4 | FT |
| 69. | 22MAO05 | Graph Theory and its Applications | 3 | 1 | 0 | 4 | MATHS |
| 70. | 22MAX01 | Data Analytics using R Programming | 3 | 0 | 2 | 4 | MATHS |
| 71. | 22MAO06 | Operations Research | 3 | 1 | 0 | 4 | MATHS |
| 72. | 22MAO07 | Number Theory and Cryptography | 3 | 1 | 0 | 4 | MATHS |
| 73. | 22PHO04 | Synthesis, Characterization and Biological Applications of Nanomaterials | 3 | 1 | 0 | 4 | PHYSICS |
| 74. | 22PHO05 | Techniques of Crystal Growth | 3 | 1 | 0 | 4 | PHYSICS |
| 75. | 22CYO04 | Corrosion Science and Engineering | 3 | 1 | 0 | 4 | CHEMISTRY |
| 76. | 22CYO05 | Chemistry of Cosmetics in Daily Life | 3 | 1 | 0 | 4 | CHEMISTRY |
| 77. | 22CYO06 | Nanocomposite Materials | 3 | 1 | 0 | 4 | CHEMISTRY |
| | | **SEMESTER VII** | | | | | |
| 78. | 22CEO02 | Introduction to Smart Cities | 3 | 0 | 0 | 3 | CIVIL |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 79. | 22CEO03 | Environmental Health and Safety | 3 | 0 | 0 | 3 | CIVIL |
| 80. | 22MEO01 | Fundamentals of Ergonomics | 3 | 0 | 0 | 3 | MECH |
| 81. | 22MEO02 | Principles of Management and Industrial Psychology | 3 | 0 | 0 | 3 | MECH |
| 82. | 22MEO03 | Waste Heat Recovery System and Storage | 3 | 0 | 0 | 3 | MECH |
| 83. | 22MTO04 | Drone System Technology | 3 | 0 | 0 | 3 | MTS |
| 84. | 22AUO02 | Vehicle Maintenance | 3 | 0 | 0 | 3 | AUTO |
| 85. | 22ECO01 | Wearable Devices | 3 | 0 | 0 | 3 | ECE |
| 86. | 22ECX04 | Electronic Hardware and Troubleshooting | 2 | 0 | 2 | 3 | ECE |
| 87. | 22EEO12 | Electric Vehicle | 3 | 0 | 0 | 3 | EEE |
| 88. | 22EEO13 | E-Waste Management | 3 | 0 | 0 | 3 | EEE |
| 89. | 22EEO14 | Embedded System Design | 3 | 0 | 0 | 3 | EEE |
| 90. | 22EEO15 | Energy Storage Systems and Controllers | 3 | 0 | 0 | 3 | EEE |
| 91. | 22EEO16 | AI Techniques for Engineering Applications | 3 | 0 | 0 | 3 | EEE |
| 92. | 22EIO06 | Introduction to Distributed Control Systems | 3 | 0 | 0 | 3 | EIE |
| 93. | 22EIO07 | Instrumentation in Aircraft Navigation and Control | 3 | 0 | 0 | 3 | EIE |
| 94. | 22EIO08 | Industry 4.0 with Industrial IoT | 3 | 0 | 0 | 3 | EIE |
| 95. | 22EIO09 | Industrial Data Communication | 3 | 0 | 0 | 3 | EIE |
| 96. | 22EIO10 | Wireless Instrumentation | 3 | 0 | 0 | 3 | EIE |
| 97. | 22EIO11 | Instrumentation Techniques in Agriculture | 3 | 0 | 0 | 3 | EIE |
| 98. | 22CSO03 | Nature Inspired optimization techniques | 3 | 0 | 0 | 3 | CSE |
| 99. | 22ITO05 | Fundamentals of Cloud Computing | 3 | 0 | 0 | 3 | IT |
| 100. | 22CDO02 | Introduction to Mobile Game Design | 3 | 0 | 0 | 3 | CSD |
| 101. | 22CDO03 | Introduction to Graphics Design | 3 | 0 | 0 | 3 | CSD |
| 102. | 22ADO02 | Neural Networks and Deep Learning | 3 | 0 | 0 | 3 | AIDS |
| 103. | 22ALO02 | Industrial Machine Learning | 3 | 0 | 0 | 3 | AIML |
| 104. | 22CHO07 | Hydrogen Energy | 3 | 0 | 0 | 3 | CHEM |
| 105. | 22CHO08 | Rubber Technology | 3 | 0 | 0 | 3 | CHEM |
| 106. | 22FTO02 | Principles of Food safety | 3 | 0 | 0 | 3 | FT |
| 107. | 22FTO03 | Fundamentals of Food Packaging and Storage | 3 | 0 | 0 | 3 | FT |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 108. | 22MAO08 | Non-Linear Optimization | 3 | 0 | 0 | 3 | MATHS |
| 109. | 22MAO09 | Optimization for Engineers | 3 | 0 | 0 | 3 | MATHS |
| 110. | 22CYO07 | Waste and Hazardous Waste Management | 3 | 0 | 0 | 3 | CHEMISTRY |
| 111. | 22CYO08 | Chemistry in Every day Life | 3 | 0 | 0 | 3 | CHEMISTRY |
| | | **SEMESTER VIII** | | | | | |
| 112. | 22CEO04 | Infrastructure Planning and Management | 3 | 0 | 0 | 3 | CIVIL |
| 113. | 22CEO05 | Environmental Laws and Policy | 3 | 0 | 0 | 3 | CIVIL |
| 114. | 22MEO04 | Safety Measures for Engineers | 3 | 0 | 0 | 3 | MECH |
| 115. | 22MEO05 | Energy Conservation in Thermal Equipments | 3 | 0 | 0 | 3 | MECH |
| 116. | 22MEO06 | Climate Change and New Energy Technology | 3 | 0 | 0 | 3 | MECH |
| 117. | 22MTO05 | Micro and Nano Electromechanical Systems | 3 | 0 | 0 | 3 | MTS |
| 118. | 22AUO03 | Public Transport Management | 3 | 0 | 0 | 3 | ECE |
| 119. | 22AUO04 | Autonomous Vehicles | 3 | 0 | 0 | 3 | ECE |
| 120. | 22ECO02 | Optical Engineering | 3 | 0 | 0 | 3 | EEE |
| 121. | 22EEO17 | Smart Grid Technologies | 3 | 0 | 0 | 3 | EEE |
| 122. | 22EEO18 | Biomass Energy Systems | 3 | 0 | 0 | 3 | EEE |
| 123. | 22EIO12 | Environmental Sensors | 3 | 0 | 0 | 3 | EIE |
| 124. | 22EIO13 | Pollution Control and Management | 3 | 0 | 0 | 3 | EIE |
| 125. | 22CSO04 | Machine Translation | 3 | 0 | 0 | 3 | CSE |
| 126. | 22CSO05 | Fundamentals of Blockchain | 3 | 0 | 0 | 3 | CSE |
| 127. | 22ITO06 | Introduction to Ethical Hacking | 3 | 0 | 0 | 3 | IT |
| 128. | 22ITO07 | Business Continuity Planning | 3 | 0 | 0 | 3 | IT |
| 129. | 22CDX02 | Virtual Reality and Augmented Reality | 3 | 0 | 0 | 3 | CSD |
| 130. | 22ADO03 | Business Analytics | 3 | 0 | 0 | 3 | AIDS |
| 131. | 22ALO03 | Machine Learning for Smart Cities | 3 | 0 | 0 | 3 | AIML |
| 132. | 22CHO09 | Industrial Accident Prevention and Management | 3 | 0 | 0 | 3 | CHEM |
| 133. | 22CHO10 | Electrochemical Engineering | 3 | 0 | 0 | 3 | CHEM |
| 134. | 22CHO11 | Smart and Functional Materials | 3 | 0 | 0 | 3 | CHEM |
| 135. | 22FTO04 | Food Ingredients | 3 | 0 | 0 | 3 | FT |
| 136. | 22FTO05 | Food and Nutrition | 3 | 0 | 0 | 3 | FT |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 137. | 22CYO09 | Chemistry of Nutrition for Women Health | 3 | 0 | 0 | 3 | CHEMISTRY | |

## GENERAL OPEN ELECTIVE
## (Common to All BE/BTech branches)

| SNo | Course Code | **Course Title** | L | T | P | C | Offering Department | Semester |
|---|---|---|---|---|---|---|---|---|
| 1. | 22GEO01 | German Language Level 1 | 4 | 0 | 0 | 4 | ECE | ALL |
| 2. | 22GEO02 | Japanese Language Level 1 | 4 | 0 | 0 | 4 | ECE | ALL |
| 3. | 22GEO03 | Design Thinking for Engineers | 3 | 1 | 0 | 4 | CSE | 5 |
| 4. | 22GEO04 | Innovation and Business Model Development | 3 | 1 | 0 | 4 | MTS | 6 |
| 5. | 22GEO05 | German Language Level 2 | 4 | 0 | 0 | 4 | ECE | ALL |
| 6. | 22GEO06 | German Language Level 3 | 3 | 0 | 0 | 3 | ECE | ALL |
| 7. | 22GEO07 | German Language Level 4 | 3 | 0 | 0 | 3 | ECE | ALL |
| 8. | 22GEO08 | Japanese Language Level 2 | 4 | 0 | 0 | 4 | ECE | ALL |
| 9. | 22GEO09 | Japanese Language Level 3 | 3 | 0 | 0 | 3 | ECE | ALL |
| 10. | 22GEO10 | Japanese Language Level 4 | 3 | 0 | 0 | 3 | ECE | ALL |
| 11. | 22GEO11 | French Language Level 1 | 4 | 0 | 0 | 4 | ECE | ALL |
| 12. | 22GEO12 | French Language Level 2 | 4 | 0 | 0 | 4 | ECE | ALL |
| 13. | 22GEO13 | French Language Level 3 | 3 | 0 | 0 | 3 | ECE | ALL |
| 14. | 22GEO14 | Spanish Language Level 1 | 4 | 0 | 0 | 4 | ECE | ALL |
| 15. | 22GEO15 | Spanish Language Level 2 | 4 | 0 | 0 | 4 | ECE | ALL |
| 16. | 22GEO16 | Spanish Language Level 3 | 3 | 0 | 0 | 3 | ECE | ALL |
| 17. | 22GEO17 | Entrepreneurship Development | 3 | 0 | 0 | 3 | MTS | 7 |
| 18. | 22GEX01 | NCC Studies (Army Wing) - I | 3 | 0 | 2 | 4 | EEE | 5 / 6 |
| 19. | 22GEX02 | NCC Studies (Air Wing) - 1 | 3 | 0 | 2 | 4 | IT | 5 / 6 |
| 20. | 22MBO01 | Cost Accounting for Engineers | 3 | 1 | 0 | 4 | MBA | 5 |
| 21. | 22MBO02 | Economic Analysis for Decision Making | 3 | 1 | 0 | 4 | MBA | 6 |
| 22. | 22MBO03 | Marketing Analytics | 3 | 1 | 0 | 4 | MBA | 7 |

| 22EGT11 - COMMUNICATION SKILLS - I | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to All Engineering and Technology Branches) | | | | | | | |
| **Programme & Branch** | **All B.E./B.Tech. Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **1** | **HS** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course is designed to impart required levels of Communication Skills and Proficiency in English language necessary for different professional contexts. | |
| **Unit – I** | **Grammar, Vocabulary, Listening, Speaking, Reading & Writing** | **9** |
| **Grammar:** Parts of speech **-** Tenses **-** Types of sentences**:** Assertive, Imperative, Interrogative & Exclamatory **–** Affirmative & Negative **-** Gerunds & Infinitives **- Vocabulary:** Affixes **-** Synonyms & Antonyms **- Listening:** Types of listening **-** Barriers to listening **-** Listening to short talks **-** TV shows **- Speaking:** Verbal & Non-verbal communication **-** Pair conversation **-** Role play **- Reading:** Types of Reading **–** Intensive: scanning, word by word, survey **- Writing:** Dialogue writing, Informal Letters **-** Paragraph writing | | |
| **Unit – II** | **Grammar, Vocabulary, Listening, Speaking, Reading & Writing** | **9** |
| **Grammar:** Voices **-** Impersonal passives **- Vocabulary:** Homonyms, Homophones & Homographs **- Listening:** Importance of listening **-** Listening to announcements & radio broadcasts **- Speaking:** Persuasive & Impromptu talks **-** Narrating a story **- Reading:** Reading comprehension **-** Articles from Newspapers/Magazines **-** Cloze exercises **- Writing:** Essay writing, Jumbled sentences | | |
| **Unit – III** | **Grammar, Vocabulary, Listening, Speaking, Reading & Writing** | **9** |
| **Grammar:** Prepositions **- Vocabulary:** Compound Nouns **- Listening:** Listening to TED Talks, Commentaries **- Speaking:** Self Introduction **- Reading:** Extensive: speed, skimming **-** Identifying lexical & contextual meanings **- Writing:** Instructions & Warnings **-** Formal letters: Seeking permission for Industrial visits & Inviting guests | | |
| **Unit – IV** | **Grammar, Vocabulary, Listening, Speaking, Reading & Writing** | **9** |
| **Grammar:** Articles & Determiners **- Vocabulary:** Technical Vocabulary **-** Analogy **-** Unscrambling words **-** Logical reasoning **- Listening:** Listening to conversations - **Speaking:** Tongue twisters **-** Skill Sharing **-** Note-taking **- Reading:** Note making **-** Paraphrasing & Summarizing **- Writing:** Recommendations & Suggestions **-** Business letters: Enquiry, Calling for quotations & placing orders | | |
| **Unit – V** | **Grammar, Vocabulary, Listening, Speaking, Reading & Writing** | **9** |
| **Grammar:** Cause and effect expressions **- Vocabulary:** Abbreviations & acronyms, Definitions **Listening:** Listening to eminent personalities **- Speaking:** Commonly mispronounced words **-** Welcome address, Chief guest address & Vote of thanks **- Reading -** IELTS type passages **- Writing:** Preparing transcript for a speech **-** Interpreting news articles & advertisements | | |
| | | **Total:45** |

| **TEXT BOOK:** | |
|---|---|
| 1. | Sanjay Kumar & Pushp Lata, “Communication Skills”, 2nd Edition, Oxford University Press, New Delhi, 2018. |

| **REFERENCES:** | |
|---|---|
| 1. | Ashraf Rizvi, "Effective Technical Communication", 2nd Edition, McGraw-Hill India, 2017. |
| 2. | S. P. Dhanavel, "English and Communication Skills for Students of Science and Engineering", Orient BlackSwan Publishers, Hyderabad, 2009. |
| 3. | Jack C. Richards and Chuck Sandy, “Passages” Student’s Book 1, 3rd Edition, Cambridge University Press, New York, 2014. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | use language effectively by acquiring vocabulary and syntax in context | Applying (K3) |
| CO2 | listen and comprehend different spoken discourses from a variety of situations | Applying (K3) |
| CO3 | speak confidently in different professional contexts and with peers | Creating (K6) |
| CO4 | comprehend different genres of texts by adopting various reading strategies | Understanding (K2) |
| CO5 | write legibly and flawlessly at varied professional contexts proficiently with appropriate choice of words and structures | Creating (K6) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 2 | | | 1 | 3 | 1 | 1 |
| CO2 | | | | | | | | | 2 | 3 | | 1 |
| CO3 | | | | | | | | | 2 | 3 | | 2 |
| CO4 | | | | | | 1 | | | | 3 | 1 | 1 |
| CO5 | | | | | | | | | | 3 | | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | | 37 | 30 | | | 33 | 100 |
| CAT2 | | 30 | 30 | | | 40 | 100 |
| CAT3 | | 33 | 34 | | | 33 | |
| ESE | | 17 | 63 | | | 20 | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22MAC11 - MATRICES AND ORDINARY DIFFERENTIAL EQUATIONS | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to all Engineering and Technology branches) | | | | | | | |
| **Programme & Branch** | **All BE/BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **1** | **BS** | **3** | **1*** | **2*** | **4** |

| | | |
|---|---|---|
| **Preamble** | To provide the skills to the students for solving different real time problems by applying matrices and ordinary differential equations. | |
| **Unit – I** | **Matrices:** | **9+3** |
| Introduction – Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof) – Cayley – Hamilton theorem (Statement and applications only) - Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Nature of Quadratic forms - Reduction of quadratic form to canonical form by orthogonal transformation – Applications of Eigen values and Eigen vectors: Stretching of an elastic membrane. | | |
| **Unit – II** | **Ordinary Differential Equations:** | **9** |
| Introduction – Solutions of First order differential equations: Exact differential equations – Leibnitz's Linear Equation – Bernoulli's equation –Clairaut's equation - Applications: Law of natural growth and decay. | | |
| **Unit – III** | **Ordinary Differential Equations of Higher Order:** | **9** |
| Linear differential equations of second and higher order with constant coefficients - Particular Integrals for the types: $e^{ax}$ – cosax / sinax – $x^n$ – $e^{ax}x^n$, $e^{ax}$ sinbx and $e^{ax}$ cosbx – $x^n$ sinax and $x^n$ cosax – Differential Equations with variable coefficients: Euler-Cauchy's equation – Legendre's equation. | | |
| **Unit – IV** | **Applications of Ordinary Differential Equations:** | **9** |
| Method of variation of parameters – Simultaneous first order linear equations with constant coefficients – Applications of differential equations: Simple harmonic motion – Electric circuits (Differential equations and associated conditions need to be given). | | |
| **Unit – V** | **Laplace Transform:** | **9** |
| Laplace Transform: Conditions for existence – Transform of elementary functions – Basic properties – Derivatives and integrals of transforms –Transforms of derivatives and integrals – Transform of unit step function – Transform of periodic functions. Inverse Laplace transform: Inverse Laplace transform of elementary functions – Partial fraction method – Convolution theorem (Statement only) – Applications: Solution of linear ODE of second order with constant coefficients. | | |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Introduction to MATLAB |
| 2. | Computation of eigen values and eigen vectors |
| 3. | Plotting and visualizing single variable functions |
| 4. | Solving first and second order ordinary differential equations |
| 5. | Solution of Simultaneous first order ODEs |
| 6. | Solving second order ODE by variation of parameters |
| 7. | Determining Laplace and inverse Laplace transform of basic functions |
| 8. | Solution of Second order ODE by employing Laplace transforms |

**Lecture:45, Tutorials and Practical:15, Total:60**

**TEXT BOOK:**

| | |
|---|---|
| 1. | Ramana B V, "Higher Engineering Mathematics", 1st Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018. |

**REFERENCES/ MANUAL / SOFTWARE:**



| | |
|---|---|
| 1. | Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016. |

| | |
|---|---|
| 2. | Kandasamy P., Thilagavathy K. and Gunavathy K., “Engineering Mathematics For First Year B.E/B.Tech”, Reprint Edition 2014, S.Chand and Co., New Delhi. |
| 3. | Duraisamy C., Vengataasalam S., Arun Prakash K. and Suresh M., "Engineering Mathematics - I", 2nd Edition, Pearson India Education, New Delhi, 2018. |
| 4. | Grewal B.S., “Higher Engineering Mathematics" 44thEdition, Khanna Publishers, New Delhi, 2018. |
| 5. | Matrices and Ordinary Differential Equations Laboratory Manual. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | solve engineering problems which needs matrix computations. | Applying (K3), Manipulation (S2) |
| CO2 | identify the appropriate method for solving first order ordinary differential equations. | Applying (K3), Manipulation (S2) |
| CO3 | solve higher order linear differential equations with constant and variable coefficients. | Applying (K3), Manipulation (S2) |
| CO4 | apply the concept of ordinary differential equations for modeling and finding solutions to engineering problems. | Applying (K3), Manipulation (S2) |
| CO5 | apply Laplace Transform to find solutions of Linear Ordinary Differential Equations | Applying (K3), Manipulation (S2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | | 3 | | | | | | | | | |
| CO2 | 3 | 3 | 2 | | 3 | | | | | | | | | |
| CO3 | 3 | 3 | 2 | | 3 | | | | | | | | | |
| CO4 | 3 | 3 | 2 | | 3 | | | | | | | | | |
| CO5 | 3 | 3 | 3 | | 3 | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 20 | 70 | | | | 100 |
| CAT2 | 10 | 20 | 70 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 20 | 70 | | | | 100 |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

*Alternate week

# 22CSC12 - PROGRAMMING IN C

**(Common to Computer Science and Engineering, Information Technology & Computer Science and Design branches)**

| **Programme& Branch** | **BE - Computer Science and Engineering,<br>BTech - Information Technology &<br>BE - Computer Science and Design** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **1** | **BS** | **3** | **0** | **2** | **4** |

| | | |
|---|---|---|
| Preamble | The course aims to provide exposure to problem-solving through programming. It introduces all the fundamental concepts of C Programming. This course provides adequate knowledge to solve problems in various domains. | |
| **Unit - I** | **Introduction to C and Control Statements:** | **9** |

The life cycle of a C program – features of C - Data - Variables – Declaring, assigning, and printing variables – Data Classification: integer, float, and character types – constants – operators and expressions – Control Structures: decision making and looping statements – Input and output functions.

| | | |
|---|---|---|
| **Unit - II** | **Arrays and Functions:** | **9** |

**Arrays:** Declaring and initializing 1D array – Two-dimensional arrays – Multidimensional arrays
**Functions:** Basics, The anatomy of a function – Types of functions based on arguments and return types – Passing 1D and 2D arrays as arguments to functions – Calling function from another function – recursive functions -Variable scope and lifetime - Storage classes

| | | |
|---|---|---|
| **Unit - III** | **Pointers and Strings:** | **9** |

**Pointers:**: Memory access and pointers, pointer basics, declaring, initializing, and dereferencing a pointer, parameter passing mechanisms, operations on pointers
**Strings**: Basics, declaring and initializing strings – pointers for string manipulation – string handling functions: standard and user-defined functions – character oriented functions, Two-dimensional array of strings

| | | |
|---|---|---|
| **Unit - IV** | **User-defined data types:** | **9** |

Structure basics –declaring and defining a structure - attributes of structures – nested structures – arrays as structure members – arrays of structure – Passing structures as arguments to functions - Unions – Bit Fields -Enumerated type

| | | |
|---|---|---|
| **Unit - V** | **File handling :** | **9** |

Basics – Opening and closing files -File pointers and buffer – File read/write functions: fgetc, fputc, fgets, fputs, fscanf, fprintf – File error handling functions - Text and Binary File – Reading and Writing binary files – Manipulating file position – other file handling functions : remove and rename.
Pre-processor directives: #define: macros with and without arguments, # include directive

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Programs for demonstrating the use of different types of operators like arithmetic, logical, relational, and ternary operators (Sequential structures) |
| 2. | Programs to Illustrate the different formatting options for input and output |
| 3. | Programs using decision making statements like ‘if’, ‘else if’, ‘switch’, conditional and unconditional ‘goto’ (Selective structures) |
| 4. | Programs for demonstrating repetitive control statements like ‘for’, ‘while’, and ‘do-while’ (Iterative structures) |
| 5. | Programs for demonstrating one-dimensional arrays |
| 6. | Programs for demonstrating two-dimensional arrays |
| 7. | Programs to demonstrate modular programming concepts using functions (Using built-in and user-defined functions) |
| 8. | Programs to implement various character and string operations with and without built-in library functions. |
| 9. | Programs to demonstrate the use of pointers |
| 10. | Programs to illustrate the use of user-defined data types |
| 11. | Programs to implement various file operations |
| 12. | Programs to demonstrate the use of pre-processor directives |

**Lecture:45, Practical:30, Total:75**

**TEXT BOOK:**

| | |
|---|---|
| 1. | Sumitabha Das, Computer Fundamentals and C Programming, 1st Edition, McGraw Hill, 2018 |

**REFERENCES/ MANUAL / SOFTWARE:**

| | |
|---|---|
| 1. | Yashavant Kanetkar, "Let us C", 16th ,BPB publications,2018. |
| 2. | Reema Thareja., “Programming in C ”, 2nd Edition, Oxford University Press, New Delhi, 2018 |
| 3. | E.Balagurusamy, "Programming in ANSI C", seventh edition, Mc Graw Hill Education,2017. |

| | **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | Identify the appropriate looping and control statements in C and develop applications using these statements | Applying (K3), Precision(S3) |
| CO2 | Develop simple C programs using the concepts of arrays and modular programming | Applying (K3), Precision(S3) |
| CO3 | Recall the basic concepts of pointers and develop C programs using strings and pointers | Applying (K3), Precision(S3) |
| CO4 | Make use of user-defined data types to solve given problems | Applying (K3), Precision(S3) |
| CO5 | Explain various file operations and develop applications using files and pre-processor directives | Applying (K3), Precision(S3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | | | | 1 | 1 | | 1 | 3 | 1 |
| CO2 | 3 | 2 | 2 | 2 | 1 | | | | 1 | 1 | | 1 | 3 | 1 |
| CO3 | 3 | 2 | 2 | 2 | 1 | | | | 1 | 1 | | 1 | 3 | 1 |
| CO4 | 3 | 2 | 2 | 2 | 1 | | | | 1 | 1 | | 1 | 3 | 1 |
| CO5 | 3 | 2 | 2 | 2 | 1 | | | | 1 | 1 | | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 30 | 60 | | | | 100 |
| CAT2 | 10 | 30 | 60 | | | | 100 |
| CAT3 | 10 | 30 | 60 | | | | 100 |
| ESE | 10 | 30 | 60 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CYT12 – CHEMISTRY FOR COMPUTER SYSTEMS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **(Common to CSE, CSD, AIDS and AIML branches)** | | | | | | | |
| **Programme & Branch** | **B.E & Computer Science and Engineering & Computer Science and Design, BTech – Artificial Intelligence and Data Science & Artificial Intelligence and Machine Learning branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **1 / 2**** | **BS** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course aims to equip the engineering students to realize the importance of chemistry in electrochemistry, corrosion and its control methods, electrochemical storage devices, insulating materials and the need for e-waste management. | |
| **Unit – I** | **ELECTROCHEMISTRY** | **9** |
| Introduction - cells - types - representation of galvanic cell – electrode potential – Nernst equation (derivation of cell EMF) – calculation of cell EMF from single electrode potential – reference electrodes: construction, working and applications of standard hydrogen electrode, standard calomel electrode, glass electrode – EMF series and its applications - potentiometric titrations (redox) – conductometric titrations – mixture of weak and strong acid vs strong base. | | |
| **Unit – II** | **CORROSION AND ITS CONTROL METHODS** | **9** |
| **Corrosion:** Introduction - chemical corrosion – Pilling-Bedworth rule - electrochemical corrosion and it's types – galvanic corrosion – differential aeration corrosion with examples - galvanic series - factors influencing rate of corrosion – measurement of corrosion (wt. loss method only). **Control methods** – sacrificial anodic protection method - corrosion inhibitors - protective coatings - pretreatment of metal surface – metallic coating: electroplating, electroless plating and hot dipping (tinning and galvanizing) methods – non-metallic coating: anodizing - organic coating: paints, constituents and functions - ceramic coatings. | | |
| **Unit – III** | **ELECTROCHEMICAL STORAGE DEVICES** | **9** |
| **Batteries:** Introduction**-** types of batteries - discharging and charging of battery - characteristics of battery - battery rating - various tests on battery -– primary battery: silver button cell - secondary battery: Ni-Cd battery -modern battery: lithium-ion battery - maintenance of batteries - choice of batteries for electric vehicle applications.<br>**Fuel Cells:** Introduction-Importance and classification of fuel cells - description, principle, components and applications of fuel cells: $H_2$-$O_2$ fuel cell, alkaline fuel cell, molten carbonate fuel cell and direct methanol fuel cell. | | |
| **Unit – IV** | **INSULATING MATERIALS** | **9** |
| Introduction - requirements - classification (solid, liquid & gas) - preparation, properties and applications of : solid inorganic insulators: glass, ceramic products - solid organic insulator: epoxy resin - liquid insulator: transformer oil - gas insulator: $SF_6$ - electrical resistivity - factors influencing electrical resistivity of materials - composition, properties and applications of high resistivity materials: constantan, molybdenum disilicide and nichrome - polymers as electrical insulators - non-polar polymers - polar polymers - polarization of polymers. | | |
| **Unit – V** | **E-WASTE AND ITS MANAGEMENT** | **9** |
| Introduction-E- Waste – definition - sources of e-waste– hazardous substances in e-waste - effects of e-waste on environment and human health- need for e-waste management– e-waste handling rules - waste minimization techniques for managing e-waste – recycling of e-waste - disposal treatment methods of e- waste- mechanism of extraction of precious metal from leaching solution – global scenario of E-waste – E-waste in India- case studies. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Wiley Editorial Board,"Wiley Engineering Chemistry", 2nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019,for Unit-I, II, III, IV. |
| 2. | Palanisamy P.N., Manikandan P., Geetha A., Manjula Rani K. & Kowshalya V.N., "Environmental Science", Revised Edition, Pearson Education, New Delhi, 2019, for Unit-III, IV, V. |

**REFERENCES:**

| | |
|---|---|
| 1. | Palanisamy P.N., Manikandan P., Geetha A.& Manjula Rani K., "Applied Chemistry", 6th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2019. |
| 2. | Payal B. Joshi, Shashank Deep, "Engineering Chemistry", Oxford University Press, New Delhi, 2019. |
| 3. | Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2018. |

**** for 2022 batch 1st sem for CSE, CSD, AIML & AIDS, for 2023 batch 1st sem for CSE & CSD & 2nd sem for AIML & AIDS**

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | apply the principle of electrochemistry for various applications | Applying (K3) |
| CO2 | make use of corrosion control methods to solve corrosion related issues. | Applying (K3) |
| CO3 | use the concepts of batteries, fuel cells and their applications in various fields. | Applying (K3) |
| CO4 | apply the knowledge of insulators to make different insulating materials for various applications | Applying (K3) |
| CO5 | utilize the knowledge to handle the e-waste and reduce its impacts on environment | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | 1 | | | 3 | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 35 | 40 | | | | 100 |
| CAT2 | 25 | 35 | 40 | | | | 100 |
| CAT3 | 25 | 35 | 40 | | | | 100 |
| ESE | 25 | 35 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CST11 - PROBLEM SOLVING AND DESIGN | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **1** | **ES** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course deals with the techniques needed to practice computational thinking and use the art of computers to solve problems. It also emphasizes the student to design a simple webpage application and hosting in online Github platform. | |
| **Unit – I** | **Fundamentals of Computer and Problem Solving** | **9** |
| Introduction – Generations of computers- Classification of computers- Basic computer organization- Applications of computers- Memory Management-Number System- Algorithms - Flowcharts – Pseudo codes – Structuring the logic: Sequential, selection and repetitive structure. | | |
| **Unit – II** | **Case Studies on Problem Solving** | **9** |
| Algorithm, Flowchart and Pseudo code for the problems: Exchanging the values of two variables – Finding the biggest number - Leap year – Quadratic equation - Counting – Summation of numbers – Factorial computation – Generation of Fibonacci Sequence-Summation of series - Base Conversion - Reversing the digits of an Integer – Palindrome | | |
| Unit – III | Web Interface | 9 |
| HTML5: Introduction to Internet – Basic tags – Lists – Tables - HTML Forms Element – Page Structured Elements – Media Tags. Cascading Style Sheet: Types of CSS – Positioning Elements – Backgrounds – Box Model – Dropdown Menus – Padding - Flexbox- grid | | |
| **Unit – IV** | **Bootstrap** | **9** |
| Introduction to BS5 – Containers – Typography – Colors – Tables – Images – Jumbotron – Alerts – Buttons - Button Groups - Progress Bars – Pagination - List Groups – Dropdowns – Collapse – Navs – Navbar – Carousel – Offcanvas - BS5 Forms: Select Menus - Checks and Radios – Range – Input Groups – Floating Labels – Form Validation | | |
| **Unit – V** | **Code Management** | **9** |
| Introduction of version control- Installation and basic concepts- creating and managing repository- copy repository- File management- Commits- Branches- Merge conflicts-tracking branches- Fetch- Push and pull repository- Fork and clone | | |
| | | **Lecture:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Elisabeth Robson and Eric Freeman, Head First HTML and CSS. 2nd edn, Shroff Publishers & Distributors, 2012 |
| 2 | S. Kuppuswami, S. Malliga, C. S. Kanimozhi, K. Kousalya, “Problem Solving and Programming”, 1st Edition, TataMcGraw Hill, 2019 |

**REFERENCES/ MANUAL / SOFTWARE:**

| | |
|---|---|
| 1. | Jon Loeliger and Matthew Mccullough, Version control with Git, 2nd Edition, Shroff Publishers & August, 2012 |
| 2. | Dromey R.G., ―How to Solve it by Computer‖, Pearson Education, 2009 |
| 3. | Sumitabha Das, “Computer Fundamentals and C Programming”, 1stEdition, McGraw Hill, 2018. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | Organize the components of computers and conversion of number systems | Applying (K3) |
| CO2 | Make use of algorithm, flowchart and pseudocode for solving sequential, selection and repetitive problems | Applying (K3) |
| CO3 | Design a static webpage using HTML and CSS | Applying (K3) |
| CO4 | Design a responsive webpage using Bootstrap | Applying (K3) |
| CO5 | Create and manage a repository using Github | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | | | | | | | | | 2 | 1 |
| CO2 | 3 | 2 | 2 | 2 | 2 | | | | | 1 | | | 2 | 1 |
| CO3 | 3 | 2 | 2 | 2 | 2 | | | | | 1 | | | 2 | 1 |
| CO4 | 3 | 2 | 2 | 2 | 2 | | | | 1 | 1 | | | 2 | 1 |
| CO5 | 3 | 2 | 2 | 2 | 2 | | | | 1 | 1 | | | 2 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT 1 | 15 | 45 | 40 | | | | 100 |
| CAT 2 | 15 | 35 | 50 | | | | 100 |
| CAT 3 | 15 | 35 | 50 | | | | 100 |
| ESE | 15 | 35 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22EEC11 - BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to Computer Science and Engineering, Artificial Intelligence and Data Science & Artificial Intelligence and Machine Learning branches) | | | | | | | |
| **Programme & Branch** | **B.E & Computer Science and Engineering, Artificial Intelligence and Data Science & Artificial Intelligence and Machine Learning branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **1** | **ES** | **3** | **0** | **2** | **4** |

| | | |
|---|---|---|
| Preamble | To provide comprehensive ideas about power Systems, AC and DC circuits, working principles and applications of basic machines in electrical engineering. | |
| **Unit – I** | **Introduction to Power Systems** | **9** |
| Fundamentals of electricity: Definition – Symbol and unit of Quantities-Work - Power and Energy - Renewable and Non-Renewable sources of Energy - Structure of Electric Power System - Comparison of Overhead and Underground Systems - Electrical Safety Aspects - Principles of Earthing-Classification. | | |
| **UNIT – II** | **DC Circuits and AC Circuits:** | **9** |
| Resistance: Resistors in Series and Parallel - Network Reduction - Star to Delta and Delta to Star Transformations - Ohm‘s Law - Kirchoff’s laws-Voltage and Current Division Rule. **AC Circuits:** Alternating (Sinusoidal) Voltage and Current, R.M.S and Average Value, Power Factor, Form Factor and Peak Factor. | | |
| **UNIT – III** | **DC Machines** | **9** |
| Construction, Principle of Operation of DC generator and DC motor, DC Generators: EMF equation, Types and applications, DC Motor: Torque Equation, types and Applications. Need for starter – DC motor Starter types and construction. | | |
| **UNIT – IV** | **AC Machines and Transformers** | **9** |
| Construction and Working Principle of Single Phase Transformer, AC Generator, Single Phase Induction Motor (Split Phase and Capacitor Start Induction Motor), Three Phase Induction Motor - DOL and Star-Delta starter- Applications. | | |
| **UNIT – V** | **Basic Electronics** | **9** |
| Theory of PN Junction Diode - Operation of Rectifiers (Half wave, Full wave) and Filters - Zener Diodes - Zener Diode as Voltage Regulator - Transistors: Types - Operation of NPN Transistor - Transistor as an Amplifier - Operation and Characteristics of Thyristor: Silicon Controlled Rectifier - UPS and SMPS (Block Diagram approach). | | |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Verification of Ohm‘s Law |
| 2. | Verification of Kirchoff’s Current Law |
| 3. | Verification of Kirchoff’s Voltage Law |
| 4. | Measurement of real power, reactive power of RC and RL circuits. |
| 5. | Load test on DC shunt motor |
| 6. | Load test on DC series motor |
| 7. | Load test on single phase induction motor |
| 8. | VI characteristics of PN junction diode |
| 9. | VI characteristics of Zener diode |
| 10. | Voltage Regulator using Zener diode |

**Lecture:45, Practical:30, Total:75**

**TEXT BOOK:**



| | |
|---|---|
| 1. | Muthusubramanian R. and Salivahanan S., “Basics of Electrical and Electronics Engineering”, $18^{th}$ reprint, Tata McGraw Hill, 2014. |

| REFERENCES/ MANUAL / SOFTWARE: | |
|---|---|
| 1. | Jegathesan V., Vinoth Kumar K. and Saravanakumar R., “Basic Electrical and Electronics Engineering”, 1st Edition, Wiley India, 2011. |
| 2. | Sukhija M.S. and Nagsarkar T.K., “Basics of Electrical and Electronics Engineering”, 1st Edition, Oxford University Press, 2012. |
| 3. | SmarajitGhosh, “Fundamentals of Electrical and Electronics Engineering”, 2nd Edition, PHI Learning, 2007. |
| 4. | Laboratory Manual |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | interpret the basic concepts of electrical power systems and Identify the various electrical parameters in circuits | Applying (K3), Manipulation (S2) |
| CO2 | analyze the DC and AC circuits | Analyzing (K4) |
| CO3 | interpret the construction and working of different types of DC machines | Applying (K3) |
| CO4 | illustrate the working of different types of AC machines and transformers | Applying (K3) |
| CO5 | demonstrate the basic functions of semiconductor devices and analyze the characteristics of semiconductor devices | Applying (K3), Precision (S3) |
| CO6 | test basic electrical machines like DC motors, induction motor and transformers | Applying (K3), Precision (S3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | | | | | | | | | 2 | 1 |
| CO2 | 3 | 1 | 2 | | | | | | | | | | 2 | 1 |
| CO3 | 3 | 1 | 2 | | | | | | | | | | 2 | 1 |
| CO4 | 3 | 2 | 2 | | | | | | | | | | 2 | 1 |
| CO5 | 3 | 1 | 2 | 1 | | | | | | | | | 2 | 1 |
| CO6 | 3 | 2 | 1 | 1 | | | | | | | | | 2 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 50 | 40 | | | | 100 |
| CAT2 | 10 | 50 | 40 | | | | 100 |
| CAT3 | 10 | 50 | 40 | | | | 100 |
| ESE | 10 | 50 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSL11 - PROBLEM SOLVING AND DESIGN LABORATORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. – Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **1** | **ES** | **0** | **0** | **2** | **1** |

| | |
|---|---|
| Preamble | This course deals with the techniques to improve computational thinking and use computers to solve problems. It also empathizes the student to design a responsive webpage application using bootstrap and deploy in GitHub platform. |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Identify and assemble the components of a computer |
| 2. | Installation of an Operating system |
| 3. | Write algorithms and draw flowcharts using Raptor Tool for problems involving sequential structures |
| 4. | Write algorithms and draw flowcharts using Raptor Tool for problems involving selection structures |
| 5. | Write algorithms and draw flowcharts using Raptor Tool for problems involving repetition |
| 6. | Design a web page using basic HTML Tags |
| 7. | Design a web page to get and validate the data from the users |
| 8. | Develop a web page and apply different stye sheets to the web page |
| 9. | Design a Webpage using Bootstrap using various grid layouts. |
| 10. | Create a repository and webpage and deploy it using GitHub |
| 11. | Managing source code with multiple branches |
| 12. | Create a scenario for merge conflicts and resolve it using GitHub |

**Total:30**

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Operating System : Windows |
| 2. | Software : Raptor |
| 3. | Laboratory Manual |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | draw a flowchart for solving different case studies in sequential, selection and repetitive problems | Applying (K3), Precision (S3) |
| CO2 | design an interactive webpage using HTML and Bootstrap | Applying (K3), Precision (S3) |
| CO3 | create and manage a repository | Applying (K3), Precision (S3) |

**Mapping of Cos with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22CYL12 – CHEMISTRY LABORATORY FOR COMPUTER SYSTEMS | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to CSE, CSD, IT, AIDS and AIML branches) | | | | | | | |
| **Programme & Branch** | **B.E & Computer Science and Engineering & Computer Science and Design, BTech – Information Technology, Artificial Intelligence and Data Science & Artificial Intelligence and Machine Learning branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **1 / 2**** | **BS** | **0** | **0** | **3** | **1** |

| | |
|---|---|
| Preamble | This course aims to impart the basic concepts of volumetric, conductometric, potentiometric, spectrophotometric and pH metry experiments for the estimation of given samples and thereby, to improve the analytical capability. It also aims to impart the knowledge on importance of water quality parameters (Ca, Mg & alkalinity) and the toxic substances (Cu, Cr) that we come across in day to day life. |

| **LIST OF EXPERIMENTS / EXERCISES:** | |
|---|---|
| 1. | Determination of strength of an unknown solution using pH meter. |
| 2. | Analysis and comparison of the strength of acids in the given mixture using conductivity meter. |
| 3. | Potentiometric approach using a Pt electrode for the estimation of iron in the given sample. |
| 4. | Spectrophotometric method for the determination of nickel. |
| 5. | Iodometric analysis of Cu content from discarded PCBs. |
| 6. | Volumetric analysis of chromium prepared from electroplating sludge. |
| 7. | Determination of Dissolved Oxygen in the given wastewater sample. |
| 8. | Assessment of the given water sample for the suitability of drinking / industrial purpose by estimating the calcium, magnesium and total hardness by EDTA method. |
| 9. | Estimation of alkalinity of river and borewell water collected from different places. |
| 10. | Determination of molecular weight of a polymer / liquid by Ostwald viscometer. |
| 11. | Construction and working of Zinc -Copper Electrochemical Cell (Demonstration). |
| 12. | Electroplating process (Demonstration). |
| | **Total:30** |

| **REFERENCES/ MANUAL /SOFTWARE:** | |
|---|---|
| 1. | Palanisamy P.N., Manikandan P., Geetha A. and Manjula Rani K., “Chemistry Laboratory Manual”, 1st Edition, Rajaganapathy Publishers, Erode, 2022. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | demonstrate the conductivity meter and pH meter to analyze the strength of the given solution. | Applying (K3), Precision (S3) |
| CO2 | analyze the amount of Cu, Cr, DO, hardness and alkalinity present in the given sample. | Applying (K3), Precision (S3) |
| CO3 | demonstrate the potentiometric and spectrophotometric method for the estimation of Fe & Ni and Viscometer for the determination of molecular weight of a polymer. | Applying (K3), Precision (S3) |

**Mapping of Cos with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 3 | | | 3 | | | | | | | |
| CO2 | 3 | 2 | 1 | 3 | | | 3 | | | | | | | |
| CO3 | 3 | 2 | 1 | 3 | | | 2 | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**** for 2022 batch 1st sem for CSE, CSD, AIML & AIDS & 2nd sem for IT,**
**for 2023 batch 1st sem for CSE, CSD, IT & 2nd sem for AIML & AIDS**

| 22EGT21 - COMMUNICATION SKILLS - II | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to All Engineering and Technology Branches) | | | | | | | |
| **Programme & Branch** | **All B.E./B.Tech. Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Communication Skills I** | **2** | **HS** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course is designed to equip students with the necessary skills to listen, read, write and speak so as to develop their linguistic and communicative competencies. | |
| **Unit – I** | **Grammar, Vocabulary, Listening, Speaking, Reading & Writing** | **9** |
| **Grammar:** Sentence Patterns **-** Simple, Compound & Complex sentences **- Vocabulary:** Portmanteau words **-** One word substitution **- Listening:** Speeches from company CEOs **-** TV debates **Speaking:** Just-a-minute talk **-** Group discussion **- Reading:** Reading for Gist **- Writing:** Job application letter with resume **–** Transcoding | | |
| **Unit – II** | **Grammar, Vocabulary, Listening, Speaking, Reading & Writing** | **9** |
| **Grammar:** Concord **- Vocabulary:** Phrasal verbs **-** Idioms & Phrases - **Listening:** Listening to celebrity talks - **Speaking:** Talking about celebrities - Practicing Pronunciation through web tools - **Reading:** Company correspondence, technical texts/working principles of a machine - **Writing:** Description: Person, Place**,** Process, Product and Picture | | |
| **Unit – III** | **Grammar, Vocabulary, Listening, Speaking, Reading & Writing** | **9** |
| **Grammar:** Discourse markers **-** Transitional words and phrases **- Vocabulary:** Commonly confused words **- Listening:** Listening to guest lectures **- Speaking:** Technical & Non-technical presentations **-** Workshop presentations **- Reading:** Reputed company profiles, Business Plans **- Writing:** a dream job/company **-** Letter to the Editor **–** Biography & Autobiography **-** Checklist | | |
| **Unit – IV** | **Grammar, Vocabulary, Listening, Speaking, Reading & Writing** | **9** |
| **Grammar:** Degrees of Comparison **-** Punctuations **–** Fragments & run-ons **- Vocabulary:** British & American **-** Spelling & words **- Listening:** Listening to global accents **-** listening to motivational speeches **-** S**peaking:** Narrating personal milestones **-** Sports commentaries **-** Movie Enactment **- Reading:** Narrative passages **- Writing:** E mail **-** Agenda & Minutes of Meeting **-** Special & Technical reports | | |
| **Unit – V** | **Grammar, Vocabulary, Listening, Speaking, Reading & Writing** | **9** |
| **Grammar:** Purpose and Function **-** If clause **-** Error detection **- Vocabulary:** Coding & Decoding **-** Alphabet test **- Listening:** Listening to sample HR Interviews **- Speaking:** Introduction to phonetics - Stress, rhythm & Intonation **–** Guided & unguided speeches/conversations **-** Giving feedback **–** Debate **- Reading:** Key Note speeches **-** Newspaper reports **-** short technical texts from journals **Writing:** Circulars **-** Critical Appreciation of a non-detailed text **-** Technical proposals | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Sanjay Kumar & Pushp Lata, “Communication Skills”, 2nd Edition, Oxford University Press, New Delhi, 2018. |

**REFERENCES:**



| | |
|---|---|
| 1. | Meenakshi Raman and Sangeeta Sharma. “Technical Communication- Principles and Practice”. 4th Edition, Oxford University Press, New Delhi, 2022. |
| 2. | Murphy Raymond, "English Grammar in Use", 5th Edition, Cambridge University Press, New York, 2019. |
| 3. | Jack C. Richards and Chuck Sandy, “Passages” Student’s Book 2, 3rd Edition, Cambridge University Press, New York, 2014. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | use functional grammar for improving communication skills | Applying (K3) |
| CO2 | listen and comprehend different accents and infer implied meanings | Applying (K3) |
| CO3 | speak clearly, initiate and sustain a discussion and negotiate using appropriate communicative strategies | Creating (K6) |
| CO4 | read different genres of texts, infer implied meanings and critically analyze and evaluate them | Understanding (K2) |
| CO5 | produce different types of narrative, descriptive expository texts and understand creative, critical, analytical and evaluative writing | Creating (K6) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 2 | | | 1 | 3 | 1 | 1 |
| CO2 | | | | | | | | | 2 | 3 | | 1 |
| CO3 | | | | | | | | | 2 | 3 | | 2 |
| CO4 | | | | | | 1 | | | | 3 | 1 | 1 |
| CO5 | | | | | | | | | | 3 | | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | | 37 | 30 | | | 33 | 100 |
| CAT2 | | 7 | 50 | | | 43 | 100 |
| CAT3 | | 17 | 50 | | | 33 | 100 |
| ESE | | 15 | 45 | | | 40 | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22MAC23 - PROBABILITY AND STATISTICS | | | | | | | |
|---|---|---|---|---|---|---|---|
| ( Common to BE - Computer Science Engineering, Computer Science and Design & BTech – Information Technology branches ) | | | | | | | |
| **Programme & Branch** | **BE - Computer Science Engineering, Computer Science and Design & BTech – Information Technology branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **2** | **BS** | **3** | **1*** | **2*** | **4** |

| | | |
|---|---|---|
| **Preamble** | To provide an in-depth knowledge in random variables, correlation, sampling theory and promote the ability to use probability distributions and analysis of variance to experimental data. | |
| **Unit – I** | **Random Variables:** | **9** |
| Discrete and Continuous random variables – Probability Mass and Probability density functions – Mathematical expectation and Variance – Moments – Moment generating function. | | |
| **Unit – II** | **Standard Probability Distributions:** | **9** |
| Discrete Distributions: Binomial distribution – Poisson distribution – Geometric distribution – Continuous Distributions: Uniform distribution – Exponential distribution – Normal distribution. | | |
| **Unit – III** | **Two Dimensional Random Variables:** | **9** |
| Introduction – Joint probability distributions – Marginal and conditional distributions – Covariance – Correlation and regression. | | |
| **Unit – IV** | **Testing of Hypothesis:** | **9** |
| Introduction – Critical region and level of significance – Types of Errors – Large sample tests: Z-test for single mean and difference of means – Small sample tests: Student's t-test for testing significance of single mean and difference of means – F-test for comparison of variances – Chi-square test: Test of goodness of fit – Test of independence of attributes. | | |
| **Unit – V** | **Design of Experiments:** | **9** |
| Analysis of variance – One way classification: Completely Randomized Design – Two way classification: Randomized Block Design – Three way classification: Latin Square Design. | | |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Introduction to R studio. |
| 2. | Identifying Mean and Variance for discrete and continuous random variables. |
| 3. | Computation of probability using Binomial, Poisson and Normal distributions. |
| 4. | Computation of correlation coefficient for the given data. |
| 5. | Finding the Marginal and conditional distributions of two-dimensional random variable. |
| 6. | Testing significance of means by student's t – test. |
| 7. | Testing the independence of attributes by Chi-square test. |
| 8. | Analyze whether the difference in means is statistically significant by completely randomized design. |

**Lecture:45, Tutorials and Practical:15, Total:60**

**TEXT BOOK:**

| | |
|---|---|
| 1. | Veerarajan, T, "Probability and Statistics, Random Processes and Queuing Theory", 1st Edition, McGraw-Hill Education, Chennai, 2019. |

**REFERENCES/ MANUAL / SOFTWARE:**


| | |
|---|---|
| 1. | William Mendenhall, Robert J. Beaver and Barbara M. Beaver, "Introduction to Probability and Statistics", 14th Edition, Cengage Learning, USA, 2013. |
| 2. | Jay L. Devore., "Probability and Statistics for Engineering and the Sciences", 9th Edition, Cengage Learning, USA, 2016. |
| 3. | Johnson. R.A., Miller. I and Freund. J., "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education, India, 2018. |
| 4. | Douglas C. Montgomery & George C. Runger, "Applied Statistics and Probability for Engineers ", 7th Edition, |

| | |
|---|---|
| | John Wiley and Sons, USA, 2018. |
| 5. | Probability and Statistics Laboratory Manual. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | interpret the concept of random variables. | Applying (K3), Manipulation (S2) |
| CO2 | apply the standard probability distributions in engineering problems. | Applying (K3), Manipulation (S2) |
| CO3 | understand the concepts of two dimensional random variables and regression. | Applying (K3), Manipulation (S2) |
| CO4 | apply statistical tests for solving engineering problems involving small and large samples. | Applying (K3), Manipulation (S2) |
| CO5 | apply the concepts of analysis of variance to experimental data. | Applying (K3), Manipulation (S2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | | 3 | | | | | | | | 1 | |
| CO2 | 3 | 2 | 3 | | 3 | | | | | | | | 2 | |
| CO3 | 3 | 2 | 1 | | 3 | | | | | | | | 1 | |
| CO4 | 3 | 3 | 1 | 3 | 3 | | | | | | | | 3 | |
| CO5 | 3 | 3 | 2 | 3 | 3 | | | | | | | | 3 | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 20 | 70 | | | | 100 |
| CAT2 | 10 | 20 | 70 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 20 | 70 | | | | 100 |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

*Alternate Week

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **22PHT22 – PHYSICS FOR COMPUTER SYSTEMS** | | | | | | | |
| **(Common to CSE, CSD, AIML & AIDS branches)** | | | | | | | |
| **Programme & Branch** | **BE/B.Tech - CSE, CSD, AIML and AIDS branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **2 / 1**** | **BS** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course aims to impart the knowledge on oscillations & waves, acoustics, ultrasonics, laser, fiber optics, semiconductors and smart materials. It also describes the applications of aforementioned topics in computer sciences. | |
| **Unit – I** | **Oscillations and Waves:** | **9** |
| Periodic motion – Oscillations – Simple harmonic motion – Differential equation of simple harmonic motion – Forced oscillations – Damped oscillations – Application of simple harmonic motion in torsional pendulum, cantilever and LC circuit – Resonance – Waves – Equation of plane progressive wave – Types of progressive waves – Reflection and transmission of waves at a boundary (qualitative) – Energy transport of progressive waves. | | |
| **Unit – II** | **Acoustics and Ultrasonics:** | **9** |
| Classification of sound – Characteristics of sound – Reverberation and reverberation time – Growth and decay of sound – Sabine's formula for reverberation time – Determination of sound absorption coefficient – Factors affecting acoustics of buildings and their remedies – Ultrasonics – Properties of ultrasonic waves – Generation of ultrasonic waves – Magnetostrictive generator and Piezoelectric generator – Non-destructive testing – Flaw detection. | | |
| **Unit – III** | **Laser and Fiber Optics:** | **9** |
| Stimulated absorption – Spontaneous emission – Stimulated emission – Einstein's coefficients and their relations – Population inversion – Pumping – $CO_2$ laser – Holography – Fiber optics – Numerical aperture and acceptance angle – Classification of optical fibers based on refractive index, modes and materials – Fiber optics communication system (qualitative) –Temperature and displacement sensors. | | |
| **Unit – IV** | **Semiconductors:** | **9** |
| Intrinsic semiconductor – Carrier concentration – Fermi level – Variation of conductivity with temperature – Determination of band gap – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductors – Hall effect – Determination of Hall coefficient – Applications – Solar Cell: Principle, construction and working. | | |
| **Unit – V** | **Smart Materials:** | **9** |
| Metallic glasses: Properties, preparation and applications – Shape memory alloys: Characteristics and applications – Nanostructure – Surface-to-volume ratio – Quantum confinement – Nanomaterials synthesis: Top-down and bottom-up approaches – Electron beam lithography – Physical vapour deposition – Carbon nanotubes: Structures, properties, synthesis by laser ablation method – Applications. | | |
| | | **Total:45** |

| | |
|---|---|
| **TEXT BOOK:** | |
| 1. | Avadhanulu M.N., Kshirsagar P.G. and Arun Murthy T.V.S., "A Textbook of Engineering Physics", 11th Edition, S. Chand & Company Pvt. Ltd., New Delhi, 2019. |
| **REFERENCES:** | |
| 1. | Hitendra K. Malik and A.K. Singh, "Engineering Physics", 2nd Edition McGraw-Hill Education , New Delhi, 2018 |
| 2. | Pandey B.K.and Chaturvedi S., "Engineering Physics" 2nd Edition, Cengage, New Delhi, 2022. |
| 3. | Tamilarasan K. and Prabu K., "Materials Science", 1st Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2019. |

**** for 2022 batch 2nd sem for CSE, CSD, AIML & AIDS, for 2023 batch 1st sem for AIML & AIDS & 2nd sem for CSE & CSD**

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | make use of the concepts of oscillatory and wave motion to comprehend the phenomena related to the propagation of elastic waves. | Applying (K3) |
| CO2 | apply the concepts of growth and decay of sound energy in a hall to compute Sabine's formula and to recognize the requirements of acoustically good buildings and also to describe the production of ultrasonic wave and the testing materials by non-destructive method. | Applying (K3) |
| CO3 | apply the concepts of stimulated emission of radiation to explain the working and the applications of laser in engineering and technology. To apply the principle of propagation of light through optical fiber to compute acceptance angle and numerical aperture and to comprehend the loss in optical fiber and also to explain fiber optic communication system and the working of fiber optic sensors. | Applying (K3) |
| CO4 | use the concept of density of states to compute the carrier concentration, electrical conductivity and band gap of intrinsic semiconductors and to compute the carrier concentration of extrinsic semiconductors, and also to explain the Hall Effect and the working of solar cell. | Applying (K3) |
| CO5 | utilize appropriate methods to prepare metallic glasses, shape memory alloys, nanomaterials and carbon nano tubes and also to comprehend their properties and applications. | Applying (K3) |

**Mapping of Cos with POs and PSOs**

| Cos/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | 2 | 2 | | 1 | 3 | 1 |
| CO2 | 3 | 2 | 2 | | | | | | 2 | 2 | | 1 | 3 | 1 |
| CO3 | 3 | 2 | 2 | | | | | | 2 | 2 | | 1 | 3 | 1 |
| CO4 | 3 | 2 | 2 | | | | | | 2 | 2 | | 1 | 3 | 1 |
| CO5 | 3 | 2 | 2 | | | | | | 2 | 2 | | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 15 | 40 | 45 | | | | 100 |
| CAT2 | 15 | 40 | 45 | | | | 100 |
| CAT3 | 20 | 45 | 35 | | | | 100 |
| ESE | 10 | 40 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

## 22CST21 - PROGRAMMING AND LINEAR DATA STRUCTURES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. – Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Problem Solving and Programming** | **2** | **ES** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course helps the students to learn the advanced concepts of C language, and basic concepts and applications of Linear data structures such as linked list, stack and queue. | |
| **Unit – I** | **Pointers and Arrays, Pointers and Strings :** | **9** |
| Pointers :Introduction – Pointers and 1D array– passing an array to a function– returning an array from function – NULL pointers – Array of pointers – Pointer-to-pointer – Pointers and 2D array - Generic pointers –Dangling Pointer-Using Pointers for string manipulation – Two dimensional array of strings - array of pointers to strings. | | |
| **Unit – II** | **Dynamic memory allocation, Pointers and Functions, Pointers and structures:** | **9** |
| Dynamic memory allocation - Function pointers :calling a function using a function pointer– Structures: Introduction – Structures in Functions –Pointers to structures-Accessing structure members - Using pointer as a function argument - Array of structures – self referential structures. | | |
| **Unit – III** | **File Handling and Preprocessor Directives :** | **9** |
| File Handling Basics – opening and closing files – Detecting the end-of-file -File pointer and file buffer – File read/write functions – formatted functions fscanf() and fprintf() –Text and Binary files- Reading and writing binary files –Manipulating file position indicator - Renaming and Removing a file - Command line Arguments. Preprocessor - #define macros with and without arguments - #include directive-Conditional Compilation. | | |
| **Unit – IV** | **Data structures and Linked List:** | **9** |
| Introduction to Data Structures – Classification – Introduction to linked lists - Linked lists vs Arrays – Singly linked list-Creating a list - Traversing a list-Adding a node-Deleting a node-Sorting a list-Destroying a list-printing linked list in reverse order- Reverse a singly list - copy a singly linked list. | | |
| **Unit – V** | **Stack and Queue:** | **9** |
| Introduction – Stack – Implementation of stack using array and linked list – Applications of stack - Infix to Postfix expression conversion - Postfix expression evaluation – Queue – Implementation of Queue using array and linked list– Other variations of Queue – Applications of Queue. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Sumitabha Das, “Computer Fundamentals &C Programming”, McGraw Hill Education(India) Private Limited, 1st Edition, 2018, for Unit I,II,III. |
| 2. | Weiss M. A., “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 2016 for Unit IV,V. |

**REFERENCES:**

| | |
|---|---|
| 1. | Yashavant Kanetkar, “Pointers in C”, BPP Publications, 4th Edition, 2017. |
| 2. | PradipDey, Manas Ghosh, “Programming in C”, Oxford Higher Education, 2nd Edition, 2016. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | make use of pointers to perform array and string operations | Applying (K3) |
| CO2 | implement functions and structures with pointers | Applying (K3) |
| CO3 | demonstrate file operations and preprocessor directives | Applying (K3) |
| CO4 | describe the different operations on singly linked list and make use of it for developing simple applications | Applying (K3) |
| CO5 | manipulate the operations on stacks and queues | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | | | | | | | | | 2 | 2 |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | 2 | 2 |
| CO3 | 2 | 2 | 1 | 1 | | | | | | | | | 2 | 2 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 2 | 2 |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | | 2 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 20 | 70 | | | | 100 |
| CAT2 | 10 | 20 | 70 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 20 | 70 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CDT21 - DESIGN THINKING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **(Common to Computer Science and Design & Computer Science and Engineering branches)** | | | | | | | | |
| **Programme & Branch** | **B.E. – Computer Science and Design & B.E. – Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** | |
| **Prerequisites** | **Nil** | **2 / 3*** | **PC** | **3** | **0** | **0** | **3** | |

| | | |
|---|---|---|
| Preamble | Design Thinking is human-centered problem solving tool which emphasize on empathy, collaboration, co-creation and stakeholder feedback to unlock creativity and innovation, to devises feasible and viable idea/solutions. | |
| **Unit – I** | **Design Thinking and Explore:** | **9** |
| **Design Thinking:** Key Principles and Mindset – Five Phases, Methods and Tools of Design Thinking – User Guide – Foundation Building for Design Thinking – **Explore:** Methods & Tools – STEEP Analysis – Strategic Priorities – Activity System – Stakeholder Mapping – Opportunity Framing. | | |
| **Unit – II** | **Empathize:** | **9** |
| **Empathize**: Methods & Tools – Field Observation – Deep User Interview – Empathy Map – User Journey Map - Need Finding – User Insights - User Persona Development. | | |
| **Unit – III** | **Experiment:** | **9** |
| **Experiment**: Methods & Tools – Ideation – SCAMPER – Analogous Inspiration – Deconstruct & Reconstruct – User Experience Journey – Prototyping– Idea Refinement. | | |
| **Unit – IV** | **Engage:** | **9** |
| **Engage:** Methods & Tools – Story Telling – Art of Story Telling – Storyboarding – Co-Creation with Users – Collect Feedback from Users. | | |
| **Unit – V** | **Evolve:** | **9** |
| **Evolve:** Methods & Tools – Concept Synthesis – Strategic Requirements –Evolved Activity Systems – Activity System Integration – Viability Analysis – Innovation Tools using User Needs, CAP, 4S – Change Management - Quick Wins. | | |
| | | **Total: 45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Lee Chong Hwa, "Design Thinking The Guidebook", Design Thinking Master Trainers of Bhutan, 2017. (E-Book) |

**REFERENCES:**

| | |
|---|---|
| 1. | Jeanne Liedtka and Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", Columbia University Press, 2011. |
| 2. | Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth FieldBook: A Step-by-Step Project Guide", Columbia University Press, 2014. |

* For 2022 batch – 2nd sem for both CSE &CSD, for 2023 batch – 2nd sem CSD & 3rd sem CSE

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | construct design challenge and reframe the design challenge into design opportunity. | Applying (K3) |
| CO2 | interview the user, and know the feelings of users to foster deep user understanding and be able to uncover the deep user insights and needs. | Applying (K3) |
| CO3 | develop ideas and prototypes by brain storming using the ideation tools. | Applying (K3) |
| CO4 | organize the user walkthrough experience using ideal user experience journey. | Applying (K3) |
| CO5 | develop smart strategies & implementation plan that will deliver/achieve the idea/solution deduced from earlier phases. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |
| CO2 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |
| CO3 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |
| CO4 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |
| CO5 | 3 | 3 | 3 | 1 | | | | | 3 | 3 | 1 | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 20 | 70 | | | | 100 |
| CAT2 | 10 | 15 | 75 | | | | 100 |
| CAT3 | 10 | 15 | 75 | | | | 100 |
| ESE | 10 | 15 | 75 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

## 22CSC23 – OBJECT ORIENTED PROGRAMMING USING C++

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E - COMPUTER SCIENCE AND ENGINEERING** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **2** | **PC** | **3** | **0** | **2** | **4** |

| | | |
|---|---|---|
| Preamble | This course is a multi-paradigm encompassing procedural, object-oriented and systems-level language that provides high-level abstraction. | |
| **Unit – I** | **Object Oriented Programming Paradigm** | **9** |
| **Introduction:** Object Oriented Programming Paradigm – Tokens, Expressions and Control Structures. **Functions :** Function prototyping – Call by Reference – Return by Reference **-** Inline Functions- Default Arguments- const Arguments - Function Overloading | | |
| **Unit - II** | **Classes and Objects:** | **9** |
| **Classes and Objects:** Specifying a class – Defining member functions – Making an outside function inline – Nesting of member functions- Private member functions- arrays within a class- Memory allocation for objects – Static Data members and Functions- Arrays of objects- Objects as function arguments- Friendly functions - Returning Objects- Local Classes**.** Constructors and Destructors | | |
| **Unit – III** | **Operator Overloading and Inheritance** | **9** |
| **Inheritance**: Defining Derived Classes – Single Inheritance – Multilevel Inheritance – Multiple Inheritance – Hierarchical Inheritance - Hybrid Inheritance - Virtual Base Class- Abstract Class. **Operator Overloading:** Defining Operator Overloading - Overloading Unary Operators- Overloading- Binary Operators. | | |
| **Unit – IV** | **Pointers, Virtual functions and Strings** | **9** |
| Pointers- Pointers to objects - this Pointer- Polymorphism - Pointers to derived classes - Virtual functions – Pure Virtual functions – Manipulating strings. | | |
| **Unit – V** | **Templates and Exception Handling** | **9** |
| **Templates:** Class Templates – Function Templates- Overloading of Template Functions**. Exception Handling:** Introduction – Basics of Exception handling- Exception handling mechanism – Throwing mechanism - Catching mechanism - Rethrowing an Exception. | | |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Programs using Inline Functions and Default Arguments. |
| 2. | Programs to implement the concept of Call by Value, Call by Reference and Call by Address. |
| 3. | Programs to implement Function overloading |
| 4. | Programs to understand Classes and objects |
| 5. | Programs using Constructors and destructors |
| 6. | Programs to understand friend function & friend class |
| 7. | Programs using Unary operator overloading. |
| 8. | Programs using Binary operator overloading. |
| 9. | Programs to demonstrate the various forms of inheritance. |
| 10. | Programs to define the Function templates and Class templates. |
| 11. | Programs to illustrate Virtual function. |
| 12. | Programs using Abstract class. |

**Lecture:45, Practical:30, Total:75**

**TEXT BOOK:**

| | |
|---|---|
| 1. | Balagurusamy, E, “Object Oriented Programming with C++”, 8th Edition, Tata McGraw-Hill, New Delhi, 2021. |

**REFERENCES/ MANUAL / SOFTWARE:**

| | |
|---|---|
| 1. | Herbert Schildt, "C++: The Complete Reference", 5th Edition, McGraw Hill Education, 2012. |
| 2. | Venugopal.K.R. Raj Buyya, "Mastering C++ ", 2nd Edition, Tata Mcgraw Hill, 2017 |


| | **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | apply the concepts of object-oriented programming | Applying (K3), Precision(S3) |
| CO2 | develop programs using classes and objects | Applying (K3), Precision(S3) |
| CO3 | build applications with various types of operator overloading and inheritance | Applying (K3), Precision(S3) |
| CO4 | demonstrate the concepts of pointers, virtual functions and Strings | Applying (K3), Precision(S3) |
| CO5 | integrate the use of Exception Handling and generic programming to solve real world problems | Applying (K3), Precision(S3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | | | | | 1 | | | 2 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 2 | | | | | 1 | | | 2 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 2 | | | | | 1 | | | 2 | 2 | 2 |
| CO4 | 3 | 2 | 2 | 2 | | | | | 1 | | | 2 | 2 | 2 |
| CO5 | 3 | 2 | 2 | 2 | | | | | 1 | | | 2 | 2 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 30 | 60 | | | | 100 |
| CAT2 | 10 | 30 | 60 | | | | 100 |
| CAT3 | 10 | 30 | 60 | | | | 100 |
| ESE | 10 | 30 | 60 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

## 22CSL21 - PROGRAMMING AND LINEAR DATA STRUCTURES LABORATORY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. – Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Problem solving and Programming** | **2** | **ES** | **0** | **0** | **2** | **1** |

| | |
|---|---|
| Preamble | This course is designed to provide a hands-on experience in basic of data structure. |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Program to access an array(1D and 2D) using pointers |
| 2. | Program to manipulate strings using pointers |
| 3. | Program to demonstrate dynamic memory allocation for 1D and 2D array |
| 4. | Program to pass an array as an argument to function and access the array using pointers |
| 5. | Programs using pointers and structures |
| 6. | Program to perform self referential structure |
| 7. | Program to perform operations on files |
| 8. | Program using conditional preprocessor directives |
| 9. | Program to implement singly linked list |
| 10. | Program to implement Stack and Queue using array |
| 11. | Program to implement Stack and Queue using linked list |
| 12. | Infix to Postfix conversion, postfix evaluation using stack |
| | **Total:30** |

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Neo co lab/ C compiler |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | implement programs to solve problems using pointers to arrays and structures | Applying (K3), Precision (S3) |
| CO2 | develop programs using files and preprocessor directives | Applying (K3), Precision (S3) |
| CO3 | use appropriate linear data structure for solving given problems | Applying (K3), Precision (S3) |

**Mapping of COs with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | 2 | | | | | | | | 2 | 3 |
| CO2 | 3 | 2 | 2 | 1 | 2 | | | | | | | | 2 | 3 |
| CO3 | 3 | 2 | 2 | 1 | 2 | | | | | | | | 2 | 3 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22PHL22 - PHYSICS LABORATORY FOR COMPUTER SYSTEMS | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to CSE, CSD, AIDS and AIML branches) | | | | | | | |
| **Programme & Branch** | **BE/B.Tech- CSE, CSD, AIDS and AIML branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **2/1**** | **BS** | **0** | **0** | **2** | **1** |

| | |
|---|---|
| Preamble | This course aims to impart hands on training in the determination of parameters such as rigidity modulus, AC frequency, velocity of ultrasound, compressibility of a liquid, wavelength of laser, particle size, acceptance angle and numerical aperture of an optical fiber, band gap, specific resistance, Hall coefficient, thickness of a thin film and knowledge on the working of UJT, and also to impart skills on writing coding / developing project / product related to societal requirement. |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Determination of the rigidity modulus of a metallic wire using torsional pendulum. |
| 2. | Studying the variation of current and voltage in a series LCR circuit / Determination of the frequency of alternating current using electrically vibrating tuning fork (Melde's apparatus). |
| 3. | Determination of the velocity of ultrasonic waves in a liquid and the compressibility of the liquid using ultrasonic interferometer. |
| 4. | (i) Determination of the wavelength of a semiconductor laser.<br>(ii) Determination of the particle size of the given powder using semiconductor laser. |
| 5. | Determination of the acceptance angle and the numerical aperture of the given optical fiber. |
| 6. | Determination of the band gap of a given semiconducting material using post-office box. |
| 7. | Determination of the specific resistance of the material of a given coil of wire using Carey-Foster's bridge. |
| 8. | Observation of the I-V characteristics of a uni junction transistor / Determination of the Hall coefficient of a material using Hall effect arrangement. |
| 9. | Determination of the thickness of a thin film by air-wedge arrangement. |
| 10. | Writing coding for any one of the above experiments / developing a project / a product. |

**Total:30**

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Physics Laboratory Manual / Record, Department of Physics, 1st Edition, 2020. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | determine the rigidity modulus of a wire, the variation of current and voltage in a series LCR circuit or the frequency of an alternating current and the velocity of ultrasound in a liquid. | Applying (K3), Precision (S3) |
| CO2 | determine the wavelength of a laser, the particle size of a powder material, the acceptance angle and the numerical aperture of an optical fiber and the band gap of semiconductor. | Applying (K3), Precision (S3) |
| CO3 | determine the specific resistivity of a given wire, the I-V characteristics of a UJT or the Hall coefficient of a material, the thickness of a thin film and develop a coding / project / product. | Applying (K3), Precision (S3) |

**Mapping of Cos with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 3 | | | | | 2 | 2 | | 2 | 3 | 1 |
| CO2 | 3 | 2 | 2 | 3 | | | | | 2 | 2 | | 2 | 3 | 1 |
| CO3 | 3 | 2 | 2 | 3 | | | | | 2 | 2 | | 2 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**** for 2022 batch - 2nd sem for CSE, CSD, AIML & AIDS, for 2023 batch - 1st sem for AIML & AIDS & 2nd sem for CSE & CSD**

**22MEL11 - ENGINEERING PRACTICES LABORATORY**

(Common to All Engineering and Technology Branches)

| **Programme & Branch** | **All BE/BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **1/ 2** | **ES** | **0** | **0** | **2** | **1** |

| | |
|---|---|
| Preamble | This course is designed to provide a hands-on experience in basic of mechanical and electrical engineering practices. |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| | **PART A – MECHANICAL ENGINEERING** |
| 1. | Prepare a Square / Rectangular / V-Shape Projection with its Counterpart for Mating and Perform the Drilling, Tapping, and Assembling Tasks from the given Square / Rectangular MS Plates using Modern Power Tools. |
| 2. | Prepare T / L / Lap Joint from given Wooden Work Piece and Make a Box / Tray out of Plywood using Modern Power Tools. |
| 3. | Perform the Thread Formation on a GI/PVC Pipe and Prepare a Water Line from the Overhead Tank that is Leak-Proof. |
| 4. | Make a Butt / Lap / Tee Joint of MS Plate using Arc Welding Process and Welding Simulator. |
| 5. | **Activity:** Prepare an Innovative Model with the Knowledge from Fitting / Carpentry / Plumbing / Welding Involving Modern Power Tools. |
| | **PART B – ELECTRICAL AND ELECTRONICS ENGINEERING** |
| 6. | Wiring circuit for fluorescent lamp and Stair case wiring |
| 7. | Wiring Circuit of Incandescent lamp using Impulse Relay |
| 8. | Measurement of Earth Resistance |
| 9. | Soldering of Simple Circuits and trouble shooting |
| 10. | Implementation of half wave and full wave Rectifier using diodes |

**Total:30**

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Engineering Practices Laboratory Manual. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | plan the sequence of operations for effective completion of the planned models / innovative articles | Creating (K6)<br>Manipulation (S2) |
| CO2 | identify and use appropriate modern power tools and complete the exercises/models accurately | Applying (K3)<br>Manipulation (S2) |
| CO3 | perform house wiring and realize the importance of earthing | Applying (K3),<br>Manipulation (S2) |
| CO4 | soldering with simple electronics circuits | Applying (K3),<br>Manipulation (S2) |
| CO5 | trouble shoot the electrical and electronic circuits | Applying (K3),<br>Manipulation (S2) |

**Mapping of COs with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | 1 | 3 | 1 | | | 3 | 3 | | 3 | | |
| CO2 | 3 | | 3 | 1 | 3 | | | | 3 | 3 | | 3 | | |
| CO3 | 3 | | 3 | 2 | 1 | | | | 2 | 2 | | 3 | 3 | 2 |
| CO4 | 3 | | 2 | 1 | 1 | | | | 2 | 3 | | 3 | 3 | 2 |
| CO5 | 3 | | 3 | 2 | 1 | | | | 2 | 2 | | 3 | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22VEC11 - YOGA AND VALUES FOR HOLISTIC DEVELOPMENT | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to All Engineering and Technology Branches) | | | | | | | |
| **Programme & Branch** | **All B.E./B.Tech. Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **1 / 2** | **HS** | **1** | **0** | **1** | **1** |

| | | |
|---|---|---|
| Preamble | Yoga or yogasanas are considered as art and science of healthy living by our ancient gurus. It is method to bring harmony of body and mind for general wellbeing. Yoga is considered as one of the greatest gifts to the world by Indians for healthy living. Students in particular are benefitted by learning yoga. | |
| **Unit – I** | **Introduction:** | **2** |
| The Origins of Yoga – Definitions - Concepts - Aims and objectives of Yoga – Yoga is a Science and Art – Rules and Regulations of Asanas – Classifications of Yogasanas – Patanjali’s Ashtanga Yoga – Pranayama – Mudras & Bandhas - Shatkarma (Cleansing Practice) - Streams of Yoga – Modern Trends in yoga. | | |
| **Unit – II** | **Yoga and Mind:** | **2** |
| The Nature of Mind - Five Elements and the Mind - Meditation and the Mind - Functions of the Mind - Role of Yoga in Psychological problems: Mood Disorders, Major Depressive Disorder, Cyclothymic Disorder. | | |
| **Unit – III** | **Yoga and Values, Diet:** | **2** |
| Human Values – Social Values – Role of Yoga in Personality Integration - Concepts of Natural Diet - Naturopathy Diet – Eliminative Diet – Soothing Diet – Constructive Diet. | | |
| **Unit – IV** | **Asanas:** | **2** |
| Prayer - Starting & Closing - Preparatory practices – Loosening Practices – Meaning, Definitions and Objectives of Asanas - Principles of Practicing Asanas. Asanas: Standing – Sitting – Prone – Supine – Suryanamaskar. | | |
| **Unit – V** | **Pranayama and Meditation:** | **2** |
| Breathing Practices for awareness - Definitions and Objectives of Pranayama - Principles of Practicing Pranayama. Pranayama: Nadi Shuddhi - Kapalabathi – Sitali – Sitkari – Bhranari – Ujjayi – Relaxation Techniques – Meditation. | | |
| **Lecture: 10, Practical: 10, Total:20** | | |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Swami satyananda saraswathi, “Asana pranayama mudra bandha”, Bihar school of yoga, 4th Edition, 1969. |
| 2. | Swami mukthi Bodhanandha, “Hatha yoga pradipika”, Bihar school of yoga, 4th Edition, 1985. |

**REFERENCES:**

| | |
|---|---|
| 1. | B.K.S. Iyenkar, “Yoga the path of holistic health”, DK Limited, 2nd Edition, 1969. |
| 2. | Selvarasu, “Kriya cleansing in yoga”, Aruvi yoga, 3rd Edition, 2002. |

| **COURSE OUTCOMES:** **On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | realize the importance of yoga in physical health. | Applying (K3) |
| CO2 | realize the importance of yoga in mental health. | Applying (K3) |
| CO3 | realize the role of yoga in personality development and diet. | Applying (K3) |
| CO4 | do the loosening practices, Asanas and realize its benefits. | Applying (K3) |
| CO5 | do the practice of Pranayama, meditation and realize its benefits | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 3 | | 2 | 1 | | | |
| CO2 | | | | | | 3 | | 2 | | | | |
| CO3 | | | | | | 3 | | 3 | | | | |
| CO4 | | | | | | 3 | | 2 | 3 | | | |
| CO5 | | | | | | 3 | | 3 | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | - | - | - | - | - | - | - |
| CAT2 | - | - | - | - | - | - | - |
| CAT3 | 20 | 30 | 50 | - | - | - | 100 |
| ESE | - | - | - | - | - | - | - |

* ±3% may be varied (CAT3 – 100 marks)

| 22TAM01 - தமிழர் மரபு | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| (Common to All Engineering and Technology Branches) | | | | | | | | |
| **Programme & Branch** | **All BE / BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **1 / 2** | **HS** | **1** | **0** | **0** | **1** |

| | | |
|---|---|---|
| Preamble | தமிழர்களின் மொழி, இலக்கியம், ஓவியங்கள், சிற்பக்கலைகள், நாட்டுப்புறக் கலைகள், வீர விளையாட்டுக்கள், திணைக் கோட்பாடுகள், இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பைப் பற்றிய அறிவை வழங்குவதே இந்த பாடத்தின் நோக்கமாகும். | |
| **அலகு – I** | **மொழி மற்றும் இலக்கியம்** | **3** |
| இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு. | | |
| **அலகு – II** | **மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை** | **3** |
| நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு. | | |
| **அலகு – III** | **நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுக்கள்** | **3** |
| தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள். | | |
| **அலகு – IV** | **தமிழர்களின் திணைக் கோட்பாடுகள்** | **3** |
| தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு- சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவும் கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி. | | |
| **அலகு – V** | **இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு** | **3** |
| இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறபகுதிகளில் தமிழ் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு. | | |
| | | **Total: 15** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | ஆ. பூபாலன், தமிழர் மரபு, VRB Publishers Pvt Ltd, 2022. |

**REFERENCES:**


| | |
|---|---|
| 1. | தமிழக வரலாறு- மக்களும் பண்பாடும்- கே கே பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்) |
| 2. | கணினித்தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்) |
| 3. | கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம்.( தொல்லியல் துறை வெளியீடு) |
| 4. | பொருநை - ஆற்றங்கரை நாகரிகம் ( தொல்லியல் துறை வெளியீடு) |

| **COURSE OUTCOMES:**<br>படிப்பை முடித்தவுடன், மாணவர்கள் | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | தமிழ் மொழி மற்றும் இலக்கியத்தில் மதிப்புமிக்க கருத்துக்களை விளக்க முடியும். | Understanding (K2) |
| CO2 | தமிழர்களின் சிற்பம் மற்றும் அவர்களின் ஓவியங்கள் பற்றி விளக்க முடியும். | Understanding (K2) |
| CO3 | தமிழர்களின் நாட்டுப்புற மற்றும் தற்காப்புக் கலைகளைப் பற்றி சுருக்கமாகக் கூற முடியும். | Understanding (K2) |
| CO4 | தமிழர்களின் திணைக் கோட்பாடுகளைப் பற்றி விளக்க முடியும். | Understanding (K2) |
| CO5 | இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு பற்றி விளக்க முடியும். | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/Pos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO2 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO3 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO4 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO5 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 40 | 60 | | | | | 100 |
| CAT2 | 40 | 60 | | | | | 100 |
| CAT3 | 40 | 60 | | | | | 100 |
| ESE | NA | | | | | | |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks)

| 22TAM01 - HERITAGE OF TAMILS | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to All Engineering and Technology Branches) | | | | | | | |
| **Programme & Branch** | **All BE / BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **1 / 2** | **HS** | **1** | **0** | **0** | **1** |

| | | |
|---|---|---|
| Preamble | The objective of this course is to impart knowledge about Tamil language, literature, paintings, sculptures, folk arts, heroic games, doctrines, contribution of Tamils to Indian culture. | |
| **UNIT I** | **Language and Literature** | **3** |
| Language families in india - dravidian languages – tamil as a classical language - classical literature in tamil – secular nature of sangam literature – distributive justice in sangam literature - management principles in thirukural - tamil epics and impact of buddhism & jainism in tamil land - bakthi literature azhwars and nayanmars - forms of minor poetry - development of modern literature in tamil - contribution of bharathiyar and bharathidhasan. | | |
| **UNIT II** | **Heritage - Rock Art Paintings to Modern Art – Sculpture** | **3** |
| Hero stone to modern sculpture - bronze icons - tribes and their handicrafts - art of temple car making - - massive terracotta sculptures, village deities, thiruvalluvar statue at kanyakumari, making of musical instruments - mridhangam, parai, veenai, yazh and nadhaswaram - role of temples in social and economic life of tamils. | | |
| **UNIT III** | **Folk and Martial Arts** | **3** |
| Therukoothu – karagattam - villu pattu - kaniyan koothu – oyillattam - leather puppetry – silambattam – valari - tiger dance - sports and games of tamils. | | |
| **UNIT IV** | **Thinai Concept of Tamils** | **3** |
| Flora and fauna of tamils & aham and puram concept from tholkappiyam and sangam literature - aram concept of tamils - education and literacy during sangam age - ancient cities and ports of sangam age - export and import during sangam age - overseas conquest of cholas. | | |
| **UNIT V** | **Contribution of Tamils to Indian National Movement and Indian Culture** | **3** |
| Contribution of tamils to indian freedom struggle - the cultural influence of tamils over the other parts of india – self-respect movement - role of siddha medicine in indigenous systems of medicine – inscriptions & manuscripts – print history of tamil books. | | |
| | | **Total: 15** |

| **TEXT BOOK:** | |
|---|---|
| 1. | S.Muthuramalingam, M.Saravanakumar, Heritage of Tamils, Yes Dee Publishing Pvt Ltd, 2023. |
| **REFERENCES:** | |
| 1. | Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies). |
| 2. | The Contribution of Tamil of the Tamils to Indian Culture(Dr.M.Valarmathi)(Puplished by International Institute of Tamil Studies). |
| 3. | Keeladi – ‘Sangam City C ivilzation on the banks of river Vaigai; (Jointly Published by: Department of Archaeology & Tamilnadu Text Book and Educational Services Corporation, Tamilnadu). |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | explain valuable concepts in language and literature of tamils. | Understanding (K2) |
| CO2 | illustrate about the tamils sculpture and their paintings. | Understanding (K2) |
| CO3 | summarize about the tamils folk and martial arts. | Understanding (K2) |
| CO4 | explain the thinai concept of tamils. | Understanding (K2) |
| CO5 | explain the contribution of Tamils to the Indian National Movement and Indian culture. | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/Pos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO2 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO3 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO4 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO5 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 40 | 60 | | | | | 100 |
| CAT2 | 40 | 60 | | | | | 100 |
| CAT3 | 40 | 60 | | | | | 100 |
| ESE | NA | | | | | | |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks)

## 22TAM02 – தமிழரும் தொழில்நுட்பமும்

**(Common to All Engineering and Technology Branches)**

| Programme & Branch | All BE/BTech Branches | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| Prerequisites | Nil | 2 / 3 | HS | 1 | 0 | 0 | 1 |

| | |
|---|---|
| முன்னுரை | தமிழ் கலாச்சாரத்தோடு ஒன்றிய தொழில் நுட்பங்களை பற்றிப் எடுத்துரைத்தல் |

| | | |
|---|---|---|
| **அலகு – I** | **நெசவு மற்றும் பானை தொழில்நுட்பம்** | **3** |

சங்க காலத்தில் நெசவு தொழில் – பானைத் தொழில்நுட்பம் கருப்பு சிவப்பு பாண்டங்கள் – பாண்டகளில் கீறல் குறியீடுகள்

| | | |
|---|---|---|
| **அலகு – II** | **வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்** | **3** |

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு – சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச்சிற்பங்களும், கோவில்களும் – சோழர் காலத்து பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரிகட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னை இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

| | | |
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| **அலகு – III** | **உற்பத்தித் தொழில்நுட்பம்** | **3** |

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

| | | |
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| **அலகு – IV** | **வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம்** | **3** |

அணை, ஏரி, குளங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

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| **அலகு – V** | **அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்** | **3** |

அறிவியல் தமிழின் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் சொற்குவைத் திட்டம்.

**Total:15**

**TEXT BOOK:**

| | |
|---|---|
| 1. | தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்), உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, 2002 |
| 2. | கணினித்தமிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016 |

**REFERENCES:**

| | |
|---|---|
| 1. | கீழடி-வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம்.(தொல்லியல் துறை வெளியீடு) |
| 2. | பொருநை-ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு) |
| 3. | Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print) |

| | |
|---|---|
| 4. | Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies). |
| 5. | Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies) |
| 6. | The Contribution of the Tamil to Indian Culture (Dr.M.Valarmathi) (Puplished by International Institute of Tamil Studies). |
| 7. | Keeladi – 'Sangam City Civilzation on the banks of river Vaigai; (Jointly Published by: Department of Archaeology & Tamilnadu Text Book and Educational Services Corporation, Tamilnadu) |
| 8. | Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author) |
| 9. | Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu) |
| 10. | Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book. |

| **COURSE OUTCOMES:**<br>படிப்பை முடித்தவுடன், மாணவர்கள் | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | தமிழ் கலாச்சாரம் மற்றும் தமிழ் சமூகத்தினுடைய நெசவு மற்றும் பானை தொழில்நுட்பம் பற்றி விளக்க முடியும். | Understanding (K2) |
| CO2 | தமிழர்களின் வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்ப ஆற்றல் பற்றி விளக்க முடியும். | Understanding (K2) |
| CO3 | தமிழர்களின் உற்பத்தித் தொழில்நுட்பம் பற்றி சுருக்கமாகக் கூற முடியும். | Understanding (K2) |
| CO4 | தமிழர்களின் வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் பற்றி விளக்க முடியும். | Understanding (K2) |
| CO5 | தமிழர்களின் அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் பற்றி விளக்க முடியும். | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO2 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO3 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO4 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO5 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 40 | 60 | | | | | 100 |
| CAT2 | 40 | 60 | | | | | 100 |
| CAT3 | 40 | 60 | | | | | 100 |
| ESE | NA | | | | | | |

*** ±3% may be varied (CAT 1,2,3 – 50 marks)**

| 22TAM02 - TAMILS AND TECHNOLOGY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **(Common to All Engineering and Technology Branches)** | | | | | | | |
| **Programme & Branch** | **All BE/BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **2 / 3** | **HS** | **1** | **0** | **0** | **1** |

| | | |
|---|---|---|
| Preamble | This course aims to impart the essential knowledge on the tamil culture and related technology | |
| **UNIT – I** | **WEAVING AND CERAMIC TECHNOLOGY** | **3** |
| Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries. | | |
| **UNIT – II** | **DESIGN AND CONSTRUCTION TECHNOLOGY** | **3** |
| Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple) – Thirumalai Nayakar Mahal – Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period. | | |
| **UNIT – III** | **MANUFACTURING TECHNOLOGY** | **3** |
| Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold – Coins as source of history – Minting of Coins – Beads making – industries Stone beads – Glass beads –Terracotta beads –Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram. | | |
| **UNIT – IV** | **AGRICULTURE AND IRRIGATION TECHNOLOGY** | **3** |
| Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society. | | |
| **UNIT – V** | **SCIENTIFIC TAMIL & TAMIL COMPUTING** | **3** |
| Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project. | | |
| | | **Total:15** |

| | |
|---|---|
| **TEXT BOOK:** | |
| 1. | Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print) |
| 2. | Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies). |
| **REFERENCES:** | |
| 1. | தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்), உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, 2002 |
| 2. | கணினித்தமிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016 |
| 3. | கீழடி வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம்.(தொல்லியல் துறை வெளியீடு) |
| 4. | பொருநை ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு |
| 5. | Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies) |
| 6. | The Contribution of the Tamils to Indian Culture (Dr.M.Valarmathi)(Puplished by International Institute of Tamil Studies). |
| 7. | Keeladi – 'Sangam City Civilzation on the banks of river Vaigai; (Jointly Published by: Department of Archaeology & Tamilnadu Text Book and Educational Services Corporation, Tamilnadu) |
| 8. | Studies in the History of India with Special Reference to Tamilnadu (dr.K.K.Pillay) (Published by : The Author) |
| 9. | Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu) |
| 10. | Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | explain weaving and ceramic technology in tamil culture and tamil society. | Understanding (K2) |
| CO2 | Illustrate about the design and construction technology. | Understanding (K2) |
| CO3 | summarize about the manufacturing technology. | Understanding (K2) |
| CO4 | explain the agriculture and irrigation technology. | Understanding (K2) |
| CO5 | explain the significance of tamil in scientific and computing. | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO2 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO3 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO4 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO5 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 40 | 60 | | | | | 100 |
| CAT2 | 40 | 60 | | | | | 100 |
| CAT3 | 40 | 60 | | | | | 100 |
| ESE | NA | | | | | | |

*** ±3% may be varied (CAT 1,2,3 – 50 marks)**

| 22GCL11 – FOUNDATION ENGINEERING LABORATORY I | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to All BE/BTech branches) | | | | | | | |
| **Programme& Branch** | **All BE/BTech branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **1 / 2** | **ES** | **0** | **0** | **6** | **3** |

| | |
|---|---|
| Preamble | This course is designed to provide foundational knowledge on engineering with hands-on experience on developing a prototype model with the basic knowledge of Computer-aided Design, Manufacturing Processes, 3D Printing Technology, Robotics and Embedded Control. |

**LIST OF EXPERIMENTS / EXERCISES:**

| PART A – Manufacturing (30 Hours) | |
|---|---|
| 1. | Selection of product, free hand sketching and detailing |
| 2. | Construction of model using Arc/TIG/MIG/Gas/Spot welding operations |
| 3. | Enhancing the model with sheet metal |
| 4. | Creating the parts of the model using lathe |
| 5. | Creating the parts of the model using milling and drilling machines |
| **PART B – Product Design and Development (30 Hours)** | |
| 1. | Free hand sketching and detailing of the component |
| 2. | 3D part modelling of the component using CAD software |
| 3. | Engineering Analysis of the component model |
| 4. | Generate the component using 3D printer |
| 5. | Value addition to the produced component using CNC milling machine, CNC laser cutting machine and CNC router |
| **PART C – Robotics (30 Hours)** | |
| 1. | Design of electronic circuit and its debugging |
| 2. | Interfacing of sensors, actuators and wireless communion modules with microcontroller |
| 3. | Assembly of Tracker Robot with accessories |
| 4. | Development of control strategies for motion control, path planning and obstacle avoidance |
| 5. | Demonstration and testing of Robot in static environment |
| | **Total:90** |

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Laboratory Manual |
| 2. | AutoCAD 2020 and SOLID WORKS 2018 Software |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | develop the prototype model using mechanical operations like welding, forming and machining processes | Applying (K3), Precision (S3) |
| CO2 | sketch 3D model and enhance the prototype using modern machines like 3D printer, CNC milling machine, CNC Laser cutter and CNC Router | Applying (K3), Precision (S3) |
| CO3 | design and develop the autonomous robot for real-time applications | Applying (K3), Precision (S3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | 2 | | | | 3 | 2 | | 2 | | |
| CO2 | 3 | 3 | 3 | | 3 | | | | 3 | 2 | | 2 | | |
| CO3 | 3 | 3 | 3 | | 2 | | | | 3 | 2 | | 2 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22GCL12 – FOUNDATION ENGINEERING LABORATORY II | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to all BE/BTech branches) | | | | | | | |
| **Programme& Branch** | **All BE/BTech branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **1 /2** | **ES** | **0** | **0** | **6** | **3** |

| | |
|---|---|
| Preamble | This course is designed to provide a foundational knowledge on engineering with hands-on experience on the house wiring, Internet of Things and Web Technologies. |

**LIST OF EXPERIMENTS / EXERCISES:**

| PART A – Electrical Installation (30 Hours) | |
|---|---|
| 1. | Develop wiring diagrams using software tools. |
| 2. | Identify and select suitable components for Energy Measurement and Circuit Protection |
| 3. | Design a wiring circuit integrating Energy Meter, MCB and RCCB |
| 4. | Develop a wiring circuit for incandescent lamp and fluorescent lamp |
| 5. | Develop and Investigate Simple and Staircase Wiring for Residential Applications |
| 6. | Design the Wiring Circuits for Calling Bell System and Dimmable Light |
| 7. | Create wiring circuits for power loads |
| 8. | Measurement of Earth Resistance and its connections. |
| **PART B – Internet of Things (30 Hours)** | |
| 1. | Design a Single layer PCB layout designing |
| 2. | Fabricate Single layer PCB printing |
| 3. | Assembling, soldering and desoldering practice on single layer PCB |
| 4. | GPIO programming in ESP8266 |
| 5. | Sensor and actuator interfacing with internet enabled microcontroller device |
| 6. | Sensor and actuator calibration |
| 7. | Integration of microcontroller based system with Cloud platform |
| **PART C – Web Technologies (30 Hours)** | |
| 1. | Design a website for an application using HTML and CSS. |
| 2. | Convert the designed website into responsive website using Bootstrap. |
| 3. | Add dynamism to the website by using JavaScript and embed the Social Media components to the website. |
| 4. | Incorporate database interaction to the website. |
| 5. | Deploy the developed website in the server. |
| | **Total:90** |

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Laboratory Manual |
| 2. | Eric T.Freeman,Elisabeth Robson, "Head First JavaScript Programming A Brain-Friendly Guide", 1st Edition, O'Reilly , 2014. |

| | |
|---|---|
| 3. | Eric T.Freeman,Elisabeth Robson, ”Head First HTML and CSS”,2nd Edition, O’Reilly , 2012 |
| 4. | Lynn Beighley,”Head First SQL”,1st Editin, O’Reilly,2007. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | design electrical wiring circuits for buildings based on their requirement | Applying(K3), Precision (S3) |
| CO2 | develop IoT based solutions and PCB for real world use cases. | Applying (K3), Precision (S3) |
| CO3 | design and host an interactive dynamic website. | Applying(K3), Precision (S3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | | | | | 1 | | | | | |
| CO2 | 3 | 2 | 2 | 1 | | | | | 1 | | | | | |
| CO3 | 3 | 2 | 2 | 1 | | | | | 1 | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

## 22CSC24 – FUNDAMENTALS OF JAVA PROGRAMMING
(for Candidates admitted in year 2023-24)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme& Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **2** | **PC** | **3** | **0** | **2** | **4** |

| | |
|---|---|
| Preamble | This course provides a concise introduction to the fundamental concepts of Java programming including generics. It introduces spring boot applications using Maven and collection classes. |

| | | |
|---|---|---|
| **Unit – I** | **Introduction to OOP, Java, Classes and Objects** | **9** |

Overview of OOP – Object oriented programming paradigms – Features of Object-Oriented Programming – Java Buzz words –Evolution of Java – Overview of Java–Data Types, Variables and Arrays – Operators – Control Statements – Classes: Class Fundamentals-objects–Assigning Object Reference Variables – Introducing Methods – Constructors – this keyword – Garbage Collection – Stack Class.

| | | |
|---|---|---|
| **Unit – II** | **Inheritance** | **9** |

Overloading Methods – Objects as Parameters – Argument Passing – Returning Objects – Recursion – Access Control – Static - final– Nested and Inner Classes – Command–Line Arguments – Variable Length Arguments.
Inheritance: Basics – Super keyword -Multilevel Hierarchy–Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance.

| | | |
|---|---|---|
| **Unit – III** | **Packages ,Interfaces and I/O** | **9** |

Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces. - Default, static, private interface methods. I/O Basics – Reading and Writing Console I/O – Reading and Writing Files..

| | | |
|---|---|---|
| **Unit – IV** | **Generics, String Handling and Collections Packages and Interfaces** | **9** |

Generics: Introduction – Example –Parameters – General Form – Generic Methods and Generic Constructors. Strings: Basic String class, methods and String Buffer Class. Collection frameworks: Overview – Collection Interfaces-Collection Classes

| | | |
|---|---|---|
| **Unit – V** | **Exception Handling and Multithreading** | **9** |

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending –Resuming, and Stopping Threads – Wrappers – Auto boxing.

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Write simple Java programs using operators, arrays and control statements. |
| 2. | Develop stack and queue data structures using classes and objects. |
| 3. | Implement the concept of method overloading with simple java program |
| 4. | Demonstrate the concepts of inheritance & polymorphism. |
| 5. | Develop an application using packages. |
| 6. | Develop an application using interfaces by accessing super class constructors and methods. |
| 7. | Develop applications to perform file operations. |
| 8. | Develop applications to demonstrate the features of generics classes and interfaces. |
| 9. | Implement programs with String classes |
| 10. | Implement the concepts of collection frameworks. |
| 11. | Implement exception handling and creation of user defined exception. |
| 12. | Implement a java program to demonstrate multithreading and inter thread communication. |

**Lecture:45, Practical:30, Total:75**

**TEXT BOOK:**

| | |
|---|---|
| 1. | Herbert Schildt., "Java: The Complete Reference", 12th Edition, McGraw Hill Education, New Delhi, 2019. |

**REFERENCES/ MANUAL / SOFTWARE:**


| | |
|---|---|
| 1. | Cay S.Horstmann., "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018 |
| 2 | E Balagurusamy ,"Programming with Java",6th Edition, Mc Graw Hill Publication,2019 |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | apply the concepts of classes and objects to solve simple problems | Applying (K3)<br>Precision(S3) |
| CO2 | develop programs using method overloading and inheritance concepts packages and interfaces | Applying (K3)<br>Precision(S3) |
| CO3 | demonstrate the use of packages , interfaces and I/O streams in java programs | Applying (K3)<br>Precision(S3) |
| CO4 | build Java applications with string, collection classes and generics concepts | Applying (K3)<br>Precision(S3) |
| CO5 | make use of exception handling mechanisms and multithreaded model to solve real world problems | Applying (K3)<br>Precision(S3) |

**Mapping of COs with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | 1 | | | | 1 | 1 | | 2 | 3 | 2 |
| CO2 | 3 | 2 | 2 | 1 | 1 | | | | 1 | 1 | | 2 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 1 | 1 | | | | 1 | 1 | | 2 | 3 | 2 |
| CO4 | 3 | 2 | 2 | 1 | 1 | | | | 1 | 1 | | 2 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 1 | 1 | | | | 1 | 1 | | 2 | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

| **22MAT32 - DISCRETE MATHEMATICAL STRUCTURES** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **(Common to Computer Science and Engineering & Computer Science and Design branches)** | | | | | | | | |
| **Programme & Branch** | **BE - Computer Science and Engineering & Computer Science and Design branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **3** | **BS** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | To impart knowledge in mathematical logic, partial ordering and lattices, investigate various category of functions and develop skills to apply group structures in coding theory. | |
| **Unit – I** | **Propositional Calculus:** | **9+3** |
| Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and Contradictions – Inverse, Converse and Contrapositive – Logical equivalences and implications –Normal forms – Principal conjunctive normal form and Principal disjunctive normal form – Rules of inference – Arguments – Validity of arguments. | | |
| **Unit – II** | **Predicate Calculus:** | **9+3** |
| Predicates – Statement function – Variables – Quantifiers – Universe of discourse – Theory of inference – Rules of universal specification and generalization – Rules of Existential specification and generalization - Validity of arguments. | | |
| **Unit – III** | **Set Theory:** | **9+3** |
| Cartesian product of sets – Relations on sets – Types of relations and their properties – Matrix representation of a relation - Graph of a relation – Equivalence relations – Partial ordering – Poset – Hasse diagram – Lattices – Properties of lattices. | | |
| **Unit – IV** | **Functions:** | **9+3** |
| Definition – Classification of functions – Composition of functions – Inverse functions – Characteristic function of a set – Recurrence relations – Solution of recurrence relations – Generating Functions – Solving recurrence relation by generating functions. | | |
| **Unit – V** | **Group Theory:** | **9+3** |
| Groups and Subgroups (Definitions only) – Homomorphism – Cosets – Lagrange‘s theorem – Normal subgroups – Coding Theory : Group codes –Hamming distance – Basic notions of error correction – Error recovery in group codes (Excluding theorems in coding theory) | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Veerarajan T., "Discrete Mathematics with Graph Theory and Combinatorics", Reprint Edition, Tata McGraw Hill Publishing Company, New Delhi, 2013. |

**REFERENCES:**



| | |
|---|---|
| 1. | Tremblay J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill, New Delhi, Reprint 2010. |
| 2. | Kenneth H. Rosen, "Discrete Mathematics and its Applications", 8th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2012. |
| 3. | Susanna S. Epp, "Discrete Mathematics with Applications", Metric Edition, Cengage Learning, USA, 2019. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | apply propositional logic to validate the arguments. | Applying (K3) |
| CO2 | apply the rules of inference and methods of proof in predicate calculus to verify the validity of arguments. | Applying (K3) |
| CO3 | possess knowledge of various set theoretic concepts. | Applying (K3) |
| CO4 | understand different types of functions and solve recurrence relations. | Understanding (K2) |
| CO5 | apply the concepts of group structures in coding theory. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | | | | | 3 | |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 1 | |
| CO3 | 3 | 2 | 1 | | | | | | | | | | | |
| CO4 | 3 | 3 | 3 | | | | | | | | | | 1 | |
| CO5 | 3 | 3 | 3 | | | | | | | | | | 3 | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 30 | 60 | | | | 100 |
| CAT2 | 10 | 30 | 60 | | | | 100 |
| CAT3 | 10 | 30 | 60 | | | | 100 |
| ESE | 10 | 35 | 55 | | | | 100 |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

| 22CST31 - JAVA PROGRAMMING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **Programme& Branch** | **B.E.- Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **3** | **PC** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides a concise introduction to the fundamental concepts of Java programming including generics. It introduces spring boot applications using Maven and collection classes. | |
| **Unit – I** | **Introduction to Java, Classes and Objects** | **9** |
| Evolution of Java – Overview of Java–Data Types, Variables and Arrays – Operators – Control Statements – Classes: Class Fundamentals-objects–Assigning Object Reference Variables –Methods – Constructors – this keyword – Garbage Collection – Stack Class. Overloading Methods – Objects as Parameters – Argument Passing – Returning Objects – Recursion – Access Control – Static - final– Nested and Inner Classes – Command–Line Arguments – Variable Length Arguments. | | |
| **Unit – II** | **Inheritance, Packages and Interfaces** | **9** |
| Inheritance: Basics – Super keyword -Multilevel Hierarchy–Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.- Default, static, private interface methods. | | |
| **Unit – III** | **Exception Handling and Multithreading** | **9** |
| Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending –Resuming, and Stopping Threads – Wrappers – Auto boxing. | | |
| **Unit – IV** | **I/O, Generics, String Handling and Collections** | **9** |
| I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Introduction – Example – Parameters – General Form – Generic Methods, Constructors and Interfaces. Strings: Basic String class, methods and String Buffer Class. Collection frameworks: Overview – Collection Interfaces-Collection Classes. | | |
| **Unit – V** | **Getting started with Spring Boot, JDBC** | **9** |
| Introducing Spring Boot and essential features - Setting up the environment- Initializing a Spring Boot project with spring initializer - Bootstrapping a First Spring Boot Application – Build Tools – Maven and Gradle, pom.xml and build. gradle, building application using Maven and Gradle with database connectivity. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Herbert Schildt., "Java: The Complete Reference", 12th Edition, McGraw Hill Education, New Delhi, 2019. for Units I,II,III,IV |
| 2. | Shagun Bakliwal, "Hands-on Application Development using Spring Boot: Building Modern Cloud Native Applications by Learning RESTFul API, Microservices, CRUD Operations, Unit Testing, and Deployment", 1st Edition, BPB Publications, 2021 for Unit V |

**REFERENCES:**

| | |
|---|---|
| 1. | Cay S.Horstmann., "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018 |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | apply the concepts of classes and objects to solve simple problems | Applying (K3) |
| CO2 | develop programs using inheritance, packages and interfaces | Applying (K3) |
| CO3 | make use of exception handling mechanisms and multithreaded model to solve real world problems | Applying (K3) |
| CO4 | build Java applications with I/O packages, string, collection classes and generics concepts | Applying (K3) |
| CO5 | develop simple spring boot applications with database connectivity | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | 2 | | | | 1 | 1 | | 2 | 3 | 2 |
| CO2 | 3 | 2 | 2 | 1 | 2 | | | | 1 | 1 | | 2 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 1 | 2 | | | | 1 | 1 | | 2 | 3 | 2 |
| CO4 | 3 | 2 | 2 | 1 | 2 | | | | 1 | 1 | | 2 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 1 | 2 | | | | 1 | 1 | | 2 | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**Assessment Tool : Neo Portal**

<table>
<tr><td colspan="8">22CST32 - DATA STRUCTURES</td></tr>
<tr><td>Programme & Branch</td><td>B.E. - Computer Science and Engineering</td><td>Sem.</td><td>Category</td><td>L</td><td>T</td><td>P</td><td>Credit</td></tr>
<tr><td>Prerequisites</td><td>Programming and Linear Data Structures</td><td>3</td><td>PC</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Preamble</td><td colspan="7">The course focuses on the basic concepts and applications of linear data structures and non-linear data structures.</td></tr>
<tr><td>Unit – I</td><td colspan="6">Linear Data Structures and its Applications:</td><td>9</td></tr>
<tr><td colspan="8">Overview of Array, List, Stack and Queue – Doubly Linked List: Structure, Operations and Implementation – Circular Linked List: Structure, Operations and Implementation – Reversing a Linked List – Cloning a Linked List – Sorting a Linked List – Applications of List: Polynomial Addition – Representing Sparse Matrices – Applications of Stack: Balancing Parenthesis – String Reversal – Applications of Queue: Reversing the Queue using Stack.</td></tr>
<tr><td>Unit – II</td><td colspan="6">Trees:</td><td>9</td></tr>
<tr><td colspan="8">Preliminaries: Implementation of Trees – Tree Traversals with an Application – Binary Trees: Implementation – Expression Trees – The Search Tree ADT – Binary Search Trees: Construction – Insertion – Deletion – Searching – Find Min – Find Max – AVL Trees: Rotation – Insertion – Deletion.</td></tr>
<tr><td>Unit – III</td><td colspan="6">Graphs:</td><td>9</td></tr>
<tr><td colspan="8">Definitions – Representation of Graphs – Types of Graphs – Graph Traversal: Depth-First Search (DFS) – Breadth-First Search (BFS) – Topological Sort – Applications of DFS: Bi-connectivity – Euler Circuits – Finding Strongly Connected Components – Applications of BFS: Bipartite Graph – Graph Coloring.</td></tr>
<tr><td>Unit – IV</td><td colspan="6">Advanced Trees:</td><td>9</td></tr>
<tr><td colspan="8">Splay Trees: Splaying – Searching – Insertion – Deletion – Red-Black Trees: Rotation – Insertion – Deletion – Priority Queues (Heaps) – Insertion (Min and Max Heap) - Deletion (Min and Max Heap) – Binary Heap – D-heaps.</td></tr>
<tr><td>Unit – V</td><td colspan="6">Searching, Sorting and Hashing:</td><td>9</td></tr>
<tr><td colspan="8">Searching: Linear search – Binary Search – Sorting: Internal Sorting: Bubble sort – Shell sort – Bucket sort – External Sorting: Multiway Merge – Polyphase Merge – Hashing: Hash Functions – Separate Chaining – Open Addressing: Linear Probing – Quadratic Probing – Double Hashing – Rehashing – Extendible Hashing – Applications of Hashing: Dictionary/Telephone Directory.</td></tr>
<tr><td colspan="8" align="right">Total:45</td></tr>
<tr><td colspan="8">TEXT BOOK:</td></tr>
<tr><td>1.</td><td colspan="7">Weiss M. A., “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 2016 for Units I,II,III,V.</td></tr>
<tr><td>2.</td><td colspan="7">Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms”, 3rd Edition, Mcgraw Hill, 2009 for Unit IV.</td></tr>
<tr><td colspan="8">REFERENCES:</td></tr>
<tr><td></td><td colspan="7">Langsam Y.M., Augenstein J. and Tenenbaum A. M., “Data Structures using C and C++”, 2nd Edition, Pearson Education, 2015.</td></tr>
</table>

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | solve the computational problems using linear data structures. | Applying (K3) |
| CO2 | determine the structure and operations on trees. | Applying (K3) |
| CO3 | apply appropriate graph algorithms for solving computing problems. | Applying (K3) |
| CO4 | implement the operations of special trees. | Applying (K3) |
| CO5 | demonstrate the concept of sorting, searching and hashing techniques. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | 1 | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | 1 | 3 | 1 |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | 1 | 3 | 1 |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | 1 | 3 | 1 |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 5 | 20 | 75 | | | | 100 |
| CAT2 | 10 | 20 | 70 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 20 | 70 | | | | 100 |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

| 22CST33 - COMPUTER ORGANIZATION | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme& Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **3** | **PC** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides knowledge on basics of computer organization, introduces various arithmetic operations and discusses the performance issues of processor, memory and I/O units. | |
| **Unit – I** | **Basic Structure of Computers and Machine Instructions** | **9** |
| Functional Units – Basic Operational Concepts – Number Representation and Arithmetic Operations – Performance – Memory Locations and Addresses – Memory Operations – Instruction and Instruction Sequencing – Addressing Modes – CISC Instruction Sets – RISC and CISC Styles. | | |
| **Unit - II** | **Arithmetic Unit** | **9** |
| Addition and Subtraction of Signed Numbers – Design of Fast Adders – Multiplication of Unsigned Numbers – Multiplication of Signed Numbers – Fast Multiplication – Integer Division – Floating Point Numbers and Operations. | | |
| **Unit - III** | **Processing Unit** | **9** |
| Fundamental Concepts – Instruction Execution – Hardware Components – Instruction Fetch and Execution Steps – Control Signals - Hardwired control – CISC Style Processors. Pipelining : Pipelining – Basic concepts – Pipeline Organization – Pipelining Issues - Data Dependencies – Memory Delay – Branch Delay – Performance Evaluation. | | |
| **Unit - IV** | **Memory System** | **9** |
| Basic Concepts – Semiconductor RAM Memories – Read-Only Memories – Direct Memory Access – Memory Hierarchy - Cache Memories : Mapping Functions – Performance Consideration – Virtual Memory – Secondary Storage : Magnetic Hard Disks. | | |
| **Unit - V** | **I/O Organization** | **9** |
| Accessing I/O Devices – Interrupts – Enabling and Disabling Interrupts – Handling Multiple Devices – Bus Structure – Bus Operation – Arbitration – Interface Circuits – Interconnection Standards : USB. | | |
| | | **Total:45** |


| **TEXT BOOK:** | |
|---|---|
| 1. | Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, “Computer Organization and Embedded Systems”, 6th Edition, McGraw Hill International Edition, 2012. |
| **REFERENCES:** | |
| 1. | Patterson David, A. and Hennessy John L., “Computer Organization and Design: The Hardware / Software Interface”, 5th Edition, Harcourt Asia, Morgan Kaufmann, Singapore, 2014. |
| 2. | Stallings William, “Computer Organization and Architecture: Designing for Performance”, 9th Edition, Pearson Education, New Delhi, 2012. |
| 3. | M. Morris Mano,” Computer System Architecture”, 3rd Edition, Pearson Education, New Delhi, 2012. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | illustrate the working of a digital computer using different addressing modes. | Applying (K3) |
| CO2 | apply algorithms for performing different arithmetic operations. | Applying (K3) |
| CO3 | demonstrate the execution of instruction in the data path of a processor using pipelining | Applying (K3) |
| CO4 | distinguish between different types of memory, and apply the mapping functions between main memory and cache. | Applying (K3) |
| CO5 | demonstrate the need for and types of interrupts in I/O transfer | Applying (K3) |

**Mapping of COs with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | 1 | | | | 1 | 1 | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | 1 | | | | 1 | 1 | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| **Test / Bloom’s Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 50 | 40 | | | | 100 |
| CAT2 | 10 | 40 | 50 | | | | 100 |
| CAT3 | 10 | 50 | 40 | | | | 100 |
| ESE | 10 | 50 | 40 | | | | 100 |

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

| 22CSC31 - DIGITAL PRINCIPLES AND DESIGN | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme& Branch** | **B.E. - Computer Science and Engineering** | **Sem** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **3** | **ES** | **3** | **0** | **2** | **4** |

| | | |
|---|---|---|
| **Preamble** | This course enables the students to understand the basic principles of number system, Binary Codes, Boolean algebra, digital logic gates, combinational and sequential circuits. It also focuses on registers, counters and programmable logic devices. | |
| **Unit – I** | **Number Systems and Boolean Algebra:** | 9 |
| Number Systems and their conversions - Complements – Signed Binary Numbers – Binary Codes – Binary Logic - Boolean Algebra: Definitions – Basic and Axiomatic –Theorems of Boolean Algebra – Boolean functions: Realization of functions using Logic gates | | |
| **Unit – II** | **Gate Level Minimization**: | 9 |
| Canonical and Standard Forms of Boolean functions – Minimization of functions using Karnaugh Map – Don't–Care Conditions – NAND and NOR Implementation– Exclusive-OR function – Minimization of functions using Quine-McCluskey method. | | |
| **Unit – III** | **Combinational Logic**: | 9 |
| Analysis procedure – Design procedure – Binary Adder &Subtractor :Half Adder – Full Adder - Half Subtractor – Full Subtractor– Magnitude Comparator – Decoders – Encoders – Multiplexers – Demultiplexers – Boolean Functions implementation using Multiplexers and Decoders. | | |
| **Unit – IV** | **Sequential Logic**: | 9 |
| Introduction – Latches and Flip-flops – Analysis of clocked sequential circuits: State Equations – State Table – State Diagram – State Reduction and Assignment– Mealy and Moore machines and their circuit design procedure. Introduction to Asynchronous Sequential Circuits: Analysis Procedure - Race conditions. | | |
| **Unit – V** | **Register, Counter and Programmable Logic:** | 9 |
| **Register, Counter and Programmable Logic**: Shift Registers: Serial Transfer – Serial Addition – Universal Shift register – Synchronous Counters: Binary Ripple Counter – BCD Ripple Counter – Ring Counter – Johnson Counter. Programmable Logic: Read - Only Memory – Programmable Logic Array – Programmable Array Logic. | | |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Verification of Boolean functions |
| 2. | Implement the following combinational logic circuits using logic gates<br>i) Half Adder and Full Adder ii) Half Subtractor and Full Subtractor |
| 3. | Design and Implement 4- Bit Adder /Subtractor. |
| 4. | Design and Implement BCD Adder /Subtractor. |
| 5. | Design and implement a 4-bit binary to gray and gray to binary code converter. |
| 6. | Simulation of Multiplexer and Demultiplexer circuits using Virtual labs |
| 7. | Design and implement decoders and encoders. |
| 8. | Implement various Flip-flops using Logic gates. |
| 9. | Design and implement various Shift Registers. |
| 10. | Design and implement various Synchronous counters. |

**Lecture:45, Practical:30, Total:75**

**TEXT BOOK:**


| | |
|---|---|
| 1. | Morris Mano M., Micheal D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson Education, 2018. |


**REFERENCES:**


| | |
|---|---|
| 1. | Salivahanan S. &Arivazhagan S., "Digital Circuits and Design", 5th Edition, Oxford University Press, New Delhi, 2018. |
| 2. | Morris Mano M., Micheal D. Ciletti, "Digital Design (Uttaranchal Technical University)", 4th Edition, Pearson Education, 2012. |
| 3. | Virtual Labs: http://vlabs.iitkgp.ac.in/dec |

| **COURSE OUTCOMES:** On completion of the course, the students will be able to | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | apply the different number systems and their conversion and boolean algebra | Applying (K3) Precision(S3) |
| CO2 | make use of map and tabulation technique to evaluate the given Boolean expression | Applying (K3) Precision(S3) |
| CO3 | make use of combinational logic circuits to evaluate the boolean expression | Applying (K3) Precision(S3) |
| CO4 | apply the concepts of sequential logic circuits to implement boolean functions | Applying (K3) Precision(S3) |
| CO5 | construct simple digital systems using registers, counters, and programmable logic devices | Applying (K3) Precision(S3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 2 | 2 | 1 | | | | | 1 | | | 3 | 1 |
| CO4 | 3 | 2 | 2 | 2 | 1 | | | | | 1 | | | 3 | 1 |
| CO5 | 3 | 2 | 2 | 2 | 1 | | | | | 1 | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 45 | 45 | | | | 100 |
| CAT2 | 10 | 45 | 45 | | | | 100 |
| CAT3 | 10 | 45 | 45 | | | | 100 |
| ESE | 10 | 45 | 45 | | | | 100 |

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

| 22TAM02 - TAMILS AND TECHNOLOGY | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to All Engineering and Technology Branches) | | | | | | | |
| **Programme & Branch** | **All BE/BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **2 / 3** | **HS** | **1** | **0** | **0** | **1** |

| | | |
|---|---|---|
| Preamble | This course aims to impart the essential knowledge on the tamil culture and related technology | |
| **UNIT – I** | **WEAVING AND CERAMIC TECHNOLOGY** | **3** |
| Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries. | | |
| **UNIT – II** | **DESIGN AND CONSTRUCTION TECHNOLOGY** | **3** |
| Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple) – Thirumalai Nayakar Mahal – Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period. | | |
| **UNIT – III** | **MANUFACTURING TECHNOLOGY** | **3** |
| Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold – Coins as source of history – Minting of Coins – Beads making – industries Stone beads – Glass beads –Terracotta beads –Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram. | | |
| **UNIT – IV** | **AGRICULTURE AND IRRIGATION TECHNOLOGY** | **3** |
| Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society. | | |
| **UNIT – V** | **SCIENTIFIC TAMIL & TAMIL COMPUTING** | **3** |
| Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project. | | |
| | | **Total:15** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print) |
| 2. | Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies). |

**REFERENCES:**

| | |
|---|---|
| 1. | தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்), உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, 2002 |
| 2. | கணினித்தமிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016 |
| 3. | கீழடி வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம்.(தொல்லியல் துறை வெளியீடு) |
| 4. | பொருநை ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு |
| 5. | Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies) |
| 6. | The Contribution of the Tamils to Indian Culture (Dr.M.Valarmathi)(Puplished by International Institute of Tamil Studies). |
| 7. | Keeladi – 'Sangam City Civilzation on the banks of river Vaigai; (Jointly Published by: Department of Archaeology & Tamilnadu Text Book and Educational Services Corporation, Tamilnadu) |
| 8. | Studies in the History of India with Special Reference to Tamilnadu (dr.K.K.Pillay) (Published by : The Author) |
| 9. | Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu) |
| 10. | Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped**<br>**(Highest Level)** |
|---|---|---|
| CO1 | explain weaving and ceramic technology in tamil culture and tamil society. | Understanding (K2) |
| CO2 | Illustrate about the design and construction technology. | Understanding (K2) |
| CO3 | summarize about the manufacturing technology. | Understanding (K2) |
| CO4 | explain the agriculture and irrigation technology. | Understanding (K2) |
| CO5 | explain the significance of tamil in scientific and computing. | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO2 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO3 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO4 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |
| CO5 | | | | | | 3 | | 3 | 2 | 2 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 40 | 60 | | | | | 100 |
| CAT2 | 40 | 60 | | | | | 100 |
| CAT3 | 40 | 60 | | | | | 100 |
| ESE | NA | | | | | | |

*** ±3% may be varied (CAT 1,2,3 – 50 marks)**

| 22CSL31 - JAVA PROGRAMMING LABORATORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme& Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **3** | **PC** | **0** | **0** | **2** | **1** |

| | |
|---|---|
| Preamble | This course provides knowledge to develop applications using java programming language and spring boot framework. |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Write simple Java programs using operators, arrays and control statements. |
| 2. | Develop stack and queue data structures using classes and objects. |
| 3. | Demonstrate the concepts of inheritance & polymorphism. |
| 4. | Develop an application using interfaces by accessing super class constructors and methods. |
| 5. | Develop an application using packages. |
| 6. | Implement exception handling and creation of user defined exception. |
| 7. | Implement a java program to demonstrate multithreading and inter thread communication. |
| 8. | Develop applications to perform file operations. |
| 9. | Develop applications to demonstrate the features of generics classes and interfaces. |
| 10. | Implement the concepts of collection frameworks. |
| 11. | Develop simple java application using spring Boot. |
| 12. | Develop applications using Maven and Gradle |

**Total:30**

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Linux / Windows |
| 2. | Eclipse IDE / Netbeans IDE |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | develop java programs using object oriented programming concepts | Applying (K3)<br>Precision(S3) |
| CO2 | develop simple applications using package, exception handling, multithreading, and generics concepts | Applying (K3)<br>Precision(S3) |
| CO3 | create simple applications using Spring Boot. | Applying (K3)<br>Precision(S3) |

**Mapping of Cos with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | 1 | | | | 1 | 1 | 1 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 2 | 1 | 1 | | | | 1 | 1 | 1 | 2 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 1 | 1 | | | | 2 | 2 | 1 | 2 | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

| 22CSL32 - DATA STRUCTURES LABORATORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. – Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Programming and Linear Data Structures** | **3** | **PC** | **0** | **0** | **2** | **1** |

| | |
|---|---|
| Preamble | This course provides knowledge to develop applications using the concepts of Linear and Non-linear Data Structures. |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Implementation of doubly linked list and its operations |
| 2. | Implementation of circular linked list and its operations |
| 3. | Implementation of polynomial addition using linked list ADT |
| 4. | Implementation of balancing symbols using stack ADT |
| 5. | Implementation of binary search tree traversals |
| 6. | Implement the operations of AVL Tree:<br>i) Store a number on to the tree<br>ii) Delete a number from the tree<br>iii) Display all the numbers in the tree |
| 7. | Implementation of graph traversal techniques |
| 8. | Implementation of topological sorting algorithm |
| 9. | Implementation of heap data structure and its operations |
| 10. | Implementation of sorting algorithms: Bubble sort and Shell sort |
| 11. | Implementation of quick sort algorithm |
| 12. | Implement the following operations in hash table using array<br>i) Store the element in hash table<br>ii) Search an element from the table<br>iii) Delete an element from the table |

**Total:30**

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Operating System : Windows/Linux |
| 2. | Software : C |
| 3. | Laboratory Manual |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | implement linear data structures and use it to solve the given problem | Applying (K3), Precision (S3) |
| CO2 | make use of non linear data structures concepts to solve the problems in real world | Applying (K3), Precision (S3) |
| CO3 | implement searching, sorting and indexing operations | Applying (K3), Precision (S3) |

**Mapping of Cos with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 2 | | | | | | | | 2 | 3 | 2 |
| CO2 | 3 | 2 | 1 | 2 | | | | | | | | 2 | 3 | 2 |
| CO3 | 3 | 2 | 1 | 2 | | | | | | | | 2 | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22GCT31- UNIVERSAL HUMAN VALUES | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to All Engineering and Technology Branches) | | | | | | | |
| **Programme & Branch** | **All BE/BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **3/6** | **BS** | **2** | **0** | **0** | **2** |

| | | |
|---|---|---|
| Preamble | To make the student to know what they 'really want to be' in their life and profession, understand the meaning of happiness and prosperity for a human being. Also to facilitate the students to understanding of harmony at all the levels of human living, and live accordingly | |
| **Unit – I** | **Introduction:** | **6** |
| Need and Basic Guidelines of Value Education – Content and Process of Value Education – Self Exploration – purpose of self-Exploration – Content and Process of Self exploration – Natural Acceptance – Realization and Understanding – Basic Human Aspirations – Continuous Happiness and Prosperity – Exploring Happiness and Prosperity – Basic Requirement for Fulfillment of Human Aspirations – Relationships – Physical Facilities – Right Understanding. | | |
| **Unit – II** | **Harmony in the Self and Body:** | **6** |
| Human Being and Body – Understanding Myself as Co–existence of Self ('I') and Body, Needs of the Self and Body, Activities in the Self and Body, Self ('I') as the Conscious Entity, the Body as the Material Entity – Exercise – Body as an Instrument– Harmony in the Self ('I) – Understanding Myself – Harmony with Body. | | |
| **Unit – III** | **Harmony in the Family and Society:** | **6** |
| Harmony in the Family – Justice – Feelings (Values) in Human Relationships – Relationship from Family to Society – Identification of Human Goal – Five dimensions of Human Endeavour. | | |
| **Unit – IV** | **Harmony in Nature and Existence:** | **6** |
| Order of Nature – Interconnectedness – Understanding the Four order – Innateness – Natural Characteristic – Basic Activity – Conformance – Introduction to Space – Co–existence of units of Space – Limited and unlimited – Active and No–activity – Existence is Co–existence. | | |
| **Unit – V** | **Implications of the above Holistic Understanding of Harmony on Professional Ethics:** | **6** |
| Values in different dimensions of Human Living – Definitiveness of Ethical Human Conduct –Implications of Value based Living – Identification of Comprehensive Human Goal – Humanistic Education – Universal Human Order – Competence and Issues in Professional Ethics. | | |
| | | **Total:30** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Gaur R.R., Sangal R., Bagaria G.P., "A Foundation Course in Human Values and Professional Ethics", 1st edition, Excell Books Pvt. Ltd., New Delhi, 2016. |

**REFERENCES:**

| | |
|---|---|
| 1. | Ivan Illich, "Energy & Equity", The Trinity Press, USA, 1974. |
| 2. | Schumacher E.F., "Small is Beautiful: a study of economics as if people mattered", Britain, 1973. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | restate the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society | Applying (K3) |
| CO2 | distinguish between the Self and the Body, understand the meaning of Harmony in the Self, the Co–existence of Self and Body | Applying (K3) |
| CO3 | infer the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships and explore their role in ensuring a harmonious society | Applying (K3) |
| CO4 | transform themselves to co-exist with nature by realising interconnectedness and four order of nature | Applying (K3) |
| CO5 | distinguish between ethical and unethical practices, and extend ethical and moral practices for a better living | Applying (K3) |

| Mapping of COs with POs and PSOs | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| CO1 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy | | | | | | | | | | | | | | |

| ASSESSMENT PATTERN - THEORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Test / Bloom's Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
| CAT1 | 25 | 75 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| ESE | NA | | | | | | 100 |
| * ±3% may be varied (CAT 1 & 2 – 60 marks & ESE – 100 marks) | | | | | | | |

| **22CSC41 - PYTHON PROGRAMMING AND FRAMEWORKS** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme& Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **4** | **ES** | **3** | **0** | **2** | **4** |
| Preamble | This course provides fundamental knowledge on Python programming and its frameworks. It also explores various packages for data manipulation and analysis. | | | | | | |
| **Unit – I** | **Basic Concepts** | | | | | | **9** |
| Introduction – Variables, Expressions and Statements – Functions – Conditionals and recursion – Fruitful Functions – return values, parameters, local and global scope, function composition, recursion – Iteration Statements – Mutable vs Immutable data types – Strings – String slices – Searching – Looping and Counting – String methods – String Comparison. | | | | | | | |
| **Unit – II** | **Data Structures** | | | | | | **9** |
| Lists – List operations – slices and methods – Dictionaries – Dictionaries as set of Counters – Looping and Dictionaries – Dictionaries and Lists – Tuples – Tuples Basics – Lists and Tuples – Dictionaries and Tuples – Sequences of sequences – Sets – Sets Basics – Set Operations – Case Study – Data Structure Selection – Files – Basic File Operations – File names and paths – Exception Handling. | | | | | | | |
| **Unit – III** | **Object Oriented Programming & Python Database Integration** | | | | | | **9** |
| Classes and Objects – Classes and Functions – Classes and methods – Object-oriented features – __init__() method – __str__() method – Operator Overloading – Type-based dispatch – Polymorphism – Inheritance – Aggregation and Association – Need for database programming – Connect Database – CRUD operations – Cursor Attributes. | | | | | | | |
| **Unit – IV** | **Data Manipulation with NumPy Arrays** | | | | | | **9** |
| Python Environment & Frameworks: Anaconda – Jupyter notebook – NumPy: The Basics of NumPy Arrays – Computation on NumPy Arrays – Aggregations – Case Study Using Aggregation and Histogram – Computation on Arrays: Broadcasting – Comparisons, Masks and Boolean Logic – Fancy Indexing - Sorting Arrays – Structured Arrays. | | | | | | | |
| **Unit – V** | **Data Manipulation with Pandas and Visualization** | | | | | | **9** |
| Data Manipulation with Pandas: Pandas Objects – Data Indexing and Selection – Operating on data – Handling missing data – Hierarchical Indexing – Concat and Append – Merge and Join – Aggregation and Grouping - Data Visualization with Matplotlib: Line plots: Line Colors and Styles – Axes Limits – Labeling Plots. | | | | | | | |

| **LIST OF EXPERIMENTS / EXERCISES:** | |
|---|---|
| 1. | Implement user-defined functions with different types of argument passing methods |
| 2. | Demonstrate the various string manipulation functions |
| 3. | Demonstrate the various operations on List, Tuple, Dictionary, and Sets |
| 4. | Implement the different file operations and exception handling |
| 5. | Implement the concept of constructors and different types of inheritance |
| 6. | Implement the concept of Aggregation, Association, and Polymorphism |
| 7. | Develop an application to illustrate CRUD operations using Python and MySQL |
| 8. | Develop an application to illustrate Array indexing, slicing, reshaping, and sorting using NumPy |
| 9. | Demonstrate Data Manipulation with Pandas |
| 10. | Demonstrate Data Visualization using line plots and histograms in Matplotlib |
| | **Lecture:45, Practical:30, Total:75** |

| **TEXT BOOK:** | |
|---|---|
| 1. | Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 1$^{st}$ Edition, O'Reilly Publishers, 2016 for Units I,II,III |
| 2. | Jake Vander Plas, "Python Data Science Handbook Essential Tools for Working with Data", 1st Edition, O'Reilly Publishers, 2019 for Units IV,V |

| **REFERENCES/ MANUAL / SOFTWARE:** | |
|---|---|
| 1. | Martin C Brown, "Python: The Complete Reference", Fourth Edition, McGraw Hill Education, 2018 |
| 2. | https://www.geeksforgeeks.org/difference-between-association-and-aggregation/ |
| 3. | https://www.i2tutorials.com/crud-operations-with-mysql-database-using-python/ |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | demonstrate the use of control structures, functions and string in Python | Applying (K3)<br>Precision(S3) |
| CO2 | make use of list, dictionaries, tuples, and sets data structures for developing applications | Applying (K3)<br>Precision(S3) |
| CO3 | implement Object Oriented Programming concepts and CRUD operations using MySQL | Applying (K3)<br>Precision(S3) |
| CO4 | perform data manipulation with NumPy arrays | Applying (K3)<br>Precision(S3) |
| CO5 | perform data manipulation with Pandas and data visualization using Matplotlib | Applying (K3)<br>Precision(S3) |

**Mapping of COs with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | 1 | | | | | | | 1 | 3 | 2 |
| CO2 | 3 | 2 | 2 | 1 | 1 | | | | | | | 1 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 1 | 1 | | | | 1 | 1 | | 1 | 3 | 2 |
| CO4 | 3 | 2 | 2 | 1 | 1 | | | | 1 | 1 | | 1 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 1 | 1 | | | | 1 | 1 | | 1 | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22CST41 - DATABASE MANAGEMENT SYSTEMS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme& Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **4** | **PC** | **3** | **0** | **0** | **3** |
| Preamble | This course focuses on the fundamentals of data models and database system design along with file organization and query processing. | | | | | | |
| **Unit – I** | **Data Models and Relational Model:** | | | | | | **9** |
| Introduction – Database System Applications – Purpose of database systems – View of data – Database Languages – Relational Databases – Database Architecture – Database Users and administrators – Relational Model – Structure of Relational Databases – Database Schema – Keys – Schema Diagrams – Relational Query Languages – Relational Algebra – Fundamental Relational Operations – Additional relational operations. | | | | | | | |
| **Unit – II** | **Database Design and SQL** | | | | | | **9** |
| Database Design – E-R model – Constraints – ER diagrams – Reduction to Relational Schema – ER design issues. SQL: Basic structure – Operations – Aggregate Functions – Sub queries – Nested Sub queries – modification of the database – Intermediate SQL: Joins – views – Index – Integrity Constraints – SQL data types and schemas – Authorization. | | | | | | | |
| **Unit – III** | **Relational Database Design:** | | | | | | **9** |
| Relational Database Design: Features of good relational designs – Functional dependency – Decomposition using functional dependencies – Normal Forms: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF – Data Storage: RAID – Tertiary storage – Overview of query processing and query optimization - File Organization – Organization of Records in Files – Data dictionary storage. | | | | | | | |
| **Unit – IV** | **Indexing, Hashing and Transactions:** | | | | | | **9** |
| Indexing, Hashing and Transactions: Ordered indices – B tree index files – B+ Tree index files – Multiple key access – Static and Dynamic Hashing – Bitmap indices – Transaction concept – Transaction model – Storage structure – Transaction atomicity and durability – Isolation – Serializability. | | | | | | | |
| **Unit – V** | **Concurrency Control and Recovery System:** | | | | | | **9** |
| Concurrency Control: Lock-based Protocols – Deadlock Handling – Multiple Granularity – Timestamp and Validation Based Protocols. Recovery System: Failure classification – Storage – Recovery and atomicity – Algorithm – Buffer management – Failure with loss of nonvolatile storage – early lock release and logical undo operations. | | | | | | | |
| | | | | | | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Silberschatz Abraham, Korth Henry F. and Sudarshan S., “Database System Concepts”, 7th Edition, McGraw Hill, New York, 2019. |

**REFERENCES:**

| | |
|---|---|
| 1. | ElmasriRamez and NavatheShamkant B., “Fundamental Database Systems”, 7th Edition, Pearson Education, New Delhi, 2017. |
| 2. | Date C.J., Kannan A. and Swamynathan S., “An Introduction to Database Systems”, 8th Edition, Pearson Education, New Delhi, 2013. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | outline the features, architecture, applications of database system and use relational algebra operations for writing queries | Applying (K3) |
| CO2 | design an ER model and use SQL statements for retrieving information from relational databases | Applying (K3) |
| CO3 | apply normalization methods for designing relational databases | Applying (K3) |
| CO4 | apply indexing and hashing techniques for effective transaction processing | Applying (K3) |
| CO5 | apply the concepts of concurrency control and recovery in a relational database | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | 1 | 3 | 1 |
| CO2 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | 1 | 1 | 3 | 1 |
| CO3 | 3 | 2 | 2 | 1 | | | | | 1 | 1 | 1 | 1 | 3 | 1 |
| CO4 | 3 | 2 | 2 | | | | | | | | | 1 | 3 | 1 |
| CO5 | 3 | 2 | 2 | | | | | | | | | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 30 | 30 | 40 | | | | 100 |
| CAT2 | 10 | 40 | 50 | | | | 100 |
| CAT3 | 10 | 40 | 50 | | | | 100 |
| ESE | 20 | 30 | 50 | | | | 100 |

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

| 22CST42 - WEB TECHNOLOGY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **4** | **PC** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides an introduction to Client-Side JS and Server-Side JS Frameworks. The course also addresses the application of Angular and ReactJS for developing web applications. | |
| **Unit - I** | **JavaScript::** | **9** |
| Introduction – Operators – Control Structures: Selection: if – if-else – switch. Repetition: while – do-while – for – break and continue. Functions: Function Definition – Scope Rules – Recursion. Array: Declaration – Initialization – Growing Arrays – Passing Arrays to Function. Event Handling-DOM-Local Storage. | | |
| **Unit – II** | **Server-side JS Framework :** | **9** |
| Node JS: Introduction – Architecture – Features – Creating Web Servers with HTTP Request – Response – Event Handling – GET and POST Methods – Modules – Express: Routing-Middleware-Error Handling. | | |
| **Unit – III** | **Database** | **9** |
| MongoDB: Basics- Connect to NoSQL Database using Node JS – Implementation of CRUD operations- PostgreSQL-Basics-Schema-Installation and connection-CRUD operations. | | |
| **Unit – IV** | **ReactJS– Part 1:** | **9** |
| React: Introduction – Installation –create React app - components – state – props - props validation – state vs props – constructor – Component API – Component Life cycle - Forms – controlled and uncontrolled component – Events – conditional rendering. | | |
| **Unit – V** | **ReactJS - Part 2:** | **9** |
| List – keys – refs – Fragments - Router – CSS – Animation – Map – Table –Code splitting – Hooks: useState–useEffect–useContext. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Paul Deitel, Harvey M.Deitel and Abbey Deitel, ―Internet and World Wide Web - How To Program, 5th Edition, Prentice Hall, 2011. [Unit 1] |
| 2. | Wieruch, Robin, “The Road to Learn React: Your Journey to Master Plain Yet Pragmatic React. Js.” Germany, Lean Publishing, 2017. [unit 4 &5] |

**REFERENCES:**

| | |
|---|---|
| 1. | Infosys campus connect material shared by infy, for Units 2 and 3 |
| 2. | https://www.javatpoint.com |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | develop interactive and dynamic web pages using JavaScript | Applying (K3) |
| CO2 | develop a web application using node JS and Express | Applying (K3) |
| CO3 | utilize SQL and NoSQL databases to connect a website to the backend | Applying (K3) |
| CO4 | apply the features of React to develop web applications. | Applying (K3) |
| CO5 | utilize react client-side JS framework to develop web applications | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | 1 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | 1 | 2 | 3 | 2 |
| CO3 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | 1 | 2 | 3 | 2 |
| CO4 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | 1 | 2 | 3 | 2 |
| CO5 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | 1 | 2 | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 20 | 60 | | | | 100 |
| CAT2 | 20 | 20 | 60 | | | | 100 |
| CAT3 | 20 | 20 | 60 | | | | 100 |
| ESE | 10 | 20 | 70 | | | | 100 |

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

| 22CST43 - OPERATING SYSTEMS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **4** | **PC** | **3** | **0** | **0** | **3** |

| | |
|---|---|
| Preamble | This course provides basic operating system structures, system call interface, process, threads, and inter-process communication. Various management functions of an operating system will also be explored. |

| | | |
|---|---|---|
| **Unit – I** | **Operating Systems Overview:** | **9** |
| Introduction – Computer System Organization – Computer System Architecture – Operations – Resource Management – Security and Protection – Virtualization – Computing Environments. Operating Systems Structures: Services – User and OS Interface – System Calls – Linkers and Loaders – Operating system Structure – Building and Booting OS. | | |
| **Unit – II** | **Process Management:** | **9** |
| Process Concept – Process Scheduling – Operations on Processes – Interprocess Communication – IPC in Shared Memory and Message Passing Systems. CPU Scheduling: Scheduling Criteria – Scheduling Algorithms. Multithreaded Programming: Threads Overview – Multicore Programming – Multithreading Models. | | |
| **Unit – III** | **Process Synchronization:** | **9** |
| The Critical Section Problem – Peterson's solution – Hardware support for Synchronization – Mutex Locks – Semaphores – Monitors. Deadlocks: Deadlock Characterization – Methods for handling deadlocks - Deadlock Prevention and Avoidance – Deadlock Detection – Recovery from Deadlock. | | |
| **Unit – IV** | **Memory Management:** | **9** |
| Main Memory: Background – Contiguous Memory Allocation – Segmentation – Paging – Swapping. Virtual Memory: Background – Demand Paging – Page Replacement – Case study: Intel 32 Architecture. | | |
| **Unit – V** | **Storage Management:** | **9** |
| Mass Storage Structure: Overview – HDD Scheduling. File System: File Concept – Access Methods – Directory Structure – Protection. File System Implementation: File System Structure – File System Operations – Directory Implementation – Allocation Methods - Free Space Management. – Security : The Security Problem – program Threats - Case study: Linux System. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley & Sons Inc., 2018. |

**REFERENCES:**


| | |
|---|---|
| 1. | William Stallings, "Operating Systems Internals and Design Principles", 9th Edition, Prentice Hall, 2018. |
| 2. | Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition, Pearson Education, 2016. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | identify appropriate system calls for a given service using various OS services and structure | Applying (K3) |
| CO2 | make use of process management strategies for scheduling processes | Applying (K3) |
| CO3 | apply different methods for process synchronization and handling deadlock | Applying (K3) |
| CO4 | make use of memory management strategies and page replacement policies to address demand paging | Applying (K3) |
| CO5 | apply various disk scheduling algorithms and elaborate file systems concepts | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | 1 | 3 | 1 |
| CO2 | 3 | 2 | 1 | | 1 | | | | 1 | 1 | | 1 | 3 | 1 |
| CO3 | 3 | 2 | 1 | | 1 | | | | 1 | 1 | | 1 | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | 1 | 1 | | 1 | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | 1 | 1 | | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 60 | 30 | | | | 100 |
| CAT2 | 10 | 30 | 60 | | | | 100 |
| CAT3 | 20 | 30 | 50 | | | | 100 |
| ESE | 10 | 30 | 60 | | | | 100 |

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

| 22CST44- DESIGN AND ANALYSIS OF ALGORITHM | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Data Structures** | **4** | **PC** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course offers formal introduction to common algorithm design techniques and methods for analyzing the performance of algorithms. | |
| **Unit – I** | **Introduction:** | **9+3** |
| Algorithm - Fundamentals of Algorithmic Problem Solving - Important Problem Types. Fundamentals of the Analysis of Algorithm Efficiency: Analysis Framework - Asymptotic Notations and its properties - Mathematical analysis for Recursive and Non-recursive algorithms - Empirical analysis of algorithm - Algorithm visualization. | | |
| **Unit – II** | **Brute Force and Divide & Conquer** | **9+3** |
| Brute Force:Selection and Bubble Sort, Sequential search and String Matching - closest pair and convex hull problem. Divide and Conquer: Merge sort - Quick sort - Binary tree traversals and related properties - Multiplication of large integers and Strassen's Matrix Multiplication - closest pair and convex hull problem. | | |
| **Unit – III** | **Decrease &Conquer and Transform & Conquer** | **9+3** |
| Decrease & Conquer: Insertion sort -Topological Sorting - Fake coin problem - Computing a Median and the Selection Problem. Transform and Conquer: Presorting - Balanced search trees - AVL trees -2-3Trees- Heaps and Heap sort. | | |
| **Unit – IV** | **Dynamic Programming and Greedy Technique** | **9+3** |
| Dynamic Programming: Warshall's and Floyd's algorithm - Optimal Binary Search Trees - Knapsack Problem and Memory functions. Greedy Technique: Prim's algorithm - Kruskal's Algorithm - Dijkstra's Algorithm - Huffman Trees and codes. | | |
| **Unit – V** | **Backtracking and Branch & Bound** | **9+3** |
| Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem. Branch and Bound: Assignment problem - Knapsack Problem - Traveling Salesman Problem - Overview of P, NP and NP-Complete Problems | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012. |

**REFERENCES:**

| | |
|---|---|
| 1. | Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009. |
| 2. | Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Reprint Edition, Pearson Education, 2006. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | analyse the efficiency of algorithms using various frameworks | Analyzing (K4) |
| CO2 | apply brute force and divide-and-conquer techniques to solve various problems and analyze their efficiency. | Analyzing (K4) |
| CO3 | utilize decrease-and-conquer and transform-and-conquer strategies for solving problems | Applying (K3) |
| CO4 | make use of dynamic programming and greedy techniques to solve problems | Applying (K3) |
| CO5 | solve difficult combinatorial problems with backtracking and branch & bound techniques | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | | | | | | | | | 1 | 3 | 2 |
| CO2 | 3 | 3 | 2 | 1 | | | | | | | | 1 | 3 | 2 |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | 1 | 3 | 1 |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | 1 | 3 | 1 |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 30 | 40 | 20 | | | 100 |
| CAT2 | 10 | 20 | 60 | 10 | | | 100 |
| CAT3 | 10 | 30 | 60 | | | | 100 |
| ESE | 10 | 20 | 50 | 20 | | | 100 |

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

**22CSL41 - DATABASE MANAGEMENT SYSTEMS LABORATORY**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme& Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **4** | **PC** | **0** | **0** | **2** | **1** |

| | |
|---|---|
| Preamble | This course helps to develop database applications for real world problems |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Demonstrate Data definition language and integrity constraints. |
| 2. | Demonstrate Data manipulation language, Data control language commands and TCL commands. |
| 3. | Execute nested and sub queries in SQL. |
| 4. | Demonstrate Join operations in SQL. |
| 5. | Create Views and index and perform SQL operations in it. |
| 6. | Demonstrate the concepts of looping using PL/SQL statements. |
| 7. | Implement Cursors and its operations. |
| 8. | Implement Triggers and its operations. |
| 9. | Develop Procedures and Functions to perform operations in SQL. |
| 10. | Mini project: (Application Development using Oracle/ SQL SERVER / MYSQL)<br>Sample Applications:<br>Inventory Control System<br>Hospital Management System<br>Railway Reservation System<br>Web Based User Identification System<br>Hotel Management System<br>Student Information System<br>Library Information System and etc., |

**Total:30**

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Front End: Microsoft Visual Studio 6.0, Microsoft .NET Framework SDK v2.0, Java etc., |
| 2. | Back End : ORACLE / SQL SERVER / MYSQL |
| 3. | Manuals: https://docs.oracle.com/cd/E11882_01/server.112/e41085.pdf |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | create and manipulate databases using SQL and PL/SQL | Applying (K3), Precision (S3) |
| CO2 | execute queries using the concepts of embedded query languages | Applying (K3), Precision (S3) |
| CO3 | develop database applications for the real world problems | Applying (K3), Precision (S3) |

**Mapping of Cos with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | 1 | 1 | 3 | 1 |
| CO2 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | 1 | 1 | 3 | 1 |
| CO3 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | 1 | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

## 22CSL42 - WEB TECHNOLOGY LABORATORY

| Programme & Branch | B.E. - Computer Science and Engineering | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| Prerequisites | Nil | 4 | PC | 0 | 0 | 2 | 1 |

| | |
|---|---|
| Preamble | This course addresses the applications of Client Side JS and Server Side JS Framework for developing web applications. |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Simple form validation using JavaScript. |
| 2. | Design a webpage to create simple interactive CGPA calculator using Event Handling |
| 3. | Design a web application using HTTP Request and HTTP Response |
| 4. | Develop simple login page by performing event handling using GET and POST method |
| 5. | Design a simple calculator using 'Modules' in Node.js. |
| 6. | Design a web application to show how a server side application responds to a client request to a particular endpoint using Routing in Express. |
| 7. | Design a webpage to maintain personal information using CRUD operations in MongoDB. |
| 8. | Design a webpage to maintain personal information using CRUD operations in PostgreSQL. |
| 9. | Design a web application using components and modules in React. |
| 10. | Design a web application with routing in React. |
| 11. | Implement various Hooks in ReactJS. |

**Total:30**

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Operating System : Windows/Linux |
| 2. | Software : MongoDB, Node and React |
| 3. | Laboratory Manual |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | Develop interactive web pages using JavaScript | Applying (K3), Precision (S3) |
| CO2 | Develop a web application to maintain information in a database using server-side scripting. | Applying (K3), Precision (S3) |
| CO3 | Apply the concepts of React to design full-fledged web applications. | Applying (K3), Precision (S3) |

**Mapping of Cos with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | | | | | | 1 | 1 | 1 | 3 | 2 |
| CO2 | 3 | 2 | 1 | 1 | | | | | | 1 | 1 | 1 | 3 | 2 |
| CO3 | 3 | 2 | 1 | 1 | | | | | | 1 | 1 | 1 | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22GCL41 - PROFESSIONAL SKILLS TRAINING - I | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to All BE/ BTech Engineering and Technology branches) | | | | | | | |
| **Programme & Branch** | **All BE/ BTech Engineering and Technology branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **4** | EC | 0 | 0 | 80 | 2 |

| | | |
|---|---|---|
| **Preamble** | This subject is to enhance the employability skills and to develop career competency | |
| **Unit – I** | **Soft Skills – I :** | **20** |
| Soft skills and its importance: Pleasure and pains of transition from an academic environment to work environment-Need for change- Fear, stress and competition in the professional world-Importance of positive attitude- Self motivation and continuous knowledge upgradation-Self-confidence. Professional grooming and practices: Basics of corporate culture-Key pillars of business etiquette- Basics of etiquette-Introductions and greetings-Rules of the handshake, earning respect, business manners-Telephone etiquette- Body Language. | | |
| **Unit – II** | **Quantitative Aptitude and Logical Reasoning – I:** | **30** |
| Problem solving level I: Number System-LCM &HCF-Divisibility test-Surds and indices-Logarithms- Ratio-proportions and variation-Partnership-Time speed and distance-Data interpretation-data representation. Logical reasoning: Family tree-Deductions-Logical connectives-Binary logic Linear arrangements- Circular and complex arrangement | | |
| **Unit – III** | **Written Communication & Verbal Aptitude** | **30** |
| Writing Skills: Writing strategies and formats Importance of Résumés Writing a Cover letter -Responding to Job Advertisements Professional e-mail Writing Responding to e-mails and business letters Technical Report writing Interpretation of Technical Data (Transcoding) Writing One-page Essays. Verbal Aptitude Synonyms Antonyms Homonyms One word substitution Idioms and Phrases Paired words Analogies Spelling test Cloze test using suitable verb forms using appropriate articles and prepositions; Spotting Errors Sentence Correction and Formation Grammar Based questions (Transformation : Active-Passive & Direct-Indirect); Rearranging Jumbled Sentences & Jumbled paragraphs, Identifying Facts, Inferences and Judgements statements | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Edgar Thorpe and Showick Thorpe, “Objective English for Competitive Examination”, 6th Edition, Pearson India Education Services Pvt Ltd, 2017. |

**REFERENCES:**


| | |
|---|---|
| 1. | Stephen Bailey, “Academic Writing: A practical guide for students”, Routledge, New York, 2011. |
| 2. | Meenakshi Raman and Sangeeta Sharma. “Technical Communication- Principles and Practice”. 4th Edition, Oxford University Press, New Delhi, 2022. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | develop the soft skills of learners to support them work efficiently in an organization as an individualand as a team | Applying (K3), Precision (S3) |
| CO2 | solve real time problems using numerical ability and logical reasoning | Applying (K3), Precision (S3) |
| CO3 | Apply communication skills effectively to understand and deliver information in various written discourses grammatically with accuracy | Applying (K3), Precision (S3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | 3 | 3 | | 3 | | 3 | 2 | | |
| CO2 | 3 | 2 | | | | 3 | 3 | | 3 | | 3 | 2 | | |
| CO3 | | 2 | | | | 3 | 3 | | 3 | 3 | 3 | 2 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 50 | 30 | | | | 100 |
| CAT2 | | 50 | 50 | | | | 100 |
| CAT3 | | 50 | 50 | | | | 100 |
| ESE | NA | | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 - 50 marks )

| 22EGL31 - COMMUNICATION SKILLS DEVELOPMENT LABORATORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to All Engineering and Technology Branches) | | | | | | | |
| **Programme & Branch** | **All B.E./B.Tech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **3 / 4** | **HS** | **0** | **0** | **2** | **1** |

| | |
|---|---|
| Preamble | This course is designed to impart necessary skills to listen, speak, read and write in order to obtain better professional communication skills. |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Self Introduction & Mock Interview |
| 2. | Job Application letter with Resume |
| 3. | Presentation: A Technical topic / Project report & a Case study |
| 4. | Situational Dialogues / Telephonic Conversations |
| 5. | Group Discussion |
| 6. | Reading Aloud |
| 7. | Listening Comprehension |
| 8. | Writing Company Profiles |
| 9. | Preparing reviews of a book/product/movie |
| 10. | Pronunciation Test |
| | **Total: 30** |

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Laboratory Manual |
| 2. | Orell Digital Language Lab Software |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped**<br>**(Highest Level)** |
|---|---|---|
| CO1 | enhance effective listening and reading skills | Understanding (K2),<br>Imitation (S1) |
| CO2 | acquire professional skills required for workplace/higher education | Applying (K3),<br>Naturalization (S5) |
| CO3 | use English language skills effectively in various situations | Applying (K3),<br>Articulation (S4) |

**Mapping of COs with POs and PSOs**

| **COs/ POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | 2 | 3 | | 3 |
| CO2 | | | | | | | | | 2 | 2 | | 2 |
| CO3 | | | | | | | | | 2 | 2 | | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22CST51 - INTERNET OF THINGS AND CLOUD COMPUTING | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **5** | **PC** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | The course describes various communication protocols for IoT, IoT levels and design methodologies and illustrates the development of simple real time IoT applications. This course also demonstrates developing real-time IoT applications using AWS cloud services. | |
| **Unit - I** | **Introduction to Internet of Things:** | **9** |
| Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT Communication Models - IoT Communication APIs – IoT enabling Technologies- IoT Levels and Templates – Domain Specific IoT- IoT and M2M - IoT Platform Design methodologies. | | |
| **Unit - II** | **Infrastructure and Service Discovery Protocols for the IoT System** | **9** |
| Low Power Wide Area Networking Technologies - Layered Architecture of IoT-Protocol architecture of IoT-Infrastructure Protocols – Device or Service Discovery for IoT – Protocols for IoT Service Discovery. | | |
| **Unit - III** | **Python for IoT and Introduction to Raspberry Pi:** | **9** |
| Python packages for IoT-Introduction to Raspberry Pi – Interfaces (serial, SPI, 12C) Programming – Python program with Raspberry Pi (interfacing external devices) – controlling output – reading input from pins – connecting IoT to (ThingSpeak) cloud. | | |
| **Unit - IV** | **Cloud for IoT Applications:** | **9** |
| Cloud computing Service models-Types of Cloud- Cloud Technology-Cloud Service Ecosystem-Cloud Enabled Environment-Cloud Inspired Enterprise Transformations- IoT and Cloud Inspired Smarter Environments- Hybrid Clouds- Federated Clouds-Special Purpose Clouds-The Emergence of Edge/Fog clouds-The Architectural Components of the Smarter Traffic System | | |
| **Unit - V** | **AWS IoT: Developing and Deploying in Internet of Things:** | **9** |
| Introduction to AWS IoT-core-connecting to AWS IoT core – AWS IoT Tutorials – Managing devices with AWS IoT- Tagging AWS IoT resources – Rules – Device shadow service – storing & retrieving sensor data using storage service – Creation of web based application for device communication | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Arshdeep Bahga and Vijay Madisetti, “Internet of Things - A Hands-on Approach”, Universities Press, 2015 for Units I & III. |
| 2. | Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press, 2017, for Unit II & IV. |
| 3 | https://docs.aws.amazon.com/iot/latest/developerguide for Unit V. |

**REFERENCES:**


| | |
|---|---|
| 1. | David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, 1st Edition, Cisco Press, 2017. |
| 2. | Rajkumar Buyya, James Broberg & Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Edition, Wiley,, 2013. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | analyze the suitability of various IoT System levels in providing an IoT-based solution for a given problem | Analyzing (K4) |
| CO2 | demonstrate the role of IoT protocols in building IoT applications | Applying (K3) |
| CO3 | make use of Raspberry Pi and the supporting Python packages to develop real-time IoT applications | Applying (K3) |
| CO4 | design smart applications using IoT with cloud computing services and deployment model | Applying (K3) |
| CO5 | develop Real-time IoT applications using AWS cloud services | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | 1 | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | 1 | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 30 | 30 | 20 | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 15 | 50 | 35 | | | | 100 |
| ESE | 10 | 45 | 30 | 15 | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CST52 - COMPUTER NETWORKS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **5** | **PC** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides an overview of the basics of data communications and networking. The course presents the top-down approach of layers and also the functionalities and protocols of different layers | |
| **Unit – I** | **Introduction to the Internet:** | **9** |
| Internet – Network edge: Access networks – Physical media – Network core: Packet switching – Circuit switching – Network of networks - Delay, loss and throughput in packet-switched networks – Protocol layers and their service models. | | |
| **Unit – II** | **Application Layer:** | **9** |
| Principles of Network applications – The web and HTTP – Electronic mail in the internet – DNS-Internet's directory service – Peer-to-Peer File Distribution – Video Streaming and Content Distribution Networks – Socket programming: Creating Network applications | | |
| **Unit – III** | **Transport Layer:** | **9** |
| Introduction and transport layer services – Multiplexing and Demultiplexing – Connectionless transport: UDP – Principles of reliable data transfer: Reliable Data Transfer over a Lossy Channel with Bit Errors: rdt3.0 - Go-Back-N – Selective Repeat – Connection-oriented transport: TCP – TCP congestion control | | |
| **Unit – IV** | **Network Layer:** | **9** |
| Overview – Inside a router – Internet Protocol (IP): IPv4, Addressing, IPv6 – Generalized forwarding and SDN –Routing algorithms: Link-State and Distance-Vector – Intra-AS routing in the Internet: OSPF – ICMP | | |
| **Unit – V** | **Link Layer and LAN:** | **9** |
| Introduction to Link layer – Error detection and correction techniques – Multiple access links and protocols – Switched LAN - Security in Computer Networks: Principles of Network Security – Principles of Cryptography: Symmetric Key Cryptography, Public Key Encryption | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Kurose James F. and Ross Keith W., "Computer Networking: A Top-Down Approach", 8th Edition, Pearson Education, New Delhi, 2022. |

**REFERENCES:**


| | |
|---|---|
| 1. | Behrouz A. Forouzan, "Data Communications and Networking", 6th Edition, McGraw Hill Education, 2022. |
| 2. | Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall, "Computer Networks", 6th Edition, Pearson Education, 2022. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | evaluate the performance of a network in terms of different QoS parameters | Applying (K3) |
| CO2 | develop client-server applications using application layer protocols | Applying (K3) |
| CO3 | identify a suitable transport layer protocol for a given application | Applying (K3) |
| CO4 | apply various routing protocols for a given network scenario | Applying (K3) |
| CO5 | demonstrate the need for link layer protocols in providing error free transmission | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | 1 | 1 | 1 | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | 1 | 1 | 1 | | 3 | 1 |
| CO3 | 2 | 2 | 1 | | | | | | 1 | 1 | 1 | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | 1 | 1 | 1 | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | 1 | 1 | 1 | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 55 | 35 | - | - | - | 100 |
| CAT2 | 10 | 45 | 45 | - | - | - | 100 |
| CAT3 | 10 | 40 | 50 | - | - | - | 100 |
| ESE | 5 | 45 | 50 | - | - | - | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

## 22CST53 - THEORY OF COMPUTATION

| Programme & Branch | B.E. – Computer Science and Engineering | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| Prerequisites | NIL | 5 | PC | 3 | 1 | 0 | 4 |

| | | |
|---|---|---|
| Preamble | The course helps the learners to know the models of computation, along with their variants in the context of formal languages and their recognizers and to familiarize students with the foundations and principles of computer science. This can be applied in designing compilers and pattern recognition system. | |
| **Unit – I** | **Formal proof and Automata** | **9+3** |
| Introduction to formal proof – Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Equivalence between NFA and DFA – Finite Automata with Epsilon transitions – Conversion of NFA into DFA – Equivalence and minimization of automata. | | |
| **Unit – II** | **Regular Expressions and properties of regular languages** | **9+3** |
| Regular expression – Equivalence of finite automata and regular expressions – Proving languages not to be regular (Pumping Lemma) – Closure properties of regular languages. | | |
| **Unit – III** | **Context Free Grammars and Push Down Automata(PDA)** | **9+3** |
| Context-Free Grammar (CFG) – Parse trees – Ambiguity in grammars and languages. PushDown Automata – Definition of the pushdown automata (PDA) – Languages of PDA – Equivalence of PDA and CFG – Deterministic Pushdown Automata. | | |
| **Unit – IV** | **Context Free Languages and Turing Machines** | **9+3** |
| Normal forms for CFG – Chomsky Normal Form and Greibach Normal Form – Pumping lemma for CFL – Closure properties of CFL – Turing machines: Basic model – definition and representation – Instantaneous Description –Transition diagram for TM – Language acceptance by TM – TM as Computer of Integer functions – Programming techniques for Turing machines (subroutines). | | |
| **Unit – V** | **Undecidability** | **9+3** |
| language that is not Recursively Enumerable (RE) – An undecidable problem that is RE –Undecidable problems about Turing machine – Post's correspondence problem – The classes P and NP –Kruskal's algorithm – Traveling Salesman Problem. | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Hopcroft J.E., Motwani R. & Ullman J.D., "Introduction to Automata Theory, Languages and Computation", 3rd Edition, Pearson Education, New Delhi, 2011. |

**REFERENCES:**

| | |
|---|---|
| 1. | Martin J., "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw-Hill, New Delhi, 2010. |
| 2. | Linz P., "Introduction to Formal Language and Computation", 4th Edition, Narosa Publishing, 2007. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | design finite automata for the regular languages | Applying (K3) |
| CO2 | construct regular expression for the regular languages | Applying (K3) |
| CO3 | demonstrate the recognition of context free languages using push down automata | Applying (K3) |
| CO4 | construct Turing Machine to accomplish specific task and argue formally about its correctness | Applying (K3) |
| CO5 | make use of Turing machines to distinguish decidable / undecidable problems | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 30 | 60 | | | | 100 |
| CAT2 | 10 | 30 | 60 | | | | 100 |
| CAT3 | 10 | 30 | 60 | | | | 100 |
| ESE | 10 | 30 | 60 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSC51 - AGILE METHODOLOGIES | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5** | **PC** | **3** | **0** | **2** | **4** |

| | |
|---|---|
| Preamble | This course introduces software engineering concepts and agile principles which is to be acquired by software engineers and developers. It also focuses on providing hands-on experience in designing and developing software systems. |

| **Unit – I** | **Process Models, Analysis and Design** | **9** |
|---|---|---|

The Software Process –Software process structure – Process models: Waterfall model – Incremental process models – Evolutionary process models – Understanding Requirements–Requirement Engineering–Eliciting Requirements –Requirement Modeling: Scenario Based Modeling–Class-Based Modeling– Design Concepts.

| **Unit – II** | **Agile Principles and Scrum** | **9** |
|---|---|---|

Understanding Agile Values–Agile Principles: 12 Principles of Agile Software–-Scrum and Self-Organizing Teams: Rules of Scrum–Scrum Values–Daily Scrum–Sprints, Planning and Retrospectives-Scrum Planning and Collective Commitment: User stories–Conditions of Satisfaction–Story Points and Velocity–Burn down Charts– Planning and Running a Sprint–Generally Accepted Scrum Practices

| **Unit – III** | **XP and Embracing Change, Lean, and Kanban** | **9** |
|---|---|---|

Primary Practices of XP–The XP values – Understanding the XP principles–Feedback Loops-Lean Thinking–Eliminate Waste–Value Stream Map–Deliver As Fast As Possible–WIP Area Chart–Pull Systems – The Principles of Kanban- – Improving Process with Kanban – Measure and Manage Flow – Emergent Behavior with Kanban

| **Unit – IV** | **Software Testing Fundamentals** | **9** |
|---|---|---|

Software testing strategies: Strategic approach – Issues – Test strategies for conventional and Object-Oriented software – Validation and System testing–Debugging–Testing conventional applications: White box testing–Basis path testing–Control structure testing–Black box testing.

| **Unit – V** | **Software Project Management** | **9** |
|---|---|---|

Software Project Management Concepts–Process and Project Metrics: Software Measurement- Metrics for Software Quality– Estimation for Software Projects: Decomposition Techniques – COCOMO Model–Project Scheduling: Basic Principles – Scheduling-Earned Value Analysis– Software Process Improvements (SPI) – The SPI Process –Capability Maturity Model Integration (CMMI).

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Create a product back log with stories. |
| 2. | Determine Release plan to decide which stories can be accomplished in the release. |
| 3. | Write Sprint plan to determine the features that can be accomplished in the first iteration, or sprint. |
| 4. | Manage the workload by executing the sprint plan. |
| 5. | Use predefined and user created queries to track project progress. |
| 6. | Prepare Schedule for reviewing sprint. |
| 7. | Create a plan to shut down the first sprint and start the next one |
| 8. | Identify use cases and develop business use case model. |
| 9. | Identify the conceptual classes (boundary, controller and entity classes) and develop a domain model with UML Class diagram. |
| 10. | Develop user interface using Python, create DB using MySQL and Perform unit and integration testing. |

**Lecture:45, Practical:30, Total:75**

**TEXT BOOK:**

| | |
|---|---|
| 1. | Roger S.Pressman & Bruce R.Maxim, "Software Engineering: A Practitioner‘s Approach", 8th Edition, McGraw-Hill Education, 2019.(Units –1,4,5) |
| 2. | Andrew Stellman and Jennifer Greene, “Learning Agile: Understanding Scrum, XP, Lean, and Kanban”, First Edition, O’Reilly Media Inc,2015. (Units 2,3) |

| REFERENCES/ MANUAL / SOFTWARE: | |
|---|---|
| 1. | Ian Sommerville, “Software Engineering”,10th Edition, Pearson Education,2014. |
| 2. | Kenneth S. Rubin, “Essential Scrum: A Practical Guide to the Most Popular Agile Process”, Addison-Wesley,2012. |
| 3. | Infosys spring board contents provided by Infosys at https://infyspringboard.onwingspan.com/web/en/page/home |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | apply the requirement engineering tasks and design concepts to the various software development models for a given scenario. | Applying (K3) Precision(S3) |
| CO2 | apply Scrum Principles for designing and implementing projects | Applying (K3), Precision(S3) |
| CO3 | Use XP, Lean and Kanban principles for developing software projects. | Applying (K3) Precision(S3) |
| CO4 | make use of various software testing techniques to test the software system and real world scenarios | Applying (K3), Precision(S3) |
| CO5 | Carry out different software project management activities for a given software application. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | | | | | | | | | | 3 | 2 |
| CO2 | 3 | 2 | 1 | 1 | 1 | | | | 2 | 1 | 2 | 1 | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | 2 | 1 | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | 2 | 1 | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 70 | 20 | | | | 100 |
| CAT2 | 10 | 75 | 15 | | | | 100 |
| CAT3 | 10 | 75 | 15 | | | | 100 |
| ESE | 10 | 75 | 15 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**22CSL51 - INTERNET OF THINGS AND CLOUD COMPUTING LABORATORY**

| Programme & Branch | B.E. - Computer Science and Engineering | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **NIL** | **5** | **PC** | **0** | **0** | **2** | **1** |

| | |
|---|---|
| Preamble | This course demonstrates the working of various communication technologies like GSM, GPRS and BLE. This course also explores the development of simple real-time IoT applications using Raspberry Pi. Further the course also helps the student develop application using cloud. |

**LIST OF EXPERIMENTS / EXERCISES:**

Mobile Communication Experiments:

| | |
|---|---|
| 1. | Experiments on GSM / GPRS<br>Basic AT Commands for Voice calls |
| 2. | Basic AT commands for Voice communication, Phone Book and SMS |

Internet of Things Experiments:

| | |
|---|---|
| 3. | Simulating traffic light controller |
| 4. | Web page integration with Raspberry Pi |
| 5. | Sensing and Sending the sensor value via SMS |
| 6. | Sending images and video via Gmail |
| 7. | Measuring sensor value and uploading the content onto cloud for analysis |
| 8. | Working with Cooja Simulator<br>• Creating an IoT scenario<br>• Sending data between an IoT client and server |

Cloud Experiments using Cloud Service Providers (AWS, Google Cloud Platform, Azure, etc.):

| | |
|---|---|
| 9. | Develop applications using Platform as a Service (like AWS greengrass/ AWS Elastic Bean Stack) |
| 10. | Develop applications implementing Infrastructure as a Service ( like AWS s3) |
| 11. | Develop applications using Software as a Service ( like AWS Lambda) |
| 12. | Mini Project |

**Total:30**

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Operating System : Windows/Linux/Contiki |
| 2. | Software : Win X Talk, Python IDE, Thingspeak, Cooja Simulator |
| 3. | Laboratory Manual |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | demonstrate the basic working principles of different communication systems like GSM, and Bluetooth | Applying (K3),<br>Precision (S3) |
| CO2 | develop simple real-time IoT applications using sensors to send SMS and images/video via Mail and upload onto the cloud | Applying (K3),<br>Precision (S3) |
| CO3 | design simple IoT scenarios for sending data between an IoT client and server using Cooja Simulator | Applying (K3),<br>Precision (S3) |

**Mapping of Cos with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 2 | | | | | | | 1 | 3 | 2 |
| CO2 | 3 | 2 | 2 | 2 | 2 | | | | 1 | 1 | 1 | 1 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 2 | | | | 1 | 1 | 1 | 1 | 2 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22CSL52 - COMPUTER NETWORKS LABORATORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5** | **PC** | **0** | **0** | **2** | **1** |

| | |
|---|---|
| Preamble | It provides an exposure to investigate the various services offered by application, transport, network and link layers and to analyze the operations of different protocols by capturing various packet traces. |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Installation and exploration of the packet analyzer/protocol analyzer tool Wireshark |
| 2. | Capture HTTP packets by retrieving different HTML files and experiment HTTP GET/POST connections and HTTP authentication using Wireshark |
| 3. | Capture the DNS packets that are generated by ordinary web-surfing activity and produce the details of DNS query and response messages using Wireshark |
| 4. | Create UDP and TCP based network applications using socket programming |
| 5. | Capture UDP packet traces through DNS messages and prepare UDP datagrams with the packet summary fields using Wireshark |
| 6. | Transfer a file to a remote server, analyze the traces of the TCP segments sent and received and investigate the behaviours of TCP using Wireshark |
| 7. | Capture packets from an execution of traceroute/tracert program and analyse the IPv4 datagram, IP fragmentation, IPv6 datagrams using Wireshark |
| 8. | Capture and Analyse the packet traces of DHCP and ICMP using Wireshark |
| 9. | Capture packet traces by retrieving an HTML file and investigate the operations of Ethernet protocol and the ARP protocol using Wireshark |
| 10. | Simulate the network topologies (Bus, Ring, Star and Mesh) using Cisco Packet Tracer |
| 11. | Simulate and identify the difference in working operation of Hub and Switch using Cisco Packet Tracer |

**Total:30**

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Wireshark |
| 2. | C / Java / Python |
| 3. | Cisco Packet Tracer |
| 4. | Laboratory Manual |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | illustrate the operations of application layer protocols by capturing HTTP and DNS packets | Applying (K3), Precision(S3) |
| CO2 | investigate the behavior of transport layer protocols by capturing UDP and TCP packets | Applying (K3), Precision(S3) |
| CO3 | examine the functionalities of network layer and LAN protocols by capturing packet traces of IPv4, IPv6, DHCP, ICMP, Ethernet and ARP | Applying (K3), Precision(S3) |

**Mapping of Cos with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 2 | 2 | | | | | | | 1 | 3 | 1 |
| CO2 | 3 | 2 | 1 | 2 | 2 | | | | | | | 1 | 3 | 1 |
| CO3 | 3 | 2 | 1 | 2 | 2 | | | | | | | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **22GCL51 - PROFESSIONAL SKILLS TRAINING - II** | | | | | | | |
| (Common to All BE/ BTech Engineering and Technology branches) | | | | | | | |
| **Programme & Branch** | **All BE/ BTech Engineering and Technology branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5** | **EC** | **0** | **0** | **80** | **2** |

| | | |
|---|---|---|
| **Preamble** | This subject is to enhance the employability skills and to develop career competency | |
| **Unit – I** | **Soft Skills – II :** | **20** |
| Group discussions: Advantages of group discussions-Structured GD- Team work: Value of team work in organizations- Definition of a team, why team-Elements of leadership, disadvantages of a team, stages of team formation- Group development activities. Facing an interview: Foundation in core subject- industry orientation / knowledge about the company- professional personality-Communication skills-Activities before Interview, upon entering interview room, during the interview and at the end Mock interviews. | | |
| **Unit – II** | **Quantitative Aptitude and Logical Reasoning – II:** | **30** |
| Problem solving level II: Money related problems-Mixtures-Symbol base problem-Clocks and calendars-Simple-linear-quadratic and polynomial equations-Special, equations-Inequalities-Sequence and series-Set theory-Permutations and combinations-Probability-Statistics-Data sufficiency- Geometry-Trigonometry-Heights and distances-Co-ordinate geometry-Mensuration. Logical reasoning: Conditionality and grouping-Sequencing and scheduling- Selections-Networks:-Codes; Cubes-Venn diagram in logical reasoning- Quant based reasoning-Flaw detection- Puzzles-Cryptarithms. | | |
| **Unit – III** | **Reading & Speaking Skills** | **30** |
| Reading: Reading comprehension– Effective Reading strategies – Descriptive, Inferential, & Argumentative reading passages – Identifying and locating factual information within a text – global reading/skimming for general understanding – selective comprehension / scanning for specific information – detailed comprehension / intensive reading – understanding the development of an argument – identifying the writer's attitude and opinions – Reading news articles in business magazines, newspapers – Reading notices and book reviews –Interpreting graphic data & Advertisements. Speaking: Mock Interviews –Self-Introduction – Sharing of Real Time Experience; Conversational Practices –Role Play – Short Talks / TED Talks –Extempore; Giving a Presentation on Various Topics – Technical / Non-Technical Topics – Project Review Presentation – Oratory and Effective Public Speaking; Pair Discussion – Group Discussion – The process of Group Discussion – Strategies to be adopted – Skills Assessed – Telephonic Conversations & Skills – Negotiating Skills. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Edgar Thorpe and Showick Thorpe, "Objective English for Competitive Examination", 6th Edition, Pearson India Education Services Pvt Ltd, 2017. |

**REFERENCES:**



| | |
|---|---|
| 1. | Aruna Koneru, "Professional Speaking Skills," Oxford University Press India, New Delhi, 2015. |
| 2. | Thorpe, Showick and Edgar Thorpe, "Winning at Interviews," 5th edition, Pearson Education, India, 2013. |
| 3. | Rizvi, Ashraf M, "Effective Technical Communication," 2nd Edition, McGraw Hill Education India, 2017. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | develop the soft skills of learners to support them work efficiently in an organization as an individualand as a team | Applying (K3), Precision (S3) |
| CO2 | solve real time problems using numerical ability and logical reasoning | Applying (K3), Precision (S3) |
| CO3 | apply reading and speaking skills effectively for various academic and professional purposes | Applying (K3), Precision (S3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | 3 | 3 | | 3 | | 3 | 2 | | |
| CO2 | 3 | 2 | | | | 3 | 3 | | 3 | | 3 | 2 | | |
| CO3 | | 2 | | | | 3 | 3 | | 3 | 3 | 3 | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | | 50 | 50 | | | | 100 |
| CAT3 | | 50 | 50 | | | | 100 |
| ESE | NA | | | | | | |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks )

| 22CST61 - COMPILER DESIGN | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **6** | **PC** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| **Preamble** | This course provides an insight into the compiler construction process as well as the design techniques for the given programming language. | |
| **Unit – I** | **Lexical Analysis** | **9** |
| Introduction – Language Processors – The structure of a compiler – Lexical Analysis – The Role of the Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – The Lexical-Analyzer Generator – Lex – Finite Automata – From Regular Expressions to Automata. | | |
| **Unit – II** | **Syntax Analysis** | **9** |
| Introduction – Context-Free Grammars – Writing a Grammar – Top-Down Parsing – Bottom-Up parsing – Operator Precedence Parser – Introduction to LR Parsing: Simple LR – More Powerful LR Parsers – Parser Generators. | | |
| **Unit – III** | **Syntax - Directed Translation and Intermediate Code Generation** | **9** |
| Syntax-Directed Translation – Evaluation orders for SDDs – Intermediate Code Generation – Variants of syntax trees – Three Address Code – Types and Declarations – Translation of Expressions – Control Flow – Backpatching – Switch Statements – Procedure calls. | | |
| **Unit – IV** | **Machine Independent Optimizations** | **9** |
| Basic Blocks and Flow Graphs – Optimization of Basic Blocks– Peephole Optimization – The Principal Sources of Optimization – Introduction to Data-Flow Analysis – loops and flow graphs. | | |
| **Unit – V** | **Code Generation and Storage Management** | **9** |
| Issues in the design of a code generation – The target Language – Addresses in the Target code – A simple code Generator – Run-Time Environments: Storage organization – Stack allocation of space – Heap Management – Introduction to garbage collection. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, 2nd Edition, Pearson India Education Pvt. Ltd., 2014. |

**REFERENCES:**

| | |
|---|---|
| 1. | Srikant Y.N. and Priti Shankar, “The Compiler Design Handbook: Optimizations and Machine Code Generation”, 2nd Edition, CRC Press, 2008 |
| 2. | Kenneth C. Louden, “Compiler Construction – Principles and Practice”, 1st edition, PWS Publishing. 1997 |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | make use of regular expression to perform lexical analysis of the source program | Applying (K3) |
| CO2 | design a syntax-analysis tool for the given grammar | Applying (K3) |
| CO3 | develop intermediate code for the source program | Applying (K3) |
| CO4 | employ optimization techniques for the given intermediate code | Applying (K3) |
| CO5 | apply suitable storage allocation technique to generate the target code | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 30 | 60 | | | | 100 |
| CAT2 | 10 | 20 | 70 | | | | 100 |
| CAT3 | 40 | 40 | 20 | | | | 100 |
| ESE | 20 | 30 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

## 22CST62 - MACHINE LEARNING

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Python Programming and Frameworks** | **6** | **PC** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course focuses on finding patterns or making predictions from empirical data. This course also explores the techniques such as supervised, unsupervised learning algorithms and reinforcement learning. | |
| **Unit – I** | **Introduction:** | **9** |
| Learning-Types of Machine Learning-Supervised Learning: Regression - Classification. The machine learning process-Some Terminology-Testing machine learning algorithms - Turning data into probabilities- The Naive Bayes classifier-The brain and the neuron - Hebb's rule-McCulloch and Pitts Neurons-Limitations of McCulloch and Pitts Neuron model - Neural networks-The perceptron. | | |
| **Unit – II** | **Linear Discriminants, Multi-layer Perceptron and Dimensionality Reduction:** | **9** |
| Linear separability-Linear regression. The Multi-layer Perceptron: Going Forwards-Going backwards- The multi-layer perceptron in practice. Dimensionality reduction-Linear Discriminant Analysis (LDA)-Principal Components Analysis (PCA). | | |
| **Unit – III** | **Supervised Learning:** | **9** |
| Gaussian mixture models: The Expectation Maximization (EM) Algorithm- Information Criteria-Nearest neighbour methods: Nearest Neighbour Smoothing-Distance measures-Support Vector Machines: Optimal separation-Kernels-Support Vector Machine Algorithm-Multi-class classification-SVM Regression Learning with Trees: Using decision trees-Constructing decision trees-Classification and Regression Trees (CART). | | |
| **Unit – IV** | **Ensemble Learning and Unsupervised Learning:** | **9** |
| Boosting: AdaBoost-Stumping. Bagging-Random Forests-Comparison with Boosting -Different ways to combine classifiers-Unsupervised Learning: K-means - K Medoids - Bayesian Networks. | | |
| **Unit – V** | **Evolutionary Learning and Reinforcement Learning:** | **9** |
| Evolutionary Learning: Genetic algorithm-Generating offspring-Using genetic algorithms-Genetic programming-Reinforcement Learning: Overview- Example: getting lost-Markov decision processes – Values-The difference between SARSA and Q-learning-Uses of reinforcement learning. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, 2nd Edition, Chapman and Hall / CRC Machine Learning and pattern Recognition Series, 2014. |

**REFERENCES:**


| | |
|---|---|
| 1. | Tom M. Mitchell, “Machine Learning”, 1st Edition, McGraw-Hill Education, India, 2013. |
| 2. | ShaiShalev-Shwartz and Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms”, 1st Edition, Cambridge University Press, USA, 2014. |
| 3. | Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das , “Machine Learning”,1st edition, Pearson Education, 2019 |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | employ the perspectives of machine learning and neural networks | Applying (K3) |
| CO2 | apply regression, multi-layer perceptron and dimensionality reduction for real world problems | Applying (K3) |
| CO3 | utilize Gaussian mixture models and tree based learning for solving a given problem | Applying (K3) |
| CO4 | employ the principles of ensemble learning and unsupervised learning for optimization | Applying (K3) |
| CO5 | make use of genetic algorithm and reinforcement learning for solving a given problem | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | | | | | | | | 1 | 3 | 1 |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | 1 | 3 | 1 |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | 1 | 3 | 1 |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | 1 | 3 | 1 |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 30 | 50 | | | | 100 |
| CAT2 | 20 | 30 | 50 | | | | 100 |
| CAT3 | 20 | 30 | 50 | | | | 100 |
| ESE | 20 | 30 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

## 22CSL61 - COMPILER DESIGN LABORATORY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. – Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **6** | **PC** | **0** | **0** | **2** | **1** |

| | |
|---|---|
| Preamble | This course introduces the basic working principles of open-source compiler construction tools like LEX and YACC. It also introduces programmatic simulation of various phases of compilers. |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Develop a lexical analyzer to recognize patterns (Ex. identifiers, constants, comments, operators etc.) and create a symbol table, while recognizing identifiers in C. |
| 2. | Design NFA from the given Regular expression. |
| 3. | Calculate ε-Closure of all the states in the given NFA. |
| 4. | Apply LEX tool to recognize tokens in the given source program. |
| 5. | Find FIRST and FOLLOW for the given grammar. |
| 6. | Implement Predictive parser of the given grammar. |
| 7. | Design a parser using YACC Tool to perform basic arithmetic operations. |
| 8. | Generate three address codes for the given simple program. |
| 9. | Implement simple code optimization techniques. (Constant folding, Strength reduction and Algebraic transformation). |
| 10. | Implement back-end of the compiler for which the three-address code is given as input and the assembly language code is produced as output. |
| | **Total:30** |

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Operating System : Windows / Linux |
| 2. | Software : C / LEX and YACC Tool |
| 3. | Laboratory Manual |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | Design a lexical analyzer to recognize tokens in the given source program and experiment with LEX tool. | Applying (K3)<br>Precision(S3) |
| CO2 | Design a parser for the given grammar and employ YACC tool for parsing. | Applying (K3)<br>Precision(S3) |
| CO3 | Implement backend of the compiler for intermediate code generation and code optimization techniques. | Applying (K3)<br>Precision(S3) |

**Mapping of Cos with POs and PSOs**

| **COs/ POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | 1 | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | 1 | 1 | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | 1 | 1 | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

## 22CSL62 - MACHINE LEARNING LABORATORY

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Python Programming and frameworks** | **6** | **PC** | **0** | **0** | **2** | **1** |

| | |
|---|---|
| Preamble | This course focuses on providing hands on experience in designing and implementing machine learning algorithms for providing solutions to the real world problems. |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Exploration of UCI, Kaggle repository datasets and tools like WEKA, Rapid Miner, Python scikit-learn, etc., |
| 2. | Perform data manipulation using NumPy and Pandas and, data visualization using matplotlib. |
| 3. | Implement Naïve Bayes classification and predict the class label for a given data. |
| 4. | Implement linear models to approximate the given data. |
| 5. | Implement multi-layer perceptron algorithm for the specified data. |
| 6. | Implement K-NN algorithm for the specified data. |
| 7. | Implement SVM algorithm for the given data. |
| 8. | Implement the concept of decision tree with suitable dataset. |
| 9. | Implement K-means clustering algorithm for the given data and visualize and interpret the result. |
| 10. | Implement genetic operators and Q-learning for the given data. |
| 11. | Build a supervised model / unsupervised model using appropriate dataset in cloud framework. |
| 12. | Mini-project: students work in team on any socially relevant problem that needs a machine learning based solution, and evaluate the model performance. |

**Total:30**

**REFERENCES/ MANUAL /SOFTWARE:**

| | |
|---|---|
| 1. | Operating System : Windows/Linux |
| 2. | Software : Weka / Rapid Miner / Python / Cloud framework |
| 3. | Laboratory Manual |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | apply probabilistic based learning and supervised learning algorithms for the given data. | Applying (K3), Precision (S3) |
| CO2 | employ the concepts of information theoretic approach and unsupervised learning algorithms for the specified data. | Applying (K3), Precision (S3) |
| CO3 | model the solutions for the given problem using genetic algorithm and reinforcement learning. | Applying (K3), Precision (S3) |

**Mapping of Cos with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | 1 | 1 | 3 | 1 |
| CO2 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | 1 | 1 | 3 | 1 |
| CO3 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | 1 | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22CSP61 - PROJECT WORK I | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **BE - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Programming Languages** | **6** | **EC** | **0** | **0** | **8** | **4** |

| | |
|---|---|
| Preamble | It provides practical exposure to the students and an opportunity to apply the computational mathematics concepts to solve the real world problems. It also gives opportunity to the students to work in a team. |

**Total:120**

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | formulate specific problem statements for ill-defined real life problems with reasonable assumptions and constraints. | Creating (K6), Precision (S3) |
| CO2 | perform literature search in the area of interest. | Evaluating (K5), Precision (S3) |
| CO3 | conduct experiments, design and analysis, solution iterations and document the results. | Evaluating (K5), Precision (S3) |
| CO4 | perform error analysis and synthesize the results and arrive at scientific conclusions. | Evaluating (K5), Precision (S3) |
| CO5 | document the results in the form of technical report and give oral presentation | Creating (K6), Precision (S3) |

**Mapping of Cos with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22CSP62 - PROJECT WORK I | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **BE - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Programming Languages** | **6** | **EC** | **0** | **0** | **10** | **5** |

| | |
|---|---|
| Preamble | It provides practical exposure to the students and an opportunity to apply the computational mathematics concepts to solve the real world problems. It also gives opportunity to the students to work in a team. |

**Total:120**

| **COURSE OUTCOMES:** **On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | formulate specific problem statements for ill-defined real life problems with reasonable assumptions and constraints. | Creating (K6), Precision (S3) |
| CO2 | perform literature search in the area of interest. | Evaluating (K5), Precision (S3) |
| CO3 | conduct experiments, design and analysis, solution iterations and document the results. | Evaluating (K5), Precision (S3) |
| CO4 | perform error analysis and synthesize the results and arrive at scientific conclusions. | Evaluating (K5), Precision (S3) |
| CO5 | document the results in the form of technical report and give oral presentation | Creating (K6), Precision (S3) |

**Mapping of Cos with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22MNT31 - ENVIRONMENTAL SCIENCE | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to All BE/BTech branches) | | | | | | | |
| **Programme & Branch** | **All B.E/B.Tech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **3 / 6** | **MC** | **2** | **0** | **0** | **0** |

| | | |
|---|---|---|
| Preamble | This course provides an approach to understand the various natural resources, ecosystem, bio-diversity, pollution control & monitoring methods for sustainable life and also to provide knowledge and to create awareness for engineering students on biological sciences. | |
| **Unit – I** | **Environmental Studies and Natural Resources** | **5** |
| Introduction to Environmental Science – uses, over-exploitation and conservation of forest, water, mineral, food, energy and land resources–case studies | | |
| **Unit – II** | **Ecosystem and Biodiversity** | **5** |
| Ecosystems: concept and components of an ecosystem -structural and functional features – Functional attributes (Food chain and Food web only). Biodiversity: Introduction – Classification – Bio geographical classification of India- Values of biodiversity – Threats and Conservation of biodiversity - case studies. | | |
| **Unit – III** | **Environmental Pollution** | **5** |
| Environmental Pollution: Definition – causes, effects and control measures of: (a) Air pollution - Climate change, global warming, acid rain, ozone layer depletion (b)Water pollution (c) Soil pollution - Role of an individual in prevention of pollution - case studies. | | |
| **Unit – IV** | **Environmental Monitoring** | **5** |
| Sustainability -three pillars of sustainability- factors affecting environmental sustainability-approaches for sustainable development - Introduction to EIA - objectives of EIA - environment protection act – air (prevention and control of pollution) act – water (prevention and control of pollution) act. | | |
| **Unit – V** | **Introduction to Biological Science** | **5** |
| Functions of Carbohydrates, lipids, proteins and nucleic acids - Cells and its organelles - plasma membrane, mitochondria and nucleus- Heredity and DNA - organization of DNA in cells - Genes and chromosomes- Cell division -Types of cell division- mitosis & meiosis - Cell cycle and molecules that control cell cycle. | | |
| | | **Total:25** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Anubha Kaushik, and Kaushik C.P., “Environmental Science and Engineering”, 6th Multicolour Edition, New Age International Pvt. Ltd., New Delhi, 2018, for Unit-I, II, III, IV. |
| 2. | Rastogi.SC, “Cells and Molecular Biology”, 2nd Edition, reprint, New Age International (P) Limited Publishers, New Delhi, 2008, for Unit-V. |

**REFERENCES:**

| | |
|---|---|
| 1. | Palanisamy P.N., Manikandan P., Geetha A., Manjula Rani K., Kowshalya V.N., “Environmental Science”, Pearson Education, New Delhi, Revised Edition 2019. |
| 2. | Mukhtar Ahmad, “Text book of modern biochemistry", Volume I & II, Oxford & IBH Publishing Co. Pvt. LTD, Delhi, 1995. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | illustrate the various natural resources and role of individual for its conservation | Understanding (K2) |
| CO2 | elaborate the features of ecosystem and biodiversity to find the need for conservation. | Understanding (K2) |
| CO3 | manipulate the sources, effects and control methods of various environmental pollution. | Applying (K3) |
| CO4 | make use of the knowledge of EIA and environmental legislation laws towards sustainability. | Applying (K3) |
| CO5 | explain the functions of carbohydrates, lipids, proteins, nucleic acids, Cells and its organelles | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | | | | | 3 | | | | | | | |
| CO2 | 2 | 1 | | | | | 3 | | | | | | | |
| CO3 | 3 | 2 | 1 | | | | 3 | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | 3 | | | | | | | |
| CO5 | 3 | 1 | | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 35 | 40 | | | | 100 |
| CAT2 | 25 | 35 | 40 | | | | 100 |
| CAT3 | NA | | | | | | |
| ESE | NA | | | | | | |

* ±3% may be varied (CAT 1, 2 – 50 marks)

| 22GEP61 - COMPREHENSIVE TEST AND VIVA | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Common to All Engineering and Technology Branches) | | | | | | | |
| **Programme & Branch** | **B.E & Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **All core Subjects of CSE** | **6** | **EC** | **0** | **0** | **0** | **2** |
| | | | | | | | |
| | | | | | | | **Total:60** |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | demonstrate knowledge in their respective programme domain. | Applying(K3) |
| CO2 | defend any type of interviews, viva-voce, and aptitude tests conducted for career progression | Applying(K3) |
| CO3 | exhibit professional etiquette and solve related engineering problems | Applying(K3) |
| CO4 | Organize the contents of the courses and discover a holistic approach to problem solving | Applying(K3) |
| CO5 | Make use of all the core courses to qualify as a fully competent graduate in computer science and design field. | Applying(K3) |

**Mapping of Cos with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | | | | | 1 | 2 | 2 | 3 | 3 | 2 |
| CO2 | 3 | 3 | 2 | 2 | | | | | 1 | 2 | 2 | 3 | 3 | 2 |
| CO3 | 3 | 3 | 2 | 2 | | | | | 1 | 2 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 2 | 2 | | | | | 1 | 2 | 2 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 2 | | | | | 1 | 2 | 2 | 3 | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22GCT71 - ENGINEERING ECONOMICS AND MANAGEMENT | | | | | | | |
|---|---|---|---|---|---|---|---|
| **(Common to All BE/BTech branches)** | | | | | | | |
| **Programme & Branch** | **All BE/BTech branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **7** | **HS** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | The aim of the course is to create fundamental knowledge on management by introducing concepts like economics, national income, marketing, operations management, accounting principles etc. | |
| **Unit – I** | **Micro Economics** | **9** |
| Economics – Basics Concepts and Principles – Demand and Supply – Law of demand and Supply – Determinants – Market Equilibrium – Circular Flow of Economic Activities and Income. | | |
| **Unit – II** | **Macro Economics, Business Ownership and Management concepts** | **9** |
| National Income and its Measurement Techniques. Inflation - Causes of Inflation – Controlling Inflation – Business Cycle - Forms of Business – Ownership Types. Management concepts: Taylor and Fayol's Principles – Functions of Management - Managerial Skills - Levels of Management - Roles of Manager. | | |
| **Unit – III** | **Marketing Management** | **9** |
| Marketing - Core Concepts of Marketing - Four P's of Marketing - New Product Development – Intellectual Property Rights (IPR), Product Life Cycle - Pricing Strategies and Decisions. | | |
| **Unit – IV** | **Operations Management** | **9** |
| Operations Management - Resources - Types of Production System - Site Selection, Plant Layout, Steps in Production Planning and Control - Inventory - EOQ Determination. | | |
| **Unit – V** | **Financial Management** | **9** |
| Accounting Principles – Financial Statements and its Uses – Depreciation - Straight Line and Diminishing Balance Method – Break Even Analysis – Capital Budgeting - Significance –Traditional and Discounted Cash Flow Methods. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Compiled by Department of Management Studies, Kongu Engineering College, "Economics and Management for Engineers", 1st Edition, McGraw Hill Education, Noida, 2013. |

**REFERENCES:**



| | |
|---|---|
| 1. | Geetika, Piyali Ghosh and Purba Roy Choudhury, "Managerial Economics", 3rd Edition, McGraw-Hill, New Delhi, 2018. |
| 2. | William J. Stevenson, "Operations Management", 14th Edition, McGraw-Hill Education, 2021. |
| 3. | William G. Nickels, James M. McHugh, Susan M. McHugh, "Understanding Business", 12th Edition, McGraw-Hill Education, New York, 2019. |

| **COURSE OUTCOMES:**<br>On completion of the course, the students will be able to | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | identify market equilibrium and interpret national income calculations and inflation issues | Applying (K3) |
| CO2 | choose a suitable business ownership for their enterprise and illustrate managerial functions | Applying (K3) |
| CO3 | infer marketing management decisions | Understanding (K2) |
| CO4 | apply appropriate operation management concept in business situations | Applying (K3) |
| CO5 | interpret financial and accounting statements and evaluate new proposals | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 2 | | | 3 | | 2 | 2 | 2 | 3 | 2 | | |
| CO2 | | 1 | 2 | | | 2 | 2 | 2 | 2 | 2 | 3 | 2 | | |
| CO3 | 1 | 2 | 1 | | | 2 | | 2 | 2 | 2 | 3 | 2 | | |
| CO4 | 1 | 2 | 1 | | | 2 | | 2 | 2 | 2 | 3 | 2 | | |
| CO5 | 2 | 2 | | | | 2 | | 2 | 2 | 2 | 3 | 2 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

## 22CSC71- DEEP LEARNING

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **7** | **PC** | **3** | **0** | **2** | **4** |

| | |
|---|---|
| Preamble | This course provides an overview Neural Networks and Deep learning techniques for solving real world problems. |

| | | |
|---|---|---|
| **Unit - I** | **Neural Network** | **9** |

**Neural Network**-Building Intelligent Machines-Limits of Traditional Computer Programs-Mechanics of Machine Learning-Neuron-Linear Perceptrons as Neurons-Feed-Forward Neural Networks-Linear Neurons and Their Limitations-Sigmoid, Tanh, and ReLU Neurons-Softmax Output Layers

**Training Feed-Forward Neural Networks:**Gradient Descent-Delta Rule and Learning Rates-Gradient Descent with Sigmoidal Neurons-Backpropagation Algorithm-Stochastic and Minibatch Gradient Descent-Test Sets, Validation Sets, and Overfitting-Preventing Overfitting in Deep Neural Networks

| | | |
|---|---|---|
| **Unit - II** | **Learning in Neural Network** | **9** |

Challenges with Gradient Descent- Local Minima in the Error Surfaces of Deep Networks - Model Identifiability - Local Minima in Deep Networks - Flat Regions in the Error Surface - Gradient Points in the Wrong Direction - Second-Order Methods -Momentum-Based Optimization-Learning Rate Adaptation

| | | |
|---|---|---|
| **Unit - III** | **Convolutional Neural Networks** | **9** |

Convolutional Neural Networks-Neurons in Human Vision-Shortcomings of Feature Selection-Vanilla Deep Neural Networks-Filters and Feature Maps-Description of the Convolutional Layer-Max Pooling-Architectural Description of Convolution Networks-Accelerating Training with Batch Normalization- Visualizing Learning in Convolutional Networks-Convolutional Filters to Replicate Artistic Styles-Convolutional Filters for Other Problem Domains

| | | |
|---|---|---|
| **Unit - IV** | **Autoencoders and Recurrent Neural Networks** | **9** |

Embedding and Representation Learning-Principal Component Analysis-Autoencoder Architecture-Denoising to Force Robust Representations-Sparsity in Autoencoders- Models for Sequence Analysis- Tackling seq2seq with Neural N-Grams- Implementing a Part-of-Speech Tagger- Dependency Parsing and SyntaxNet- Beam Search and Global Normalization- Stateful Deep Learning Models-Recurrent Neural Networks- Challenges with Vanishing Gradients- Long Short-Term Memory (LSTM) Units- Augmenting Recurrent Networks with Attention- Dissecting a Neural Translation Network

| | | |
|---|---|---|
| **Unit - V** | **Case studies- Applications** | **9** |

Introduction to Keras and Tensorflow- Building a CNN for image classification - Sentiment Analysis Model using LSTM – Deep Learning for Network intrusion detection – Speech recognition using Deep learning

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Exploration of deep learning frameworks Tensorflow and Keras |
| 2. | Create a simple Neural network to perform classification |
| 3. | Test the performance of multi-layer neural network with different activation functions |
| 4. | Improve the performance of the neural network with hyper parameter tuning |
| 5. | Implement a Convolutional Neural Network model for image classification |
| 6. | Improve performance of Convolutional Neural Network by tuning hyper parameters |
| 7. | Implement an Auto encoder for dimensionality reduction |
| 8. | Implement Object detection using Convolution Neural Network |
| 9. | Develop a sentiment analysis model using LSTM |
| 10. | Improve performance of LSTM by tuning hyper parameters |

**Lecture:45, Practical:30, Total:75**

**TEXT BOOK:**

| | |
|---|---|
| 1. | Nikhil Buduma , Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms, 1st Edition, O"Reilly Series, June 2017 |

**REFERENCES/ MANUAL / SOFTWARE:**


| | |
|---|---|
| 1. | Ian Goodfellow, Yoshua Bengio, and Aaron Courvill, “Deep Learning”, MIT Press, 1st Edition, 2016. |
| 2. | Josh Patterson and Adam Gibson, "Deep Learning – A Practitioner‟s Approach", 1 Edition, O‟Reilly Series, 2017. |
| 3. | Indra den Bakker, "Python Deep Learning Cookbook", 1 Edition, Packt Publishing, 2017. |


| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | apply the concepts of neural network to solve simple problems | Applying (K3) Precision(S3) |
| CO2 | Utilize different approaches to improve learning in neural networks | Applying (K3), Precision(S3) |
| CO3 | exemplify the concepts of CNN models and apply it for solving computer vision related problems | Applying (K3) Precision(S3) |
| CO4 | Make use of autoencoders for dimensionality reductions and Apply the concepts of RNN models for solving sequential modeling problems | Applying (K3), Precision(S3) |
| CO5 | Identify suitable deep learning models for developing real world applications | Applying (K3), Precision(S3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | | 1 | 3 | 1 |
| CO4 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | | 1 | 3 | 1 |
| CO5 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 50 | 30 | | | | 100 |
| CAT2 | 20 | 50 | 30 | | | | 100 |
| CAT3 | 15 | 50 | 35 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**22CSP71 - PROJECT WORK II PHASE I**

| **Programme & Branch** | **BE - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **7** | **EC** | **0** | **0** | **10** | **5** |

| | |
|---|---|
| Preamble | It provides practical exposure to the students and an opportunity to apply the computational mathematics concepts to solve the real world problems. It also gives opportunity to the students to work in a team. |
| | **Total:150** |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | formulate specific problem statements for ill-defined real-life problems with reasonable assumptions and constraints. | Creating (K6), Precision (S3) |
| CO2 | perform literature search in the area of interest. | Evaluating (K5), Precision (S3) |
| CO3 | conduct experiments, design and analysis, solution iterations and document the results. | Evaluating (K5), Precision (S3) |
| CO4 | perform error analysis and synthesize the results and arrive at scientific conclusions. | Evaluating (K5), Precision (S3) |
| CO5 | document the results in the form of technical report and give oral presentation | Creating (K6), Precision (S3) |

**Mapping of Cos with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22CSP72 - PROJECT WORK II PHASE I | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **BE - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **7** | **EC** | **0** | **0** | **12** | **6** |

| | |
|---|---|
| Preamble | It provides practical exposure to the students and an opportunity to apply the computational mathematics concepts to solve the real world problems. It also gives opportunity to the students to work in a team. |
| | **Total:150** |

| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | formulate specific problem statements for ill-defined real-life problems with reasonable assumptions and constraints. | Creating (K6), Precision (S3) |
| CO2 | perform literature search in the area of interest. | Evaluating (K5), Precision (S3) |
| CO3 | conduct experiments, design and analysis, solution iterations and document the results. | Evaluating (K5), Precision (S3) |
| CO4 | perform error analysis and synthesize the results and arrive at scientific conclusions. | Evaluating (K5), Precision (S3) |
| CO5 | document the results in the form of technical report and give oral presentation | Creating (K6), Precision (S3) |

**Mapping of Cos with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

| 22CSP81 - PROJECT WORK II PHASE II | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **BE - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **8** | **EC** | **0** | **0** | **8** | **4** |

| | |
|---|---|
| Preamble | It provides practical exposure to the students and an opportunity to apply the computational mathematics concepts to solve the real world problems. It also gives opportunity to the students to work in a team. |

**Total:120**

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | formulate specific problem statements for ill-defined real-life problems with reasonable assumptions and constraints. | Creating (K6), Precision (S3) |
| CO2 | perform literature search in the area of interest. | Evaluating (K5), Precision (S3) |
| CO3 | conduct experiments, design and analysis, solution iterations and document the results. | Evaluating (K5), Precision (S3) |
| CO4 | perform error analysis and synthesize the results and arrive at scientific conclusions. | Evaluating (K5), Precision (S3) |
| CO5 | document the results in the form of technical report and give oral presentation | Creating (K6), Precision (S3) |

**Mapping of Cos with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

| **22CSE01 - MOBILE COMMUNICATION** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Computer Networks** | **5** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides an insight on wireless communication technologies from 2G to 5G. The System and Protocol architectures of various mobile communication technologies are also explored in this course. | |
| **Unit – I** | **Introduction to Wireless Communication:** | **9** |
| Wireless transmission – Frequencies for radio transmission – Signals – Antennas – Signal Propagation – Multiplexing – Spread spectrum –cellular systems- MAC for Motivation – SDMA – FDMA – TDMA – CDMA. | | |
| **Unit – II** | **Telecommunication and Satellite systems:** | **9** |
| GSM: Mobile services - System architecture - Radio interface - Protocols - Localization and calling – Handover - Security - New data services– Satellite Systems – Basics – Routing - Localization-Handover. | | |
| **Unit – III** | **Wireless LAN:** | **9** |
| Wireless LAN - Infrared Vs Radio Transmission – Infrastructure Networks and Ad-hoc Networks. IEEE 802.11 –System architecture- Protocol architecture – Physical layer – Medium access control layer – MAC management. Bluetooth-User Scenarios-Architecture. | | |
| **Unit – IV** | **Mobile Network and Transport Layer:** | **9** |
| Mobile IP- Goals, assumptions and requirements – Entities and terminologies – IP packet delivery – Agent discovery – Registration – Tunneling and Encapsulation – Dynamic Host Configuration Protocol – Mobile ad-hoc networks. Traditional TCP – Classical TCP improvements | | |
| **Unit – V** | **Advanced Wireless Technologies** | **9** |
| LTE Radio Access – Basic technologies – Radio interface architecture – Overall system architecture – 5G wireless access – 5G general design principles – 5G key technology components. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Jochen Schiller, "Mobile Communications", Second Edition, PHI/Pearson Education, 2016 |

**REFERENCES:**



| | |
|---|---|
| 1. | Erik Dahlman, Stefan Parkvall, Johan Skold, "4G, LTE-Advanced Pro and The Road to 5G", Third Edition, Academic Press, 2016. |
| 2. | Gordon L.Stuber "Principles of Mobile Communication" ,First Edition, Kluwer Academic Publishers, 1999. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | determine the suitable medium access control techniques for a given communication scenario. | Applying (K3) |
| CO2 | apply the concepts of GSM and Satellite systems for a given scenario. | Applying (K3) |
| CO3 | choose a suitable wireless technology for the given Communication scenario. | Applying (K3) |
| CO4 | demonstrate the working of Mobile IP and TCP Protocols for a given wireless Communication. | Applying (K3) |
| CO5 | summarize the principles behind advanced wireless technologies. | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 60 | 30 | | | | 100 |
| CAT2 | 10 | 60 | 30 | | | | 100 |
| CAT3 | 10 | 60 | 30 | | | | 100 |
| ESE | 10 | 60 | 30 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE02 - DATA SCIENCE | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **5** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course integrates the fields within computer science, machine learning, statistics and hypothesis testing in the context of data science and its applications to create adept and well-rounded data scientist | |
| **Unit - I** | **Introduction** | **9** |
| Introduction– Data Science - Data Science and Other Fields - The Relationship between Data Science and Information Science - Computational Thinking - Issues of Ethics, Bias, and Privacy in Data Science - Data Types – Data Collections – Data Pre-processing. Techniques: Data Analysis and Data Analytics - Descriptive Analysis - Diagnostic Analytics - Predictive Analytics - Prescriptive Analytics - Exploratory Analysis - Mechanistic Analysis. | | |
| **Unit - II** | **Machine Learning** | **9** |
| Introduction- Linear Regression – Multiple Linear Regression - Gradient Descent – Supervised Learning: kNN – Decision Tree – Naïve Bayes - Unsupervised Learning : k-means - Expectation Maximization – Reinforcement Learning | | |
| **Unit - III** | **Applications, Evaluations, and Methods** | **9** |
| Solving Data Problems: Collecting and Analyzing Twitter Data – Collecting and Analyzing YouTube Data – Analyzing Yelp Reviews and Ratings. Data Collection Methods – Picking Data Collection and Analysis Method: Quantitative Methods, Qualitative Methods – Evaluation: Comparing Models – Cross-Validation. | | |
| **Unit - IV** | **Statistics** | **9** |
| Role to Statistics -Estimation of Parameter and Sampling Distribution: Point Estimation - Sampling Distributions and the Central Limit Theorem. Statistical Intervals for a Single Sample: Confidence Interval on Mean – variance and Standard Deviation - Guidelines - Bootstrap - Tolerance and Prediction Intervals. | | |
| **Unit - V** | **Hypothesis Testing** | **9** |
| Hypothesis Testing - Tests on the Mean, Variance and Standard Deviation of Single Sample and Two Samples - Nonparametric Test for Single Sample and Two Samples - Hypothesis Tests in Simple Linear Regression - Multiple Linear Regression. | | |

| **TEXT BOOK:** | |
|---|---|
| 1 | Chirag Shah, "A Hands-On Introduction to Data Science", 1st Edition, Kindle Edition, 2020 for Units I,II,III |
| 2 | Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, Sixth Edition, Wiley, 2013 for Units IV,V |
| **REFERENCES:** | |
| 1 | Joel Grus, "Data Science from the Scratch", O'Reilly, 2015 |
| 2 | Frank Kane, "Hands-On Data Science and Python Machine Learning", First edition, Packt Publication, 2017 |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | apply preprocessing techniques to collect, clean, and prepare data and Visualize and present the inference using various tools | Applying (K3) |
| CO2 | Use machine learning techniques to solve real time problems | Applying (K3) |
| CO3 | utilize the data analysis techniques for handling applications with large data | Applying (K3) |
| CO4 | make use of the statistical foundations of data science and analyze the degree of certainty of predictions using statistical test and models | Applying (K3) |
| CO5 | structure engineering decision making problem as hypothesis tests. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/ POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | | 1 | 3 | 1 |
| CO2 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | | 1 | 3 | 1 |
| CO3 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | | 1 | 3 | 1 |
| CO4 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | | 1 | 3 | 1 |
| CO5 | 3 | 2 | 1 | 1 | | | | | 1 | 1 | | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 50 | 40 | | | | 100 |
| CAT2 | 10 | 40 | 50 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 30 | 60 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**22CSE03 - BUILDING ENTERPRISE APPLICATIONS**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course offers an insight into enterprise application development and deployment. | |
| **Unit – I** | **Analysis and Modeling** | **9** |
| Introduction to enterprise applications and their types – Software engineering methodologies – Life cycle of raising an enterprise application – Introduction to skills required to build an enterprise application – Key determinants of successful enterprise applications – Measuring the success of enterprise applications. Inception of enterprise applications – Enterprise analysis – business modeling – requirements elicitation – use case modeling – prototyping – Non functional requirements – requirements validation – planning and estimation. | | |
| **Unit – II** | **Architecting and Designing** | **9** |
| Concept of architecture – Views and viewpoints – Enterprise architecture – Logical architecture – Technical architecture and Design, Different technical layers, Object – Oriented Analysis and Design – Best practices – Data architecture and design – relational, XML, and other structured data representations. | | |
| **Unit – III** | **Architectural Design** | **9** |
| Technical architecture – Infrastructure architecture and design elements – Networking, Internetworking, and Communication Protocols – IT Hardware and Software – Middleware –Policies for Infrastructure Management, Deployment Strategy, Documentation of application architecture and design. | | |
| **Unit – IV** | **Construction** | **9** |
| Construction readiness of enterprise applications – defining a construction plan – defining a package structure, setting up a configuration management plan – setting up a development environment – introduction to the concept of Software Construction Maps – construction of technical solutions layers – methodologies of code review – static code analysis – build and testing. Dynamic code analysis – code profiling and code coverage. | | |
| **Unit – V** | **Testing and Rolling out Enterprise Applications** | **9** |
| Testing an enterprise application – Testing levels and approaches – Testing environments – integration testing – performance testing – penetration testing – usability testing – globalization testing and interface testing – user acceptance testing – rolling out an enterprise application. | | |
| | | **Total:45** |

**TEXT BOOK:**

1. Anubhav Pradhan, Satheesha B. Nanjappa, Senthil K. Nallasamy, Veerakumar Esakimuthu, “Raising Enterprise Applications”, 1st Edition, Wiley India Pvt. Ltd., 2014.

**REFERENCES:**

1. David R. Heffelfinger, “Java EE 8 Application Development”, 1st Edition, Packt Publishing, 2017.
2. Karl Wiegers, Joy Beatty, “Software Requirements “, 1st Edition, Microsoft Press Publications, 2013.

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | apply the concepts of enterprise analysis and business modeling for an application | Applying (K3) |
| CO2 | design and document the application architecture. | Applying (K3) |
| CO3 | determine the importance of application framework for designing application components | Applying (K3) |
| CO4 | perform code review, code analysis and build process for implementing enterprise applications | Applying (K3) |
| CO5 | Determine various testing strategies needed to deploy enterprise applications | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE04 - ARTIFICIAL INTELLIGENCE | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **5** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course focuses on search methods, game representation in artificial intelligence. | |
| **Unit – I** | **Intelligent Agents and Blind search:** | **9** |
| Definition – History – Agents and Environments – Good behaviour and the concepts of rationality – Nature of environments – Structure of intelligent agents. State space search: Generate and Test – Simple search – Depth First Search (DFS) – Breadth First Search (BFS) – Comparison of DFS and BFS – Depth Bounded DFS. | | |
| **Unit – II** | **Informed Search Methods:** | **9** |
| Informed Search Methods: Heuristic Search: Heuristic functions – Best First Search – Hill Climbing – Local maxima – Solution state space – Variable neighbourhood descent – Beam search – Tabu search. Peak to Peak Methods. Brute force – Branch and Bound – Refinement search. | | |
| **Unit – III** | **A* and Randomized Search Methods:** | **9** |
| Algorithm A* - Admissibility of A*– Recursive Best First Search. Escaping local maxima: Iterated hill climbing – Simulated annealing – Genetic algorithms (GA) – Travelling Salesman Problem (TSP) – GA based methods for TSP. | | |
| **Unit – IV** | **Game playing, Planning and Constraint Satisfaction:** | **9** |
| Board games – Game playing algorithms: Algorithm Minimax – Algorithm AlphaBeta – B* Search – Limitations of search. The STRIPS domain – Forward state space planning – Backward state space planning – Goal stack planning – Plan space planning | | |
| **Unit – V** | **Prepositional Logic, First Order Logic and Inferencing:** | **9** |
| Formal logic – Propositional logic – Resolution in propositional logic – First Order Logic (FOL) – Incompleteness of forward chaining – Resolution refutation in FOL – Horn clauses and SLD resolution – Backward chaining Formal logic – Propositional logic – Resolution in propositional logic – First Order Logic (FOL) – Incompleteness of forward chaining – Resolution refutation in FOL – Horn clauses and SLD resolution – Backward chaining | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Khemani D., “A First Course in Artificial Intelligence”, 1st Edition, 9th reprint, McGraw Hill Education (India) Private Limited, 2019 for Units I,II,III,IV,V |
| 2. | Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, Pearson Education, 2013 for Unit I |

**REFERENCES:**


| | |
|---|---|
| 1. | Elaine Rich, Kelvin Knight & Shivashankar B Nair, "Artificial Intelligence", 3rd Edition, McGraw Hill Education, India, 2017. |
| 2. | John Paul Mueller & Luca Massaron, “Artificial Intelligence For Dummies”, 1st edition, For Dummies, India, 2018. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | apply the concepts of Intelligence agent and blind searching techniques to solve the given problem | Applying (K3) |
| CO2 | organize the effectiveness of heuristics in informed search methods. | Applying (K3) |
| CO3 | identify optimal solutions using A* and randomized search methods. | Applying (K3) |
| CO4 | apply game playing and planning in problem solving. | Applying (K3) |
| CO5 | utilize propositional logic and first order logic in knowledge-based reasoning. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 60 | 30 | | | | 100 |
| CAT2 | 10 | 50 | 40 | | | | 100 |
| CAT3 | 10 | 50 | 40 | | | | 100 |
| ESE | 10 | 50 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

<table>
<tr><td colspan="8">22CSE05 - C# AND .NET FRAMEWORK</td></tr>
<tr><td>Programme & Branch</td><td>B.E. - Computer Science and Engineering</td><td>Sem.</td><td>Category</td><td>L</td><td>T</td><td>P</td><td>Credit</td></tr>
<tr><td>Prerequisites</td><td>Nil</td><td>5</td><td>PE</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
</table>

| | | |
|---|---|---|
| Preamble | To articulate the concepts of .Net and its platform in Model-View-Controller. | |
| **Unit – I** | **Introduction to C#** | **9** |
| Introduction C# – Overview about .NET - C# basics - Working with variables - Working with null values -Exploring console applications – Displaying output to the user - format strings - Getting text input from the user -Importing a namespace -Getting key input and arguments-Setting options with arguments - Controlling Flow and Converting Types. | | |
| **Unit – II** | **Object-Oriented Programming in C#** | **9** |
| Building Your Own Types with Object-Oriented Programming - Implementing interface and inheriting classes – Packaging .NET Types - Working with common .NET types - Managing File system. | | |
| **Unit – III** | **ASP.NET Core Web Application using Razor Pages** | **9** |
| ASP.NET Framework – Anatomy of an ASP.NET core project – ASP.NET MVC Views – Serving HTML content – View Engine – Passing data to a view - Razor pages - Razor Syntax.. | | |
| **Unit – IV** | **Data Manipulation using Razor Pages** | **9** |
| Design considerations – Securing the application – Access to application data – Generic application backend - Data access in .NET core – EF core common tasks – Designing a web API. | | |
| **Unit – V** | **ASP.NET Core Ecosystem** | **9** |
| ASP .NET core runtime environment – ASP .NET core host – Embedded HTTP Server – core middleware – Deploying an ASP .NET core application – publishing – deploying – migration and adoption strategies. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Mark J. Price, “C# 8.0 and .NET Core 3.0 – Modern Cross-Platform Development”, 4th Edition, Packt Publishing Limited, 2019 for Units I,II |
| 2. | Dino Esposito, “Programming ASP.NET Core”, 1st Edition, Pearson Education Inc., 2018 for Units III, IV, V. |

**REFERENCES:**


| | |
|---|---|
| 1. | Herbert Schildt, “The Complete Reference: C# 4.0”, Tata McGraw Hill, 2012. |
| 2. | Christian Nagel et al. “Professional C# 2012 with .NET 4.5”, Wiley India, 2012. |
| 3. | Andrew Troelsen , “Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | interpret the fundamental skills in C# programming Language and to build used defined types | Applying (K3) |
| CO2 | develop programs using class, inheritance and interfaces. | Applying (K3) |
| CO3 | develop web pages using ASP.NET platform. | Applying (K3) |
| CO4 | perform data manipulation using Razor pages. | Applying (K3) |
| CO5 | deploy ASP .NET applicaation | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | | | | | | | | | 3 | 2 |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | 3 | 2 |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | 3 | 2 |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | 3 | 2 |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 45 | 30 | | | | 100 |
| CAT2 | 20 | 50 | 30 | | | | 100 |
| CAT3 | 20 | 35 | 45 | | | | 100 |
| ESE | 10 | 40 | 50 | | | | 100 |

* ±3% may be varied (CAT 1 & 2 – 50 marks & ESE – 100 marks)

<table>
<tr><td colspan="8">22CSE06 - UNIX INTERNALS</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td>Programme & Branch</td><td>B.E. – Computer Science and Engineering</td><td>Sem.</td><td>Category</td><td>L</td><td>T</td><td>P</td><td>Credit</td></tr>
<tr><td>Prerequisites</td><td>Operating Systems</td><td>5</td><td>PE</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td>Preamble</td><td colspan="7">This course describes the internal algorithms and structures that form the basis of UNIX operating system and their relationship to the programmer interface.</td></tr>
<tr><td>Unit – I</td><td colspan="6">Overview and Buffer Cache</td><td>9</td></tr>
<tr><td colspan="8">General Overview of the System: History – System structure – User perspective – Operating System Services – Assumptions about Hardware. Introduction to the Kernel: Architecture of the UNIX Operating System – Introduction to System Concept. The Buffer Cache: Buffer headers – Structure of the Buffer Pool – Scenarios for Retrieval of a Buffer – Reading and Writing Disk Blocks – Advantages and Disadvantages of the Buffer Cache.</td></tr>
<tr><td>Unit – II</td><td colspan="6">Internal Representation and System Calls for the file system</td><td>9</td></tr>
<tr><td colspan="8">Internal Representation of Files: Inodes – Structure of a Regular File – Directories –Conversion of a Path Name to an Inode – Super Block – Inode Assignment to a New File – Allocation of Disk Blocks. System Calls: Open – Read/Write – File And Record Locking – Adjusting the Position of File I/O – lseek – close – File Creation – Creation of Special Files – Changing Directory – Root – Owner - Mode – stat and fstat – Pipes – dup – Mounting and Unmounting File Systems – link – unlink.</td></tr>
<tr><td>Unit – III</td><td colspan="6">Processes</td><td>9</td></tr>
<tr><td colspan="8">Process States and Transitions – Layout of System Memory – The Context of a Process – Saving the Context of a Process – Manipulation of the Process Address Space. Process Control: process Creation – Signals – Process Termination – Awaiting Process Termination – Invoking other programs – User Id of a Process – Changing the size of a Process – Shell – System Boot and the INIT Process – Process Scheduling.</td></tr>
<tr><td>Unit – IV</td><td colspan="6">Memory Management and I/O Sub systems</td><td>9</td></tr>
<tr><td colspan="8">Memory Management Policies:- Swapping – Demand Paging – A Hybrid System with Swapping and Demand Paging. The I/O Subsystem: Driver Interfaces System configuration – Systems calls and Driver interfaces – Interrupt Handlers – Disk Drivers – Terminal Drivers – Streams.</td></tr>
<tr><td>Unit – V</td><td colspan="6">Interprocess Communication and Multiprocessor Systems</td><td>9</td></tr>
<tr><td colspan="8">Interprocess Communication: Process Tracing – System V IPC – Messages – Shared memory – Semaphores – Network communications – Sockets. Multiprocessor Systems: Problems – Solution with Master/Slave Processors, and Semaphores.</td></tr>
<tr><td colspan="8" align="right">Total:45</td></tr>
<tr><td colspan="8">TEXT BOOK:</td></tr>
<tr><td>1.</td><td colspan="7">Maurice J. Bach, “The Design of the Unix Operating System”, 1st Edition, Pearson Education, 2015.</td></tr>
<tr><td colspan="8">REFERENCES:</td></tr>
<tr><td>1.</td><td colspan="7">Dave Taylor, “Learning Unix for OS X Going Deep with the Terminal and Shell”, 2nd Edition, Oreilly Publication, 2016.</td></tr>
<tr><td>2.</td><td colspan="7">Robert Love, "Linux Kernel Development", 3rd Edition, Addison Wesley, 2010.</td></tr>
<tr><td>3.</td><td colspan="7">Paul Love, Joe Merlino, Jeremy C. Reed, Craig Zimmerman & Paul Weinstein,” Beginning Unix”, Wiley Publishing Inc, 2005</td></tr>
<tr><td colspan="8"></td></tr>
</table>

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | discuss the system structure, architecture of Unix operating system, buffer cache and apply for reading and writing disk blocks | Applying (K3) |
| CO2 | apply various system calls for file manipulations | Applying (K3) |
| CO3 | express process state transitions and apply process scheduling in real world cases | Applying (K3) |
| CO4 | make use of memory swapping and I/O driver interfaces for given scenario | Applying (K3) |
| CO5 | employ the concepts of inter process communication for the given scenario | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 15 | 60 | 25 | | | | 100 |
| CAT2 | 15 | 55 | 30 | | | | 100 |
| CAT3 | 15 | 50 | 35 | | | | 100 |
| ESE | 15 | 55 | 30 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| **22CSE07 - DATA WAREHOUSING AND DATA MINING** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **5** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | The course provides a comprehensive knowledge about building a data warehouse and performs data mining using various techniques. | |
| **Unit – I** | **Introduction** | **9** |
| Data Mining – Steps in Knowledge Discovery Process – Diversity of data types – Kinds of Knowledge – Confluence of multiple disciplines – Data mining and applications – society – Data types – Statistics of data – Similarity and distance measures. | | |
| **Unit – II** | **Data Preprocessing and Data Warehousing** | **9** |
| Data quality – Data Cleaning – Integration – Transformation – Dimensionality reduction – Data Warehouse – Modeling: schema and measures – OLAP operations – Data cube computation – methods. | | |
| **Unit – III** | **Pattern Mining** | **9** |
| Basic concepts – Frequent itemset mining methods – Pattern evaluation methods – Mining: various kinds of pattern – approximate patterns – constraint-based pattern mining – Mining: sequential patterns – subgraph patterns. | | |
| **Unit – IV** | **Classification** | **9** |
| Basic Concepts – Decision Tree Induction – Bayes Classification methods – Lazy learners – Linear classifiers – model evaluation and selection – Support Vector Machines – Rule-based and pattern-based classification – k-Nearest Neighbor Classifier – Classification with weak supervision. | | |
| **Unit – V** | **Cluster Analysis** | **9** |
| Cluster analysis – Partitioning Methods – Hierarchical Methods – Density based Methods – Grid based Methods – Evaluation of clustering. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Jiawei Han, Jian Pei, Hanghang Tong, “Data Mining: Concepts and Techniques, The Morgan Kaufmann Series in Data Management Systems”, 4th Edition, Kindle Edition, 2022. |

**REFERENCES:**


| | |
|---|---|
| 1. | Berson Alex, and Smith Stephen J, “Data Warehousing, Data Mining and OLAP”, 1st Edition, Tata McGraw-Hill, New Delhi, 2004. |
| 2. | Bharat Bhushan Agarwal & Sumit Prakash Tayal, “Data Mining and Data Warehousing Paperback – 1”, January 2018. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | describe the concepts of data mining and perform statistical analysis of data | Applying (K3) |
| CO2 | apply preprocessing techniques and design data warehouse | Applying (K3) |
| CO3 | apply association rule mining methods to solve the given problem | Applying (K3) |
| CO4 | apply classification techniques to solve real world problems | Applying (K3) |
| CO5 | utilize different clustering methods for various applications | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | 15 | 25 | 60 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 30 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| **22CSE08 - CRYPTOGRAPHY AND NETWORK SECURITY** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| **Programme & Branch** | **B.E. – Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Computer Networks** | **6** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course describes cryptographic algorithms deployed for offering confidentiality, integrity, authentication and non-repudiation. | |
| **Unit – I** | **Introduction to Network Security and Symmetric Ciphers:** | **9** |
| Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services – Security Mechanisms – Model for Network Security – Classical encryption techniques – Block ciphers and Data Encryption Standard – Advanced Encryption Standard – Block cipher operation. | | |
| **Unit – II** | **Asymmetric Ciphers:** | **9** |
| Public key cryptography and RSA – Other Public key cryptosystems – Diffie-Hellman Key Exchange – Elgamal Cryptographic System – Elliptic Curve Arithmetic – Elliptic Curve Cryptography | | |
| **Unit – III** | **Cryptographic Data Integrity Algorithms:** | **9** |
| Cryptographic hash functions – Message authentication codes: Message Authentication Requirements – Message Authentication Functions – Requirements for Message Authentication Codes – Security of MACs – MACs Based on Hash Functions: HMAC – Digital signatures: Elliptic Curve Digital Signature Algorithm. | | |
| **Unit – IV** | **Mutual Trust:** | **9** |
| Key management and distribution: symmetric key distribution using symmetric and asymmetric encryption – Distribution of public keys – X.509 Certificates – Public key infrastructure – User authentication: Remote user authentication principles – Remote user authentication using symmetric and asymmetric encryption – Kerberos – Federated identity management – Personal identity verification. | | |
| **Unit – V** | **Network and Internet Security:** | **9** |
| Transport level security – Wireless network security – Electronic mail security –Wireless security – S/MIME-pretty good privacy - IP security overview – Intruder – Firewalls – Need for firewall – Firewall characteristics and Access policy – Types of firewalls. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | William Stallings, "Cryptography and Network Security", 7th Edition, Pearson Education, 2018 |

**REFERENCES:**

| | |
|---|---|
| 1. | Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata McGraw Hill, 2015. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | apply various symmetric key cryptography techniques to solve the problems | Applying (K3) |
| CO2 | make use of various public key cryptography techniques for solving real time problems | Applying (K3) |
| CO3 | explore hashing and digital signature techniques | Applying (K3) |
| CO4 | demonstrate the various mutual trust and user authentication mechanisms | Applying (K3) |
| CO5 | determine the appropriate security protocols and standards for the given application | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 20 | 50 | 30 | | | | 100 |
| ESE | 10 | 50 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE09 - BUSINESS INTELLIGENCE AND ITS APPLICATIONS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **6** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course focuses on learners to apply the BI concepts and techniques to various applications for making better decisions | |
| **Unit – I** | **Business View of Information Technology Applications** | **9** |
| Business View of Information Technology: Core Business Processes – Baldrige Business Excellence Framework – Purpose of using IT in Business – Characteristics of Internet-ready IT Applications – Enterprise Applications – Information users and their requirements. Case Study: GoodLife HealthCare Group, Good Food Restaurants Inc, Ten To Ten Retail Stores. Types of Digital Data: Introduction – Structured Data – Unstructured Data – Semi-Structured Data – Difference between semi-structured and structured data. | | |
| **Unit – II** | **Business Intelligence and Data Integration** | **9** |
| Business Intelligence: Definition – Evolution – Need for BI – BI Value Chain – Business Analytics. BI Concepts: BI Framework – BI Users – BI Applications – BI Roles and Responsibilities – Data Integration : Need for Data Warehouse – Definition of Data Warehouse – Data mart – Ralph Kimbal's Approach vs. W.H.Inmon's Approach – Goals of Data Warehouse –ETL Process – Data Integration Technologies – Data Quality – Data Profiling. | | |
| **Unit – III** | **OLTP, OLAP and Multidimensional Data Modeling** | **9** |
| Introduction to OLTP and OLAP: OLTP – OLAP – OLAP Architectures. Multidimensional Data Modeling: Data Models – Role of OLAP Tools in BI – OLAP Operations –Basics of Data Modeling –Types of Data Model – Data Modeling Techniques – Fact Table –Dimension Table –Dimensional Models –Dimensional Modeling Life Cycle –Designing the Dimensional Model. | | |
| **Unit – IV** | **Performance Management and Enterprise Reporting** | **9** |
| Measures, Metrics, KPIs and Performance Management: Understanding Measures and Performance – Measurement System – Role of metrics –KPIs – Enterprise Reporting: Reporting Perspectives – Report Standardization and Presentation Practices – Enterprise Reporting Characteristics – Balanced Scorecard – Dashboards –Creating Dashboards – Scorecards vs. Dashboards – Analysis. | | |
| **Unit – V** | **Role of Statistics in Analytics and BI Applications** | **9** |
| Understanding Statistics: Role of Statistics in Analytics–Data Description and Summarization – Statistical Test – Application of Analysis in Industries. BI Applications: Understanding BI and Mobility – BI and Cloud Computing – BI for ERP systems – Social CRM and BI. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Prasad R.N. and Seema Acharya, "Fundamentals of Business Analytics", 2nd Edition, Wiley-India Publication, 2020 |

**REFERENCES:**

| | |
|---|---|
| 1. | Ramesh Sharda, Dursun Delen and Efraim Turban, "Business Intelligence, Analytics, and Data Science: A Managerial Perspective", 4th Edition, Pearson Education, 2017. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | demonstrate the enterprise view of IT applications and identify the different types of digital data | Applying (K3) |
| CO2 | make use of BI concepts and techniques to experiment ETL process | Applying (K3) |
| CO3 | compare OLTP with OLAP systems and design dimensional model | Applying (K3) |
| CO4 | apply different software design techniques for a given problem | Applying (K3) |
| CO5 | apply BI to mobile, cloud, ERP and social CRM systems | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 15 | 45 | 40 | | | | 100 |
| CAT2 | 15 | 40 | 45 | | | | 100 |
| CAT3 | 15 | 40 | 45 | | | | 100 |
| ESE | 10 | 45 | 45 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE10 - GRAPH THEORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. – Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Discrete Mathematics** | **6** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | The course introduces various concepts behind graphs and trees and their applications to solve real-world problems. | |
| **Unit – I** | **Introduction, Paths and Circuits** | **9** |
| **Introduction:** Graph – Definition and Terminologies – Applications of Graphs – Finite and Infinite Graphs – Incidence and Degree – Isolated Vertex – Pendant Vertex – Null Graph. **Paths and Circuits:** Isomorphism – Sub-graphs – Walks, Paths and Circuits – Connected Graphs, Disconnected Graphs and Components – Euler Graphs – Operations on Graphs – Hamiltonian Paths and Circuits – Traveling-Salesman Problem. | | |
| **Unit – II** | **Trees and Cut Sets** | **9** |
| Trees – Properties of Trees – Pendant Vertices in a Tree – Distance and Centers in Trees – Rooted and Binary Trees – On Counting Trees – Spanning Trees - Fundamental Circuits – Finding all Spanning Trees of a Graph – Spanning Trees in a Weighted Graph – Cut-Sets – Properties of Cut-Set – All Cut-Sets in a Graph - Fundamental Circuit and Cut-Sets - Connectivity and Separability – Network Flows. | | |
| **Unit – III** | **Planarity and Vector Space of a Graph** | **9** |
| Combinatorial vs. geometric Graphs – Planar Graph – Kuratowski's Two Graphs – Different Representations of a Planar Graph – Detection of Planarity – Geometric and Combinatorial Dual – Thickness and Crossings – **Vector Spaces**: Sets with One Operation and Two Operations – Modular Arithmetic and Galois Fields – Vectors and Vector Spaces – Vector Space Associated with a Graph. | | |
| **Unit – IV** | **Matrices, Coloring, Covering and Partitioning** | **9** |
| Matrix Representation – Incidence Matrix – Sub-Matrices – Circuit Matrix – Cut-Set Matrix – Path Matrix – Adjacency Matrix – Graph Coloring – Chromatic Number – Chromatic Partitioning – Chromatic Polynomial – Matchings – Coverings – The Four-Color Problem. | | |
| **Unit – V** | **Directed Graphs and Enumeration of graphs** | **9** |
| Directed Graphs – Types – Digraphs and Binary Relations – Directed Paths and Connectedness – Euler Digraphs – Fundamental Circuits in Digraphs – Adjacency Matrix of a Digraph – Paired Comparisons and Tournaments – Enumeration of Graphs: Types of Enumeration – Counting Labeled Trees and Unlabeled Trees. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Narsingh Deo, "Graph Theory with Application to Engineering & Computer Science", 1st Edition, Dover Publications, Inc, 2016. |

**REFERENCES:**

| | |
|---|---|
| 1. | Bela Bollobas, "Modern Graph Theory", 2nd edition, Springer, 2021. |
| 2. | Reinhard Diestel, "Graph Theory", 5th edition, Springer, 2017. |
| 3. | L.R.Foulds , "Graph Theory Applications", Springer , 2016. |
| 4. | West, D. B., "Introduction to Graph Theory", 3rd Edition, Prentice-Hall, Englewood Cliffs, NJ, 2015 |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped**<br>**(Highest Level)** |
|---|---|---|
| CO1 | Apply the basic graph theories to solve the problems. | Applying (K3) |
| CO2 | Utilize Trees and Cut-Sets to solve real-world scenarios. | Applying (K3) |
| CO3 | Implement the concept of Planarity and Vector space of a graph. | Applying (K3) |
| CO4 | Show various graph representations and make use of coloring and partitioning of graphs | Applying (K3) |
| CO5 | Use digraphs and enumeration of graphs to solve real world problems. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 2 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 2 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 2 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 2 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 2 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 40 | 35 | | | | 100 |
| CAT2 | 25 | 40 | 35 | | | | 100 |
| CAT3 | 30 | 40 | 30 | | | | 100 |
| ESE | 30 | 40 | 30 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE11 - DISTRIBUTED SYSTEMS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Operating Systems and Computer Networks** | **6** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides an understanding of distributed systems architecture and the principles on which the internet and distributed applications and file systems are developed. | |
| **Unit – I** | **Characteristics and System Models** | **9** |
| Characteristics: Introduction – Examples – Trends – focus on resource sharing – Challenges in distributed systems – Case study: The World Wide Web. System models: physical – Architectural and Fundamental models. | | |
| **Unit – II** | **Interprocess Communication, Remote Invocation and Indirect Communication** | **9** |
| Inter process communications: Introduction – the API for the Internet protocol – External data representation and Marshalling – Multicast Communication – Network Virtualization – Case study: MPI. Remote Invocation: Introduction – request-reply protocol – Remote Method Invocations – Case study: Java RMI. Indirect Communication: Group communication – Publish-Subscribe systems – message queues and shared memory approaches. | | |
| **Unit – III** | **Peer to Peer Systems, Distributed File Systems and Name Services** | **9** |
| Peer-to-peer Systems: Introduction – Napster and its legacy – Peer-to-peer – Middleware – Routing overlays Case study: Pastry. Distributed File System: Introduction – file service architecture – Case Study – Andrew File System. Name Services: Introduction – Name Services and DNS – directory services – case study: Global Name Service. | | |
| **Unit – IV** | **Time Synchronization, Transactions and Concurrency Control, Distributed Transactions** | **9** |
| Time Synchronization: Introduction – clocks – events and process states – synchronizing physical clocks – logical time and logical clocks. Transaction and Concurrency Control: transactions – nested transaction – locks – optimistic concurrency control and timestamp ordering. Distributed transactions: – flat and nested – atomic commit protocols and concurrency control. | | |
| **Unit – V** | **Replication, Distributed Multimedia Systems and Designing Distributed Systems** | **9** |
| Replication: System model and group communications – fault tolerant services – Case Study: The p architecture. Distributed Multimedia Systems: Characteristics of multimedia data – Quality of service management – Resource Management – Stream Adaptation – Case Study: – BitTorrent. Designing Distributed Systems: GOOGLE Case Study – architecture and design philosophy – communication paradigms – data Storage and coordination services – Distributed Computation services. | | |
| | | **Total:45** |

**TEXT BOOK:**



| | |
|---|---|
| 1. | Coulouris. George, Dollimore, Jean and Kindberg Tim., “Distributed Systems Concepts and Design”, 5th Edition, Pearson Education, 2021 |



**REFERENCES:**



| | |
|---|---|
| 1. | Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, 2nd Edition, Pearson Education, 2013. |
| 2. | Pradeep K Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2012. |

| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | discuss the characteristics, models of distributed system and apply it for application development | Applying (K3) |
| CO2 | apply different communication models in distributed application development | Applying (K3) |
| CO3 | express the services offered by distributed systems and apply it in real world cases | Applying (K3) |
| CO4 | apply synchronization and concurrency in transactions | Applying (K3) |
| CO5 | determine a suitable architecture for fault-tolerant and multimedia distributed systems | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 15 | 60 | 25 | | | | 100 |
| CAT2 | 15 | 55 | 30 | | | | 100 |
| CAT3 | 15 | 55 | 30 | | | | 100 |
| ESE | 15 | 55 | 30 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE12 - DEEP LEARNING AND ITS APPLICATIONS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **6** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides an overview of Neural Networks and Deep learning techniques for solving real-world problems. | |
| **Unit – I** | **Neural Network** | **9** |

**Neural Network**-Building Intelligent Machines-Limits of Traditional Computer Programs-Mechanics of Machine Learning-Neuron-Linear Perceptron as Neurons-Feed-Forward Neural Networks-Linear Neurons and Their Limitations-Sigmoid, Tanh, and ReLU Neurons-Softmax Output Layers

**Training Feed-Forward Neural Networks**: Gradient Descent-Delta Rule and Learning Rates-Gradient Descent with Sigmoidal Neurons-Backpropagation Algorithm-Stochastic and Minibatch Gradient Descent-Test Sets, Validation Sets, and Overfitting-Preventing Overfitting in Deep Neural Network

| | | |
|---|---|---|
| **Unit – II** | **Learning in Neural Network** | **9** |

Challenges with Gradient Descent- Local Minima in the Error Surfaces of Deep Networks - Model Identifiability - Local Minima in Deep Networks - Flat Regions in the Error Surface - Gradient Points in the Wrong Direction - Second-Order Methods -Momentum-Based Optimization-Learning Rate Adaptation

| | | |
|---|---|---|
| **Unit – III** | **Convolutional Neural Networks** | **9** |

Convolutional Neural Networks-Neurons in Human Vision-Shortcomings of Feature Selection-Vanilla Deep Neural Networks-Filters and Feature Maps-Description of the Convolutional Layer-Max Pooling - Architectural Description of Convolution Networks-Accelerating Training with Batch Normalization- Visualizing Learning in Convolutional Networks-Convolutional Filters to Replicate Artistic Styles-Convolutional Filters for Other Problem Domains

| | | |
|---|---|---|
| **Unit – IV** | **Autoencoders and Recurrent Neural Networks** | **9** |

Embedding and Representation Learning-Principal Component Analysis-Autoencoder Architecture-Denoising to Force Robust Representations-Sparsity in Autoencoders- Models for Sequence Analysis- Tackling seq2seq with Neural N-Grams- Implementing a Part-of-Speech Tagger- Dependency Parsing and SyntaxNet- Beam Search and Global Normalization- Stateful Deep Learning Models- Recurrent Neural Networks- Challenges with Vanishing Gradients- Long Short-Term Memory (LSTM) Units- Augmenting Recurrent Networks with Attention- Dissecting a Neural Translation Network

| | | |
|---|---|---|
| **Unit – V** | **Case studies- Applications** | **9** |

Introduction to Keras and Tensorflow- Building a CNN for image classification - Sentiment Analysis Model using LSTM – Deep Learning for Network intrusion detection – Speech recognition using Deep learning

**Total:45**

**TEXT BOOK:**


| | |
|---|---|
| 1. | Nikhil Buduma , Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms, 1st Edition, O"Reilly Series, June 2017 |


**REFERENCES:**


| | |
|---|---|
| 1. | Ian Goodfellow, Yoshua Bengio, and Aaron Courvill, “Deep Learning”, MIT Press, 1st Edition, 2016. |
| 2. | Josh Patterson and Adam Gibson, "Deep Learning – A Practitioner"s Approach", 1 Edition, O"Reilly Series, 2017. |
| 3. | Indra den Bakker, "Python Deep Learning Cookbook", 1 Edition, Packt Publishing, 2017. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | apply the concepts of neural networks to solve simple problems. | Applying (K3) |
| CO2 | utilize different approaches to improve learning in neural networks. | Applying (K3) |
| CO3 | exemplify the concepts of CNN models and apply them for solving computer vision related problems. | Applying (K3) |
| CO4 | make use of autoencoders for dimensionality reductions and apply the concepts of RNN models for solving sequential modeling problems. | Applying (K3) |
| CO5 | identify suitable deep learning models for developing real world applications. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | | 1 | 3 | 1 |
| CO4 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | | 1 | 3 | 1 |
| CO5 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | | 1 | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 50 | 30 | | | | 100 |
| CAT2 | 20 | 50 | 30 | | | | 100 |
| CAT3 | 15 | 50 | 35 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE13 - GRAPHICS AND MULTIMEDIA | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **6** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides knowledge on how the graphical objects are represented in a computer system and presented to the end user. It also demonstrates how those objects are manipulated via various transformations and explores the ways of representing the different types of digital content over Internet and demonstrates the creation of simple 2D animation. | |
| **Unit – I** | **Introduction to Graphics** | **9** |
| **Introduction to Graphics:** Introduction - Graphics applications -Graphics systems – Output Primitive: Line, Circle and Ellipse drawing algorithms – Attributes of Output Primitives. | | |
| **Unit – II** | **Two Dimensional Modeling** | **9** |
| **Two Dimensional Modeling:** Two Dimensional Geometric Transformations – Two Dimensional Clipping and Viewing – Structures and Hierarchical Modeling. | | |
| **Unit – III** | **Three Dimensional Modeling** | **9** |
| Three Dimensional Modeling: Three dimensional geometric and modeling transformations - Visible surface detection methods - Color models and Color applications. | | |
| **Unit – IV** | **Introduction to Multimedia** | **9** |
| Introduction to Multimedia: Introduction – Uses of Multimedia – Interaction Technologies and Devices – Text – Digital Images. | | |
| **Unit – V** | **Animation** | **9** |
| Animation: Digital Audio – Audio-Visual Media: Video and Animation – Creating Animation – Designing Multimedia. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Hearn Donald and Baker M. Pauline, “Computer Graphics C Version”, 2nd Edition, Pearson Education, 2008 for Units I,II,III |
| 2. | Ashok Banerji and Ananda Mohan Ghosh, “Multimedia Technologies”, 1st Edition, Tata McGraw Hill, 2010 for Units IV ,V |

**REFERENCES:**

| | |
|---|---|
| 1. | Jeffcoate & Judith. “Multimedia in Practice: Technology and Applications”, 1st Edition, Prentice Hall of India, 2007 |
| 2. | Foley James D., Van Dam, Andries, Feiner Steven K. and Hughes John F., “Computer Graphics: Principles and Practice”, 2nd Edition, Pearson Education, 2005. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | develop simple applications with 2D objects | Applying (K3) |
| CO2 | apply various transformations, clipping & viewing operations on 2D objects | Applying (K3) |
| CO3 | manipulate 3D objects by applying transformation and detecting visible surface | Applying (K3) |
| CO4 | design simple project using multimedia components | Applying (K3) |
| CO5 | apply the different phases in multimedia design to develop a multimedia project | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 2 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 40 | 50 | | | | 100 |
| CAT2 | 15 | 40 | 45 | | | | 100 |
| CAT3 | 30 | 50 | 20 | | | | 100 |
| ESE | 10 | 40 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE14 - BLOCKCHAIN TECHNOLOGIES | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides a comprehensive introduction to the theoretical and practical aspects of blockchain technology. | |
| **Unit – I** | **Blockchain 101** | **9** |
| The growth of blockchain technology- Distributed systems - The history of blockchain - Bockchain – Consensus - CAP theorem and blockchain. Decentralization using blockchain – Routes to decentralization - Blockchain and full ecosystem decentralization – Pertinent terminology – Platforms for decentralization – Innovative trends. | | |
| **Unit – II** | **Cryptography Technical Foundations** | **9** |
| Introduction –– Cryptographic primitives - Advanced Encryption Standard(AES) – Public Key Cryptography – Asymmetric cryptography – Integer factorization – Discrete logarithm - Elliptic Curve Cryptography - Public and private keys – RSA – Digital signatures – Hash functions – Cryptographic constructs and blockchain technology. | | |
| **Unit – III** | **Bitcoins and Alternative Coins** | **9** |
| Bitcoin-an overview –Cryptographic keys - Transactions – Blockchain – Mining – The Bitcoin Network – Wallets – Bitcoin payments Alternative Coins - Theoretical foundations - Bitcoin limitations – development of altcoins – Smart Contracts. | | |
| **Unit – IV** | **Ethereum 101** | **9** |
| Ethereum overview – The Ethereum network – components of the Ethereum ecosystem – The Ethereum virtual machine(EVM) – Smart Contracts – Blocks and block chain – Wallets and client software – Nodes and miners – APIs, tools, and DApps – Supporting protocols – Programming languages – Ethereum Development Environment – Development tools and frameworks. | | |
| **Unit – V** | **Hyperledger** | **9** |
| Projects under Hyperledger – Hyperledger reference architecture – Hyperledger Fabric – Hperledger sawtooth – Setting up a Sawtooth development environment – Blockchains-Outside of Currencies: Internet of Things – Government – Health – Finance. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Imran Bashir, “Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more”, 3rd Edition, Packt Publishing, 2020. |

**REFERENCES:**

| | |
|---|---|
| 1. | Brenn Hill, Samanyu Chopra, Paul Valencourt, “Blockchain Quick Reference: A guide to exploring decentralized blockchain application development”, 1st Edition, Packt publishing, 2018. |
| 2. | Imran Bashir, “Mastering Blockchain” 2nd Edition: Distributed ledger technology, decentralization, and smart contracts explained, 2018. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | determine the basics and various real time applications of blockchain | Applying (K3) |
| CO2 | apply decentralization and cryptography for blockchain applications | Applying (K3) |
| CO3 | make use of blockchain technology for bitcoin, alternative coins and develop smart contracts | Applying (K3) |
| CO4 | develop a distributed application using Ethereum | Applying (K3) |
| CO5 | deploy an application using Hyperledger | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 30 | 50 | 20 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 10 | 50 | 40 | | | | 100 |
| ESE | 20 | 50 | 30 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**22GEE02 TOTAL QUALITY MANAGEMENT**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Mechanical Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | |
|---|---|
| Preamble | This course deals with quality concepts and Total Quality Management (TQM) principles focusing on process quality for customer perspective. It also deals with the basic and modern quality management tools including ISO standards |

**Unit – I** **Quality Concepts and Principles** **9**

Definition of Quality - Dimensions of Quality - Quality Planning - Quality Assurance and Control - Quality Costs with Case Studies - Elements / Principles of TQM - Historical Review – Leadership – Qualities / Habits - Quality Council - Quality Statements, Strategic Planning – Importance - Case Studies - Deming Philosophy - Barriers to TQM Implementation – Cases with TQM Success and Failures.

**Unit – II** **TQM-Principles and Strategies** **9**

Customer Satisfaction - Customer Perception of Quality - Customer Complaints - Customer Retention, Employee Involvement – Motivation - Empowerment - Teams - Recognition and Reward - Performance Appraisal, Continuous Process Improvement - Juran's Trilogy - PDSA Cycle - 5S - Kaizen, Supplier Partnership - Partnering - Sourcing - Supplier Selection - Supplier Rating - Relationship Development, Performance Measures – Purpose – Methods - Cases.

**Unit – III** **Control Charts for Process Control** **9**

Basic Seven Tools of Quality and its Role in Quality Control, Statistical Fundamentals - Measures of Central Tendency and Dispersion, Population and Sample - Normal Curve - Control Charts for Variables and Attributes - Process Capability - Case Study - Introduction to Six Sigma.

**Unit – IV** **TQM-Modern Tools** **9**

New Seven Tools of Quality, Benchmarking - Need - Types and Process, Quality Function Deployment - House of Quality (HOQ) Construction - Case Studies, Introduction to Taguchi's Robust Design - Quality Loss Function - Design of Experiments (DOE), Total Productive Maintenance (TPM) - Uptime Enhancement, Failure Mode and Effect Analysis (FMEA) - Risk Priority Number (RPN) – Process - Case Studies.

**Unit – V** **Quality Systems** **9**

Need for ISO 9000 and Other Quality Systems - ISO 9000: 2015 Quality System – Elements - Implementation of Quality System - Documentation - Quality Auditing, Introduction to ISO 14000 - IATF 16949 - TL 9000-IEC 17025 - ISO 18000 - ISO 20000 - ISO 22000 - ISO21001. Process of Implementing ISO - Barriers in ISO Implementation.

**Total:45**

**TEXT BOOK:**


| | |
|---|---|
| 1. | Besterfield Dale H., Besterfield Carol, Besterfield Glen H., Besterfield Mary, Urdhwareshe Hemant & Urdhwareshe Rashmi. "Total Quality Management", 5th Edition, Pearson Education, Noida, 2018. |


**REFERENCES:**


| | |
|---|---|
| 1. | Subburaj Ramasamy, "Total Quality Management", McGraw Hill Education, New Delhi, 2017. |
| 2. | James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, Cengage Learning, 2012. |
| 3. | David Goetsch & Stanley Davis, "Quality Management for Organizational Excellence: Introduction to Total Quality", 8th Edition, Pearson, 2017. |

| **COURSE OUTCOMES:**<br>On completion of the course, the students will be able to | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | demonstrate the evolution of TQM principles | Understanding (K2) |
| CO2 | illustrate the principles and strategies of TQM | Understanding (K2) |
| CO3 | use control charts and identify process capability of a process | Applying (K3) |
| CO4 | apply various quality tools and techniques in both manufacturing and service industry | Applying (K3) |
| CO5 | choose appropriate quality standards and implement them in the respective industry | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | | | | 1 | | | | | | 1 | | 3 |
| CO2 | 2 | 2 | | | | 1 | | | | | | 1 | | 3 |
| CO3 | 2 | 2 | | | | 1 | | | | | | 1 | | 3 |
| CO4 | 2 | 2 | | | | 1 | | | | | | 1 | | 3 |
| CO5 | 1 | 1 | | | | 1 | | | | | | 1 | | 3 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 45 | 30 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 25 | 45 | 30 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

| 22CSE15 - DECISION SUPPORT SYSTEMS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Database Management Systems** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course focuses on various Decision Support Systems and their technologies collectively represented as analytics and the fundamental methods, techniques and the software used to design and develop these systems. | |
| **Unit – I** | **Decision Making and Analytics** | **9** |
| Foundations and Technologies for Decision Making – Introduction – Phases of Decision Making Process – The Intelligence phase – Design Phase – Choice Phase – Implementation Phase – Decision Support System Capabilities – Classification – Components of Decision Support System – Application case study. | | |
| **Unit – II** | **Descriptive Analytics** | **9** |
| Data Warehousing – Definition – Data warehousing process overview – Data warehouse architecture – ETL process – Data warehouse development with application case study – Data warehouse implementation Issues – Real time Data warehouse with application case study – Data warehouse administration and security issues. | | |
| **Unit – III** | **Predictive Analytics** | **9** |
| Text Analytics, Text Mining and Sentiment Analysis – Concepts – Natural Language Processing – Text mining approaches – Text mining process with application case study – Text mining tools – Sentiment Analysis overview – Sentiment analysis applications – Sentiment analysis process. | | |
| **Unit – IV** | **Web Analytics, Web Mining and Social Analytics** | **9** |
| Web Analytics, Web Mining and Social Analytics – Web mining overview – Web content and web structure mining – Web usage mining – Web analytics maturity model and web analytics tools – Social analytics and social network analysis with application case study – Social media concepts – Social media analytics. | | |
| **Unit – V** | **Prescriptive Analytics** | **9** |
| Model based decision making – DSS modeling – Structure – Certainty, Uncertainty and Risk – Decision modeling with spreadsheets – Decision analysis with decision tables and trees – Automated Decision Systems and Expert Systems – Artificial intelligence – Basic concepts of expert systems – Structure of expert systems with application case study – Knowledge engineering – Development of Expert system. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Ramesh Sharda, Dursun Delen, Efraim Turban, “Business Intelligence and Analytics Systems for Decision Support”, 10th Edition, Pearson Education, 2018. |

**REFERENCES:**

| | |
|---|---|
| 1. | Diego Galar Pascual “Artificial Intelligence Tools: Decision Support Systems in Condition Monitoring and Diagnosis”, 1st Edition,CRC Press, 2015. |
| 2. | Michelle M.H. Seref, Ravindra A. Ahuja, Wayne L. Winston, “ Developing Spreadsheet-Based Decision Support Systems”, 2nd Edition, Dynamic Ideas, 2011 |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | adapt to different phases, components and classifications in decision support systems | Applying (K3) |
| CO2 | carry out descriptive analytics process and data warehouse development | Applying (K3) |
| CO3 | perform text analytics, text mining and sentiment analysis for the given application | Applying (K3) |
| CO4 | perform web analytics, web mining and social analytics for the specified application | Applying (K3) |
| CO5 | demonstrate model based decision support system and expert system for an application | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 10 | 40 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**22CSE16 - SOCIAL NETWORK ANALYSIS**

| Programme & Branch | B.E. - Computer Science and Engineering | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Machine Learning** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | |
|---|---|
| Preamble | This course introduces various methods, models and concepts behind social network analysis. This course also describes about how to manipulate, analyze and visually display social network data. |

**Unit – I** **Introduction and Random Walks in Social Networks** **9**

Statistical Properties of Social Networks: Preliminaries – Static Properties – Dynamic Properties – Random Walks on Graphs: Background – Random Walk based Proximity Measures – Other Graph-based Proximity Measures – Graph-theoretic Measures for Semi-supervised Learning – Clustering with random walk based measures – Algorithms – Applications – Evaluation and datasets.

**Unit – II** **Community Discovery and Node Classification in Social Networks** **9**

Community Discovery in Social Networks: Communities in Context – Core Methods – Quality Functions – The Kernighan-Lin(KL) algorithm – Agglomerative/Divisive Algorithms – Spectral Algorithms – Multi-level Graph Partitioning – Markov Clustering – Node Classification in Social Networks: Problem Formulation – Methods using Local Classifiers – Random Walk based Methods – Applying Node Classification to Large Social Networks.

**Unit – III** **Social Influence Analysis and Expert Location in Social Networks** **9**

Social Influence Analysis: Influence Related Statistics – Social Similarity and Influence – Influence Maximization in Viral Marketing – Expert Location in Social Networks: Expert Location without Graph Constraints – Expert Location with Score Propagation – Expert Team Formation – Other related approaches.

**Unit – IV** **Link Prediction and Privacy In Social Networks** **9**

Link Prediction in Social Networks: Feature based Link Prediction – Feature Set Construction – Classification Models – Bayesian Probabilistic Models – Link Prediction by Local Probabilistic Models – Network Evolution based Probabilistic Model – Hierarchical Probabilistic Model – Probabilistic Relational Model - Privacy in Social Networks: Privacy breaches in social networks – Privacy definitions for publishing data – Privacy preserving mechanisms.

**Unit – V** **Visualization and Mining in Social Networks** **9**

Visualizing Social Networks: Structural Visualization – Semantic and Temporal Visualization – Statistical Visualization – Data Mining in Social Media: Data Mining in a Nutshell - Social Media - Motivations for Data Mining in Social Media - Data Mining Methods for Social Media -Text Mining in Social Networks: Keyword Search: Query Semantics and Answer Ranking – Keyword search over XML and relational data – Keyword search over graph data – Classification Algorithms – Clustering Algorithms.

**Total:45**

**TEXT BOOK:**

1. Charu C. Aggarwal, "Social Network Data Analytics", 1st Edition Springer, 2015.

**REFERENCES:**

1. Peter Mika, "Social Networks and the Semantic Web", 1st Edition, Springer, 2007.
2. BorkoFurht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | summarize statistical properties of Social Networks and apply random walk approaches for social network analysis | Applying (K3) |
| CO2 | make use of statistical methods for classification and community discovery in Social Networks | Applying (K3) |
| CO3 | carry out social influence and expert location in Social Networks | Applying (K3) |
| CO4 | use statistical methods for link prediction and describe privacy preservation methods in Social Networks | Applying (K3) |
| CO5 | employ visualization and apply text mining techniques in Social Networks | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 40 | 35 | | | | 100 |
| CAT2 | 25 | 40 | 35 | | | | 100 |
| CAT3 | 30 | 40 | 30 | | | | 100 |
| ESE | 30 | 40 | 30 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE17 - HUMAN COMPUTER INTERFACE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course aims to equip the students with the human factors to be considered, capability of computer systems, and the process involved in designing an effective user interface for a system. It also focuses on the imparting the knowledge required to design the interfaces for web applications. | |
| **Unit – I** | **Human and Computer** | **9** |
| The Human: Introduction – Input – output Channels – Human memory – Thinking: reasoning and problem – solving – Individual differences – Psychology and the design of interactive systems. The computer: Introduction – Text entry devices – Positioning – pointing and drawing – Display devices – Devices for VR and 3D interactive - Paper: printing and scanning – Memory – Processing and networks. | | |
| **Unit – II** | **Human Interaction with the System** | **9** |
| The Interaction: Introduction – Models of interaction – Frameworks and HCI – Ergonomics – Interaction styles – Elements of the WIMP interface – Interactivity – The context of the interaction – Experience – Engagement and fun – Paradigm for interaction. | | |
| **Unit – III** | **Design Process** | **9** |
| Interaction design basics: Introduction – The process of design – User focus – Scenarios – Navigation design – Screen design and layout – Iteration and Prototyping. HCI in the software process: The software life cycle – Usability engineering – Iterative design and prototyping – Design rationale. Design rules: Principles to support usability – Standards – Guidelines – Golden rules and heuristics – HCI patterns. Universal Design: Universal design principles – Mulit-modal interaction – Designing for diversity. | | |
| **Unit – IV** | **Designing Web Interface – Part 1** | **9** |
| Principle one – Make it Direct: In-page editing - Drag and drop – Direct selection. Principle Two – Keep it Lightweight. Principle Three – Stay on the Page: Overlays – Inlays – Virtual pages – Process flow. | | |
| **Unit – V** | **Designing Web Interface – Part 2** | **9** |
| Principle Four - Provide an Invitation: Static invitations – Dynamic invitations. Principle Five - Use Transitions: Transition patterns – Purpose of transitions. Principle Six – React Immediately: Lookup patterns – Feedback patterns. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Alan Dix, Janet Finlay, Gregory D.Abowd and Russell Beale, "Human-Computer Interaction", Pearson education, 3rd, 2009, for Units I, II , III. |
| 2. | Bill Scott and Theresa Neil, "Designing Web Interfaces", 1st Edition, O'Reilly, 2009, for Units IV ,V. |

**REFERENCES:**

| | |
|---|---|
| 1. | Andrew Sears, Julie A. Jacko, "The Human-Computer Interaction Handbook Fundamentals, Evolving Technologies, and Emerging Applications", 2nd Edition, Taylor & Francis Group, 2008. |
| 2. | J. Preece, Y. Rogers, H. Sharp, D. Benyon, S. Holland and T. Carey. "Human-Computer Interaction", Addison Wesley, 1994. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | organize capabilities of both humans and computers from the viewpoint of human information processing. | Applying (K3) |
| CO2 | build a human–computer interaction (HCI) model using appropriate models of interaction and interaction styles. | Applying (K3) |
| CO3 | apply the design process, standards, guidelines, and universal design principles to design an efficient HCI systems | Applying (K3) |
| CO4 | make use of the first three principles of web interface design to design an interactive interface for a web application | Applying (K3) |
| CO5 | design an interactive web interface with invitations, transitions, and patterns | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | | | | | | | | | 1 | 3 |
| CO2 | 3 | 2 | 3 | 1 | | | | | | | | | 1 | 3 |
| CO3 | 3 | 3 | 3 | 2 | | | | | | | | | 1 | 3 |
| CO4 | 3 | 2 | 3 | 1 | | | | | | | | | 1 | 3 |
| CO5 | 3 | 2 | 3 | 1 | | | | | | | | | 1 | 3 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 50 | 40 | | | | 100 |
| CAT2 | 15 | 40 | 45 | | | | 100 |
| CAT3 | 15 | 40 | 45 | | | | 100 |
| ESE | 10 | 40 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

<table>
<tr><td colspan="9">22CSE18 - OPTIMIZATION TECHNIQUES</td></tr>
<tr><td colspan="9"></td></tr>
<tr><td>Programme & Branch</td><td>B.E. - Computer Science and Engineering</td><td>Sem.</td><td>Category</td><td>L</td><td>T</td><td>P</td><td colspan="2">Credit</td></tr>
<tr><td>Prerequisites</td><td>NIL</td><td>7</td><td>PE</td><td>3</td><td>0</td><td>0</td><td colspan="2">3</td></tr>
<tr><td colspan="9"></td></tr>
<tr><td>Preamble</td><td colspan="8">This course provides an insight modern optimization technique used in various domains. It also introduces the metaheuristic optimization methods as solutions to multi-objective problems.</td></tr>
<tr><td>Unit – I</td><td colspan="7">Optimization Problem</td><td>9</td></tr>
<tr><td colspan="9">Statement of an optimization problem: design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of optimization problems classification based on the existence of constraints – nature of the design variables – physical structure of the problem – nature of the equations involved – permissible values of the design variables – deterministic nature of the variables – separability of the functions – number of objective functions – optimization techniques. Classical optimization techniques: single-variable optimization – multivariable optimization – convex programming problem</td></tr>
<tr><td>Unit – II</td><td colspan="7">Linear Programming</td><td>9</td></tr>
<tr><td colspan="9">Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation of the simplex method – simplex algorithm. Integer linear programming: Graphical Representation – Gomory’s cutting plane method.</td></tr>
<tr><td>Unit – III</td><td colspan="7">Nonlinear Programming</td><td>9</td></tr>
<tr><td colspan="9">Constrained optimization techniques – random search methods – complex method – sequential linear programming – transformation techniques – basic approach of the penalty function method – interior penalty function method – convex programming problem – exterior penalty function method – extrapolation techniques in the interior penalty function method – extended interior penalty function methods – penalty function method for problems with mixed equality and inequality constraints – penalty function method for parametric constraints – est problems: welded beam design – speed reducer (gear train) design.</td></tr>
<tr><td>Unit – IV</td><td colspan="7">Dynamic Programming</td><td>9</td></tr>
<tr><td colspan="9">Multistage decision processes – types of multistage decision problems – concept of sub optimization and principle of optimality – computational procedure in dynamic programming – illustrating the calculus method of solution – illustrating the tabular method of solution – conversion of a final value problem into an initial value problem – linear programming as a case of dynamic programming – continuous dynamic programming.</td></tr>
<tr><td>Unit – V</td><td colspan="7">Modern Methods of Optimization</td><td>9</td></tr>
<tr><td colspan="9">Genetic algorithms – simulated annealing – particle swarm optimization – solution of the constrained optimization problem – ant colony optimization – optimization of fuzzy systems neural-network-based optimization – metaheuristic optimization methods – multilevel and multiobjective optimization.</td></tr>
<tr><td colspan="9" align="right">Total:45</td></tr>
<tr><td colspan="9">TEXT BOOK:</td></tr>
<tr><td>1.</td><td colspan="8">Singiresu S. Rao, “Engineering Optimization: Theory and Practice”, 5th Edition, John Wiley and Sons, 2019.</td></tr>
<tr><td colspan="9">REFERENCES:</td></tr>
<tr><td>1.</td><td colspan="8">George Bernard Dantzig, MukundNarain Thapa, “Linear programming”, 3rd Edition, Springer series in operations research 2003.</td></tr>
<tr><td>2.</td><td colspan="8">H.A. Taha, “Operations Research: An Introduction”, 10th Edition, Pearson/Prentice Hall, 2017.</td></tr>
<tr><td>3.</td><td colspan="8">David G.Luenberger, Yinyu Ye, “Linear and Non-Linear Programming”, 3rd Edition, Springer, 2008.</td></tr>
<tr><td colspan="9"></td></tr>
</table>

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | investigate the optimization problem and the classical optimization techniques | Applying (K3) |
| CO2 | apply the linear programming model as a solution to various problems with linear functions | Applying (K3) |
| CO3 | make use of non-linear programming model to solve the constrained optimization problems | Applying (K3) |
| CO4 | develop optimal solutions for multistage decision problems using dynamic programming | Applying (K3) |
| CO5 | apply modern optimization techniques to solve decision problems | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 15 | 35 | 50 | | | | 100 |
| CAT2 | 15 | 35 | 50 | | | | 100 |
| CAT3 | 15 | 35 | 50 | | | | 100 |
| ESE | 10 | 40 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE19 - WEB MINING | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides knowledge about web searching, indexing, query processing and web content mining. | |
| **Unit – I** | **Information Retrieval and Web Search** | **9** |
| Basic Concepts – Information Retrieval Models – Relevance Feedback – Evaluation Measures – Text and Web Page Preprocessing – Inverted Index and its compression – Latent Semantic Indexing – Web Search – Meta-Searching and Combining Multiple Rankings – Web Spamming. | | |
| **Unit – II** | **Web Crawling** | **9** |
| Basic Crawler Algorithm – Implementation Issues – Universal Crawlers – Focused Crawlers – Topical Crawlers – Evaluation – Crawler Ethics and Conflicts. | | |
| **Unit – III** | **Wrapper Generation** | **9** |
| Preliminaries – Wrapper Induction-Instance-Based Wrapper Learning – Automatic Wrapper Generation: Problems – String Matching and Tree Matching – Multiple Alignment – Building DOM Trees – Extraction Based on a Single List Page and Multiple pages – Introduction to Schema Matching – Pre-Processing for Schema Matching-Schema – Level Match – Domain and Instance-Level Matching – Combining similarities. | | |
| **Unit – IV** | **Web Usage Mining** | **9** |
| Web Usage Mining – Clickstream Analysis – Log Files – Data Collection and Pre-Processing – Data Modeling for Web Usage Mining – The BIRCH Clustering Algorithm – Affinity Analysis and the A Priori Algorithm – Discretizing the Numerical Variable: Binning – Applying the A Priori Algorithm to CCSU Web Log Data – Discovery and Analysis of Web Usage Patterns – Recommender Systems and Collaborative Filtering. | | |
| **Unit – V** | **Opinion Mining** | **9** |
| The Problem of Opinion Mining – Document Sentiment Classification – Sentence Subjectivity and Sentiment Classification – Opinion Lexicon Expansion – Aspect-Based Opinion Mining – Mining Comparative Opinions Search and Retrieval – Opinion Spam Detection. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Bing Liu, “ Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data Centric Systems and Applications)”,2nd Edition, Springer, 2011 for Units I, II, III, V ,IV part 1.. |
| 2. | Zdravko Markov, Daniel T. Larose, “Data Mining the Web: Uncovering Patterns in Web Content, Structure, and Usage”, John Wiley & Sons, Inc., 2010 for Unit IV part 2. |

**REFERENCES:**


| | |
|---|---|
| 1. | Guandong Xu, Yanchun Zhang, Lin Li, “Web Mining and Social Networking: Techniques and Applications”, 1st Edition, Springer, 2011. |
| 2. | Soumen Chakrabarti, “Mining the Web: Discovering Knowledge from Hypertext Data”, Morgan Kaufmann, edition 2007. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | determine information retrieval models and methods related to Web search | Applying (K3) |
| CO2 | apply algorithms for Web crawling applications | Applying (K3) |
| CO3 | utilize wrapper to extract structured data | Applying (K3) |
| CO4 | analyze and model the behavioral patterns and users' profiles on interacting with a website | Analyzing (K4) |
| CO5 | apply opinion mining techniques to classify opinions | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO4 | 3 | 3 | 2 | | | | | | | | | | 3 | 2 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 50 | 30 | | | | 100 |
| CAT2 | 20 | 50 | 30 | | | | 100 |
| CAT3 | 20 | 40 | 30 | 10 | | | 100 |
| ESE | 20 | 30 | 40 | 10 | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| **22CSE20 - WIRELESS AND SENSOR NETWORKS** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Computer Networks** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course makes the learners to know the architecture, protocols for information gathering and energy management in wireless sensor network. This course also gives insight into challenges, various attacks and countermeasures for attacks in wireless sensor networks. | |
| **Unit – I** | **Wireless Sensor Networks Architecture** | **9** |
| Introduction: Sensors – Sensor Node Architecture – Sensor Network Architecture – Mote Technology – Comparison of MANET and WSN – Requirements and Challenges of WSN – Challenges for a WSN – WSN Applications – Wireless Sensor Networks Architecture: Introduction – Network Protocol Stack – Communication Standards – IEEE 802.11 – IEEE 802.15.4 – ZigBee – 6LoWPAN. | | |
| **Unit – II** | **Information Gathering** | **9** |
| Introduction – Routing – Flat-based Routing Algorithms – Sensor Protocols for Information Negotiation (SPIN) –Hierarchical Routing Algorithms – LEACH Routing Protocol – Information Gathering Based on Geographic Locations – Geographical Routing – Greedy Perimeter Stateless Routing – Landmark-based Routing – Data Aggregation – Content-based Naming. | | |
| **Unit – III** | **Energy Management in WSN** | **9** |
| Introduction – Duty Cycling – Independent Strategies – Dependent Strategies – Independent Sleep/Wakeup Schemes – Asynchronous Schemes – TDMA-based MAC Protocols – Contention-based MAC Protocols – Hybrid MAC Protocols – Data-driven Approaches – Energy-aware Routing Protocols – Hierarchical Energy-aware Routing – Location-based Routing – Data Aggregation-based Routing. | | |
| **Unit – IV** | **Security in WSN** | **9** |
| Introduction – Challenges in WSN – Attacks in WSN – Protection against Attacks – Key Management – Secure Routing in WSNs – Attacks on Routing Protocols – Countermeasures for Attacks – Intrusion Detection in WSN. | | |
| **Unit – V** | **Operating Systems for WSNs** | **9** |
| Introduction – Architecture – Execution Model – Scheduling – Power Management – Communication – Case Study on Popular Operating Systems- Programming WSNs : Introduction – TinyOS – Contiki – Castalia – NS-3. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Nandini Mukherjee, Sarmistha Neogy, Sarbani Roy, "Building Wireless Sensor Networks Theoretical & Practical Perspectives", CRC Press, Taylor & Francis Group, 2016. |

**REFERENCES:**


| | |
|---|---|
| 1. | Ibrahiem M. M. El Emary, S. Ramakrishnan, "Wireless Sensor Networks From Theory to Applications", 1st Edition, CRC Press, 2016. |
| 2. | Jun Zheng, Abbas, "Wireless Sensor Networks: A Networking Perspective" Jamalipour, 2009 |
| 3. | Rastko R. Selmic, Vir V. Phoha, Abdul Serwadda "Wireless Sensor Networks: Security, Coverage, and Localization"-2016. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | identify an appropriate wireless network for the given scenario | Applying (K3) |
| CO2 | demonstrate various routing protocols for gathering information in Wireless sensor networks | Applying (K3) |
| CO3 | utilize energy management schemes in wireless sensor networks | Applying (K3) |
| CO4 | examine various challenges, attacks and counter measures for attacks in wireless sensor networks | Applying (K3) |
| CO5 | determine an appropriate operating system for a wireless sensor application | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE21 - MODELING AND SIMULATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course focuses on applications of computer simulation and modeling to real world simple and complex problems. | |
| **Unit – I** | **Modeling Process** | **9** |
| Classification of modeling – Steps of modeling – System Dynamics: Unconstrained Growth and Decay - Constrained Growth – Drug Dosage – Force and Motion: Modeling Falling and Skydiving. | | |
| **Unit – II** | **System Dynamics Models** | **9** |
| Competition – Modeling of Competition – Predator – Prey Model – Modeling the spread of SARS – SIR Model – SAR Model – Enzyme Kinetics – Enzymatic Reactions. | | |
| **Unit – III** | **Data Driven Models** | **9** |
| Functions – Empirical Models – Simulating with Randomness: Simulations – Random numbers from various distributions – Random Walk. | | |
| **Unit - IV** | **Cellular Automation** | **9** |
| Diffusion – Spreading of Fire – Periodic Boundary Conditions – Movement of Ants – Formulating a Model - High Performance Computing: Concurrent Processing – Parallel Algorithms. | | |
| **Unit - V** | **Matrix Models** | **9** |
| Matrices for Population Studies – Population Matrices and High-Performance Computing - Time after Time – Age - Structured Model - Modeling with Markov Chains - Problems from Psychology to Genetics. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Angela B. Shiflet, George W. Shiflet, “Introduction to Computational Science: Modeling and Simulation for the Sciences”, 2nd Edition, Princeton University Press, 2018. |

**REFERENCES:**



| | |
|---|---|
| 1. | Jerry Banks, John S. Carson, Barry L. Nelson, David M. Nicol, “Discrete-Event System Simulation: Pearson New International Edition”, 5th Edition, Pearson Education Limited, 2013. |
| 2. | R. Panneerselvam, P. Senthilkumar, System Simulation, Modeling and Languages, PHI learning Pvt Ltd., 2013. |
| 3. | Harvey Gould, Jan Tobochnik and Wolfgang Christian. “An Introduction to Computer Simulation Methods Applications to Physical Systems”, Third Edition, Addison Wesley Publishing Group, 2016. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | model system dynamics with and without constraints | Applying (K3) |
| CO2 | construct models for systems with interactions | Applying (K3) |
| CO3 | make use of randomness and data for modeling | Applying (K3) |
| CO4 | utilize cellular automation for modeling natural processes, concurrent processing and parallel algorithms | Applying (K3) |
| CO5 | apply matrix theory in problem solving | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 30 | 45 | 25 | | | | 100 |
| CAT2 | 10 | 45 | 45 | | | | 100 |
| CAT3 | 25 | 45 | 30 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**22CSE22 - PARALLEL COMPUTING ARCHITECTURE AND PROGRAMMING**

| Programme & Branch | B.E. – Computer Science and Engineering | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Computer Organization** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course deals with computer architecture of uniprocessor and multiprocessor systems with an emphasis on parallel programming to achieve high performance. | |
| **Unit – I** | **Parallel Architectures** | **9** |
| Motivation: Modern scientific method – Evolution of supercomputing – Modern parallel computers – Seeking concurrency – Data clustering – Programming Parallel computers. Parallel Architectures: Introduction – Interconnection networks – Processor Arrays – Multiprocessors – Multicomputer – Flynn's Taxonomy. | | |
| **Unit – II** | **Parallel Algorithm Design and Message-Passing Programming** | **9** |
| Parallel Algorithm Design: Introduction – Task/Channel model – Foster's Design methodology – Boundary value problem – finding the maximum – The n-Body problem – Adding data input. Message-Passing Programming: Message-passing model – Message-passing interface – Circuit satisfiability – Introducing collective communication – Benchmarking parallel performance | | |
| **Unit – III** | **Parallel Algorithms** | **9** |
| The Sieve of Eratosthenes: Sequential algorithm, Sources of parallelism – Data Decomposition options – Developing the parallel algorithm – Analysis of parallel Sieve algorithm – documenting the parallel program. Floyd's Algorithm: The All-Pairs shortest path problem – Creating arrays at run time – Designing the parallel algorithm – Point-to-point communication – Documenting the parallel program. | | |
| **Unit – IV** | **Performance Analysis and Sorting** | **9** |
| Performance Analysis: Speedup and efficiency – Amdhal's Law – Gustafsan-Barsis's Law – The Karp-Flatt Metric – The Isoefficiency Metric. Sorting: Quick sort – A parallel quick sort – Hyper quick sort – parallel sorting by regular sampling. | | |
| **Unit – V** | **Shared-Memory Programming and Combining MPI and OPenMP** | **9** |
| Shared-Memory Programming: The Shared-memory model – Parallel for loops – Declaring private variables – Critical sections – Reductions – Performance Improvement – More general data parallelism – Functional parallelism. Combining MPI and OPenMP: Conjugate – Jacobi method. | | |
| | | **Total:45** |

**TEXT BOOK:**


1. Michael J. Quinn., "Parallel Programming in C with MPI and OpenMP", 1st Edition(2003), McGraw Hill Education(India), Reprint 2014.


**REFERENCES:**


1. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture: A Hardware/ Software Approach", Morgan Kaufmann,Elsevier, 1st Edition, 2013.
2. P. Pacheco, M. Malensek, "An Introduction to Parallel Programming", 2nd Edition, Morgan Kaufmann, Publishers, 2022.

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | explain the fundamental concept of computer architecture in the modern parallel computers andmake use of it for designing parallel systems | Applying (K3) |
| CO2 | utilize parallel algorithms and message passing interface methods for inter-process communication | Applying(K3) |
| CO3 | make use of parallel programming concepts in developing parallel algorithms | Applying(K3) |
| CO4 | analyze the performance of parallel algorithms | Analyzing(K4) |
| CO5 | make use of MPI and openMP programming concepts for shared memory programming | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| **CO2** | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| **CO3** | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| **CO4** | 3 | 3 | 2 | | 1 | | | | | | | | 3 | 2 |
| CO5 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 15 | 55 | 30 | | | | 100 |
| CAT2 | 15 | 50 | 35 | | | | 100 |
| CAT3 | 15 | 55 | 30 | | | | 100 |
| ESE | 15 | 55 | 30 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE23 - DIGITAL MARKETING | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides the basics of digital marketing, its underlying technologies and frameworks, consumer behavior aspects including demand management and Integrated Marketing Communications for digital platform | |
| **Unit - I** | **Basics of Digital Marketing** | **9** |
| Evolution of Digital Marketing – Digital Marketing an Introduction – Internet Marketing: Underlying Technology and Frameworks – Digital Marketing Framework – Factors Impacting Digital Marketplace –Value Chain Digitization – The Consumer for Digital Marketing – Consumer Behavior on the Internet – Evolution of Consumer Behavior Models – Managing Consumer Demand – Integrated Marketing Communications. | | |
| **Unit - II** | **Digital Marketing Strategy Development** | **9** |
| Digital Marketing Assessment Phase: Elements of the Assessment Phase – Digital Marketing Internal Assessment – Digital Marketing Objectives Planning – Digital Marketing Strategy Definition: Digital Marketing Strategy Groundwork – Defining the Digital Marketing Mix – Digital Marketing Strategy Roadmap. | | |
| **Unit - III** | **Digital Marketing Planning and Setup** | **9** |
| Digital Marketing Communications and Channel Mix: Digital Marketing Planning Development – Designing the Communication Mix – Introduction to Digital Marketing Channels. Digital Marketing Operations Setup : Understanding Digital Marketing Conversion – Basics of Web Development and Management – User Experience, Usability, and Service Quality Elements. | | |
| **Unit - IV** | **Digital Marketing Execution** | **9** |
| Digital Marketing Campaign Management: Basic Elements of Digital Campaigns – Basic Elements of Digital Campaign Management – Implementing Intent – Based Campaigns (Search Execution) – Implementing Brand – Based Campaigns (Display Execution) – Campaign Execution for Emerging Marketing Models – Campaign Analytics and Marketing RoI. Digital Marketing Execution Elements – Managing Digital Marketing Revenue – Managing Service Delivery and Payment – Managing Digital Implementation Challenges. | | |
| **Unit - V** | **Digital Business Present and Future** | **9** |
| Digital Marketing – Landscape and Emerging Areas: Digital Marketing – Global Landscape – Digital Marketing – The Indian View – Digital Marketing – Emerging Trends and Concepts. A Career in Digital Marketing: Emerging Opportunities for Digital Marketing Professionals – Building a Career in Digital Marketing - – Top Digital Marketing Areas as Career Tracks –Approaching a Career in Digital Marketing. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Puneet Bhatia, “Fundamentals of Digital Marketing”, 2nd Edition, June 2019. |

**REFERENCES:**

| | |
|---|---|
| 1. | R S N Pillai, Bagavathi, "Modern marketing Priinciples and Practices", 2nd Edition, 2020. |
| 2. | Dominik Kosorin, “Introduction to Programmatic Advertising”, 1st Edition, 2017. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | Illustrate the basic concepts of digital marketing | Applying (K3) |
| CO2 | carry out the various digital marketing strategies | Applying (K3) |
| CO3 | illustrate the digital marketing operation setup and web development | Applying (K3) |
| CO4 | make use of the digital marketing campaign management | Applying (K3) |
| CO5 | analyze the emerging areas of digital marketing | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 2 | 1 |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | 2 | 1 |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | 2 | 1 |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | 2 | 1 |
| CO5 | 3 | 3 | 2 | 2 | | | | | | | | | 2 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 50 | 30 | | | | 100 |
| CAT2 | 20 | 50 | 30 | | | | 100 |
| CAT3 | 20 | 50 | 30 | | | | 100 |
| ESE | 15 | 55 | 30 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**22CSF01 - BIG DATA ANALYTICS**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. – Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **7** | **PE** | **2** | **0** | **2** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides knowledge about Big data and its framework, storage, and stream processing with SPARK and KAFKA | |
| **Unit – I** | **Introduction to Big Data** | 9 |
| Introduction – Types of Digital Data – characteristics – evolution – definition – challenges – Big Data – Big Data Analytics – importance – data science – terminologies used in Big Data environments – Analytics Tools. | | |
| **Unit – II** | **Hadoop and MapReduce** | 9 |
| Hadoop Introduction – RDBMS Vs Hadoop – Distributed computing challenges – Hadoop Overview – HDFS – Processing data with Hadoop – Interacting with Hadoop Ecosystem. Introduction to MapReduce Programming – Mapper – Reducer – Combiner – Partitioner– Searching - Sorting – Compression. | | |
| **Unit – III** | **MongoDB and Cassandra** | 9 |
| Introduction to MongoDB – Terms used in MongoDB– Data types in MongoDB – MongoDB Query Language. Introduction to Cassandra – Features of Cassandra – CQL Data types – CQLSH– CRUD operations – Collections – Alter commands – Import and Export – Querying System tables. | | |
| **Unit – IV** | **Hive and PIG** | 9 |
| Introduction to Hive – Architecture – Data types – File format – Hive Query Language – RCFile implementation. Introduction to Pig – Pig on Hadoop – Data types – Running Pig – Execution modes of Pig – HDFS commands – Relational Operators – Eval function – Complex Data types. | | |
| **Unit – V** | **SPARK and KAFKA** | 9 |
| Introduction – SPARK architecture – SPARK SQL – SPARK Streaming – SPARK Eco system – SPARK for Big Data Processing – SPARK applications – Apache KAFKA – KAFKA Architecture – Use cases. | | |

**LIST OF EXPERIMENTS / EXERCISES:**

1. Working with HDFS commands
2. Write a MapReduce program to count the occurrences of similar words across files.
3. Write a MapReduce program to search for a specific keyword in a file.
4. Implement CRUD operations in MongoDB.
5. Implement Arrays and Aggregate functions in MongoDB.
6. Create and use collections in Cassandra.
7. Implement DML and DDL in Hive
8. Implement joins, aggregations and Group By in Hive
9. Implement Eval, Union and Split in Pig
10. Write a program to create user defined functions in Pig.

**Lecture:45, Practical:30, Total:75**

**TEXT BOOK:**

| | |
|---|---|
| 1. | Seema Acharya and Subhashini Chellappan, “Big Data and Analytics”, 2nd Edition, Wiley, 2019.(unit 1-4). |
| 2. | Dr.Anil Maheshwari, “Big Data”, 2 nd Edition, McGraw Hill Education, 2019. (Unit -5) |

**REFERENCES:**


| | |
|---|---|
| 1. | EMC Education Services, ”Data science and Big data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, John Wiley and Sons, 2015. |
| 2. | https://spark.apache.org/docs/latest/ |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | describe the characteristics of big data and use it to identify zFqzthe types of digital data | Applying (K3)<br>Precision (S3) |
| CO2 | implement MapReduce programs on Hadoop framework | Applying (K3)<br>Precision (S3) |
| CO3 | develop a database application using MangoDB and Cassandra | Applying (K3)<br>Precision (S3) |
| CO4 | use hive and Pig to build database applications | Applying (K3)<br>Precision (S3) |
| CO5 | use spark and Kafka for streaming a large volume of data | Applying (K3)<br>Precision (S3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 2 | | 2 | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 2 | | 2 | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 2 | | 2 | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 50 | 30 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 10 | 50 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE24 - CROSS PLATFORM APPLICATION DEVELOPMENT | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Web Technology** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course gives insight into the design and development of cross-platform mobile applications that are suitable for both Android and iOS platforms using React Native framework. | |
| **Unit – I** | **Introduction to Flutter and React Native** | **9** |
| Introduction: Introduction to Cross-platform applications – Flutter vs Native – Introduction to Flutter – Flutter UI: Widgets-themes-Layout, UI Forms, and gestures. React Native: Setting Up Your Environment - Creating a Simple React Native App - Implementing Complex User Interfaces. | | |
| **Unit – II** | **Complex User Interfaces** | **9** |
| Implementing Complex User Interfaces – Dealing with universal applications - Detecting orientation changes - Using a WebView to embed external websites – Linking to websites and other applications - Creating a form component Implementing Complex User Interfaces – Creating a map app with Google Maps - Creating an audio player – Creating an image carousel - Adding push notifications to the app – Implementing browser-based authentication | | |
| **Unit – III** | **Basic and Advanced Animations** | **9** |
| Adding Basic Animations to the App: Introduction – Creating simple animations – Running multiple animations – Creating animated notifications – Expanding and collapsing containers – Creating a button with a loading animation. Adding Advanced Animations to Your App: Introduction – Removing items from a list component – Creating a Facebook reactions widget – Displaying images in fullscreen. | | |
| **Unit – IV** | **Data Storage and Retrieval** | **9** |
| Working with Application Logic and Data: Introduction – Storing and retrieving data locally – Retrieving data from a remote API – Sending data to a remote API – Establishing real-time communication with WebSockets - Integrating persistent database functionality with Realm – Masking the application upon network connection loss - Logging in with Facebook. Implementing Redux: Introduction Installing Redux and preparing our project - Defining actions – Defining reducers – Setting up the Redux store – Communicating with a remote API - Connecting the store to the view – Storing offline content using Redux. | | |
| **Unit – V** | **Third-Party Plugins and Native Functionality** | **9** |
| App Workflow and Third-Party Plugins: React Native development tools – Planning the app and choosing your workflow – Using NativeBase for cross-platform UI components – Using a pure React Native app (React Native CLI) – Using glamorous-native for styling UI components – Using react-native-spinkit for adding animated loading indicators – Using react-native-side-menu for adding side navigation menus – Using react-native-modal box for adding modals. Adding Native Functionality – Deploying Your App. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Dan Ward, “React Native Cookbook”, 2nd Edition, Packt Publishing, 2019 for Unit I Part II, II, III, IV , V |
| 2. | Eric Windmill “Flutter in Action”,1st Edition Manning Publications 2020 for Unit 1 Part I. |

**REFERENCES:**


| | |
|---|---|
| 1. | Jonathan Lebensold, “React Native Cookbook - Bringing the Web to Native Platforms”, 1st Edition, O’Reilly Media, 2018. |
| 2. | Rap Payne ,“Beginning App Development with Flutter: Create Cross-Platform Mobile Apps”, 1st Edition Apress Berkeley, CA, 2019 |

| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | design a mobile application using the simple and complex UI features in React Native and Flutter | Applying (K3) |
| CO2 | develop universal mobile applications that run on mobile phones and tablets | Applying (K3) |
| CO3 | design UI components with simple and advanced animations | Applying (K3) |
| CO4 | make use of Redux to manage the application flow and data | Applying (K3) |
| CO5 | employ open source third-party plugins to create React Native applications | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | 2 | | | | 1 | 1 | | | 3 | 2 |
| CO2 | 3 | 2 | 1 | | 2 | | | | 1 | 1 | | | 3 | 2 |
| CO3 | 3 | 2 | 1 | | 2 | | | | 1 | 1 | | | 3 | 2 |
| CO4 | 3 | 2 | 1 | | 2 | | | | 1 | 1 | | | 3 | 2 |
| CO5 | 3 | 2 | 1 | | 2 | | | | 1 | 1 | | | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 40 | 50 | | | | 100 |
| CAT2 | 10 | 40 | 50 | | | | 100 |
| CAT3 | 10 | 35 | 55 | | | | 100 |
| ESE | 10 | 30 | 60 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE25 - APPROXIMATION ALGORITHMS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Design and Analysis of Algorithms** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course explores the different approximation algorithms and their application in design of optimized solution for the computational problems. | |
| **Unit - I** | **Greedy Algorithms** | **9** |
| Introduction – Set Cover: The greedy algorithm – Layering – Application to shortest superstring – Steiner Tree and TSP: Metric Steiner tree – MST based algorithm – Metric TSP – A simple factor 2 algorithm – Improving the factor to 3/2 – Multiway Cut and kCut: The multiway cut problem – The minimum k-cut problem – k-Center: Parametric pruning applied to metric k-center – The weighted version. | | |
| **Unit - II** | **Layering** | **9** |
| Feedback Vertex Set: Cyclomatic weighted graphs – Layering applied to feedback vertex set – Shortest Superstring: A factor 4 algorithm – Improving to factor 3 – Knapsack – Bin Packing – Minimum Makespan Scheduling – Euclidean TSP. | | |
| **Unit – III** | **LP-Based Algorithms** | **9** |
| Introduction to LP-Duality: The LP-duality theorem – Min-max relations and LP-duality – Two fundamental algorithm design techniques – Set Cover via Dual Fitting – Rounding Applied to Set Cover – Set Cover via the Primal-Dual Schema – Maximum satisfiability – Scheduling on Unrelated Parallel Machine. | | |
| **Unit – IV** | **Graph Cuts** | **9** |
| Multicut and Integer Multicommodity Flows in Trees – Multiway Cut – Multicut in General Graphs – Sparsest Cut: Demands multicommodity flow – Linear programming formulation – Metrics, cut packing and l1-embeddability – Low distortion l1- embeddings for metrics – LP-rounding algorithm – Application. | | |
| **Unit – V** | **LP relaxation problems** | **9** |
| Steiner Forest: LP-relaxation and dual – Primal-dual schema with synchronization – Steiner Network: LP-relaxation and half integrity – The technique of iterated rounding – Characterizing extreme point solutions – A counting argument – Facility Location – k-Median – Semi definite Programming. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Vijay V. Vazirani, “Approximation Algorithms”, 1st Edition, Second Printing, Springer, 2013. |

**REFERENCES:**

| | |
|---|---|
| 1. | Teofilo F. Gonzalez, “Handbook of Approximation Algorithms and Metaheuristics”, 2nd Edition, CRC Press, 2020. |
| 2. | Ding-zhu Du, Ker-I Ko, Xiaodong Hu,” Design and Analysis of Approximation Algorithms”, Springer New York, 2011. |
| 3. | David P. Williamson, David B. Shmoys,” The Design of Approximation Algorithms”, Cambridge University Press, 2011. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | design a greedy technique to approximate the general computations | Applying (K3) |
| CO2 | implement layering techniques to obtain the optimized solutions | Applying (K3) |
| CO3 | apply linear programming to approximate the set cover and associated problems | Applying (K3) |
| CO4 | modify approximation techniques for graph cut problems | Applying (K3) |
| CO5 | use relaxation techniques to approximate the linear programming techniques | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 15 | 35 | 50 | | | | 100 |
| CAT2 | 15 | 35 | 50 | | | | 100 |
| CAT3 | 15 | 35 | 50 | | | | 100 |
| ESE | 10 | 40 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

## 22GEE01 - FUNDAMENTALS OF RESEARCH

| **Programme & Branch** | **All BE/BTech branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **7** | **GE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course familiarizes the fundamental concepts/techniques adopted in research, problem formulation and also disseminate the process involved in collection, consolidation of published literature and rewriting them in a presentable form using latest tools. | |
| **Unit – I** | **Introduction to Research** | **9** |
| Introduction to Research: Types and Process of Research - Outcomes of Research - Sources of Research Problem - Characteristics of a Good Research Problem - Errors in Selecting a Research Problem - Importance of Keywords. | | |
| **Unit – II** | **Literature Review** | **9** |
| Literature Review: Literature Collection - Methods - Analysis - Citation Study - Gap Analysis - Problem Formulation Techniques. | | |
| **Unit – III** | **Research Methodology** | **9** |
| Research Methodology: Appropriate Choice of Algorithms/Methodologies/Methods – Data Collection – Primary Data Analysis – Experimental Methods and Result Analysis - Investigation of Solutions for Research Problem - Interpretation - Research Limitations. | | |
| **Unit – IV** | **Journals and Papers** | **9** |
| Journals and Papers: Journals in Science/Engineering - Indexing and Impact factor of Journals. Plagiarism and Research Ethics. Types of Research Papers - Original Article/Review Paper/Short Communication/Case Study. | | |
| **Unit – V** | **Reports and Presentations** | **9** |
| How to Write a Report - Language and Style - Format of Project Report - Title Page - Abstract - Table of Contents - Headings and Sub-Headings - Footnotes - Tables and Figures - Appendix - Bibliography etc - Different Reference Formats. Presentation using PPTs. Research Tools. | | |
| | | **Total:45** |

**TEXT BOOK:**


| | |
|---|---|
| 1. | Walliman, Nicholas. “Research Methods: The basics”. 2nd edition, Routledge, 2017. |


**REFERENCES:**


| | |
|---|---|
| 1. | Mishra, S.B. and Alok, S. “Handbook of research methodology” Educreation Publishing, 2017 |
| 2. | Kumar, Ranjit. “Research Methodology: A step-by-step guide for beginners”. SAGE Publications Limited, 2019. |
| 3. | Nayak, J.K. and Singh, P. “Fundamentals of Research Methodology Problems and Prospects”. SSDN Publishers & Distributors, 2021. |

| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | list the various stages in research and categorize the quality of journals | Applying (K3) |
| CO2 | formulate a research problem from published literature/journal papers | Evaluating (K5) |
| CO3 | write, present a journal paper/ project report in proper format | Creating (K6) |
| CO4 | select suitable journal and submit a research paper | Applying (K3) |
| CO5 | compile a research report and the presentation | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 1 | 1 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 3 | 3 | 1 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 3 | 1 | 1 | 3 | 3 | 3 | 1 | 3 | 3 | 3 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | | 40 | 50 | 10 | | | 100 |
| CAT2 | | 30 | 50 | 10 | 10 | | 100 |
| CAT3 | | 20 | 30 | 30 | 10 | 10 | 100 |
| ESE | | 40 | 40 | 10 | 10 | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE26 - SOFTWARE DEFINED NETWORKS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Computer Networks** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides an insight on programmability protocols, interfaces, controllers and its applications in various environments like data centers and service provider networks. | |
| **Unit – I** | **Introduction to SDN** | **9** |
| Introduction: Basic packet switching terminology – The modern data center – Traditional switch architecture – Autonomous and dynamic forwarding table. Evolution of switches and control planes – Cost- SDN Implications for Research and Innovation – Data center innovation – Data center needs. The Genesis of SDN: The evolution of networking technology – Forerunners of SDN – Getting started with mininet and experimenting with mininet. | | |
| **Unit – II** | **SDN and OpenFlow** | **9** |
| Fundamental characteristics of SDN – SDN operation – SDN devices – SDN controllers – Alternate SDN methods. The OpenFlow specification: OpenFlow overview – OpenFlow 1.0 and OpenFlow basics - OpenFlow 1.1 Additions - OpenFlow 1.2 Additions - OpenFlow 1.3 Additions – OpenFlow Limitations. NetApp Development: Simple forwarding in OpenDayLight controller. | | |
| **Unit – III** | **SDN Interfaces** | **9** |
| Alternative definitions of SDN: Potential drawbacks of open SDN – SDN via APIs- SDN via hypervisor based overlays – SDN via opening up the device – Network Functions virtualization – Alternatives overlap and ranking. SDN open source: Open source licensing issues – OpenFlow source code – Switch implementation – Controller implementations – Orchestration and Network virtualization – Simulation, Testing and Tools – OpenStack – Applying SDN open source. | | |
| **Unit – IV** | **SDN in the Data center** | **9** |
| Data center definition – Data center demands – Tunneling technologies for the data center – Path technologies in the data center – SDN and shortest path complexity – Ethernet fabrics in the data center – SDN use cases in the data center – Open SDN versus Overlays in the data center – Real-world data center implementation. | | |
| **Unit – V** | **SDN environments and applications** | **9** |
| SDN in other environment – Wide area networks – Service provider and carrier networks – Campus networks – Hospitality networks – Mobile networks – In-Line network functions – Optical networks. SDN Applications: Reactive versus Proactive applications – A simple reactive Java application – Creating network virtualization tunnels – offloading flows in the data center – Access control for the campus – Traffic engineering for the service providers –NetApp Development: A simple Firewall. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Paul Goransson ,Chuck Black and Timothy Culver, "Software Defined Networks: A Comprehensive Approach", 2nd Edition, Morgan Kaufmann, 2017. |

**REFERENCES:**



| | |
|---|---|
| 1. | Siamak Azodolmolky, "Software Defined Networking with OpenFlow", Packt Publishing, 2013. |
| 2. | Thomas D. Nadeau and Ken Gray, "SDN: Software Defined Networks",1st Edition, O'Reilly Media, 2013. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | apply the programmability in the network using software defined network | Applying (K3) |
| CO2 | model a networking task using Open Flow protocol | Applying (K3) |
| CO3 | demonstrate the networking application using software defined network interfaces and open source tools | Applying (K3) |
| CO4 | employ the software defined network architecture in the data centers | Applying (K3) |
| CO5 | develop various applications of SDN | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**22CSE27 - INFORMATION SECURITY**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Computer Networks** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | |
|---|---|
| Preamble | This course focuses on wide spectrum of topics from legal and ethical issue, risk management, and implementation issues in the context of information security. |

| | | |
|---|---|---|
| **Unit – I** | **Information Security and The Need for Security** | **9** |
| The history of Information Security – CNSS Security model-Components of an Information System – Security in the system life cycle – Security professionals and the organization – Communities of interest – Information Security: Threat and Attacks– Compromises to intellectual property – Deviations in Quality of Service-Espionage – Force of nature – Human Error – Information Extortion – Sabotage-Software attacks – Technical hardware failures – Technical software failures. | | |
| **Unit – II** | **Issues in Information Security and Planning for Security** | **9** |
| Law and ethics in information Security – Relevant U.S. Laws-International laws and legal bodies – Ethics and Information security – Codes of ethics of professional organizations – Key U.S. Federal agencies – Planning for Security: Information security policy, standards, and practices – The Information security blueprint – Security education, training, and awareness program. | | |
| **Unit – III** | **Risk Management** | **9** |
| Risk Identification: Planning and organizing the process – Identifying, inventorying and categorizing assets- Classifying and prioritizing threats – Specifying asset vulnerabilities; Risk assessment: Planning and organizing risk assessment- Determining the loss frequency – Calculating risk – Assessing risk acceptability – The FAIR approach to risk assessment – Risk control – Quantitative versus qualitative risk management practices-Recommended risk control practices. | | |
| **Unit – IV** | **Security Technology** | **9** |
| Access Control: Access control mechanisms – Biometrics – Access control architecture models – Firewalls: Firewall processing modes – Firewall architecture – Selecting the right firewalls – Configuring and managing firewalls – Content filters – Protecting remote connections – Intrusion detection and prevention systems – Honeypots, Honeynets, and padded cell systems – Scanning and analysis tools. | | |
| **Unit – V** | **Implementing Information Security and Security &Personnel** | **9** |
| Information security project management – Technical aspects of implementation-Nontechnical aspect of implementation – Information security certification and accreditation-Credentials for information security professionals-Employment policies and practices-Security considerations for temporary employees, consultants, and other workers-Internal control strategies – Privacy and the security of personnel data. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Michael E. Whitman and Herbert J. Mattord, “Principles of Information Security”, 6th Edition, Cengage Learning, India, 2018. |

**REFERENCES:**


| | |
|---|---|
| 1. | Charles P. Pfleeger and Shari Lawrence Pfleeger, “Security in Computing”, 5th Edition, Prentice Hall, 2018. |
| 2. | Micki Krause, Harold F. Tipton, “Handbook of Information Security Management”, Vol. 6, 6th Edition, CRC Press, 2012. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | determine the types of attacks and security breaches in securing information | Applying (K3) |
| CO2 | apply security policies, standards and practices to handle legal, ethical and professional issue in information security | Applying (K3) |
| CO3 | Carry out a risk assessment by identifying the risks | Applying (K3) |
| CO4 | utilize security technologies to protect information against attacks | Applying (K3) |
| CO5 | Make use of technical, non technical and security personnel aspects to provide information security. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 50 | 30 | | | | 100 |
| CAT2 | 20 | 50 | 30 | | | | 100 |
| CAT3 | 20 | 50 | 30 | | | | 100 |
| ESE | 20 | 50 | 30 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

## 22CSE28 - INTELLIGENT SYSTEMS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Artificial Intelligence** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course covers theoretical issues, applications and implementation techniques of intelligent systems. | |
| **Unit – I** | **Problem Solving and Searching** | **9** |
| Evolution of Modern Computational Intelligence: Roots of AI – Modern AI- Metamodern AI – Problem Solving by Search: Basics of Searching-Tree Based Search – Graph Search – Search Methods Classification - Uninformed Search Methods – Informed Search: Heuristics – Best First Search – Greedy Search – A* Search – Comparisons and Remarks – A* Variants – Iterative Search: Hill Climbing Simulated Annealing – Tabu Search – Means Ends – Adversarial Search: MIN-MAX Algorithm – Alpha-beta Pruning. | | |
| **Unit – II** | **Logic and Knowledge Base Systems** | **9** |
| Knowledge Representation and Reasoning: Propositional Logic – First Order Predicate Logic – Resolution in Propositional Logic and FOPL – Rule-Based Expert Systems: Elements – Structure – Types – Conflict Resolution – Benefits and Capabilities – Types of Expert Systems – Examples of Expert Systems – Managing Uncertainty in Rule Based Expert Systems: Uncertainty and Various approaches to deal with it– Bayesian Theory – Certainty Factors. | | |
| **Unit – III** | **Fuzzy and Neural Systems** | **9** |
| Fuzzy Expert Systems: Fuzzy Sets – Fuzzy Rules – Fuzzy Inference – Artificial Neural Networks: Similarities between Biological and ANN – Neural Networks Types – The Perceptron – Multi-layer Perceptron – Advanced Artificial Neural Networks: Jordan Network – Elman Network – Hopfield Network – Self Organizing Networks – Neocognitron – Application of Neural Network. | | |
| **Unit – IV** | **Learning from Data** | **9** |
| Machine Learning: Terminology – Learning Steps – Learning Systems Classification – Machine Learning Example – Decision Trees: Building a Decision Tree – Overfitting in Decision Trees – Decision Trees Variants - Evolutionary Algorithms: Building an Evolutionary Algorithm – Genetic Algorithms – Variation Operators – Population Models – Survivor Selection and Reinsertion – Basic Genetic Algorithm – Evolutionary Meta-heuristics: Representation – Mutation – Recombination – Controlling the Evolution – Evolutionary Programming – Genetic Programming. | | |
| **Unit – V** | **Bio-Inspired Intelligence** | **9** |
| Swarm Intelligence: Particle Swarm Optimization – Ant Colonies Optimization – Hybrid Intelligent Systems: Models of HCI Architectures – Neuro-fuzzy systems – Evolutionary Fuzzy Systems – Evolutionary Neural Networks – Hybrid Evolutionary Algorithms. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Crina Grosanand, Ajith Abraham, "Intelligent Systems – A modern approach", Springer – Verlag Berlin Heidelberg, 1st Edition, 2011. |

**REFERENCES:**

| | |
|---|---|
| 1. | Robert J. Schalkoff, “Intelligent Systems Principles, Paradigms and Pragmatics”, 1st Edition, Jones and Bartlett Publishers, LLC, 2011. |
| 2. | N.P.Padhy, “Artificial Intelligence and Intelligent Systems”, Illustrated Edition, Oxford University Press, 2005. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | apply various search techniques and heuristics for solving problems | Applying (K3) |
| CO2 | make use of logic in knowledge representation and reasoning | Applying(K3) |
| CO3 | determine the role of fuzzy and neural systems in building intelligent systems | Applying(K3) |
| CO4 | utilize the machine learning techniques for data analysis | Analyzing(K4) |
| CO5 | apply bio-inspired algorithms and build hybrid intelligence systems | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 3 | 2 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 50 | 30 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 20 | 50 | 30 | | | | 100 |
| ESE | 20 | 50 | 30 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE29 - SOFTWARE PROJECT MANAGEMENT | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Software Engineering** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | |
|---|---|
| Preamble | This course provides an insight into detailed project management activities including project evaluation, planning, estimation, monitoring and control activities especially for software projects. |

| | | |
|---|---|---|
| **Unit – I** | **Introduction to Software Project Management** | **9** |
| Introduction - Importance – Types of project – Activities – Plans, methods and methodologies – Ways of Categorizing software projects – Stakeholders – Setting objectives – Business case – Project success and failure - Management and management control – Traditional vs. Modern project management practices. Project Evaluation: Introduction – A business case – Project Portfolio Management – Evaluation of Individual Projects – Cost Benefit Evaluation Techniques – Risk Evaluation – Programme management – Managing the allocation of resources within programme – Strategic programme management – Creating a programme – Aids – Reservations – Benefits. | | |
| **Unit – II** | **Project Planning** | **9** |
| Introduction – Select project - Identify project scope and objectives, project infrastructure – Analyse project characteristics – Identify project products and activities – Estimate effort for activity – Identify activity risks - Allocate Resources – Review plan – Execute plan. Software Effort Estimation : Introduction – Estimates – Problems with over and under estimates – Basis – Techniques – Bottom-up Estimating – Top down approach and parametric models – Expert Judgement – Estimating by analogy – Albrecht FP – FP Mark II - COSMIC FFP – COCOMO II. | | |
| **Unit – III** | **Activity Planning** | **9** |
| Objectives – Project Schedule – Projects and Activities – Sequencing and Scheduling Activities –Network Planning Models – Formulation – Time dimension - Forward Pass – Backward Pass – Identifying the critical path - Activity Float – Shortening Project Duration – Identifying critical activities – Activity on Arrow Networks. Risk Management: Risk – Categories of Risk – Framework – Risk Identification – Risk Assessment – Risk Planning – Risk management – Applying PERT Technique – Monte Carlo Simulation – Critical chain concepts. | | |
| **Unit – IV** | **Monitoring and Control** | **9** |
| Creating Framework – Collecting The Data – Review - Visualizing Progress – Cost Monitoring – Earned Value Analysis – Prioritizing Monitoring – Getting Project Back To Target – Change Control. Managing Contracts: Introduction – Types of Contract – Stages In Contract Placement – Typical Terms of A Contract – Contract Management – Acceptance. | | |
| **Unit – V** | **Managing People** | **9** |
| Introduction – Understanding Behaviour – Organizational Behaviour: A Background – Selecting The Right Person For The Job – Instruction in the best methods – Motivation – The Oldham–Hackman Job Characteristics Model – Stress – Health and Safety. Working in Teams: Introduction – Becoming A Team – Decision Making– Organizational & Team Structures – Coordination Dependencies – Dispersed and virtual teams – Communication Generes – Communication Plans – Leadership. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Bob Hughes, Mike Cotterell and Rajib Mall, “Software Project Management”, 6th Edition, Tata McGraw Hill, New Delhi, 2017. |

**REFERENCES:**


| | |
|---|---|
| 1. | Pankaj Jalote, “Software Project Management in Practice”, 8th Edition, Pearson, 2015. |
| 2. | Watts S. Humphrey, “PSP: A self-improvement process for software engineers”, 1st Edition, Addison-Wesley, 2005. |
| 3. | Robert K. Wysocki “Effective Software Project Management”, 2nd Edition, Wiley Publication,2011. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | apply project evaluation technique to choose best project | Applying (K3) |
| CO2 | calculate the efforts required for the project plan | Applying (K3) |
| CO3 | plan, schedule and sequence the activities and determine the risks | Applying (K3) |
| CO4 | develop visualization charts to monitor the progress of projects and to control the risks involved | Applying (K3) |
| CO5 | apply the methods of managing people and organizing teams while developing a software project | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | | | | | | | 2 | | 3 | 1 |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | 2 | | 3 | 1 |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | 2 | | 3 | 1 |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | 2 | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | 1 | | 2 | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | 20 | 35 | 45 | | | | 100 |
| CAT3 | 20 | 55 | 25 | | | | 100 |
| ESE | 10 | 45 | 45 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE30 - DATA VISUALIZATION TECHNIQUES | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides complex information in a way that is easier to interpret by turning information into visually engaging images and stories. | |
| **Unit – I** | **Introduction** | **9** |
| Visualization – visualization process – role of cognition – Pseudocode conventions – Scatter plot - Data foundation: Types of data - Structure within and between records - Data preprocessing –perception in visualization – Visualization foundations – The visualization process in detail – semiology of graphical symbols - The eight visual variables | | |
| **Unit – II** | **Spatial and Geospatial, Time oriented data and Multivariate data** | **9** |
| One, two, three dimensional data – Dynamic data – Combining techniques - Visualization of spatial data - Visualization of point data - Visualization of line data - Visualization of area data - Issues in Geospatial data Visualization –Characterizing and visualizing Time oriented data- Point, Line ad region based techniques for multivariate data. | | |
| **Unit – III** | **Tree, Graph, Networks, Text and Document** | **9** |
| Displaying hierarchical structure – Displaying Arbitrary Graphs/Networks – Other issues. Visualization techniques for Tree- Graph and Networks - Levels of text representation – Vector space model – Single Document Visualization – Document collection visualization- Extended text visualization. | | |
| **Unit – IV** | **Designing Effective Visualization** | **9** |
| Steps in Designing Visualization – problems in Designing Effective Visualization – Comparing and evaluating visualization techniques – Visualization Systems. | | |
| **Unit – V** | **Information Dashboard Design** | **9** |
| Characteristics of dashboards – Key goals in visual design process – Dashboard display media – Designing dashboards for usability – Meaningful organization – Maintaining consistency – Aesthetics of dashboards – Testing for usability – Case Studies: Sales dashboard, Marketing analysis dashboard. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Matthew O. Ward. , Georges Grinstein and Daniel Keim., “Interactive Data Visualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC Press, 2015 for Units I, II, III and IV. |
| 2. | Stephen Few, "Information Dashboard Design: The Effective Visual Communication of Data", 2nd Edition, O'Reilly, 2013 for Unit V |

**REFERENCES:**

| | |
|---|---|
| 1. | Stephen Few., "Now you see it: Simple Visualization Techniques for Quantitative Analysis", Analytics Press, 2009. |
| 2. | Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | describe principles of visual perception and carryout preprocessing in real time data | Applying (K3) |
| CO2 | apply visualization techniques for various data analysis tasks | Applying (K3) |
| CO3 | apply visualization techniques for the applications using unstructured data | Applying (K3) |
| CO4 | make use of different visualization techniques for the given problems | Applying (K3) |
| CO5 | design information dashboard for Sales and marketing analysis | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 55 | 25 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| **22CSE31 - INFORMATION RETRIEVAL** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Machine Learning** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | |
|---|---|
| Preamble | This course discusses about the basic concepts of IR and various modeling techniques to build a text or multimedia based IR system. |

| **Unit – I** | **Introduction and Classic IR Models** | **9** |
|---|---|---|
| Introduction and Classic IR Models: Information Retrieval The IR Problem The IR System Search Interfaces Today-Visualization in Search Interfaces. Modeling: IR Models Classic Information Retrieval Algebraic Models: Neural Network Model. | | |
| **Unit – II** | **Relevance Feedback, Languages and Query Properties** | **9** |
| Relevance Feedback, Languages and Query Properties: A Framework for feedback methods Explicit Relevance feedback Implicit feedback through local analysis Global analysis. Documents: Metadata Documents formats. Queries Query Language Query Properties. | | |
| **Unit – III** | **Text Operations** | **9** |
| Text Operations: Text Properties, Document Preprocessing, Text Compression, Text Classification: Characterization of Text Classification Unsupervised Algorithms Supervised Algorithms: Decision Tree, SVM Classifier, Feature Selection or Dimensionality Reduction, Evaluation Metrics: Accuracy and Error. | | |
| **Unit – IV** | **Web Retrieval and Web Crawling** | **9** |
| Web Retrieval and Web Crawling: The Web Search Engine Architectures: Cluster Based Architecture Distributed Architectures Search Engine Ranking Browsing. Web Crawling: Applications of a Web Crawler Taxonomy Architecture and Implementation Scheduling Algorithms Evaluation. | | |
| **Unit – V** | **Applications** | **9** |
| Applications: Enterprise Search Tasks Architecture. Library Systems: Online Public Access Catalogues IR System and Document Databases. Digital Libraries: Architecture and Fundamentals. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Ricardo Baeza Yates, Berthier Ribeiro Neto, “Modern Information Retrieval: The Concepts and Technology Behind Search”, 2nd Edition, Pearson Education Asia, 2011. |

**REFERENCES:**

| | |
|---|---|
| 1. | Chowdhury G.G., “Introduction to modern Information Retrieval “, 2nd Edition., Facet Publishing, 2019. |
| 2. | Daniel Jurafsky, James H. Martin, “Speech and Language Processing”, 1st Edition, Pearson Education, 2000. |
| 3. | C. Manning, P. Raghavan, and H. Schütze. “Introduction to Information Retrieval “, Cambridge University Press, 2008. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | describe principles of various IR models and carryout issues of information retrieval in real time data | Applying (K3) |
| CO2 | apply feedback methods for local and global analysis and also discuss about document formats and query properties | Applying (K3) |
| CO3 | apply various text operations for the applications | Applying (K3) |
| CO4 | make use of web crawling and web retrieval techniques for the given problems | Applying (K3) |
| CO5 | explore different applications with IR architecture and its features | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 55 | 20 | | | | 100 |
| CAT2 | 20 | 30 | 50 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| **22CSE32 - COMPUTER VISION** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **7** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This is a basic course on Computer Vision. Starting with fundamentals of vision, it explores image segmentation and feature based alignment. It also deals with motion and image stitching. It finally concludes with some applications for computer vision. | |
| **Unit – I** | **Fundamentals of Vision** | **9** |
| Overview of computer vision – A brief history – Image formation: geometric primitives and transformation – hotometric image formation – The digital camera. | | |
| **Unit – II** | **Image Processing and Feature detection** | **9** |
| Image Processing: point operators – linear filtering – more neighbourhood operators – Fourier transforms – pyramids and wavelets –Geometric transformations. Feature detection and matching: points and patches – Edges and contours – Contour tracking – Lines and vanishing points. | | |
| **Unit – III** | **Segmentation and Image Alignment** | **9** |
| Segmentation: Graph-based segmentation – mean shift– normalized cuts – Image alignment and stitching: Pairwise alignment – Image stitching – global alignment – compositing. | | |
| **Unit – IV** | **Motion** | **9** |
| Motion Estimation: Translational alignment – parametric motion – optical flow – layered motion. Structure from motion: geometric intrinsic calibration – pose estimation – Two-frame structure from motion – Multi-frame structure from motion. | | |
| **Unit – V** | **Applications** | **9** |
| Recognition: instance recognition – image classification: Feature based methods – deep networks – object detection: Face detection –.General object detection – Medical image segmentation. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Richard Szeliski, " Computer Vision: Algorithms and Applications", 2nd Edition, Springer International, 2022 |

**REFERENCES:**



| | |
|---|---|
| 1. | Reinhard Klette, "Concise Computer Vision: An introduction into Theory and Algorithms", Springer International, 2014 |
| 2. | E.R. Davies, "Computer and Machine Vision", 4th Edition, Elsevier, 2012 |
| 3. | Akshay Kulkarni, Adarsha Shivananda & Nitin Ranjan Sharma, "Computer Vision Projects with PyTorch: Design and Develop Production-Grade Models " , 1st Edition, 2022 |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | outline the fundamental concepts of computer vision and apply to solve real case scenarios | Applying (K3) |
| CO2 | make use of basic image processing and feature detection concepts | Applying (K3) |
| CO3 | experiment with different types of segmentation and feature-based alignments | Applying (K3) |
| CO4 | interpret how different types of motion affect the structure of the objects | Applying (K3) |
| CO5 | Illustrate recognition as an application of computer vision | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 40 | 30 | 30 | | | | 100 |
| CAT2 | 40 | 30 | 30 | | | | 100 |
| CAT3 | 30 | 40 | 30 | | | | 100 |
| ESE | 30 | 40 | 30 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE33 - NATURAL LANGUAGE PROCESSING | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **8** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | The course provides the foundation on Natural Language Processing concepts. Staring from words as the unit of a language, this course deals with statistical models, word embeddings and sequence modeling using advanced neural architectures. It also illustrates some practical NLP systems like Machine translation, Question Answering systems and chatbots. | |
| **Unit – I** | **Words and Their Statistical Models** | **9** |
| Regular Expressions – Words – Corpora – Text normalization – Minimum edit distance. N-Gram Language Models – N-Grams – Evaluating Language Models – Generalizations and zeros – Smoothing – Kneser-Ney Smoothing – Huge Language Models – Backoff – Perplexity vs. Entropy. Naive-Bayes classifiers –Naive-Bayes as Language Model – Evaluation – Test set and cross validation – Statistical significance testing | | |
| **Unit – II** | **Vectors and Embeddings** | **9** |
| Lexical Semantics – Vector Semantics – Words and Vectors – Cosine for measuring similarity – TF-IDF: weighing terms in vectors – pointwise Mutual Information (PMI) – Applications of TF-IDF and PPMI – Word2Vec – Visualizing embeddings – Bias and Embeddings – Evaluating vector models. Neural Network Language Models – Units – XOR problem – Feed Forward Neural Networks – Training Neural Nets – Neural Language Models. | | |
| **Unit – III** | **Sequence Labeling and Deep Learning Architectures** | **9** |
| English word classes –Part-of-Speech (PoS) Tagging – Named Entities and Named Entities Tagging – HMM PoS – Conditional Random Fields – Evaluation of Named Entity Recognition. Deep Learning Architectures for sequence modeling – Recurrent Neural Networks – Managing contexts in RNNs: LSTMs and GRUs – Self Attention Networks (Transformers) – Potential harms from Language Models. | | |
| **Unit – IV** | **Machine Translation (MT) and Encoder-Decoder Models** | **9** |
| Language divergences and Typology – The Encode-Decoder model –Encoder-Decoder with RNNs – Attention – Beam Search – Encoder-Decoder with Transformers –Practical details on building MT systems – MT evaluation – Bias and ethical issues. | | |
| **Unit – V** | **Practical NLP Systems** | **9** |
| **Question Answering**: Information Retrieval – IR based Factoid Question Answering – Entity Linking – Knowledge based Question Answering – Using Language Models for Question Answering – Classic QA models – Evaluation of factoid answers. **Chatbots and Dialogue systems** – Properties of human conversations – Chatbots – GUS: a simple frame-based dialogue system – Evaluating dialogue systems – Dialogue system design. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Daniel Jurafsky and James H. Martin, “Speech and Language Processing”, 3rd Edition, Pearson Education, New Delhi, 2020. |

**REFERENCES:**

| | |
|---|---|
| 1. | Christopher Manning and Hinrich Schuetze,” Foundations of Statistical Natural Language Processing”, 1st Edition, MIT Press, London, 2000. |
| 2. | Li Deng and Yang Liu, ” Deep Learning in Natural Language Processing“,1st Edition, Springer,2018 |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | identify the fundamentals of wireless sensor networks and identify an appropriate wireless network for the given scenario | Applying (K3) |
| CO2 | apply various routing protocols for gathering information in Wireless sensor networks | Applying (K3) |
| CO3 | utilize energy management schemes in wireless sensor networks | Applying (K3) |
| CO4 | examine various challenges, attacks and counter measures for attacks in wireless sensor networks | Applying (K3) |
| CO5 | develop an appropriate operating system for a wireless sensor application | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE34 - CYBER FORENSICS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Network Security** | **8** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course imparts fundamental principles and techniques for digital forensics investigation and security management. | |
| **Unit - I** | **Digital Forensics Investigations and Workstations** | **9** |
| An overview of Digital forensics- Preparing for Digital investigations- Maintaining Professional Conduct-Preparing a Digital Forensics Investigation-Procedures for Private Sector High Tech Investigations-Understanding Data Recovery Workstations and Software-Conducting an Investigation- Understanding Forensics Lab Accreditation Requirements-Determining the Physical Requirements for a Digital Forensics Lab-Selecting a Basic Forensic Workstation. | | |
| **Unit - II** | **Data Acquisition** | **9** |
| Understanding Storage Formats for Digital Evidence-Determining the Best Acquisition Method-Contingency Planning for Image Acquisitions-Using Acquisition Tools-Validating Data Acquisitions-Performing RAID Data Acquisitions-Using Remote Network Acquisition Tools-Using Other Forensics Acquisition Tools | | |
| **Unit - III** | **Processing Crime and Incident Scenes** | **9** |
| Identifying Digital Evidence – Collecting Evidence in Private Sector Incident Scenes –Processing Law Enforcement Crime Scenes – Preparing for a Search –Securing a Computer Incident or Crime Scene –Seizing Digital Evidence at the Scene –Storing Digital Evidence –Obtaining a Digital Hash –Reviewing a Case. | | |
| **Unit - IV** | **Current Digital Forensic Tools and Graphic Files** | **9** |
| Evaluating Digital Forensics Tool Needs-Digital Forensics Software Tools-Digital Forensics Hardware Tools-Validating and Testing Forensics Software-Recognizing a Graphics File-Understanding Data Compression-Identifying Unknown File Formats. | | |
| **Unit - V** | **Digital Forensic Validation and E-mail Investigations** | **9** |
| Determining What Data to Collect and Analyze-Validating Forensic Data-Addressing Data Hiding Techniques-Exploring the Role of E-mail in Investigations-Exploring the Roles of the Client and Server in E-mail-Investigating E-mail Crimes and Violations-Understanding E-mail Servers-Using Specialized E-mail Forensics Tools-Applying Digital Forensics Methods to Social Media Communications. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Nelson Bill, Phillips Amelia and Steuart Christopher, “Guide to Computer Forensics and Investigations”, 6th Edition, Cengage Learning, 2018. |

**REFERENCES:**


| | |
|---|---|
| 1. | Nhien-An Le-Khac, Kim-Kwang Raymond Choo, "Cyber and Digital Forensic Investigations", Springer, 2020. |
| 2. | Oettinger, W, “Learn Computer Forensics”, Packt Publishing, 2020. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | Illustration on digital forensic investigation with a systematic approach | Applying (K3) |
| CO2 | carry out acquisition of data using various tools | Applying (K3) |
| CO3 | practice the seizure of digital evidence in a crime scene | Applying (K3) |
| CO4 | examine the uses of forensic tools in forensic examination | Applying (K3) |
| CO5 | analyze the recovery of graph files and investigating E-mail crimes | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 2 | 1 |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | 2 | 1 |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | 2 | 1 |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | 2 | 1 |
| CO5 | 3 | 3 | 2 | 2 | | | | | | | | | 2 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 15 | 35 | 50 | | | | 100 |
| CAT2 | 15 | 35 | 50 | | | | 100 |
| CAT3 | 15 | 35 | 50 | | | | 100 |
| ESE | 10 | 40 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| **22CSE35 - PREDICTIVE DATA ANALYTICS** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **8** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides the fundamental concepts of predictive data analytics and provides knowledge on the applications of predictive data analytics to solve real world problems | |
| **Unit – I** | **Overview of Predictive Analytics and Setting Up the Problem** | **9** |
| **Overview of Predictive Analytics**: Predictive Analytics – Predictive Analytics vs. Business Intelligence – Predictive Analytics vs. Statistics – Predictive Analytics vs. Data Mining – Challenges in Using Predictive Analytics. **Setting up the Predictive Modeling project**: Predictive Analytics Processing Steps: CRISP-DM – Defining Data for Predictive Modeling – Defining the Target Variable – Defining Measures of Success for Predictive Models. | | |
| **Unit – II** | **Data Understanding and Preparation** | **9** |
| **Data Understanding**: Single Variable Summaries – Data Visualization in One Dimension – Histograms – Multiple Variable Summaries – Data Visualization. **Data Preparation**: Variable Cleaning – Feature Creation. | | |
| **Unit – III** | **Descriptive Modeling** | **9** |
| **Descriptive Modeling**: Data Preparation Issues with Descriptive Modeling – Principal Component Analysis – Clustering Algorithms. **Interpreting Descriptive Models**: Standard Cluster Model Interpretation. | | |
| **Unit – IV** | **Predictive Modeling** | **9** |
| **Predictive Modeling**: Decision Trees – Logistic Regression – K-Nearest Neighbor –Naive Bayes – Linear Regression – **Assessing Predictive Models**: Batch Approach to Model Assessment. | | |
| **Unit – V** | **Model Ensemble and Deployment** | **9** |
| **Model Ensembles**: Motivation for Ensembles – Bagging – Boosting – Improvements to Bagging and Boosting – Interpreting Model Ensembles. **Model Deployment**: General Deployment Considerations – Case Study. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Dean Abbott, "Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst", 2nd edition, John Wiley & Sons, 2021. |

**REFERENCES:**



| | |
|---|---|
| 1. | John D.Kelleher, Brain Mac Namee, Aoife D'Arcy, "Fundamentals of Machine Learning for Predictive Data Analytics", 2nd edition, MIT Press, 2020. |
| 2. | Gopal M, "Applied Machine Learning", McGraw Hill Education,2nd edition, 2021 |
| 3. | Albright S Christian, Winston Wayne L, "Business Analytics: Data analysis and Decision Making", 7th edition, South Western College Publication, 2019. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | explore the processing steps of predictive analysis for solving real time problems | Applying (K3) |
| CO2 | make use of data for modeling project | Applying (K3) |
| CO3 | utilize various descriptive modeling algorithms | Applying (K3) |
| CO4 | implement different types of predictive modeling algorithms | Applying (K3) |
| CO5 | apply predictive analytics concepts to real world applications | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 60 | 30 | - | - | - | 100 |
| CAT2 | 10 | 50 | 40 | - | - | - | 100 |
| CAT3 | 10 | 50 | 40 | - | - | - | 100 |
| ESE | 5 | 55 | 40 | - | - | - | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE36 - SOFTWARE QUALITY AND TESTING | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Software Engineering** | **8** | **PE** | **3** | **0** | **0** | **3** |
| Preamble | This course focuses on the implementation of appropriate functionality that satisfies the requirements/needs of its targeted client/users for the intended software system, product, or service correctly and efficiently. | | | | | | |
| **Unit – I** | **Software Quality Assurance and Role in an Organization** | | | | | | **9** |
| Defining Quality – Quality Attributes- Challenge in globally outsourced business- Importance of Quality – Quality Control Vs Quality assurance –Quality assurance during SDLC Phases- Understanding SQA function – Quality Policy, Quality Manual, Quality Management Systems and the role of Management. | | | | | | | |
| **Unit – II** | **Software Measurement and Metrics** | | | | | | **9** |
| Product quality – Models for software product Quality – Process Quality Aspects. Measurement in software life-cycle – Defect metrics- Measurement Structure, Model and Scales. Review Techniques: Need- Structured Walkthroughs –Inspections –Various roles and responsibilities involved in Inspections – Inspection related Checklists. | | | | | | | |
| **Unit – III** | **Basics of Testing** | | | | | | **9** |
| Introduction – Definition – Testing Approaches – Essentials – features and principles of software Testing. Testing Environment: Assessing Capabilities – Staff Competency and User Satisfaction – Creating an environment supportive of software testing – Building the software testing process: Testing Guidelines. | | | | | | | |
| **Unit – IV** | **Software Testing process** | | | | | | **9** |
| Overview of Software Testing Process – Organizing for testing: Workbench – Input – Procedure. Developing the test plan: Workbench – Input – Procedure. Verification testing: Workbench – Input – Procedure. Validation testing: Workbench – Input – Procedure. | | | | | | | |
| **Unit – V** | **Analyzing and reporting** | | | | | | **9** |
| Analyzing and reporting test results: Workbench – Input – Procedure. Acceptance and Operational Testing: Workbench-Input Procedures. Post-Implementation Analysis: Workbench– Input – Procedure. | | | | | | | |
| | | | | | | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Nina S. Godbole, "Software Quality Assurance Principles and Practice", 2nd Edition, Narosa Publishing House, 2017- for Units I , II. |
| 2. | Perry William, "Effective Methods for Software Testing", 3rd Edition, Wiley, India, 2018 - for Units III, IV , V. |

**REFERENCES:**

| | |
|---|---|
| 1. | Kshirasagar Nak Priyadarshi, “Software Testing And Quality Assurance-Theory and Practice”, Tripathy John Wiley & Sons Inc,2008 |
| 2. | , Milind Limaye , “Software Quality Assurance”, TMH , New Delhi, 2011. |

| **COURSE OUTCOMES:<br>On completion of the course, the students will be able to** | | **BT Mapped<br>(Highest Level)** |
|---|---|---|
| CO1 | apply quality assurance steps at each phase of SDLC and conduct reviews and inspections | Applying (K3) |
| CO2 | apply the concepts, metrics, and models in software quality assurance | Applying (K3) |
| CO3 | apply the step by step activities and set up environment for software testing | Applying (K3) |
| CO4 | develop procedures and workbenches for various testing process | Applying (K3) |
| CO5 | apply testing for client server, web based and software security systems and identify the agile methods for improving the testing process | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 30 | 50 | 20 | | | | 100 |
| CAT2 | 20 | 50 | 30 | | | | 100 |
| CAT3 | 20 | 50 | 30 | | | | 100 |
| ESE | 25 | 30 | 45 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSE37 - RANDOMIZED ALGORITHMS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **B.E. - Computer Science and Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Design and Analysis of Algorithms, Data Structures and Algorithms** | **8** | **PE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | In this course, the power of randomization in the design and analysis of algorithms is introduced. The most widely used techniques for the analysis of randomized algorithms and the behaviour of random structures from a theoretical perspective are covered. | |
| **Unit – I** | **Introduction** | **9** |
| Min-Cut Algorithm - Binary Planar Partitions - A Probabilistic Recurrence - Computation Model and Complexity Classes-Gametheoretic techniques: Game Tree Evaluation - The Minimax principle - Randomness and Non-uniformity - Moments and deviations: Occupancy Problems, Markov and Chebyshev Inequalities. | | |
| **Unit – II** | **Tail Inequalities** | **9** |
| Chernoff Bound - Routing in a parallel Computer - A wiring Problem – Martingales - The probabilistic method Overview - Maximum Satisfiability - Expanding Graphs - Lovasz Local Lemma - Method of Conditional Probabilities. | | |
| **Unit – III** | **Markov Chains** | **9** |
| A 2-SAT Example - Markov Chains- Random Walks on Graphs-Electrical Networks - Cover Times- Graph Connectivity - Expanders and Rapidly Mixing Random Walks - Probability Amplification by Random Walks on Expanders. | | |
| **Unit – IV** | **Data Structures on Randomized algorithm** | **9** |
| Fundamental Data-structuring problem - Random Treaps - Skip Lists - Hash Tables Universal Family of Hash Functions - Perfect Hashing - Graph algorithms - All-pairs Shortest Paths - Min-cut Problem - Minimum Spanning Trees. | | |
| **Unit – V** | **Randomized Computational Geometry** | **9** |
| Randomized Incremental Construction - Convex Hulls in the Plane - Delaunay Triangulations - Trapezoidal Decompositions - Random Sampling - Linear Programming Randomized Approximation Schemes-PRAM model and its sorting-Byzantine Agreement. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Rajeev Motwani and Prabhakar Raghavan, “Randomized Algorithms”, 1st Edition, Cambridge University Press, Reprint 2010. |

**REFERENCES:**

| | |
|---|---|
| 1. | Michael Mitzenmacher & Eli Upfal, “Probability and Computing: Randomized Algorithms and Probabilistic Analysis”, Cambridge University Press, 2005 |
| 2. | Grimmett and Stirzaker, “Probability and Random Processes”, Oxford, 2001. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | apply the basic concepts in the design and analysis of randomized algorithms | Applying (K3) |
| CO2 | develop tail inequalities and different probability that are frequently used in algorithmic application | Applying (K3) |
| CO3 | determine the use of Markov chains and Random walks in the different practical applications | Applying (K3) |
| CO4 | identify and apply the suitable data structures and graph algorithms for applications | Applying (K3) |
| CO5 | examine the different geometrical, parallel and distributed algorithms for various randomness applications | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 15 | 35 | 50 | | | | 100 |
| CAT2 | 15 | 35 | 50 | | | | 100 |
| CAT3 | 15 | 35 | 50 | | | | 100 |
| ESE | 10 | 40 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSX01 - FUNDAMENTALS OF DATABASE | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of CSE) | | | | | | | |
| **Programme & Branch** | **All BE/BTech Branches except CSE** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **0** | **2** | **4** |

| | | |
|---|---|---|
| Preamble | This course provides the learners to know the fundamentals of database and SQL language to create and manipulate the database | |
| **Unit – I** | **Introduction to Database Management** | **9** |
| Introduction – Database System – Example – Characteristics – Importance of Databases – File System Vs Database System – DBMS Users – Data abstraction – Levels of abstraction – Data Independence – Database System Architecture – Database administrator – Choosing a DBMS – Enterprise Database: Advantages, Concerns, Designing. | | |
| **Unit – II** | **Data Models** | **9** |
| Introduction – Benefits of Data Modelling – Types Modelling – Phases of Data Modelling – ER model – Generalization, Specialization and Aggregation – Database Design Process – Strength and Weakness of ER Model – Case study of Building an ER Model. Relational Model – Data Structure – Mapping the ER Model to Relational Model – Data Manipulation – Data Integrity – Advantages of Relational Model. | | |
| **Unit – III** | **SQL** | **9** |
| SQL – Data Definition: CREATE, ALTER and DROP commands– Keys and Constraints – Data Manipulation: SQL Data Retrieval– Views: Creating views from single and multiple relations – DML operations on views – Embedded and Dynamic SQL. | | |
| **Unit – IV** | **Functional Dependency and Normalization** | **9** |
| Undesirable Properties and Schema refinement – Decomposition using functional dependencies: 1NF, 2NF, 3NF, BCNF – Desirable properties of Decomposition – Multi valued Dependencies. | | |
| **Unit – V** | **Indexing and Hashing** | **9** |
| Types of Memories – Secondary Storage – Buffer Management. File Structure – Heap file – Sequential file. Index – Types of Index – Indexed sequential file – B+ tree. Static hashing – External hashing – Dynamic Hashing. | | |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Write the queries using Data definition language. |
| 2. | Implement the Integrity Constraints on Database. |
| 3. | Write the queries using Data manipulation language. |
| 4. | Implement various Aggregate functions on Database |
| 5. | Write queries using Set operations on various Relations. |
| 6. | Write nested and sub queries on Database |
| 7. | Implement the various Join operations using SQL |
| 8. | Write the queries using DCL and TCL commands |
| 9. | Create Views and perform SQL operations in it |
| 10. | Perform SQL operations using index |

**Lecture:45, Practical:30, Total:75**

**TEXT BOOK:**

| | |
|---|---|
| 1. | G K Gupta, “Database Management Systems”, 1st Edition, Tata Mc Graw Hill, 2018. |

**REFERENCES/ MANUAL / SOFTWARE:**

| | |
|---|---|
| 1. | Silberschatz. Abraham, Korth, Henry F. and Sudarshan S., “Database System Concepts”, 7th Edition, McGraw Hill, New York, 2021. |
| 2. | Back End : ORACLE / SQL SERVER / MYSQL |

| **COURSE OUTCOMES:** **On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | outline the features, architecture and applications of database system and choose an appropriate Databases | Applying (K3) Precision (S3) |
| CO2 | design a relational database using ER model | Applying (K3) Precision (S3) |
| CO3 | manipulate the relational database with SQL statements | Applying (K3) Precision (S3) |
| CO4 | design relational database using normalization methods | Applying (K3) Precision (S3) |
| CO5 | apply indexing and hashing techniques in the design of relational database | Applying (K3) Precision (S3) |

**Mapping of COs with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | 1 | | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | 1 | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | 1 | | | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | 1 | | | | | | | | | |
| CO5 | 3 | 2 | 1 | 1 | 1 | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| **Test / Bloom’s Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 50 | 40 | - | - | - | 100 |
| CAT2 | 10 | 35 | 55 | - | - | - | 100 |
| CAT3 | 10 | 30 | 60 | - | - | - | 100 |
| ESE | 5 | 35 | 60 | - | - | - | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSX02 - DATA SCIENCE FOR ENGINEERS | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of CSE) | | | | | | | |
| **Programme & Branch** | **All BE/BTech Branches except CSE** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **0** | **2** | **4** |

| | | |
|---|---|---|
| Preamble | This course introduces data science and the essentials of applied statistics required in the context of data science and its applications. | |
| **Unit – I** | **Introduction** | **9** |
| Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – Building the model– presenting findings and building applications. | | |
| **Unit – II** | **Descriptive Statistics** | **9** |
| Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores. | | |
| **Unit – III** | **Predictive Analytics** | **9** |
| Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression – regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations – regression towards the mean. | | |
| **Unit – IV** | **Python Libraries for Data Wrangling** | **9** |
| Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping. | | |
| **Unit – V** | **Data Visualization** | **9** |
| Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn. | | |

| **LIST OF EXPERIMENTS / EXERCISES:** | |
|---|---|
| 1. | Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages. |
| 2. | Working with Numpy arrays. |
| 3. | Working with Pandas data frames. |
| 4. | Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics. |
| 5. | Perform the following Predictive Analytics<br>a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.<br>b. Bivariate analysis: Linear and logistic regression modeling<br>c. Multiple Regression analysis<br>d. Also compare the results of the above analysis for the two data sets. |
| 6. | Implement the following using Regression model<br>a. Import data from web storage. Name the dataset and now do Logistic Regression to find out the relation between variables that are affecting the admission of a student in an institute based on his or her GRE score, GPA obtained and rank of the student.<br>b. Apply multiple regressions, if data have a continuous independent variable.<br>c. Apply on the above dataset. Apply regression Model techniques to predict the data on the above dataset. |
| 7. | Apply and explore various plotting functions on a given data set<br>a. Normal curves<br>b. Density and contour plots<br>c. Correlation and scatter plots<br>d. Histograms<br>e. Three-dimensional plotting. |
| 8. | Visualizing Geographic Data with Basemap. |
| 9. | Develop a Data Science project using Python code to build a recommendation system that recommends movies to users. |
| 10. | Develop a Data Science project using Python to determine whether the consumer's attitude towards a particular product or topic is positive, negative, or neutral. |
| | **Lecture:45, Practical:30, Total:75** |

| TEXT BOOK: | |
|---|---|
| 1. | Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016 for Unit I. |
| 2. | Robert S. Witte and John S. Witte, “Statistics”, 11th Edition, Wiley Publications, 2017 for Units II, III |
| 3. | Jake VanderPlas, “Python Data Science Handbook Essential Tool for Working with Data”, O’Reilly, 2016 for Units IV,V. |
| **REFERENCES/ MANUAL / SOFTWARE:** | |
| 1. | Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green TeaPress, 2014. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | utilize the skills of data science processes such as data inspecting and cleansing | Applying (K3)<br>Precision (S3) |
| CO2 | perform the different types of descriptive analytics for the data science process | Applying (K3)<br>Precision (S3) |
| CO3 | demonstrate the correlation and regression analytics on standard data sets for the data science | Applying (K3)<br>Precision (S3) |
| CO4 | use the Python Libraries for Data Wrangling in data science | Applying (K3)<br>Precision (S3) |
| CO5 | apply visualization techniques to interpret and explore data | Applying (K3)<br>Precision (S3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | 1 | 1 | | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | 1 | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | 1 | | | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | 1 | | | | | | | | | |
| CO5 | 3 | 2 | 1 | 1 | 1 | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **22CSX03 - ENTERPRISE APPLICATION DEVELOPMENT USING JAVA** | | | | | | | |
| **(Offered by Department of CSE)** | | | | | | | |
| **Prog. & Branch** | **ALL BE/BTech Branches except CSE** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Pre requisite** | **Java Programming** | **5** | **OE** | **3** | **0** | **2** | **4** |
| Preamble | This course offers good knowledge on how to develop an enterprise-oriented applications using java technologies and hosting with application server. | | | | | | |

| | | |
|---|---|---|
| **UNIT – I** | **Network Programming and RMI** | **9** |
| Network Programming - Basics - Classes and Interfaces - InetAddress - Factory methods - Instance Methods - Inet4Address and Inet6Address - TCP/IP Client Sockets - URL - URLConnection - HttpURLConnection -URI Class - Cookies - TCP/IP Server sockets - Datagrams - RMI architecture - Developing Simple RMI applications. | | |
| **UNIT – II** | **Servlets and JSP** | **9** |
| Introduction - HTTP Servlet Basics: Servlet API - Page Generation - Web Applications. Servlet Life Cycle: Servlet Alternatives - Reloading - init and destroy - Single Thread Model - Background Processing - Load on Startup - Client-Side Caching - Server-Side Caching - Retrieving information - Sending HTML information - Java Server Pages : Basics - Expression and Declaration - Directives - Includes and Forwards - Custom Tag libraries - Simple JSP program. | | |
| **UNIT – III** | **J2EE, Application Server and Software Architectures** | **9** |
| J2EE architecture - EJB - Session, Entity and Message driven beans - Model View Control (MVC) architecture – Case study: Application server - Apache Tomcat - Introduction - Installation - services - Hosting Java Apps with server. Types of software architectures - SOA and Monolith Architecture - Micro Services - Micro Service Architecture - Application Layer - Business Layer - Enterprise Layer - Infra Layer - REST API - Advantages with Micro Services | | |
| **UNIT – IV** | **Configuration of Spring Framework** | **9** |
| Basics of Spring framework - Annotation - Built annotations - Dependency injection - Starters : Web Starter - Data JPA Starter - DevTools for rapid application development : Run JAR - Application Properties - Automatic Restart - Live Reload - Server Port Number | | |
| **UNIT – V** | **SpringBoot Framework and Database connectivity** | **9** |
| Spring Boot: Introduction to Spring vs. Spring Boot vs. Spring MVC - Architecture - Initializr Modules – Interface - Database - Working with JPA - POJO classes - MYSQL - Working with Hibernate - Data JPA with CRUD Repositories - Data JPA with custom methods - Data JPA with custom queries | | |
| | | **Lecture:45, Practical : 30 Total: 75** |

**List of Exercises:**

1. Develop chat application using TCP and UDP
2. Develop a RMI application
3. Develop servlet-based Login application for session tracking
4. Develop a simple application using JSP
5. Create web application using Servlets, JDBC and JSP
6. Develop an EJB application that demonstrates Entity Bean
7. Implement an EJB application that demonstrates Session Bean
8. Develop an application and hosting with tomcat server
9. Develop a simple application using Spring with database connectivity
10. Deploy simple database application using SpringBoot

**TEXT BOOKS:**

1. Schildt, Herbert, “Java: The Complete Reference”, 9th Edition, Tata McGraw-Hill, New Delhi, 2014.
2. Mark Heckler, “Spring Boot: Up and Running: Building Cloud Native Java and Kotlin Applications”, 1st Edition, O'Reilly Media Inc., USA, 2021.

**REFERENCES:**

1. Asbury, Stephen and Weiner, Scott R.,”Developing Java Enterprise Applications”, 2nd Edition, Wiley Publications, 2001.
2. Claudio Eduardo de Oliveira, Greg L. Turnquist, Alex Antonov, “Developing Java Applications with Spring and Spring Boot”, Packt publishing, Mumbai, 2018
3. Craig Walls, “Spring in Action”, 5th Edition, Manning Publications, Dream Tech Press, New Delhi, 2018
4. https://www.javatpoint.com

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1: | construct network with socket programming concepts and RMI architecture | Applying (K3)<br>Precision (S3) |
| CO2: | interpret server side programming using JSP and Servlets | Applying (K3)<br>Precision (S3) |
| CO3: | make use of EJB, application server and microservice architecture and its concepts | Applying (K3)<br>Precision (S3 |
| CO4: | experiment with annotations, dev tools in Spring framework | Applying (K3)<br>Precision (S3) |
| CO5: | utilize JPA/Hibernate for Spring Boot database connectivity | Applying (K3)<br>Precision (S3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

**ASSESSMENT PATTERN**

| Test/Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT 1 | 40 | 40 | 20 | | | | 100 |
| CAT 2 | 40 | 30 | 30 | | | | 100 |
| CAT 3 | 40 | 30 | 30 | | | | 100 |
| ESE | 30 | 40 | 30 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**22CSO01 - COMPUTATIONAL SCIENCE FOR ENGINEERS**

**(Offered by Department of CSE)**

| **Programme & Branch** | **All BE/BTech Branches except CSE** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course focuses on applications of computer simulation and modeling to real world simple and complex problems. | |
| **Unit – I** | **Modeling Process** | **9+3** |
| Model Classifications – Steps of the Modeling Process – System Dynamics: Unconstrained Growth and Decay – Rate of Change – Differential Equation – Difference Equation – Simulation Program – Analytical Solution – Further Refinement – Unconstrained Decay – Reports – Constrained Growth: Carrying Capacity – Revised Model – Equilibrium and Stability – Drug Dosage: Onecompartment Model of Single Dose and Repeated Doses – Mathematics of Repeated Doses – Sum of Finite Geometric Series – Two-compartment Model. | | |
| **Unit – II** | **Force and Motion** | **9+3** |
| Modeling Falling and Skydiving: Acceleration, Velocity and Position – Physics Background – Friction during Fall – Modeling a Skydive – Assessment of the Skydive Model – Bungee Jumping: Physics Background – Vertical Springs – Modeling a Bungee Jump – The Pendulum Clock: Simple Pendulum – Linear Damping – Pendulum Clock – Rocket motion: Physics Background – System Dynamics Model. | | |
| **Unit – III** | **System Dynamics Models** | **9+3** |
| Competition: Community Relations – Introduction to Competition – Modeling – Predator-Prey Model: Lotka-Volterra Model – Particular Situations – Modeling the spread of SARS: SIR Model – SARS Model – Reproductive Number – Enzyme Kinetics: Enzymatic Reactions – Differential Equations – Model – Moles vs. Molar – Results – Michaelis-Menten Equation – Modeling Inhibition. | | |
| **Unit – IV** | **Data Driven Models** | **9+3** |
| Functions: Linear – Quadratic – Polynomial – Square Root – Exponential – Logarithmic – Logistic – Trigonometric – Empirical Models: Linear Empirical Model – Predictions – Linear Regression – Non-Linear One-term Model – Multi-term Models – Advanced Fitting with Computational Tools – Simulating with Randomness: Simulations: Disadvantages of Computational Simulations – Element of Chance – Measure of Quality – Simulation Development – Different Range of Random Numbers – Random numbers from various distributions – Rejection Method – Random Walk. | | |
| **Unit – V** | **Matrix Models** | **9+3** |
| Matrices for Population Studies: Population Matrices and High-Performance Computing – Vectors – Vector Addition – Multiplication by Scalar – Dot Product – Matrices – Scalar Multiplication and Matrix Sums – Matrix Multiplication – Square Matrices – Matrices and Systems of Equations – Time after Time: The Problem – Age-structured Model – Leslie Matrices – Age Distribution over Time – Projected –population Growth Rate – Stage-structured Model – Algorithms – Sensitivity Analysis for Age and Stage Structured Model – Applicability of Leslie and Lefkovitch Matrices – Need for High-Performance Computing – Modeling with Markov Chains – The next Flu Pandemic. | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Angela B. Shiflet, George W. Shiflet, “Introduction to Computational Science: Modeling and Simulation for the Sciences”, 2nd Edition, Princeton University Press, 2014. |

**REFERENCES:**


| | |
|---|---|
| 1. | Jerry Banks, John S. Carson, Barry L. Nelson, David M. Nicol, “Discrete-Event System Simulation: Pearson New International Edition”, 5th Edition, Pearson Education Limited, 2013. |
| 2. | R. Panneerselvam, P. Senthilkumar, “System Simulation, Modelling and Languages”, PHI learning Pvt.Ltd. 2013. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | model system dynamics with and without constraints | Applying (K3) |
| CO2 | determine system dynamics involved in force and motion | Applying (K3) |
| CO3 | construct models for systems with interactions | Applying (K3) |
| CO4 | make use of randomness and data for modeling | Applying (K3) |
| CO5 | apply matrix theory in problem solving | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | | | | | | | | | | | |
| CO2 | 3 | 3 | 1 | | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 3 | 1 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 30 | 50 | 20 | | | | 100 |
| CAT2 | 10 | 45 | 45 | | | | 100 |
| CAT3 | 25 | 45 | 30 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

<table>
<tr><td colspan="8">22CSO02 - FORMAL LANGUAGES AND AUTOMATA THEORY</td></tr>
<tr><td colspan="8">(Offered by Department of CSE)</td></tr>
<tr><td>Programme & Branch</td><td>All BE/BTech Branches except CSE</td><td>Sem.</td><td>Category</td><td>L</td><td>T</td><td>P</td><td>Credit</td></tr>
<tr><td>Prerequisites</td><td>NIL</td><td>5</td><td>OE</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
</table>

| | | |
|---|---|---|
| Preamble | The course helps the learners to know the models of computation, along with their variants in the context of formal languages and their recognizers and to familiarize students with the foundations and principles of computer science. This can be applied in designing compilers and pattern recognition system. | |
| **Unit – I** | **Formal proof and Automata** | **9+3** |
| Introduction to formal proof – Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Equivalence between NFA and DFA – Finite Automata with Epsilon transitions – Conversion of NFA into DFA – Equivalence and minimization of automata. | | |
| **Unit – II** | **Regular Expressions and properties of regular languages** | **9+3** |
| Regular expression – Equivalence of finite automata and regular expressions – Proving languages not to be regular (Pumping Lemma) – Closure properties of regular languages. | | |
| **Unit – III** | **Context Free Grammars and Push Down Automata(PDA)** | **9+3** |
| Context-Free Grammar (CFG) – Parse trees – Ambiguity in grammars and languages. PushDown Automata – Definition of the pushdown automata (PDA) – Languages of PDA – Equivalence of PDA and CFG – Deterministic Pushdown Automata. | | |
| **Unit – IV** | **Context Free Languages and Turing Machines** | **9+3** |
| Normal forms for CFG – Chomsky Normal Form and Greibach Normal Form – Pumping lemma for CFL – Closure properties of CFL – Turing machines: Basic model – definition and representation – Instantaneous Description –Transition diagram for TM – Language acceptance by TM – TM as Computer of Integer functions – Programming techniques for Turing machines (subroutines). | | |
| **Unit – V** | **Undecidability** | **9+3** |
| language that is not Recursively Enumerable (RE) – An undecidable problem that is RE – Undecidable problems about Turing machine – Post's correspondence problem – The classes P and NP –Kruskal's algorithm – Traveling Salesman Problem. | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**


1. Hopcroft J.E., Motwani R. & Ullman J.D., "Introduction to Automata Theory, Languages and Computation", 3rd Edition, Pearson Education, New Delhi, 2011.


**REFERENCES:**


1. Martin J., "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw-Hill, New Delhi, 2010.
2. Linz P., "Introduction to Formal Language and Computation", 4th Edition, Narosa Publishing, 2007.

| **COURSE OUTCOMES**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | design finite automata for the regular languages | Applying (K3) |
| CO2 | construct regular expression for the regular languages | Applying (K3) |
| CO3 | demonstrate the recognition of context free languages using push down automata | Applying (K3) |
| CO4 | construct Turing Machine to accomplish specific task and argue formally about its correctness | Applying (K3) |
| CO5 | make use of Turing machines to distinguish decidable / undecidable problems | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 30 | 50 | | | | 100 |
| CAT2 | 20 | 30 | 50 | | | | 100 |
| CAT3 | 20 | 30 | 50 | | | | 100 |
| ESE | 10 | 30 | 60 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEO03 - DESIGN THINKING FOR ENGINEERS | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Computer Science and Engineering ) | | | | | | | |
| **Programme & Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | Design Thinking is human-centered problem solving tool which emphasize on empathy, collaboration, co-creation and stakeholder feedback to unlock creativity and innovation, to devises feasible and viable idea/solutions. | |
| **Unit – I** | **Design Thinking and Explore:** | **9+3** |
| **Design Thinking**: Key Principles and Mindset – Five Phases, Methods and Tools of Design Thinking – User Guide – Foundation Building for Design Thinking – **Explore**: Methods & Tools – STEEP Analysis – Strategic Priorities – Activity System – Stakeholder Mapping – Opportunity Framing. | | |
| **Unit – II** | **Empathize** | **9+3** |
| **Empathize**: Methods & Tools – Field Observation – Deep User Interview – Empathy Map – User Journey Map - Need Finding – User Insights - User Persona Development. | | |
| **Unit – III** | **Experiment** | **9+3** |
| **Experiment**: Methods & Tools – Ideation – SCAMPER – Analogous Inspiration – Deconstruct & Reconstruct – User Experience Journey – Prototyping– Idea Refinement. | | |
| **Unit – IV** | **Engage** | **9+3** |
| **Engage**: Methods & Tools – Story Telling – Art of Story Telling – Storyboarding – Co-Creation with Users – Collect Feedback from Users. | | |
| **Unit – V** | **Evolve** | **9+3** |
| **Evolve**: Methods & Tools – Concept Synthesis – Strategic Requirements –Evolved Activity Systems – Activity System Integration – Viability Analysis – Innovation Tools using User Needs, CAP, 4S – Change Management - Quick Wins. | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Lee Chong Hwa, "Design Thinking The Guidebook", Design Thinking Master Trainers of Bhutan, 2017. (E-Book) |

**REFERENCES:**


| | |
|---|---|
| 1. | Jeanne Liedtka and Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", Columbia University Press, 2011. |
| 2. | Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth FieldBook: A Step-by-Step Project Guide", Columbia University Press, 2014. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | Construct design challenge and reframe the design challenge into design opportunity. | Applying (K3) |
| CO2 | Interview the user, and know the feelings of users to foster deep user understanding and be able to uncover the deep user insights and needs. | Applying (K3) |
| CO3 | Develop ideas and prototypes by brain storming using the ideation tools. | Applying (K3) |
| CO4 | Organize the user walkthrough experience using ideal user experience journey. | Applying (K3) |
| CO5 | Develop smart strategies & implementation plan that will deliver/achieve the idea/solution deduced from earlier phases. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO 1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |
| CO2 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |
| CO3 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |
| CO4 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |
| CO5 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Tests | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT 1 | 10 | 20 | 70 | | | | 100 |
| CAT 2 | 10 | 15 | 75 | | | | 100 |
| CAT 3 | 10 | 15 | 75 | | | | 100 |
| ESE | 10 | 15 | 75 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSX04 – FOUNDATIONS OF MACHINE LEARNING | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of CSE) | | | | | | | |
| **Programme & Branch** | **All BE/BTech Branches except CSE** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **6** | **OE** | **3** | **0** | **2** | **4** |

| | | |
|---|---|---|
| Preamble | The course focuses on the methodology of how to translate a data driven business problem into an effective solution by using Machine Learning paradigm. | |
| **Unit – I** | **Introduction** | **9** |
| Introduction- Resurgence of ML, Relation with Artificial Intelligence (AI), Machine Learning Problems. Mathematical needs – Basics of Matrices, Numerical Methods, Probability and Statistics, Linear Algebra and Differential Calculus towards Machine Learning. | | |
| **Unit – II** | **Machine Learning Categories and Tool Box** | **9** |
| Supervised Learning – Unsupervised Learning – Reinforcement Learning – ML Toolbox: Data – Infrastructure - Algorithms. Advanced Toolbox: Big data – Infrastructure – Advanced Algorithms. Machine Learning tool kit in MATLAB. | | |
| **Unit – III** | **Data Scrubbing and Setting up your Data** | **9** |
| Data Scrubbing: Feature Selection – Row Comparison – One hot Encoding – Binning – Handling Missing Data – Calculation of Mean, Variance and Standard Deviation. Setting up your Data: Generalization of Data – Train and Test segments – Deciding of total quantity of data needed – Cross Validation. | | |
| **Unit – IV** | **Basics of Regression, Clustering and Error Measurements** | **9** |
| Linear Regression – Multi linear Regression - Logistic Regression – Support Vector Machine - Clustering: K-Nearest Neighbors – K Means – Setting K. Bias and Variance. Error calculation: Mean Absolute Error (MAE) - Root Mean Squared Error (RMSE) - Relative Squared Error (RSE) - Relative Absolute Error (RAE) - Coefficient of Determination (R2 or R-squared). | | |
| **Unit – V** | **Advanced Learning** | **9** |
| Reinforcement Learning – Neural Networks – Building a Neural Network – Ensemble Modeling- Decision Tree – Building a Decision Tree- Bootstrap Aggregation – Boosting - Random Forests – Deep Learning. | | |

**LIST OF EXPERIMENTS / EXERCISES:**

| | |
|---|---|
| 1. | Implementation of Python basic Libraries such as Math, Numpy and Scipy. |
| 2. | Implementation of Python Libraries for ML application such as Pandas and Matplotlib. |
| 3. | Write a python program to compute Mean, Median, Mode, Variance and Standard Deviation using Datasets. |
| 4. | Implement Naïve Bayes theorem to classify the English text. |
| 5. | Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions |
| 6. | Write a program to compute reshaping the data, filtering the data, merging the data and handling the missing values in data sets. |
| 7. | Write a program to implement SVM classification. |
| 8. | Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. |
| 9. | Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. |

**Lecture:45, Practical:30, Total:75**

**TEXT BOOK:**

| | |
|---|---|
| 1. | Oliver Theobald, "Machine Learning for Absolute Beginners", 3rd Edition, Scatterplot Press, 2020. |

**REFERENCES/ MANUAL / SOFTWARE:**

| | |
|---|---|
| 1. | RajendraAkerkar, "Introduction to Artificial Intelligence", 2nd Edition, PHI Learning Pvt Ltd, August,2014. |
| 2. | GopinathRebala, Ajay Ravi, Sanjay Churiwala, "An Introduction to Machine Learning", 1st Edition, Springer Nature,Switzerland, 2019. |
| 3. | Windows,Python. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | relate machine learning basics and the importance of mathematics towards machine learning technologies. | Applying (K3)<br>Precision (S3) |
| CO2 | use toolbox for basic methods for different applications with the basic concepts of Python through examples | Applying (K3)<br>Precision (S3) |
| CO3 | perform pre-processing on data to be used in machine learning models and algorithms | Applying (K3)<br>Precision (S3) |
| CO4 | formulate own learning model for a specified application. | Applying (K3)<br>Precision (S3) |
| CO5 | apply decision tree and neural networks for solving a given problem. | Applying (K3)<br>Precision (S3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | 20 | 30 | 50 | | | | 100 |
| CAT3 | 20 | 30 | 50 | | | | 100 |
| ESE | 10 | 40 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSX05 - WEB ENGINEERING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **(Offered by Department of CSE)** | | | | | | | | |
| **Programme& Branch** | **All BE/BTech Branches except CSE** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **6** | **OE** | **3** | **0** | **2** | **4** |

| | | |
|---|---|---|
| Preamble | This course aims to equip the students with the necessary skills to design and develop web applications. | |
| **Unit – I** | **UI Design** | **9** |
| HTML 5 – Basic Tags – Input Tags – Page Structure Elements – Cascading Style Sheet: Inline Styles – Embedded Style Sheets – Conflicting Styles – Linking External Style Sheets – Positioning Elements – Background – Element Dimensions – Box Model and Text Flow – Media types and Media queries – Drop-Down Menus | | |
| **Unit – II** | **Client Side Scripting – Part 1** | **9** |
| Introduction – Control Statements – Functions: Function Definition – Random Number Generation: Scaling and Shifting Random Number – Displaying Random Images – Scope Rules – Global Functions – Recursion – Recursion vs Iterations. Arrays: Declaring and Allocating Arrays – Random Image Generator using Array – Sorting and Searching Array | | |
| **Unit – III** | **Client Side Scripting – Part 2** | **9** |
| Java Script Objects: Introduction – Math Object – String Object – Date Object – Boolean and Number Objects – Document Objects – Document Object Model: DOM Nodes and Trees – DOM Collections – Dynamic Style – Dynamic Styles to Create Animated Effects - Events – Event Handling: Load Event – Mousemove – Mouseover and Mouseout - Form Processing Events | | |
| **Unit – IV** | **Web Server and Database with MySQL** | **9** |
| Relational Database Concepts – Basic SQL – SELECT – INSERT – UPDATA – DELETE – MySQL – Setting Up a MySQL User Account – Creating Databases in MySQL – Web Servers – Introduction – HTTP Transactions – Multitier Application Architecture – Client-Side Scripting versus Server-Side Scripting Accessing Web Servers – XAMPP Installation – Running the Examples Using Apache HTTP Server | | |
| **Unit – V** | **Server Side Scripting using PHP** | **9** |
| Introduction – Data Type Conversion – Operators – Arrays – Strings Comparisons – String Processing: Searching for Expressions – Representing Patterns – Finding Matches – Character Classes – Finding Multiple Instance of a Pattern – Regular Expressions – Form Processing – Database Connectivity – Session Tracking. | | |

| **LIST OF EXPERIMENTS / EXERCISES:** | |
|---|---|
| 1. | Create a GitHub repository and explore its features |
| 2. | Design a static web page using HTML tags and host it in github repository. |
| 3. | Apply CSS3 Text, Background, and Border properties to design an attractive web page |
| 4. | Design a web page with navigation bar using appropriate CSS3 properties |
| 5. | Design an online Registration Form for any real-time application |
| 6. | Validate the values of various input fields in a registration form using JavaScript |
| 7. | Develop a simple dynamic web application to retrieve the user details from a Web Form and display the same on a web page using PHP |
| 8. | Create a database with necessary tables and execute SQL queries using phpMyAdmin and MySQL |
| 9. | Develop any real-time web application using PHP and MySQL |
| 10. | Apply Session Tracking in PHP to manage users' session in a website |
| | **Lecture:45, Practical:30, Total:75** |

| TEXT BOOK: | |
|---|---|
| 1. | Paul Deitel, Harvey M.Deitel and Abbey Deitel, "Internet and World Wide Web - How To Program", 5th Edition, Prentice Hall, 2012. |
| **REFERENCES/ MANUAL / SOFTWARE:** | |
| 1. | 1. Xavier C, "World Wide Web Design with HTML", Tata McGraw Hill, New Delhi, 2017. |
| 2. | Luke Welling and Laura Thomson, PHP and MySQL Web Development", 5th Edition, Pearson Education, 2016. |

| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | Design static web pages using HTML5 and CSS3 | Applying (K3), Precision (S3) |
| CO2 | Design interactive web pages using the basic programming constructs of JavaScript | Applying (K3), Precision (S3) |
| CO3 | Make use of DOM and Event handling in JavaScript to validate an online registration form | Applying (K3), Precision (S3) |
| CO4 | Create and manipulate relational databases using MySQL | Applying (K3), Precision (S3) |
| CO5 | Develop a real-time dynamic web application using PHP and MySQL | Applying (K3), Precision (S3) |

**Mapping of COs with POs and PSOs**

| COs/ POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 15 | 30 | 55 | | | | 100 |
| CAT2 | 15 | 40 | 45 | | | | 100 |
| CAT3 | 15 | 40 | 45 | | | | 100 |
| ESE | 10 | 30 | 60 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| **22CSO03 - NATURE INSPIRED OPTIMIZATION TECHNIQUES** | | | | | | | |
|---|---|---|---|---|---|---|---|
| (**Offered by Department of CSE**) | | | | | | | |
| **Programme & Branch** | **All BE/BTech Branches except CSE** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **7** | **OE** | **3** | **0** | **0** | **3** |
| | | | | | | | |
| Preamble | This course provides an introduction to nature inspired techniques and applications. | | | | | | |
| **Unit – I** | **Introduction** | | | | | | **9** |
| Philosophy of Natural Computing-Three Branches: A Brief Overview-Conceptualization-Individuals-Entitiesndagents-Parallelism and Distributivity-Interactivity–Adaptation-Feedback-Self-Organization-Complexity-Emergence and Reductionism-Bottom-up Vs Top-Down-Determination-Chaos and Fractals. | | | | | | | |
| **Unit – II** | **Computing Inspired By Nature** | | | | | | **9** |
| Evolutionary Computing-Hill Climbing and Simulated Annealing-Evolutionary biology-Darwin's Dangerous Idea-Genetics Principles-Standard Evolutionary Algorithm-Genetic Algorithms-Selection-Crossover-Mutation-Neurocomputing-Artificial neurons-network architectures-learning approaches-Hebbian learning-Single layer perceptron-Multi-layer perceptron-Self organization maps- discrete Hopfield network. | | | | | | | |
| **Unit – III** | **Swarm Intelligence** | | | | | | **9** |
| Introduction - Ant Colonies- Ant Foraging Behavior- Ant Colony Optimization- Simple ACO and scope of ACO algorithms – Ant Clustering Algorithm (ACA)- Swarm Robotics- Foraging for food- Social Adaptation of Knowledge - Particle Swarm Optimization(PSO)-Scope of PSO-social systems to particle swarm. | | | | | | | |
| **Unit – IV** | **Immuno Computing** | | | | | | **9** |
| Introduction-Immune System-Physiology and main components-Pattern Recognition and Binding-adaptive immune response-Self/Non-self discrimination- Immune Network Theory-Danger Theory-artificial immune systems-Evaluating Interaction- Immune Algorithms-Bone Marrow Models-Negative selection algorithms-Clonal selection and affinity maturation-Artificial Immune Networks. | | | | | | | |
| **Unit – V** | **Computing With New Natura Materials** | | | | | | **9** |
| DNA Computing - Basic concepts - DNA Molecule - Filtering models- Adleman's experiment - Test tube programming language-Formalmodels-UniversalDNAComputers-ScopeofDNAComputing-FromClassicaltoDNAComputing-Quantumcomputing-Introduction-basic concepts from quantum theory-principles from quantum mechanics. | | | | | | | |
| **Total:45** | | | | | | | |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Leandro Nunesde Castro,"Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", 1st Edition, Chapman & Hall/CRC, Taylor and Francis Group, 2007. |

**REFERENCES:**


| | |
|---|---|
| 1. | FloreanoD. and Mattiussi C.,"Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", 1st Edition, MITPress, Cambridge, 2008. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | Apply fundamental concepts in Nature Inspired Systems to solve computational problems. | Applying(K3) |
| CO2 | Manipulate the evolutionary and neuro Computing techniques inspired by nature. | Applying(K3) |
| CO3 | Implement collective intelligence of biological systems to computing. | Applying(K3) |
| CO4 | Develop immune systems behavior to computing and optimization. | Applying(K3) |
| CO5 | Make use of the characteristics of DNA computing and Quantum Computing. | Applying(K3) |

**Mapping of COs with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| **Test / Bloom’s Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 45 | 35 | | | | 100 |
| CAT2 | 20 | 30 | 50 | | | | 100 |
| CAT3 | 20 | 30 | 50 | | | | 100 |
| ESE | 10 | 40 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| **22CSO04 - MACHINE TRANSLATION** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **(Offered by Department of CSE)** | | | | | | | |
| **Programme & Branch** | **All BE/BTech Branches except CSE** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **8** | **OE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | The course helps the learners to know the basic concepts of neural networks and design of machine translation models with the core aspects of training and decoding. This course also helps in building a state of the - art model in machine translation. | |
| **Unit – I** | **Introduction** | **9** |
| The Translation Problem: Goals of Translation – Ambiguity – Linguistic view – Data view. Uses of Machine Translation: Information Access – Aiding Human Values – Communication – NLP Pipelines - Multimodal Translation. History: Neural Networks – Machine Translation. Evaluation: Task based Evaluation – Human Assessments – Automatic Metrics – Metrics Research. | | |
| **Unit – II** | **Neural Network Based Machine Translation models** | **9** |
| Neural Networks: Linear models – Multiple Layers – Nonlinearity – Inference – Back-Propagation Training – Exploiting Parallel Processing. Computation Graphics: Neural Network as Computation Graphs – Gradient Computations. Neural Language Models: Feed-Forward Language Models – Word Embeddings – Noise Contrastive Estimation –Recurrent Neural Language Models – LSTM Models – Gate Recurrent Units. | | |
| **Unit – III** | **Encoding and Decoding of Translation Model** | **9** |
| Translation: Encoder-Decoder Approach – Adding an Alignment Model – Training. Decoding: Beam Search – Ensemble Decoding – Reranking – Optimizing Decoding – Directing Decoding | | |
| **Unit – IV** | **Refining Machine Translation Model** | **9** |
| Machine Learning Tricks: Failures – Ensuring Randomness – Adjusting Learning Rate – Avoiding Local Optima – Addressing Vanishing and Exploding Gradients – Sentence Level Optimization. Alternate Architecture: Components of NN – Attention Models-Convolutional Machine Translation and Neural Networks with Attention – Self-Attention: Transformer. Revisiting Words: Word Embeddings – Large Vocabularies-Character Based Models. | | |
| **Unit – V** | **Adaptation and Linguistic Structure** | **9** |
| Adaptation: Domains – Mixture Models – Sub Sampling – Fine-Tuning -Using Monolingual Data – Multiple Language Pairs – Training on Related Tasks. Linguistic Structure: Guided Alignment Training – Modeling Coverage- Adding Linguistic Annotation | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Philipp Koehn, “Neural Machine Translation”, Cambridge University Press, 2020. |

**REFERENCES:**



| | |
|---|---|
| 1. | Gloria Corpas Pastor, Johanna Monti, Ruslan Mitkov, Violeta Seretan, “Multiword Units in Machine Translation and Translation Technology “,John Benjamins Publishing Company , 2018. |
| 2. | Bernard Scott , “Translation, Brains and the Computer A Neurolinguistic Solution to Ambiguity and Complexity in Machine Translation” Springer International Publishing, 2018 |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to,** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | summarize the basic concepts and techniques of Machine Translator. | Understanding (K2) |
| CO2 | apply Neural Network concepts to build Machine Translation models | Applying (K3) |
| CO3 | make use of encoding and decoding approaches for building Machine Translation models | Applying (K3) |
| CO4 | apply optimization techniques to refine the Machine Translation models | Applying (K3) |
| CO5 | utilize adaptation techniques and linguistic approaches to finetune the machine translation model | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | | |
| CO2 | 3 | 2 | 2 | | | | | | | | | | | |
| CO3 | 3 | 2 | 2 | | | | | | | | | | | |
| CO4 | 3 | 2 | 2 | | | | | | | | | | | |
| CO5 | 3 | 2 | 2 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 30 | 50 | 20 | | | | 100 |
| CAT2 | 30 | 50 | 20 | | | | 100 |
| CAT3 | 25 | 50 | 25 | | | | 100 |
| ESE | 35 | 45 | 20 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSO05 – FUNDAMENTALS OF BLOCKCHAIN | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of CSE) | | | | | | | |
| **Programme & Branch** | **All BE/BTech Branches except CSE** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **8** | **OE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides technical fundamentals of Blockchain, practical implications, and hands on development aspects of blockchain applications. | |
| **Unit – I** | **Introduction** | **9** |
| History – Introduction to Blockchain – Centralized vs. Decentralized Systems – Layers of Blockchain – Importance of Blockchain – Blockchain Uses and Use Cases – Laying the Blockchain Foundation – Cryptography – Symmetric Key Cryptography – Cryptographic Hash functions – MAC and HMAC – Asymmetric Key cryptography – Diffie-Helman Key Exchange – Symmetric vs Asymmetric Key Cryptography. | | |
| **Unit – II** | **Working of Blockchain** | **9** |
| Game Theory: Prisoner's Dilemma – Byzantine Generals' Problem – Components of Computer Science Engineering: The Blockchain – Merkle Trees – Properties of Blockchain Solutions – Blockchain Transactions – Distributed Consensus Mechanisms – Blockchain Applications – Scaling Blockchain. | | |
| **Unit – III** | **Bitcoin** | **9** |
| The History of Money – Introduction to Bitcoin - Working with Bitcoins – The Bitcoin Blockchain: Block structure – The Genesis Block – The Bitcoin Network: Network Discovery for a New Node – Bitcoin Transactions – Consensus and Block Mining – Block Propagation – Bitcoin Scripts – Full Nodes vs. SPVs – Bitcoin Wallets. | | |
| **Unit – IV** | **Ethereum and Introduction to Hyperledger** | **9** |
| Bitcoin to Ethereum – Ethereum Blockchain – Ethereum Smart Contracts – Ethereum Virtual Machine and Code Execution – Ethereum Ecosystem – Swarm – Whisper – DApp – Development Components – Hyperledger - Introduction – Projects: Fabric – Sawtooth Lake – Iroha – Blockchain Explorer – Fabric Chaintool – Fabric SDK Py – Corda. | | |
| **Unit – V** | **Blockchain Application Development** | **9** |
| Decentralized Applications – Blockchain Application Development – Interacting with Bitcoin Blockchain – Sending Transactions – Creating a Smart Contract – Executing Smart Contract Functions – Public vs. Private Blockchains – Decentralized Application Architecture – Building an Ethereum DApp. | | |
| | | **Total:45** |

**TEXT BOOK:**


| | |
|---|---|
| 1. | Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, "Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions", 1st Edition, APress, 2018. |


**REFERENCES:**


| | |
|---|---|
| 1. | Brenn Hill, Samanyu Chopra, Paul Valencourt, "Blockchain Quick Reference: A guide to exploring decentralized blockchain application development", 1st Edition, Packt publishing, 2018. |
| 2. | Imran Bashir, "Mastering Blockchain Distributed ledgers, decentralization and smart contracts Explained", 1st Edition, Packt Publishing, 2017. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | explore the history, background, and theoretical aspects of blockchain and apply in real case scenarios | Applying (K3) |
| CO2 | demonstrate core components and working of blockchain | Applying (K3) |
| CO3 | apply Bitcoin’s technical concepts for real case scenarios | Applying (K3) |
| CO4 | adapt Ethereum blockchain for different use cases | Applying (K3) |
| CO5 | demonstrate the end-to-end development of a decentralized application | Applying (K3) |

**Mapping of COs with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| **Test / Bloom’s Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
|---|---|---|---|---|---|---|---|
| CAT1 | 30 | 50 | 20 | | | | 100 |
| CAT2 | 30 | 50 | 20 | | | | 100 |
| CAT3 | 30 | 50 | 20 | | | | 100 |
| ESE | 30 | 50 | 20 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEO01 - GERMAN LANGUAGE LEVEL 1 | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Electronics and Communication Engineering) | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **All** | **OE** | **4** | **0** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course serves as an introduction to the German language and awareness towards German lifestyle and cultural aspects of Germany and German speaking countries. One can learn to introduce oneself and able to gain the basic day to day vocabulary. On keen learning one would be able to understand the sentence structure and be able to reciprocate to basic questions | |
| **Unit – I** | **Good Day (Guten Tag)** | **12** |
| Greetings, Self-introduction and introducing others, Numbers, Alphabets, Countries and languages spoken. Grammar – W questions, Simple sentences, Verb conjugation and personal pronoun. | | |
| **Unit – II** | **Friends & Colleague ( Freund und Kollegen):** | **12** |
| Hobbies, Profession, Week, Months, Season and Generate Profile. Grammar – Articles, Plural, Verbs – have and to be, Yes/No questions. | | |
| **Unit – III** | **n the City (In der Stadt):** | **12** |
| Name of places/buildings in the city, asking for directions, Understanding means of transport. Grammar – definite and indefinite articles, Negation articles and Imperative | | |
| **Unit – IV** | **Food and Appointment (Essen und Termin):** | **12** |
| Food, Shopping, initiate conversations to understand and do shopping. Grammar – Accusative case, Verbs with Accusative. Understanding time and reciprocating, Appointments, Asking excuse, Family. Grammar – Prepositions: *am, um, von...bis,* Possessive articles- *mein, dein*.., Modal verbs- *müssen, können, wollen* | | |
| **Unit – V** | **Socializing ( Zeit mit Freunden):** | **12** |
| Planning together, Birthday, Invitation, Restaurant, looking for specific information in texts. Grammar – Separable verbs, Prepositions with Accusative case, Past tense of have and to be, Personal pronoun with Accusative. | | |
| | | **Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, “Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch und Glossar with 2 CDs”, Goyal Publishers, Delhi, 2015. |

**REFERENCES:**

| | |
|---|---|
| 1. | https://ocw.mit.edu – Massachusetts Institute of Technology Open Courseware |
| 2. | https://www.dw.com/en/learn-german - Deutsche Welle, Geramany’s International Broadcaster |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped**<br>**(Highest Level)** |
|---|---|---|
| CO1 | understand structure of language and introducing each other | Remembering (K1) |
| CO2 | understand vocabulary on seasons and basic verbs | Understanding (K2) |
| CO3 | ask for directions in a new place and avail transport as required | Understanding (K2) |
| CO4 | understand food habits of German and ask for appointments. | Understanding (K2) |
| CO5 | learn to socialize in a German speaking country | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEO02 - JAPANESE LANGUAGE LEVEL 1 | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Electronics and Communication Engineering) | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **All** | **OE** | **4** | **0** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | The basic level of Japanese which provides understanding of Hiragana, Katakana and 55 Kanjis also enables one to greet, introduce oneself and other person and also provides the ability to understand basic day to day conversations | |
| **Unit – I** | **Introduction to Hiragana and Katakana:** | **12** |
| Chart 1, Chart 2, Chart 3, Annexures 1 and 2 and basic Japanese rules along with similar sounded vocabularies for each chart. | | |
| **Unit – II** | **Introduction to Nouns, various particles and usages:** | **12** |
| Forming simple sentences, asking questions, positioning differentiation and owning fundamentals – new particles and usages | | |
| **Unit – III** | **Introduction of Verbs, time and place markers:** | **12** |
| Usage of action words in sentences and framing them – place and time markers usages – giving and receiving – omission of certain particles in a sentence. | | |
| **Unit – IV** | **Introduction of Adjectives, Adverbs and usages:** | **12** |
| Describing nouns and verbs and framing them to relate day to day conversations- positive and negative ending of the same – introduction of the likes and dislikes expressions | | |
| **Unit – V** | **Introduction to Counters and Kanji:** | **12** |
| How to use numbers-How to use quantifiers-Present form of adjectives and Nouns-Other necessary particles-How to use numbers and quantifiers – 55 kanji characters | | |
| | | **Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | "MINNA NO NIHONGO–Japanese for Everyone", 2nd Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017. |

**REFERENCES:**


| | |
|---|---|
| 1. | Margherita Pezzopane, "Try N5", 2nd Edition, Tankobon Softcover, Japan, 2017. |
| 2. | Sayaka Kurashina, "Japanese Word Speedmaster", 2nd Edition, Tankobon Softcover, Japan, 2018. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | read and understand typical expression in Hiragana and Katakana | Remembering (K1) |
| CO2 | greet and introduce oneself and other | Understanding (K2) |
| CO3 | communicate day to day conversations – basic level | Understanding (K2) |
| CO4 | understand the Kanjis in Japanese Script | Understanding (K2) |
| CO5 | comprehend concept of numbers, days, months, time and counters | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEO03 - DESIGN THINKING FOR ENGINEERS | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Computer Science and Engineering ) | | | | | | | |
| **Programme & Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | Design Thinking is human-centered problem solving tool which emphasize on empathy, collaboration, co-creation and stakeholder feedback to unlock creativity and innovation, to devises feasible and viable idea/solutions. | |
| **Unit – I** | **Design Thinking and Explore:** | **9+3** |
| **Design Thinking**: Key Principles and Mindset – Five Phases, Methods and Tools of Design Thinking – User Guide – Foundation Building for Design Thinking – **Explore**: Methods & Tools – STEEP Analysis – Strategic Priorities – Activity System – Stakeholder Mapping – Opportunity Framing. | | |
| **Unit – II** | **Empathize** | **9+3** |
| **Empathize**: Methods & Tools – Field Observation – Deep User Interview – Empathy Map – User Journey Map - Need Finding – User Insights - User Persona Development. | | |
| **Unit – III** | **Experiment** | **9+3** |
| **Experiment**: Methods & Tools – Ideation – SCAMPER – Analogous Inspiration – Deconstruct & Reconstruct – User Experience Journey – Prototyping– Idea Refinement. | | |
| **Unit – IV** | **Engage** | **9+3** |
| **Engage**: Methods & Tools – Story Telling – Art of Story Telling – Storyboarding – Co-Creation with Users – Collect Feedback from Users. | | |
| **Unit – V** | **Evolve** | **9+3** |
| **Evolve**: Methods & Tools – Concept Synthesis – Strategic Requirements –Evolved Activity Systems – Activity System Integration – Viability Analysis – Innovation Tools using User Needs, CAP, 4S – Change Management - Quick Wins. | | |
| **Lecture:45, Tutorial:15, Total:60** | | |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Lee Chong Hwa, "Design Thinking The Guidebook", Design Thinking Master Trainers of Bhutan, 2017. (E-Book) |

**REFERENCES:**


| | |
|---|---|
| 1. | Jeanne Liedtka and Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", Columbia University Press, 2011. |
| 2. | Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth FieldBook: A Step-by-Step Project Guide", Columbia University Press, 2014. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | Construct design challenge and reframe the design challenge into design opportunity. | Applying (K3) |
| CO2 | Interview the user, and know the feelings of users to foster deep user understanding and be able to uncover the deep user insights and needs. | Applying (K3) |
| CO3 | Develop ideas and prototypes by brain storming using the ideation tools. | Applying (K3) |
| CO4 | Organize the user walkthrough experience using ideal user experience journey. | Applying (K3) |
| CO5 | Develop smart strategies & implementation plan that will deliver/achieve the idea/solution deduced from earlier phases. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |
| CO2 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |
| CO3 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |
| CO4 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |
| CO5 | 3 | 3 | 3 | 1 | | | | | 3 | 2 | 1 | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Tests | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT 1 | 10 | 20 | 70 | | | | 100 |
| CAT 2 | 10 | 15 | 75 | | | | 100 |
| CAT 3 | 10 | 15 | 75 | | | | 100 |
| ESE | 10 | 15 | 75 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**22GEO04 - INNOVATION AND BUSINESS MODEL DEVELOPMENT**

(Offered by Department of Mechatronics Engineering)

| Programme & Branch | All BE/BTech Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **6** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course will inspire the students to think innovation concepts and ideas for business model developments. | |
| **Unit - I** | **Innovation and Design Thinking:** | **9+3** |
| Innovation and Creativity– Types of innovation – challenges in innovation- steps in innovation management- 7 concerns of design. Design Thinking and Entrepreneurship – Design Thinking Stages: Empathize – Define – Ideate – Prototype – Test. Design thinking tools: Analogies – Brainstorming – Mind mapping | | |
| **Unit - II** | **User Study and Contextual Enquiry:** | **9+3** |
| Explanatory research – primary and secondary data – classification of secondary data – sources of secondary data – qualitative research – focus groups – depth interviews – analysis of qualitative data – survey methods – observations- Process of identifying customer needs –organize needs into a hierarchy –establish relative importance of the needs- Establish target specifications | | |
| **Unit - III** | **Product Design:** | **9+3** |
| Techniques and tools for concept generation, concept evaluation – Product architecture –Minimum Viable Product (MVP)- Product prototyping – tools and techniques– overview of processes and materials – evaluation tools and techniques for user-product interaction | | |
| **Unit - IV** | **Business Model Canvas (BMC):** | **9+3** |
| Lean Canvas and BMC - difference and building blocks- BMC: Patterns – Design – Strategy – Process–Business model failures: Reasons and remedies | | |
| **Unit - V** | **IPR and Commercialization:** | **9+3** |
| Need for Intellectual Property- Basic concepts - Different Types of IPs: Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design– Patent Licensing - Technology Commercialization – Innovation Marketing | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**


1. Rishikesha T.Krishnan, “8 Steps To Innovation: Going From Jugaad To Excellence”, Collins India, 2013.


**REFERENCES:**


1. Peter Drucker, “Innovation and Entrepreneurship”, Routledge CRC Press, London, 2014.
2. Eppinger, S.D. and Ulrich, K.T. “Product design and development”, 7th edition, McGraw-Hill Higher Education, 2020.
3. Alexander Osterwalder, “Business model generation: A handbook for visionaries, game changers, and challengers”, 1st edition, John Wiley and Sons; 2010
4. Indian Innovators Association, “Patent IPR Licensing – Technology Commercialization – Innovation Marketing: Guide Book for Researchers, Innovators”, Notion Press, Chennai, 2017

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | understand innovation need and design thinking phases | Understanding (K2) |
| CO2 | identify, screen and analyse ideas for new products based on customer needs | Analysing (K4) |
| CO3 | develop and analyse the product concepts based on the customer needs and presents the overall architecture of the product. | Analysing (K4) |
| CO4 | predict a structured business model for MVP | Applying (K3) |
| CO5 | practice the procedures for protection of their ideas' IPR | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 2 | | | 2 | | | | | | 3 | | |
| CO2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | | |
| CO3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | |
| CO4 | | | | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | | |
| CO5 | | | | 3 | 2 | 2 | | 3 | 2 | 3 | 3 | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 30 | 40 | 10 | | | 100 |
| CAT2 | 20 | 30 | 40 | 10 | | | 100 |
| CAT3 | 30 | 30 | 40 | | | | 100 |
| ESE | 20 | 30 | 30 | 20 | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEO05 - GERMAN LANGUAGE LEVEL 2 | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Electronics and Communication Engineering ) | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | German Language Level 1 | **All** | **OE** | **4** | **0** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course aims to help the learner to acquire the vocabulary as per the Common European framework of German language A1 level competence. This course will help to assimilate the basic grammar structures and gain vocabulary to understand and reciprocate in daily life situations on a broader sense. A thorough learner will be able to gain a comprehensive understanding of the German grammar and confidently articulate in day today situations | |
| **Unit – I** | **Contacts(Kontakte):** | **12** |
| Understanding Letters, simple instructions, speaking about language learning, finding specific information in text, Acknowledging the theme and understanding conversations, Making appointments. Grammar – Preposition with Dative, Articles in Dative and Accusative possessive articles. | | |
| **Unit – II** | **Accomodation(Die Wohnung):** | **12** |
| Understanding Accommodation advertisements, describing accommodation and directions, responding to an invitation, Expressing feelings, Colours. Grammar – Adjective with to be verb, Adjective with *sehr/zu*, Adjective with Accusative, prepositions with Dative | | |
| **Unit – III** | **Are you Working?(Arbeiten Sie):** | **12** |
| Daily Schedule, speaking about past, understanding Job openings advertisements, Opinions, Telephonic conversations, Speaking about Jobs. Grammar – Perfect tense, Participle II – regular and irregular verbs, Conjunctions – *und, oder, aber* | | |
| **Unit – IV** | **Clothes and Style(Kleidung und mode):** | **12** |
| Clothes, Chats on shopping clothes, reporting on past, Orienting oneself in Supermarkets, Information and research about Berlin. Grammar – Interrogative articles and Demonstrative articles, Partizip II – separable and non-separable verbs, Personal pronouns in Dative, Verbs with Dative | | |
| **Unit – V** | **Health and Vacation(Gesundheit und Urlaub):** | **12** |
| Personal information, Human Body parts, Sports, Understanding instructions and prompts, health tips. Grammar – Imperative with *du/Ihr*, Modal verbs – sollen, müssen, nicht dürfen, dürfen. Suggestions for travel, Path, Postcards, weather, Travel reports, Problems in hotel, Tourist destinations. Grammar – Pronoun: *man*, Question words – *Wer, Wen, Was, Wem*, Adverbs – *Zuerst, dann, Später, Zum Schl* | | |
| | | **Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, "Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch und Glossar with 2 CDs", Goyal Publishers, Delhi, 2015. |
| 2. | |

**REFERENCES:**

| | |
|---|---|
| 1. | https://ocw.mit.edu – Massachusetts Institute of Technology Open Courseware |
| 2. | https://www.dw.com/en/learn-german - Deutsche Welle , Geramany's International Broadcaster |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | understand letters and simple texts | Remembering (K1) |
| CO2 | assimilate vocabulary on Accommodation and invitation | Understanding (K2) |
| CO3 | comprehend concept of time, telephonic conversation and job-related information | Understanding (K2) |
| CO4 | understand how to do shopping in a German store | Understanding (K2) |
| CO5 | understand body parts and how to plan personal travel | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

## 22GEO06-GERMAN LANGUAGE LEVEL 3

(Offered by Department of Electronics and Communication Engineering )

| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | German Language Level 2 | **All** | **OE** | **3** | **0** | **0** | **3** |

| Preamble | This course provides enriching information about various everyday situations in personal and professional life and enhances the vocabulary and speaking ability to respond to and also seek information in those situations. It also equips one to express opinions and negotiate appointments. With diligent learning one can capture all basic grammatical structure to answer confidently in everyday situations. |
|---|---|

| **Unit – I** | **All about food (Rund Ums Essen):** | **9** |
|---|---|---|

Understand information about person, Speak about food, Introduce self and others, Understand and explain a picture base story, To justify something, To speak about feelings, To express opinions, To answer questions on a text, To describe a restaurant. Grammar: Possessive Articles in Dative, Yes/No questions, Reflexive verbs, Sentence with 'weil'

| **Unit – II** | **School days ( Nach der Schulzeit):** | **9** |
|---|---|---|

Understand School reports, Speak and write comments about schooldays, To speak about habits, Understand and provide City-Tipps, To Understand School types in Germany and speak about it. Grammar: Modal verbs in Past tense, Positional Verbs, Two-way prepositions in Dativ and Akkusativ.

| **Unit – III** | **Media in everyday life (Medien in Alltag):** | **9** |
|---|---|---|

To speak about advantages and disadvantages of Media, formulate comparisons, Express your own opinion, Talk about Movies, Understand and Write Movie reviews. Grammar: Comparative degree, Comparative Sentences with 'Als' and 'Wie', Subordinate clause with 'dass', Superlative degree.

| **Unit – IV** | **Feelings and expressions (Gefühle):** | **9** |
|---|---|---|

Express thanks and congratulations, Talk about feelings, To understand information about festivals and speak about it, To describe a city, Express joy and regrets, Understand and write Blog entries, Write appropriate heading. Grammar: Subordinate Clause with 'Wenn', Adjectives to be used along with definite articles.

| **Unit – V** | **Profession and Travel ( Beruf und Reisen):** | **9** |
|---|---|---|

To have a conversation at ticket counter, To talk about leisure activities, To gather information from Texts, Introduce people, Express career preferences, Ideate the dream job, To prepare and make telephone calls, To understand text about Workplace. Ask for information, Express uncertainty, Understand and give directions, Understand a newspaper article, Say your own opinion, Talk about the way to work, Describe a statistic, Understand information about a trip, Talk about travel. Grammar: Adjective to be used along with indefinite articles, Prepositions, verb – 'werden', Subordinate clause – indirect questions, All units will include elements for reading, writing, speaking and listening.

**Total:45**

**TEXT BOOK:**

| | |
|---|---|
| 1. | Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, "Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch und Glossar with 2 CDs", Goyal Publishers, Delhi, 2015 |
| 2. | |

**REFERENCES:**


| | |
|---|---|
| 1. | Rosa-Maria Dallapiazza , Eduard von Jan, Till Schonherr, "Tangram 2 (German)" , Goyal Publishers, Delhi, 2011. |
| 2. | https://www.dw.com/en/learn-german - Deutsche Welle , Geramany's International Broadcaster |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | understand German food style, restaurant and be able express oneself. | Remembering (K1) |
| CO2 | understand German school system and discuss about habits and provide City-Tipps | Understanding (K2) |
| CO3 | analyze and compare media in everyday life. | Understanding (K2) |
| CO4 | express feelings, describe a city and write blog entries. | Understanding (K2) |
| CO5 | seek and provide information in a professional setup, give directions to others and talk about travel | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

<table>
<tr><td colspan="9">22GEO07-GERMAN LANGUAGE LEVEL 4</td></tr>
<tr><td colspan="9">(Offered by Department of Electronics and Communication Engineering )</td></tr>
<tr><td>Programme& Branch</td><td>All BE/BTech Engineering and Technology Branches</td><td>Sem.</td><td>Category</td><td>L</td><td>T</td><td>P</td><td colspan="2">Credit</td></tr>
<tr><td>Prerequisites</td><td>German Language Level 3</td><td>All</td><td>OE</td><td>3</td><td>0</td><td>0</td><td colspan="2">3</td></tr>
<tr><td colspan="9"></td></tr>
<tr><td>Preamble</td><td colspan="8">This course imparts knowledge about interacting with external world, understanding various cultural aspects, behaviour and addressing relationships in personal and professional front. It helps one to understand reports from various media and at work. Enhance learner’s grammatical exposure and cover the core basic grammatical concepts which would lay the foundation to have a better hold of the language. With focused learning one should be able to read and respond to reports, write simple formal and informal letters and text messages and be able to engage in simple conversations in known situations.</td></tr>
<tr><td>Unit – I</td><td colspan="7">Learning (Lernen):</td><td>9</td></tr>
<tr><td colspan="9">Understanding and describing learning problems, Understanding and giving advice, Giving reasons, Understanding reports about everyday work life, Talking about everyday working life, Understanding a radio report, Understanding and making a mini-presentation. Grammar: Conjunctions- denn,weil, Konjuntiv II: Sollte( suggestions), Genitive, Temporal prepositions – bis, über + Akkusativ,ab+dativ</td></tr>
<tr><td>Unit – II</td><td colspan="7">Athletic (Sportlich):</td><td>9</td></tr>
<tr><td colspan="9">Expressing enthusiasm, hope, disappointment, Understanding and writing fan comments, Formulating follow-ups, Making suggestions and reacting, Making an appointment, Understanding a report about an excursion, Understanding difficult texts, Introducing a tourist attraction. Grammar: Conjunctions – deshalb, trotzdem, Verbs with Dativ and Akkusativ</td></tr>
<tr><td>Unit – III</td><td colspan="7">Living Together (Zusammen Leben):</td><td>9</td></tr>
<tr><td colspan="9">To complain, apologize & give in, As for something, Understand experience reports, Report on the past, Talk about pets, Respond to information, Write and correct a story. Grammatik: Konjunctiv II- könnte, Subordinate clauses – als and Wenn.</td></tr>
<tr><td>Unit – IV</td><td colspan="7">Good Entertainment (Gute Unterhaltung):</td><td>9</td></tr>
<tr><td colspan="9">Talk about music style, Buy concert tickets, Introduce a musician / band, Understand newspaper reports, Give more detailed information about a person, Understand information about painting, Understand description of a picture, Describe a picture. Grammatik: Interrogative Articles: Was fuer eine? , Pronouns – man/jemand/niemand and alles/etwas/nichts , Relative sentences in Nominativ</td></tr>
<tr><td>Unit – V</td><td colspan="7">Passage of time and Culture (Zeitablauf & Kultur):</td><td>9</td></tr>
<tr><td colspan="9">Talk about wishes, Express wishes, Give Suggestions, Understand a conversation, Plan something together, To ask others something, Understand a text, Exchange information, Talk about proverbs, write a story. Understand information about other cultures, Discuss about behavior, Express intentions, Use the appropriate salutation, Understand tips in a text, Talk about forms of addressing others, Give more information, Discuss about clichés and write about them. All units will include elements for reading, writing, speaking and listening. Grammatik: Konjunctiv II (Wishes, Suggestions), Verbs with prepositions, W- questions with prepositions, Relative sentences in Akkusativ, Subordinate clauses with damit and Um…Zu.</td></tr>
<tr><td colspan="9" align="right">Total:45</td></tr>
<tr><td colspan="9">TEXT BOOK:</td></tr>
<tr><td>1.</td><td colspan="8">Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, “Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch”, Goyal Publishers, Delhi, 2015.</td></tr>
<tr><td colspan="9">REFERENCES:</td></tr>
<tr><td>1.</td><td colspan="8">Rosa-Maria Dallapiazza, Eduard von Jan, Till Schonherr, “Tangram 2 (German)”, Goyal Publishers, Delhi, 2011.</td></tr>
<tr><td>2.</td><td colspan="8">https://www.dw.com/en/learn-german - Deutsche Welle, Geramany’s International Broadcaster</td></tr>
<tr><td colspan="9"></td></tr>
</table>

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | leverage learning in Workplace, understanding reports and make presentation. | Remembering (K1) |
| CO2 | reciprocate to different situations, make appointment and understand texts. | Understanding (K2) |
| CO3 | handle relationships and respond appropriately to exchange information | Understanding (K2) |
| CO4 | familiarize to various channels of entertainment | Understanding (K2) |
| CO5 | know about various cultural aspects, usage of proverbs and cliches. | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEO08 - JAPANESE LANGUAGE LEVEL 2 | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Electronics and Communication Engineering ) | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Japanese Language Level 1** | **All** | **OE** | **4** | **0** | **0** | **4** |

| | |
|---|---|
| Preamble | The basic level of Japanese which provides understanding of Hiragana, Katakana and 110 Kanjis and provides the ability to understand basic conversations and also enables one to request other person and also understand Casual form |

| | | |
|---|---|---|
| **Unit – I** | **Introduction to groups of verbs:** | **12** |
| tai form-Verb groups-te form-Give and ask permission to do an action-Present continuous form-Restrict other person from doing an action-nouns-Basic Questions | | |
| **Unit – II** | **Introduction to Casual Form:** | **12** |
| nai form-Dictionary form-ta form-Polite style and Casual style differences-Conversation in plain style-Place of usage of Polite style and Casual style | | |
| **Unit – III** | **Express opinions and thoughts:** | **12** |
| Introduction to new particle-Express someone one's thought-Convey the message of one person to another-Ask someone if something is right -Noun modifications | | |
| **Unit – IV** | **Introduction to If clause and remaining Kanjis:** | **12** |
| If clause tara form-Express gratitude for an action done by other person-Hypothetical situation-Particles to use in case of Motion verbs-50 Kanjis | | |
| **Unit – V** | **Introduction to giving and receiving with te form and "when, even if" usages:** | **12** |
| Providing to and getting from differences - Understanding of situations and framing sentences using when and even if..etc. | | |
| | | **Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | "MINNA NO NIHONGO–Japanese for Everyone", 2nd Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017 |

**REFERENCES:**



| | |
|---|---|
| 1. | Margherita Pezzopane, "Try N5", 2nd Edition, Tankobon Softcover, Japan, 2017. |
| 2. | Sayaka Kurashina, "Japanese Word Speedmaster", 2nd Edition, Tankobon Softcover, Japan, 2018. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped**<br>**(Highest Level)** |
|---|---|---|
| CO1 | differentiate groups of verbs and its forms | Remembering (K1) |
| CO2 | understand Polite form and Casual form of Japanese | Understanding (K2) |
| CO3 | comprehend personal communication and express greetings | Understanding (K2) |
| CO4 | understand the Kanjis in Japanese Script and If clause | Understanding (K2) |
| CO5 | comprehend concept of “even if”, “when” and job-related information | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| **Test / Bloom’s Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEO09 - JAPANESE LANGUAGE LEVEL 3 | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Electronics and Communication Engineering ) | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Japanese Language Level 2** | **All** | **OE** | **3** | **0** | **0** | **3** |
| | | | | | | | |
| Preamble | The intermediate level of Japanese which provides understanding of all forms ofverbs, adverbs, conjunctions, etc. which includes 150 Kanji's and provides the ability to comprehend conversations encountered in daily life | | | | | | |
| **Unit – I** | **Introduction to Potential verbs:** | | | | | | **9** |
| Causes and Reasons-Favouring Expressions-Expressing a State-Potential Verb Sentences-Simultaneous actions-Verb Groups-te Form-Customary Actions-Nouns-Basic Questions and Kanji's. | | | | | | | |
| **Unit – II** | **Introduction to Transitive and Intransitive verbs:** | | | | | | **9** |
| Consequence of verbs- Embarrassment about Facts- Consequence of Verbs with an Intentions-Affirmative Sentences- Conjunctions-Basic Questions and kanji's. | | | | | | | |
| **Unit – III** | **Introduction to Volitional forms:** | | | | | | **9** |
| Expressions of Speakers Intention-Expressing Suggestion or Advice-Usage of Adverbs and Quantifiers-Basic Questions and kanji's. | | | | | | | |
| **Unit – IV** | **Introduction to Imperative and Prohibitive verbs:** | | | | | | **9** |
| Commanding person- Interrogatives-Expressions of Third Person-Actions and its Occurrence - Possibilities of an Action-Changing of States Basic Questions and Kanji's. | | | | | | | |
| **Unit – V** | **Introduction to Conditional form and Passive verbs:** | | | | | | **9** |
| Description of Requirement and Speaker's Judgement, HabitualActions, Directions and suggestions-Passive forms of Verbs-Basic Questions and Kanji's. | | | | | | | |
| | | | | | | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | "MINNA NO NIHONGO–Japanese for Everyone", 2nd Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017. |

**REFERENCES:**

| | |
|---|---|
| 1. | Margherita Pezzopane, "Try N5", 2nd Edition, Tankobon Softcover, Japan, 2017. |
| 2. | Sayaka Kurashina, "Japanese Word Speedmaster", 2nd Edition, Tankobon Softcover, Japan, 2018. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | read and understand BasicVocabularies. | Remembering (K1) |
| CO2 | understand Conversations used in daily life. | Understanding (K2) |
| CO3 | comprehend personal communication and express greetings. | Understanding (K2) |
| CO4 | understand the Kanji's in Japanese Script. | Understanding (K2) |
| CO5 | comprehend Coherent conversations in everyday situations. | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEO10 -JAPANESE LANGUAGE LEVEL 4 | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Electronics and Communication Engineering ) | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **JAPANESE LANGUAGE LEVEL 3** | **All** | **OE** | **3** | **0** | **0** | **3** |
| | | | | | | | |
| Preamble | The intermediate level of Japanese provides understanding of expressions of verbs, its pattern, Relationships which also includes 150 Kanji's and also provides the ability to understand relationship among the people. | | | | | | |
| **Unit – I** | **Introduction to Reasoning:** | | | | | | **9** |
| Causes and Sequences-Causes and Effects-Interrogative Patterns-Adjective as a Noun -Basic Questions and Kanji's | | | | | | | |
| **Unit – II** | **Introduction to Exchanging of things:** | | | | | | **9** |
| Expressions for Giving and Receiving of Things-Polite Expression of Request-Indicating a Purpose of Actions-Basic Quantifiers-Basic Questions and kanji's. | | | | | | | |
| **Unit – III** | **Introduction to States of an Action:** | | | | | | **9** |
| Sentence Pattern to Indicate Appearance-Degree of Action and State-Adjectives as Adverbs- Convey information -Basic Questions and kanji's. | | | | | | | |
| **Unit – IV** | **Introduction to Causative Verbs:** | | | | | | **9** |
| Causative Forms of Verbs-Asking Opportunity to do something-Hypothetical Questions-Judgement and Course of an actions-Basic Questions and Kanji's. | | | | | | | |
| **Unit – V** | **Introduction to Relationship in Social Status:** | | | | | | **9** |
| Honorific expressions- Respectful expressions- Humble expressions-Polite expressions-Basic Questions and Kanji's. | | | | | | | |
| | | | | | | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | "MINNA NO NIHONGO–Japanese for Everyone", 2nd Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017. |

**REFERENCES:**


| | |
|---|---|
| 1. | Margherita Pezzopane, "Try N5", 2nd Edition, Tankobon Softcover, Japan, 2017. |
| 2. | Sayaka Kurashina, "Japanese Word Speedmaster", 2nd Edition, Tankobon Softcover, Japan, 2018. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | read and Understand Relationship of a Person. | Remembering (K1) |
| CO2 | understand Conversations Used in Everyday Activities. | Understanding (K2) |
| CO3 | comprehend Contents at Near Natural Speed. | Understanding (K2) |
| CO4 | understand the Kanji's in Japanese Script.. | Understanding (K2) |
| CO5 | comprehend Orally Presented Materials. | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| **22GEO11 - FRENCH LANGUAGE LEVEL 1** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| (Offered by Department of Electronics and Communication Engineering ) | | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Fundamentals of French Language** | **All** | **OE** | **4** | **0** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course provides a foundation of the French language as well as an understanding of the French culture and lifestyle of France and other French-speaking nations. The student will be learning how to introduce him/herself and acquire basic everyday vocabulary. By following the structured curriculum and practicing the same as per the learning process, one can comprehend the structure of sentences and respond to basic communications | |
| **Unit – I** | **Introduction** | **12** |
| French and French culture, alphabets, pronunciation, accents, rules, and terms for pronunciation (mas-fem), Salutations, numbers. | | |
| **Unit – II** | **Daily Life** | **12** |
| Subject Pronoun, Francophonie's, adjectives – colors, week, months, seasons. | | |
| **Unit – III** | **Articles and Verbs** | **12** |
| Articles - Indefinite, definite, partitive, and contracted, (examples), introductions to verbs, 1st group of verb | | |
| **Unit – IV** | **In the City** | **12** |
| 2nd group of verbs, irregular verbs (avoir, etre, faire …..) present yourself & negative sentences. (faire and Jouer verb with the expressions) | | |
| **Unit – V** | **Food and Culture** | **12** |
| Prepositions – preposition of places (country, cities and etc), Imperative mode, invitations, culture – food (wine, cheese ….) Future (recent future) | | |
| | | **Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | A1 – saison |

**REFERENCES:**

| | |
|---|---|
| 1. | Apprenons les francais – 0 and 1 |
| 2. | Grammaire – langue et de civilization francaises – Mauger G, Les idees – 0 and 1 |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | Understand the grammatical structure of the language and introduce self to others. | Remembering (K1) |
| CO2 | Understand basic verbs and appropriate vocabulary. | Understanding (K2) |
| CO3 | Ask for directions and arrange for transportation, etc, as needed. | Understanding (K2) |
| CO4 | Understand the food habits of France and ask for appointments | Understanding (K2) |
| CO5 | Learn to socialize in French-speaking countries | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | **2** |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEO12 -FRENCH LANGUAGE LEVEL 2 | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Electronics and Communication Engineering ) | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Fundamentals of French Language** | **All** | **OE** | **4** | **0** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course is designed to assist students in developing vocabulary in accordance with the Common European Framework of Reference for Languages at the A2 level. This course will aid in the integration of basic grammar structures as well as the acquisition of vocabulary necessary to comprehend and respond in everyday circumstances. The learner will be able to develop a thorough comprehension of French grammar and confidently express themselves in everyday circumstances. | |
| **Unit – I** | **French and You** | **12** |
| Habits, Strengths & Weakness, Recommendations, Sentiments, Motivations, about favorite films and Types of screens in the movie world, Verbs (Regulars and irregulars), Reflexive Verbs, Prepositions | | |
| **Unit – II** | **Eat and Repeat** | **12** |
| Favorite foods, Recopies, Types of meals, Describing House and Kitchen, Presentation of the recipe, Comparatives, Possessive pronouns, Present continuous tense, Simple conditional form | | |
| **Unit – III** | **Vacation** | **12** |
| Invitations, presentation, Greetings, Goodbyes, Activities on vacation, past experiences, Describing favorite place, Recommendations on various tours, Past perfect, Past imperfect tense | | |
| **Unit – IV** | **Likes and Views** | **12** |
| Favorite persons & things, Giving advice, Experience, Moods, Illness, Discomforts, Symptoms, Roleplay (Doctor & Patient, Guide & Tourist, Pharmacist & Patient), Past perfect, Past indefinite, Imperative | | |
| **Unit – V** | **Then and Now** | **12** |
| Habits, customs, circumstances of the past and present, Debates on past and present situations and feelings. Past imperfect tense, Past perfect and Present comparatives. | | |
| | | **Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | A2 – Saison |

**REFERENCES:**

| | |
|---|---|
| 1. | Apprenons les francais – 0 and 1 |
| 2. | Grammaire – langue et de civilization francaises – Mauger G .Les idees – 0 and 1 |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | Understand the French language in deep and its usage | Remembering (K1) |
| CO2 | Preparation of their Favorite recipes, Know the Objects used in Kitchen and house. | Understanding (K2) |
| CO3 | Converse about their vacation, their Favorite Destination | Understanding (K2) |
| CO4 | Understand complex verbs and be able to communicate about their past experiences | Understanding (K2) |
| CO5 | Know the difference between Past and Present and Compare them. | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEO13- FRENCH LANGUAGE LEVEL 3 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| (Offered by Department of Electronics and Communication Engineering ) | | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Fundamentals of French Language** | **All** | **OE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course gives knowledge regarding a variety of personal and professional circumstances, as well as improving vocabulary and speaking abilities to reply to and seek information in those settings. It also gives you the ability to articulate yourself and arrange appointments. With perseverance, one can master all of the essential grammatical structures needed to respond confidently in everyday circumstances. It almost gives you an idea of how Natives communicate. | |
| **Unit – I** | **Start Over** | **9** |
| Use of periphrases, Discuss a day in life, work, problems in the world, Predictions about the future (actions and situations), Hypothetical situations, Imperfect and future tense. | | |
| **Unit – II** | **Prohibitions and More** | **9** |
| Prohibitions, Obligations, Habits to change, social customs, Use of the subjunctive, Describe synopsis of Movie and its relation to real life, Debate on books vs movies, usage of connectors, Object Direct and Indirect. | | |
| **Unit – III** | **Let's be Creative** | **9** |
| Write a letter by describing the problem, talk about desires and Necessities, propose solutions, Recommendations and Suggestions, Create an Advertisement, Give Instructions, Imperative negative, Use of Object Direct, and Indirect | | |
| **Unit – IV** | **Travel and Communication** | **9** |
| Talk about Tours, Types of tourism and communication, Send messages, petitions, Talk to people on the telephone, Roleplay (Tourists and Guide, Tourists and Travel agents), Past Pluscumperfect, All Past tenses. | | |
| **Unit – V** | **Let's Talk** | **9** |
| Expression of Interests, Sentiments, Feelings, Sensations, Manias etc. Certain suggestions to make a better future, the use of superlatives, Exclamatory phrases, subjunctives. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | B1 – Saison |

**REFERENCES:**

| | |
|---|---|
| 1. | Apprenons les francais – 0 and 1 |
| 2. | Grammaire – langue et de civilization francaises – Mauger G Les idees – 0 and 1 |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | Learn on Future tense. | Remembering (K1) |
| CO2 | Understand Permissions and Prohibitions. | Understanding (K2) |
| CO3 | Knowing about Letter writing, Creating Ads, Expressing Desires, and Instructing Others. | Understanding (K2) |
| CO4 | Understanding rules for travel and Enhancing communications. | Understanding (K2) |
| CO5 | Expressing the feelings and emotions using advanced grammar | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | **2** |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEO14 - SPANISH LANGUAGE LEVEL 1 | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Electronics and Communication Engineering ) | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Fundamentals of Spanish Language** | **All** | **OE** | **4** | **0** | **0** | **4** |

| | |
|---|---|
| Preamble | This course provides a foundation of the Spanish language as well as an understanding of the Spanish culture and lifestyle of Spain and other Spanish-speaking nations. The student will be learning how to introduce him/herself and acquire basic everyday vocabulary. By following the structured curriculum and practicing the same as per the learning process, one can comprehend the structure of sentences and respond to basic communications. |

| | | |
|---|---|---|
| **Unit – I** | **Greetings and Good byes (Los Saludos y Despidirse):** | **12** |
| Greetings,Self-Introduction , Formal and Informal ways of introducing oneself and others, Alphabets& Numbers, Countries and Languages Spoken, Parts of Grammar – Noun, Personal Pronoun, Describe surroundings and its vocabulary | | |
| **Unit – II** | **Vida Cotidiana (Daily Life):** | **12** |
| Time of the day, Days of the week, Months of the year, Seasons, Verb (To be, To Have), Adverbs, Likes and Dislikes, Personality and physical description, simple sentences | | |
| **Unit – III** | **Friends and Family (Amigos y La Familia):** | **12** |
| Vocabulary of family, Animals, Professions, Parts of the body, Opinions on family cultures, Articles – Definite and Indefinite, Hobbies, Regular and Irregular verbs. | | |
| **Unit – IV** | **In the City (En la Cuidad):** | **12** |
| Buildings in the city, Name of the places, asking for directions, Helping each other, Description of house and its components, Modes of Transport, Grammar - Possessive articles, prepositions | | |
| **Unit – V** | **Food and Culture( La comida y cultura):** | **12** |
| Food (types and varieties) , shopping, ordering at a restaurant, inviting to parties, Roleplay (as diner and customer, salesman and customer…etc.) Past tense (all three tenses-Past Participle, Indefinite past and past imperfect- (to be and to have) | | |
| | | **Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Chicos Chicas Libro de Alumno nivel 1, Ma Angeles Palomino , edelsa, GRUPO DIDASCALIA, S.A., plaza cuidad de salta,3-28043 MADRID(ESPANA). |

**REFERENCES:**

| | |
|---|---|
| 1. | https://nuevadelhi.cervantes.es/en/spanish_courses/students/spanish_general_courses/spanish_courses_level_a1.htm |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | understand the grammatical structure of the language and introduce self to others. | Remembering (K1) |
| CO2 | understand basic verbs and appropriate vocabulary. | Understanding (K2) |
| CO3 | ask for directions and arrange for transportation, etc, as needed. | Understanding (K2) |
| CO4 | understand the food habits of Spain and Latin countries and ask for appointments | Understanding (K2) |
| CO5 | learn to socialize in Spanish speaking countries | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | **2** |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEO15 - SPANISH LANGUAGE LEVEL 2 | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Electronics and Communication Engineering ) | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Fundamentals of Spanish Language** | **All** | **OE** | **4** | **0** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course aims to help the Learner to acquire the vocabulary as per theframework of Spanish language A2 level competence. This course will help to assimilate the basicgrammar structures and gain vocabulary to understand and reciprocate in daily life situations on a broader sense. A thorough learner will be able to gain a comprehensive understanding of the Spanish grammar and confidently articulate in day today situations. | |
| **Unit – I** | **Spanish and You (El Español y tú)** | **12** |
| Habits, Strengths & Weakness, Recommendations, Sentiments, Motivations, About favorite films and Types of screens in the movie world, Verbs(Regulars and irregulars), Reflexive Verbs, Prepositions | | |
| **Unit – II** | **Eat and Repeat (**Comer y repetir**)** | **12** |
| Favorite foods, Recipies, Types of meals, Describing House and Kitchen, Presentation of recipe, Comparatives, Possessive pronouns, Present continuous tense, Simple conditional form | | |
| **Unit – III** | **Its Vacation Time (**Tiempo de vacaciones) | **12** |
| Invitations, presentation, Greetings, Goodbyes, Activities on vacation, past experiences, Describing favorite place, Recommendations on various tours, Past perfect, Past imperfect tense, Usage of Todavia or No | | |
| **Unit – IV** | **Likes and Views (**Gustasyvistas) | **12** |
| Favorite persons & things, Giving advices, Experience, Moods, Illness, Discomforts, Symptoms, Roleplay (Doctor & Patient, Guide & Tourist, Pharmacist & Patient), Past perfect, Past indefinite, Imperative | | |
| **Unit – V** | **Then and Now( Antes y Ahora)** | **12** |
| Habits, customs, circumstances of the past and present, Debates on past and present situations and feelings. Past imperfect tense, Past perfect and Present comparatives. | | |
| | | **Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | AULA INTERNACIONAL 2 (A2) Jaime Corpas, AgusinGarmendia, Nuria Sanchez, Carmen Soriano Goyal Publishers and Distributors Pvt LTD, 86, UB Jawahar Nagar, Kamla Nagar, Delhi-110007. |

**REFERENCES:**

| | |
|---|---|
| 1. | https://nuevadelhi.cervantes.es/en/spanish_courses/students/spanish_general_courses/spanish_courses_level_a1.htm |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped**<br>**(Highest Level)** |
|---|---|---|
| CO1 | understand the Spanish language in deep and its usage | Remembering (K1) |
| CO2 | prepare for their Favorite recipes, Know the Objects used in Kitchen and house. | Understanding (K2) |
| CO3 | converse about their vacation, their Favorite Destination | Understanding (K2) |
| CO4 | understand complex verbs and be able to communicate about their past experiences | Understanding (K2) |
| CO5 | know the difference between Past and Present and Comparing them. | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | **2** |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **22GEO16 - SPANISH LANGUAGE LEVEL 3** | | | | | | | |
| (Offered by Department of Electronics and Communication Engineering ) | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Fundamentals of Spanish Language** | **All** | **OE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides enriching information about various everyday situations in personal and professional life and enhances the vocabulary and speaking ability to respond to and also seek information in those situations. It also equips one to express opinions and negotiate appointments. With diligent learning one can capture all basic grammatical structure to answer confidently in everyday situations. It almost gives a basic idea on how Natives speak. | |
| **Unit – I** | **Start Over( Volver a Empezar)** | **9** |
| Use of periphrases, Discuss a day in life, work, problems in the world, Predictions about future (actions and situations),Hypothetical situations, Imperfect and future tense. | | |
| **Unit – II** | **Prohibitions and More(Prohibiciones y mas)** | **9** |
| Prohibitions, Obligations, Habits to change, social customs, Use of subjunctive, Describe synopsis of Movie and its relation to real life, Debate on books vs movies, usage of connectors, Object Direct and Indirect. | | |
| **Unit – III** | **Let's be Creative (Seamoscreatives)** | **9** |
| Write a letter by describing the problem,talk about desires and Necessities, propose solutions, Recommendations and Suggestions, Create an Advertisement, Give Instructions, Imperative negative, Use of Object Direct and Indirect. | | |
| **Unit – IV** | **Travel and Communication (Viajar y comunicar)** | **9** |
| Talk about Tours, Types of tourism and communication, Send messages, petitions, Talk to people on telephone, Role play(Tourists and Guide, Tourists and Travel agents), Past Pluscumperfect, All Past tenses. | | |
| **Unit – V** | **Let's Talk(Hablemos)** | **9** |
| Expression of Interests, Sentiments, Feelings, Sensations, Manias etc. Certain suggestions to make a better future, use of superlatives, Exclamatory phrases, subjunctive. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Aula International 3 (B1) [Paperback] Jaime Corpas, Agusin Garmendia, Nuria Sanchez, Carmen Soriano Goyal Publishers and Distributors Pvt LTD, 86, UB Jawahar Nagar, Kamla Nagar, Delhi-110007. |

**REFERENCES:**

| | |
|---|---|
| 1. | https://nuevadelhi.cervantes.es/en/spanish_courses/students/spanish_general_courses/spanish_courses_level_a1.htm |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | learn on Future tense. | Remembering (K1) |
| CO2 | understand about Permissions and Prohibitions. | Understanding (K2) |
| CO3 | knowing about Letter writing, Creating Ads, Expressing Desires and Instructing Others. | Understanding (K2) |
| CO4 | understanding rules for travel and Enhance communications. | Understanding (K2) |
| CO5 | expressing the feelings and emotions using advanced grammar | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | **2** |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO5 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEO17 - ENTREPRENEURSHIP DEVELOPMENT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **(Offered by Department of Mechatronics Engineering)** | | | | | | | | |
| **Programme & Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Engineering Economics & Management** | **7** | **OE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | The purpose of this course to create entrepreneurial awareness among engineering students. | |
| **Unit – I** | **Entrepreneurship Concepts:** | **9** |
| Entrepreneurship & Entrepreneur- Role in Economic Development - Factors affecting Entrepreneurship- Creativity and Innovation - Entrepreneurship vs Intrapreneurship- Entrepreneurial Motivation factors – Types of Entrepreneurship & Entrepreneurs - Characteristics of Entrepreneurs - Entrepreneurship Development in India | | |
| **Unit – II** | **Entrepreneurial Ventures and opportunity assessment:** | **9** |
| New venture creation – Bootstrapping, Minipreneurship, Start-ups, Acquiring, Franchising & Social venturing - Venture development stages - Models of market opportunity- Opportunity assessment: Critical Factors In Opportunity Assessment, Idea vs Opportunity, Evaluation process, Global opportunities for entrepreneurs. | | |
| **Unit – III** | **Business Plan:** | **9** |
| Designing Business Model- Business Model Canvas- Objectives of a Business Plan - Business Planning Process – Structure of a Business Plan – Technical, Marketing, Financial Feasibility assessment - Competitive analysis - Common errors in Business Plan formulation - Presentation of the Business Plan: The 'Pitch'- case studies | | |
| **Unit – IV** | **Financing and accounting:** | **9** |
| Forms of entrepreneurial capital – Sources of Financial capital: debt financing- Commercial banks and other sources, equity financing: Initial Public offering (IPO), Private placement - Venture capitalists - Angel investors-New forms of financing: Impact investors, Micro-financing, Peer-to-Peer Lending, Crowd funding - Natural capital. Preparing Financial Budget, Break even analysis, Taxation-Direct and indirect taxes, Insolvency and Bankruptcy- Case Study | | |
| **Unit – V** | **Small Business Management:** | **9** |
| Definition of Small Scale Industries: Strengths and Weaknesses, Sickness in Small Enterprises: Symptoms -Causes and remedies- Indian Startup Ecosystem – Institutions supporting small business enterprises, Business Incubators – Government Policy for Small Scale Enterprises - Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger, FDI and Sub-Contracting | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Donald F. Kuratko,"Entrepreneurship: Theory, Process, Practice", 11th Edition, Cengage Learning, Boston, 2020. |

**REFERENCES:**


| | |
|---|---|
| 1. | Robert D. Hisrich, Michael P. Peters & Dean A. Shepherd, Sabyasachi Sinha "Entrepreneurship", 11th Edition, McGraw Hill, Noida, 2020. |
| 2. | Charantimath Poornima .M, "Entrepreneurship Development and Small Business Enterprises", 3rd Edition, Pearson Education, Noida, 2018. |
| 3. | Gordon E & Natarajan K, "Entrepreneurship Development", 6th Edition, Himalaya Publishing House, Mumbai, 2017. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | understand the importance of entrepreneurship and demonstrate the traits of an entrepreneur | Applying (K3) |
| CO2 | identify suitable entrepreneurial ventures and business opportunity | Applying (K3) |
| CO3 | assess the components of business plan | Analyzing (K4) |
| CO4 | appraise the sources of finance and interpret accounting statements | Applying (K3) |
| CO5 | interpret the causes of sickness of small scale enterprises and its remedies | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 2 | 2 | 1 | 1 | | 3 | 2 | | |
| CO2 | 1 | 2 | 2 | 2 | | 2 | 2 | 1 | 1 | | 3 | 2 | | |
| CO3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | | |
| CO4 | 1 | 1 | 2 | 1 | | 2 | 1 | 1 | 1 | 2 | 3 | 2 | | |
| CO5 | 1 | 1 | 2 | 1 | | 2 | 1 | 1 | 1 | 2 | 3 | 2 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | 20 | 30 | 30 | 20 | | | 100 |
| CAT3 | 30 | 30 | 40 | | | | 100 |
| ESE | 10 | 30 | 40 | 20 | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22GEX01 – NCC Studies (Army Wing) – I | | | | | | | |
|---|---|---|---|---|---|---|---|
| **(Offered by Department of Electrical and Electronics Engineering)** | | | | | | | |
| **Programme & Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5 / 6** | **OE** | **3** | **0** | **2** | **4** |

| | | |
|---|---|---|
| Preamble | This course is designed especially for NCC Cadets. This course will help develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams, learning military subjects including weapon training. | |
| **Unit - I** | **NCC Organisation & National Integration** | **9** |
| NCC Organisation – History of NCC- NCC Organisation- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honours and Awards – Incentives for NCC cadets by central and state govt. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration. | | |
| **Unit - II** | **Basic physical Training & Drill** | **9** |
| Basic physical Training – various exercises for fitness( with Demonstration)-Food – Hygiene and Cleanliness.<br>Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill- guard mounting. ( WITH DEMONSTRATION) | | |
| **Unit - III** | **Weapon Training** | **9** |
| Main Parts of a Rifle- Characteristics of 5.56mm INSAS rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing( WITH PRACTICE SESSION) - Characteristics of 7.62mm SLR- LMG- carbine machine gun. | | |
| **Unit - IV** | **Social Awareness and Community Development** | **9** |
| Aims of Social service-Various Means and ways of social services- family planning – HIV and AIDS- Cancer its causes and preventive measures- NGO and their activities- Drug trafficking- Rural development programmes - MGNREGA-SGSY-JGSY-NSAP-PMGSY-Terrorism and counter terrorism- Corruption – female foeticide -dowry –child abuse-RTI Act- RTE Act- Protection of children from sexual offences act- civic sense and responsibility | | |
| **Unit - V** | **Specialized Subject (ARMY)** | **9** |
| Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war- Param Vir Chakra- Career in the Defence forces- Service tests and interviews-Fieldcraft and Battlecraft-Basics of Map reading including practical. | | |
| | | **Lecture :45, Practical:30, Total:75** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | National Cadet Corps- A Concise handbook of NCC Cadets by Ramesh Publishing House, New Delhi, 2014 |

**REFERENCES:**


| | |
|---|---|
| 1. | Cadets Handbook – Common Subjects SD/SW published by DG NCC, New Delhi. |
| 2. | Cadets Handbook- Specialized Subjects SD/SW published by DG NCC, New Delhi |
| 3. | NCC OTA Precise published by DG NCC, New Delhi. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion. | Applying (K3) |
| CO2 | demonstrate Health Exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders.. | Applying (K3) |
| CO3 | basic knowledge of weapons and their use and handling. | Applying (K3) |
| CO4 | understanding about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils | Applying (K3) |
| CO5 | acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 3 | 3 | 3 | 3 | 3 | | | | |
| CO2 | | | | | 3 | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | - | - | - | - | - | - | - |
| CAT2 | - | - | - | - | - | - | - |
| CAT3 | - | - | - | - | - | - | - |
| ESE | The examination and award of marks will be done by the Ministry of Defence, Government of India which includes all K1 to K6 knowledge levels. The maximum marks for the End Semester Examination is 500 marks. It will be converted to 100 marks. | | | | | | |

| 22GEX02 - NCC STUDIES (AIR WING) – I | | | | | | | |
|---|---|---|---|---|---|---|---|
| **(Offered by Department of Information Technology)** | | | | | | | |
| **Programme & Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5 / 6** | **OE** | **3** | **0** | **2** | **4** |

| | | |
|---|---|---|
| Preamble | This course is designed especially for NCC Cadets. This course will help develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams, honing qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets. | |
| **Unit–I** | **NCC Organization and National Integration** | **9+3** |
| NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training - NCC badges of Rank - Honors' and Awards – Incentives for NCC cadets by central and state govt. History and Organization of IAF - Indo-Pak War-1971 - Operation Safed Sagar. National Integration - Unity in diversity - contribution of youth in nation building - national integration council - Images and Slogans on National Integration. | | |
| **Unit–II** | **Drill and Weapon Training** | **9+3** |
| Drill- Words of commands - position and commands - sizing and forming - saluting - marching - turning on the march and wheeling - saluting on the march - side pace, pace forward and to the rear - marking time - Drill with arms - ceremonial drill - guard mounting.(WITH DEMONSTRATION). Main Parts of a Rifle - Characteristics of .22 rifle - loading and unloading – position and holding - safety precautions – range procedure - MPI and Elevation - Group and Snap shooting - Long/Short range firing (WITH PRACTICE SESSION). | | |
| **Unit–III** | **Principles of Flight** | **9+3** |
| Laws of motion-Forces acting on aircraft – Bernoulli's theorem - Stalling - Primary control surfaces – secondary control surfaces - Aircraft recognition. | | |
| **Unit-IV** | **Aero Engines** | **9+3** |
| Introduction of Aero engine -Types of engine - piston engine - jet engines - Turbo prop engines-Basic Flight Instruments - Modern trends. | | |
| **Unit–V** | **Aero Modeling** | **9+3** |
| History of aeromodeling - Materials used in Aero-modeling - Types of Aero-models – Static Models - Gliders - Controlline models - Radio Control Models - Building and Flying of Aero-models. | | |
| | | **Lecture:45, Tutorial:30, Total:75** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | "National Cadet Corps - A Concise handbook of NCC Cadets", Ramesh Publishing House, NewDelhi, 2014. |

**REFERENCES/ MANUAL / SOFTWARE:**

| | |
|---|---|
| 1. | "Cadets Handbook – Common Subjects SD/SW", DGNCC, New Delhi. |
| 2. | "Cadets Handbook – Specialised Subjects SD/SW", DGNCC, New Delhi. |
| 3. | "NCCOTA Precise", DGNCC, New Delhi. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | build sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion. | Applying (K3) |
| CO2 | demonstrate the sense of discipline with smartness and have basic knowledge of weapons and their use and handling | Applying (K3) |
| CO3 | illustrate various forces and moments acting on aircraft | Applying (K3) |
| CO4 | outline the concepts of aircraft engine and rocket propulsion | Applying (K3) |
| CO5 | design, build and fly chuck gliders/model air planes and display static models. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 3 | 3 | 3 | 3 | 3 | | | | |
| CO2 | | | | | 3 | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | - | - | - | - | - | - | - |
| CAT2 | - | - | - | - | - | - | - |
| CAT3 | - | - | - | - | - | - | - |
| ESE | The examination and award of marks will be done by the Ministry of Defence, Government of India which includes all K1 to K6 knowledge levels. The maximum marks for the End Semester Examination is 500 marks. It will be converted to 100 marks. | | | | | | |

| 22MBO01 - COST ACCOUNTING FOR ENGINEERS | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Management Studies ) | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **NIL** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | To provide an In-depth study of the Cost Accounting principles and techniques for identification, analysis and classification of costs components to facilitate decision Making. | |
| **Unit – I** | **Introduction to Cost Accounting** | **9 + 3** |
| **Introduction to Cost Accounting:** Meaning - Scope, objectives and significance of Cost Accounting its relationship with financial accounting and management accounting– cost centres – cost units – Elements of cost – classification of cost – preparation of cost sheet. | | |
| **Unit – II** | **Cost Ascertainment – Elements of cost** | **9 + 3** |
| **Material Costs:** Procurement of materials – Inventory management and control – scrap, spoilage, defectives and wastage<br>**Labour Costs:** Time Keeping, Time booking and payroll – Labour turnover – principles and methods of remuneration and incentive schemes.<br>**Overheads:** Collection, classification and apportionment and allocation of overheads. | | |
| **Unit – III** | **Basic Costing Methods** | **9 + 3** |
| Operating Costing - Meaning - Preparation of Operating Cost Sheet - Transport Costing - Power Supply Costing - Hospital Costing. | | |
| **Unit – IV** | **Advanced Costing Methods** | **9 + 3** |
| Features of Job Costing - Batch Costing - Preparation of Cost Sheet Under Job Costing, and Batch Costing - Process Costing - Process Loss - Normal and Abnormal Loss. | | |
| **Unit – V** | **Cost Accounting Techniques** | **9 + 3** |
| **Budget and Budgetary Control**: Budgetary control as a management Tool – Installation of Budgetary control system classification of budgets – Fixed and Flexible Budgeting.<br>**Standard Costing and Variance Analysis:** Budgetary control and standard costing – Suitability of standard costing – Standard costing as a management Tool – Cost variances – Direct material cost variances – Direct labour cost variances – Overhead variances – Sales variance. | | |
| | | **Lecture: 45, Tutorial: 15, Total:60** |

**TEXT BOOKS**

| | |
|---|---|
| 1. | JawaharLal, SeemaSrivastava, Manisha Singh, " Cost Accounting, Text, Problems and Cases", 6th Edition, McGraw Hill Education, New Delhi, 2020. |
| 2. | William Lanen, Shannon Anderson and Michael Maher, "Fundamentals of cost Accounting",7th Edition, McGraw Hill Education, New Delhi, 2020. |

**REFERENCES**

| | |
|---|---|
| 1. | M.N.Arora and PriyankaKatyal, "Cost Accounting", 5th Edition, Vikas publishing House, New Delhi, 2023. |
| 2. | Ravi M.Kishore, " Cost and Management Accounting", 6th Edition, Taxmann, New Delhi, 2021 |
| 3. | M.N.Arora, "Cost and Management Accounting",11th Edition, Vikas Publishing, New Delhi, 2021. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | understand the conceptual frame work of cost accounting | Understanding (K2) |
| CO2 | understand the basic concepts and process in determination of cost of product and services | Understanding (K2) |
| CO3 | use the basic costing methods in different business situation | Applying (K3) |
| CO4 | demonstrate the advanced costing methods in various decision making situation | Applying (K3) |
| CO5 | prepare various types of budgets and determine variance in different situations. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | 2 | 3 | 1 | | |
| CO2 | | | | | | | | | | 2 | 3 | 1 | | |
| CO3 | | | | | | | | | | 2 | 3 | 1 | | |
| CO4 | | | | | | | | | | 2 | 3 | 1 | | |
| CO5 | | | | | | | | | | 2 | 3 | 1 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 30 | 70 | | | | | 100 |
| CAT2 | 15 | 35 | 50 | | | | 100 |
| CAT 3 | 15 | 35 | 50 | | | | 100 |
| ESE | 25 | 25 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

**22MBO02 Economic Analysis for Decision Making**

(Offered by Department of Management Studies )

| Programme& Branch | All BE/BTech Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Basic understanding of differential calculus** | **6** | **OE** | **3** | **1** | **0** | **4** |

| | |
|---|---|
| Preamble | The course aims at introducing a few vital techniques required for carrying out economic analysis for making informed managerial decisions. |

**Unit – I** **Economic Optimization** **9 + 3**

**Economic Optimization:**
Theory of firm – Business versus Economic profit – Revenue relations – Cost relations – Profit relations – Marginal versus incremental concept.

**Unit – II** **Forecasting** **9 + 3**

**Forecasting:** Forecasting applications – Techniques –Naire method – Moving average – Exponential smoothing - Trend analysis – Linear Trend – Growth Trend – Sales, cost and revenue forecasting.

**Unit – III** **Production and Cost Analysis** **9 + 3**

**Production:** Production function – Returns to scale and returns to factor – Total, managerial and average product – Law of diminishing returns – Optimal input usage – Production function estimation.
**Cost Analysis:** Economic and Accounting costs – Time in cost analysis – Short run cost – Long run cost – cost relations – cost volume – profit analysis.

**Unit – IV** **Competitive Market Analysis** **9 + 3**

**Competitive Market Analysis:** Characteristics of competitive markets – Profit maximisation – Marginal analysis in competition – competitive market supply curve – Equilibrium in competitive markets - Monopoly – Monopolistic competition.

**Unit – V** **Game theory and Competitive Strategy** **9 + 3**

Game Theory Basics - Prisoner's Dilemma - Saddle Point - Two Person Zero Sum Game - Games without Saddle Points - Dominance Rule - Mixed Strategies.

**Lecture: 45, Tutorial: 15, Total:60**

**TEXT BOOKS**


1. Mark Hirschey, “Managerial Economics”, 12th Edition, Cengage Learning, New Delhi, 2022.
2. Geetika, PiyaliGhosh, Purba Roy Choudhury, “Managerial Economics”, 3rd Edition, McGraw Hill Education, New Delhi, 2019.


**REFERENCES**


1. Gupta. G, “Managerial Economics”, 2nd Edition, McGraw Hill Education, New Delhi, 2019.
2. Ahuja. H. L, “Principles of Microeconomics”, 22nd Edition, S. Chand Publishing, New Delhi, 2019.
3. PanneerSelvam R, P. Sivasankaran, P. Senthilkumar., “Managerial Economics”, 1st Edition, Cengage Learning, New Delhi, 2018.

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | Understand revenue, cost and profit relations and apply techniques to find best course of action. | Applying (K3) |
| CO2 | Apply appropriate forecasting techniques for estimating sales, cost and revenue. | Applying (K3) |
| CO3 | Understand the relation between inputs and output of production system and perform cost – volume – profit analysis | Applying (K3) |
| CO4 | Apply market equilibrium concepts in monopoly and monopolistically competitive markets. | Applying (K3) |
| CO5 | Understand game theory and apply in different strategic decisions | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2 | | | | | 1 | 3 | | | |
| CO2 | | | | | 2 | | | | | 1 | 3 | | | |
| CO3 | | | | | 2 | | | | | 1 | 3 | | | |
| CO4 | | | | | 2 | | | | | 1 | 3 | | | |
| CO5 | | | | | 2 | | | | | 1 | 3 | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 35 | 35 | 30 | | | | 100 |
| CAT2 | 15 | 45 | 40 | | | | 100 |
| CAT 3 | 15 | 35 | 50 | | | | 100 |
| ESE | 5 | 40 | 55 | | | | 100 |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

| 22MBO03 Marketing Analytics | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| (Offered by Department of Management Studies ) | | | | | | | | |
| **Programme& Branch** | **All BE/BTech Engineering and Technology Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Basic understanding of differential calculus** | **7** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | Marketing analytics enables marketers to measure, manage and analyze marketing performance to maximize its effectiveness and optimize return on investment (ROI). This course exposes the students with the tools to measure customer value and apply analytic tools to various marketing decisions. | |
| **Unit – I** | **Market & Marketing Analytics** | **9 + 3** |
| **Introduction** - Introduction to marketing analytics, Models & Metrics<br>**Market Insight** - Market sizing.<br>**Market Segmentation** –Segmentation, Targeting & Positioning | | |
| **Unit – II** | **Business & Competition** | **9 + 3** |
| **Competitive Analysis** - Competitor identification, analysis, and actions<br>**Business Strategy** –Scenarios, Decision Model, Metrics<br>**Business Operations** - Forecasting | | |
| **Unit – III** | **Product and Price** | **9 + 3** |
| **Product and Service Analytics** - Conjoint analysis and product/service metrics<br>**Price Analytics** - Pricing techniques and assessment | | |
| **Unit – IV** | **Distribution & Promotion** | **9 + 3** |
| **Distribution Analytics** –Characteristics, Channel evaluation and selection, Multichannel distribution and metrics.<br>**Promotion Analytics** - Promotion budget estimation and allocation, Metrics | | |
| **Unit – V** | **Sales** | **9 + 3** |
| **Sales Analytics** - Metrics for sales, profitability, and support | | |
| | | **Lecture: 45, Tutorial: 15, Total:60** |

**TEXT BOOKS**


| | |
|---|---|
| 1. | Stephen Sorger, "Marketing Analytics: Strategic Models and Metrics", 1st Edition, Admiral Press, UK, 2016. |
| 2. | Wayne L. Winston, "Marketing Analytics: Data-Driven Techniques with Microsoft Excel", 1st Edition, Wiley, New Delhi, 2018. |


**REFERENCES**


| | |
|---|---|
| 1. | Tommy Blanchard, "Data Science for Marketing Analytics", 1st Edition, Packt Publishing, UK, 2019. |
| 2. | Mike Grigsby, "Marketing Analytics", 2nd Edition, Kogan Page, UK, 2018. |
| 3. | David A. Aaker, V. Kumar, Robert P. Leone, George S. Day., "Marketing Research", 1st Edition, Wiley, New Delhi, 2019. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | Understand the importance of Analytics in Marketing, size and segment the market | Understanding (K2) |
| CO2 | Understand the Business, competition and its related decisions. | Understanding (K2) |
| CO3 | Identify important features of a product and suitable pricing methods. | Applying (K3) |
| CO4 | Assess Channel performance and Promotion Metrics. | Applying (K3) |
| CO5 | Assess sales performance. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | 2 | 3 | 1 | | |
| CO2 | | | | | | | | | | 2 | 3 | 1 | | |
| CO3 | | | | | | | | | | 2 | 3 | 1 | | |
| CO4 | | | | | | | | | | 2 | 3 | 1 | | |
| CO5 | | | | | | | | | | 2 | 3 | 1 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 35 | 65 | | | | | 100 |
| CAT2 | 15 | 35 | 50 | | | | 100 |
| CAT 3 | 15 | 15 | 70 | | | | 100 |
| ESE | 25 | 25 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

| 22MAO01 - MATHEMATICAL FOUNDATIONS FOR MACHINE LEARNING | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Mathematics) | | | | | | | |
| **Programme & Branch** | **All B.E/.BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | To impart the basic knowledge in linear algebra, decomposition of matrices, continuous optimization, linear regression and support vector machines which provide the foundations for machine learning and deep learning. | |
| **Unit – I** | **Vector Spaces:** | **9+3** |
| Real Vector spaces (Definition & Problems) – Subspaces – Linear Combinations – Linear dependence and independence – Basis and dimension – Row space, Column space and Null Space. | | |
| **Unit – II** | **Linear Transformations:** | **9+3** |
| Introduction – Rank and nullity. – Dimension theorem – Kernel and range – Change of basis – Composition and inverse transformations – Matrices of linear transformations. | | |
| **Unit – III** | **Inner Product Spaces:** | **9+3** |
| Norms – Inner products – Length and Distance – Angle and Orthogonality – Orthonormal Basis – Gram-Schmidt Process – QR-Decomposition. | | |
| **Unit – IV** | **Matrix Decomposition and Vector Calculus:** | **9+3** |
| Matrix Decomposition: Cholesky decomposition – Singular Value Decomposition.<br>Vector Calculus: Differentiation of Univariate Functions – Partial Differentiation and Gradients – Gradients of Vector valued functions – Gradients of matrices – Useful Identities for Computing Gradients – Higher Order Derivatives – Linearization and Multivariate Taylor Series. | | |
| **Unit – V** | **Optimization:** | **9+3** |
| Introduction – Classification of Optimization Problems – Constrained multivariable optimization with inequality constraints – Kuhn Tucker conditions – Lagrange's multiplier method –- Unconstrained optimization: Steepest descent method – Newton's method. | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**


| | |
|---|---|
| 1. | Howard Anton and Chris Rorres, "Elementary Linear Algebra", 11th Edition, John Wiley & Sons, New Delhi, 2014 for Units I,II,III. |
| 2. | M. P. Deisenroth, A. A. Faisal, and C. S. Ong, "Mathematics for Machine Learning", 1st Edition Cambridge University Press, 2019 for Units – IV, V. |


**REFERENCES:**


| | |
|---|---|
| 1. | David C. Lay, Steven R. Lay, Judith McDonald, "Linear Algebra and its Applications", 5th Edition, Pearson Education, New Delhi, 2016. |
| 2. | Ethem Alpaydin, "Introduction to Machine Learning(Adaptive Computation and Machine Learning series)", 4th Edition, MIT Press,USA,2020. |
| 3. | R. O. Duda, E. Hart, and D.G. Stork, "Pattern classification", 2nd Edition, John Wiley & Sons, 2012. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | understand the concepts of vector spaces. | Understanding (K2) |
| CO2 | interpret the concepts of linear transformations. | Understanding (K2) |
| CO3 | apply the concept of inner product space and decompose the given matrix by means of orthonormal vectors. | Applying (K3) |
| CO4 | demonstrate the knowledge of factorisation of matrices and vectors in Machine learning. | Understanding (K2) |
| CO5 | identify suitable optimization algorithms for machine learning applications. | Applying (K2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 1 | | | | | | | | | | | | |
| CO3 | 3 | 2 | | | | | | | | | | | | |
| CO4 | 3 | 3 | 3 | 1 | | | | | | | | | | |
| CO5 | 3 | 2 | 3 | 3 | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 15 | 65 | 20 | | | | 100 |
| CAT2 | 15 | 65 | 20 | | | | 100 |
| CAT3 | 15 | 50 | 60 | | | | 100 |
| ESE | 10 | 40 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

| 22MAO02 - NUMERICAL COMPUTING | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Mathematics) | | | | | | | |
| **Programme & Branch** | **All B.E/.BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | To impart knowledge in interpolation, numerical differentiation and integration. Also develop skills to apply numerical algorithms to identify roots of algebraic and transcendental equations, finding eigen values and solve linear system of equations, ordinary differential equations. | |
| **Unit – I** | **Solution to Algebraic and Transcendental Equations and Eigen value problems:** | **9+3** |
| Solution to Algebraic and Transcendental Equations**:** Bisection method **-** Iteration method – Method of false position – Newton-Raphson method<br>Iterative method for Eigen values: Power method – Jacobi's method. | | |
| **Unit – II** | **Solution of Simultaneous Linear Algebraic equations:** | **9+3** |
| Introduction - Direct methods: Gauss elimination method – Gauss - Jordan method – LU decomposition method – Crout's method –Iterative methods: Gauss Jacobi and Gauss – Seidel methods. | | |
| **Unit – III** | **Interpolation:** | **9+3** |
| Interpolation with equal intervals: Newton's forward and backward difference formulae – Central difference interpolation formulae: Gauss forward and backward interpolation formulae – Interpolation with unequal intervals: Lagrange's interpolation formula – Newton's divided difference formula. | | |
| **Unit – IV** | **Numerical Differentiation and Integration:** | **9+3** |
| Differentiation using Newton's forward, backward and divided difference formulae – Numerical integration: Trapezoidal rule – Simpsons 1/3rd rule – Simpsons 3/8th rule – Double integrals using Trapezoidal and Simpson's rules. | | |
| **Unit – V** | **Numerical Solution of First order Ordinary Differential Equations:** | **9+3** |
| Single step methods**:** Taylor series method – Euler method – Modified Euler method – Fourth order Runge-Kutta method – Multi step methods: Milne's predictor corrector method – Adam's Bashforth method. | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Veerarajan T, Ramachandran T., "Numerical Methods", 1st Edition, Tata McGraw Hill Publishing Company, New Delhi, 2018. |

**REFERENCES:**



| | |
|---|---|
| 1. | Kandasamy, P., Thilakavathy, K. and Gunavathy, K., "Numerical Methods", Reprint Edition, S.Chand & Co, New Delhi, 2016. |
| 2. | Sankara Rao. K., "Numerical Methods for Scientists and Engineers", 3rd Edition, Prentice Hall of India Pvt. Ltd, , New Delhi, 2007. |
| 3. | Steven C. Chapra, Raymond P. Canale., "Numerical Methods for Engineers", 7th Edition, McGraw-Hill Education, 2014. |
| 4. | Sastry, S.S, "Introductory Methods of Numerical Analysis", 5th Edition, PHI Learning Pvt. Ltd, 2015. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | apply various numerical techniques to solve algebraic and transcendental equations. | Applying (K3) |
| CO2 | solve simultaneous linear equations by numerical methods. | Applying (K3) |
| CO3 | compute intermediate values of given evenly (or) unevenly spaced data. | Applying (K3) |
| CO4 | apply the concepts of numerical differentiation and integration in real time applications. | Applying (K3) |
| CO5 | identify the solution of first ordinary differential equations by numerical methods. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | | |
| CO2 | 3 | 2 | 2 | | | | | | | | | | | |
| CO3 | 3 | 3 | 2 | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 3 | 3 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| **Test / Bloom’s Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 15 | 75 | | | | 100 |
| CAT2 | 10 | 15 | 75 | | | | 100 |
| CAT3 | 10 | 15 | 75 | | | | 100 |
| ESE | 10 | 15 | 75 | | | | 100 |

* ±3% may be varied (CAT 1,2  & 3 – 50 marks & ESE – 100 marks)

| 22MAO03 - STOCHASTIC PROCESSES AND QUEUING THEORY | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Mathematics) | | | | | | | |
| **Programme & Branch** | **All B.E/.BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | To provide an in-depth knowledge in random variables, random process, correlation and promote the ability to apply suitable queuing models to real time applications. | |
| **Unit – I** | **Random Variables:** | **9+3** |
| Discrete and Continuous random variables – Probability Mass and Probability density functions – Mathematical expectation and Variance – Moments – Moment generating functions. | | |
| **Unit – II** | **Random processes:** | **9+3** |
| General concepts and definitions – Classification – Stationary process – Markov chains – Transition probabilities – Poisson process. | | |
| **Unit – III** | **Correlation and Spectral densities:** | **9+3** |
| Auto Correlation – Cross Correlation – Properties (Without Proof) – Power spectral density – Cross spectral density – Properties (Without Proof) – Wiener- Khintchine relation – Relationship between cross power spectrum and cross correlation function. | | |
| **Unit – IV** | **Queuing Theory:** | **9+3** |
| Characteristics of a queueing system – Kendall's notation – Queuing model I ( Infinite capacity single server Poisson queue model) (M/M/1) : (∞/FIFO) – Little's formulae – Queuing model II (Infinite capacity multiple server Poisson queue model (M/M/C): (∞/FIFO) – Queuing model III (Finite capacity single server Poisson queue model) (M/M/1): (N/FIFO) – Queueing model IV (Finite capacity multiple server Poisson model) (M/M/C) : (N/ FIFO). | | |
| **Unit – V** | **Non-Markovian Queues and Queue Networks:** | **9+3** |
| Introduction to Non-Markovian queues – M/G/1 queue – Pollaczek-Khintchine formula – Series queues – Open and Closed queuing networks | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**


| | |
|---|---|
| 1. | Veerarajan, T, "Probability and Statistics, Random Processes and Queuing Theory", 1st edition, McGraw-Hill Education, Chennai, 2019. |


**REFERENCES:**


| | |
|---|---|
| 1. | Athanasios Papoulis, S. Unnikrishna Pillai., "Probability, Random Variables and Stochastic Processes", 4th edition, McGraw Hill, New Delhi, 2017. |
| 2. | Allen A.O., "Probability, Statistics and Queuing Theory", 2nd Edition, Academic Press, New Delhi, 1990. |
| 3. | Roy D. Yates and David J. Goodman, "Probability and Stochastic Processes - A friendly Introduction for Electrical and Computer Engineers", 3rd edition, John Wiley & Sons, 2014. |
| 4. | John F. Shortle, James M. Thompson, Donald Gross and Carl M. Harris, "Fundamentals of Queuing Theory", 5th edition, John Wiley and Sons, New York, 2018. |

| **COURSE OUTCOMES:** **On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | apply random variables suitably in practical problems. | Applying (K3) |
| CO2 | apply the concept of random process in communication problems. | Applying (K3) |
| CO3 | understand the concepts and properties of Spectral Density Function and Cross Correlation function. | Understanding (K2) |
| CO4 | use the appropriate queuing model for a given practical application. | Applying (K3) |
| CO5 | identify the real time queue in computer networks and take decision accordingly. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 2 | | | | | | | | | | | | |
| CO3 | 3 | 2 | | | | | | | | | | | | |
| CO4 | 3 | 3 | 3 | | | | | | | | | | 2 | |
| CO5 | 3 | 3 | 3 | | | | | | | | | | 3 | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 20 | 70 | | | | 100 |
| CAT2 | 10 | 30 | 60 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 20 | 70 | | | | 100 |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

| 22MAO04 - STATISTICS FOR ENGINEERS | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Mathematics) | | | | | | | |
| **Programme & Branch** | **All B.E/.BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | To impart the basic knowledge in presentation of data, descriptive statistical measures and provide skills to apply correlation, suitable non- parametric tests and control charts to control the variations in real time applications. | |
| **Unit – I** | **Organization and Presentation of Data:** | **9+3** |
| Introduction to Statistics – Collection of data – Classification and tabulation of data – Types of data: primary, secondary, quantitative and qualitative data – Types of Measurements: nominal, ordinal, discrete and continuous data – Presentation of data – Diagrammatic and Graphical Representation: Histogram - Frequency curve - Frequency polygon - Cumulative frequency distributions – Ogive curves – Stem and leaf chart. | | |
| **Unit – II** | **Descriptive Statistics:** | **9+3** |
| Measures of location or central tendency: Arithmetic mean – Median – Mode – Geometric mean – Harmonic mean – Partition values: Quartiles – Deciles and percentiles – Measures of dispersion: Mean deviation – Quartile deviation – Standard deviation – Coefficient of variation – Measures of skewness – Kurtosis. | | |
| **Unit – III** | **Correlation and Regression:** | **9+3** |
| Correlation and Regression: Scatter Diagram – Karl Pearson's Correlation Coefficient – Rank Correlation - Regression Coefficients – Fitting of Regression Lines.<br>Multiple Correlation and Regression: Multiple and partial correlation – Method of least squares – Plane of regression – Properties of residuals – Coefficient of multiple correlation – Coefficient of partial correlation – Multiple correlation with total and partial correlations – Regression and partial correlations in terms of lower order coefficient.. | | |
| **Unit – IV** | **Non-parametric tests:** | **9+3** |
| Introduction – Sign test: One sample sign test – Sign test for paired samples – Signed rank test – Rank Sum test: Mann Whitney U test – Kruskal-Wallis test – One sample run test – Tests of randomness. | | |
| **Unit – V** | **Statistical Quality Control:** | **9+3** |
| Introduction to Statistical quality control – Control charts – Control chart for variables: $\bar{X}$-chart – R-chart – s-chart – Charts for attributes: np-chart – p-chart – c-chart. | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | S.P.Gupta, "Statistical Methods", 44th Revised Edition, Sultan Chand & Sons, New Delhi, 2011 for Units I,II, V |
| 2. | S.C.Gupta, V.K.Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand & Sons, New Delhi, 2022. for Units III, IV. |

**REFERENCES:**


| | |
|---|---|
| 1. | Jay L. Devore., "Probability and Statistics for Engineering and the Sciences", 9th Edition, Cengage Learning, USA, 2016. |
| 2. | G.C.Beri, "Business Statistics", 3rd Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2011. |
| 3. | Johnson. R.A., Miller. I and Freund. J., "Probability and Statistics for Engineers", 9th Edition, Pearson Education, India, 2018. |
| 4. | Anthony Hayter, "Probability and Statistics for Engineers and Scientists", 4th Edition, Cengage Learning, USA, 2012. |
| 5. | J. K. Sharma, "Business Statistics", 5th Edition, Vikas Publishing House Pvt Ltd, Noida, 2020. |

| **COURSE OUTCOMES:** **On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | demonstrate the classification of data and present the data in various forms. | Understanding (K2) |
| CO2 | compute and interpret descriptive statistical measures using numerical and graphical techniques. | Applying (K3) |
| CO3 | apply statistical methods like correlation, regression analysis in analysing and interpreting experimental data. | Applying (K3) |
| CO4 | use appropriate non-parametric test to analyze experimental data. | Applying (K3) |
| CO5 | identify suitable control charts for monitoring processes.. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | | | | | |
| CO2 | 3 | 2 | | | | | | | | | | | | |
| CO3 | 3 | 3 | 2 | | | | | | | | | | | |
| CO4 | 3 | 3 | 1 | | | | | | | | | | | |
| CO5 | 3 | 3 | 3 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 40 | 50 | | | | 100 |
| CAT2 | 10 | 20 | 70 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 20 | 70 | | | | 100 |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

**22PHO01 - THIN FILM TECHNOLOGY**
(Offered by Department of Physics)

| Programme & Branch | All BE/BTech Branches | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course aims to impart the essential knowledge on deposition, characterization and application of thin films in various engineering fields, and also provides motivation towards innovations. | |
| **Unit – I** | **Theories and models of thin film growth:** | **9+3** |
| Introduction – Theories of thin film nucleation: Impingement, Adsorption and Thermal accommodation – The capillarity model – The atomistic models – Structural consequences of thin film nucleation – The four stages of film Growth – The incorporation of defects during growth. | | |
| **Unit – II** | **Vacuum technology:** | **9+3** |
| Principle and working of vacuum pumps: Roots vacuum pump, Rotary pump, Diffusion pump, Turbo molecular pump, Cryogenic pump, Ion pump, Ti-sublimation pump – Measurement of Pressure: Bayet-Albert gauge, Pirani and Penning gauge – Cold cathode and hot cathode ionization gauges – Pressure controlling system (qualitative). | | |
| **Unit – III** | **Deposition of thin films - Physical methods:** | **9+3** |
| Thermal evaporation – Electron beam evaporation – Pulsed laser deposition – Ion plating – DC sputtering – RF sputtering – Magnetron sputtering – Reactive sputtering – Molecular beam epitaxy - Demonstration of deposition of thin films by RF sputtering. | | |
| **Unit – IV** | **Deposition of thin films – Chemical methods:** | **9+3** |
| Chemical vapor deposition – Sol-gel method – Chemical bath deposition – Hydro thermal methods – Electroplating deposition – Electroless deposition – Spray Pyrolysis - Spin coating. | | |
| **Unit – V** | **Characterization and Applications of thin films:** | **9+3** |
| Characterization: X-ray diffraction, Energy dispersive X-ray analysis, Atomic probe microscopy, Scanning Tunneling Microscope, X-ray Photoemission Spectroscopy, UV-vis spectroscopy and Four probe resistivity – Applications (qualitative): Thin film solar cells, Thin film gas sensors, Thin films for information storage and Optical coatings. | | |
| | | **Lecture: 45, Tutorial: 15, Total: 60** |

**TEXT BOOK:**


| | |
|---|---|
| 1. | Maissel L.I. and Glang R, Hand book of Thin Film Technology, Reprint, McGraw Hill Inc., New York, 1970, (Unit I – IV) |
| 2. | Sam Zhang, Lin Li and Ashok Kumar, Materials Characterization Techniques, 1st edition, CRC Press, Boca Raton, 2008 (Unit V) |


**REFERENCES:**


| | |
|---|---|
| 1. | Ohring M, Material Science of Thin Films, 2nd Edition, Academic Press, New Jersey, 2001 |
| 2. | Goswami A, Thin Film Fundamentals, Reprint, New Age International (P) Ltd, New Delhi, 2003 |
| 3. | Chopra K. L, Thin Film Phenomena, Illustrated, McGraw Hill Inc., New York, 1969 |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | utilize the appropriate theory and models to comprehend the thin film growth process. | Applying (K3) |
| CO2 | apply the principle of vacuum pump to explain select methods to create vacuum and to make use of the principle of vacuum gauge to explain the measurement of vacuum by select methods. | Applying (K3) |
| CO3 | describe the deposition of thin films by select physical methods using the principle of working of respective methods. | Applying (K3) |
| CO4 | explain the deposition of thin films by select chemical methods using the principle of working of respective methods. | Applying (K3) |
| CO5 | make use of select characterization techniques to comprehend the properties of thin films and also to illustrate the various device applications of thin films. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| **COs/POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO2 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO3 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO4 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO5 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| **Test / Bloom’s Category*** | **Remembering (K1) %** | **Understanding (K2) %** | **Applying (K3) %** | **Analyzing (K4) %** | **Evaluating (K5) %** | **Creating (K6) %** | **Total %** |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 35 | 40 | | | | 100 |
| CAT2 | 25 | 35 | 40 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

*** ±3% may be varied (CAT 1, 2, 3 – 50 marks & ESE – 100 marks)**

**22PHO02 - HIGH ENERGY STORAGE DEVICES**
(Offered by Department of Physics)

| **Programme& Branch** | **All BE/BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course aims to impart the essential knowledge on the fundamental principles and application areas of proven technologies and materials for energy storage solutions, together with an overview of development trends in this engineering field. | |
| **Unit – I** | **Introduction to Energy Storage:** | **9+3** |
| An overview of energy storage systems (qualitative): Thermal energy storage, mechanical energy storage, chemical energy storage, electrical energy storage, electrochemical energy storage, electrostatic energy storage, magnetic energy storage and optical energy storage – General criteria of energy storage systems – Conventional batteries: fundamentals and applications – Grid connected and off grid energy storage systems and requirements. | | |
| **Unit – II** | **Thermal storage and Mechanical Storage:** | **9+3** |
| Thermal storage: Thermal properties of materials, principle of operations, efficiency factors, large scale and medium scale operations – Merits and demerits of thermal storage system – Recent development in thermal storage systems. Mechanical Storage: Types of mechanical storage systems, principle of operations, emerging advances and technologies in mechanical storage systems – Flywheel. | | |
| **Unit – III** | **Magnetic storage, Electro-optic, Optical and Chemical Storage:** | **9+3** |
| Magnetic storage: Principle of operation, emerging challenges and a review on devices and technology. Electro-optic and optical storage: Emerging devices and upcoming technologies (qualitative). Chemical storage: Power to gas – Hydrogen and Methane. Power to liquid – Bio fuels – Aluminum-Boron, silicon, and zinc. | | |
| **Unit – IV** | **Electrochemical Storage:** | **9+3** |
| Materials, Principle of operation, positive electrode materials, negative electrode materials, electrolytes. Li-ion batteries: Principle of operation, battery components, design of electrodes, cell and battery fabrications – Building block cells – Battery modules and packs –Li-polymer batteries – Applications – Future developments: Sodium-battery, magnesium battery, aluminum battery and silicon battery. | | |
| **Unit – V** | **Fuel Cells, Hydrogen storage and Super capacitors:** | **9+3** |
| Fuel Cells: Introduction to fuel cells, PEM (polymer electrolyte membrane), Hydrogen PEM fuel cell, direct methanol fuel cell, alkaline fuel cells and solid oxide fuel cells. Hydrogen storage systems: Solid state hydrogen storage tanks, gas phase hydrogen storage tanks, cryogenic hydrogen storage tanks and liquid phase hydrogen storage tanks. Super capacitors: Features of super capacitors, basic principle of operation, performance and technologies of super capacitors. | | |
| | | **Lecture: 45, Tutorial: 15, Total: 60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Robert A. Huggins, Energy Storage, Springer, 2010, (Unit I – V) |
| 2. | Ehsani, Y. Gao, S. Gay, A. Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles, CRC Press, New York, 2005 (Unit I - V) |

**REFERENCES:**


| | |
|---|---|
| 1. | Yuping Wu, Lithium-Ion Batteries: Fundamentals and Applications (Electrochemical Energy Storage and Conversion), CRC Press, United Kingdom, 2015 |
| 2. | Trevor M. Letcher, Storing Energy: with Special Reference to Renewable Energy Sources, 2nd edition, Elsevier, 2022 |
| 3. | D. Linden and T. S. Reddy, Handbook of Batteries, 4th edition, McGraw Hill, Newyork, 2011 |

| **COURSE OUTCOMES:** **On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | utilize the appropriate concepts and models to comprehend the basics of energy storage systems. | Applying (K3) |
| CO2 | apply the principle of thermal and mechanical storage systems to explain the working and the recent advancements in thermal and mechanical storage systems. | Applying (K3) |
| CO3 | ultilize the principle of operation of magnetic storage systems, electro-optic, optical and chemical storage systems to illustrate the respective process under gone in these techniques. | Applying (K3) |
| CO4 | explain the principle of operation of electrochemical storage device and materials used and to elucidate the construction and working of various types of high energy storage batteries. | Applying (K3) |
| CO5 | make use of various techniques to construct different types of fuel cells and to explain the advanced techniques involved in hydrogen storage systems and also to explain the principle and working of super capacitors. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO2 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO3 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO4 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO5 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 35 | 40 | | | | 100 |
| CAT2 | 25 | 35 | 40 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

*** ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)**

## 22PHO03 - STRUCTURAL AND OPTICAL CHARACTERIZATION OF MATERIALS

(Offered by Department of Physics)

| Programme& Branch | All BE/BTech Branches | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course aims to impart the essential knowledge on the characterization of materials using X-ray diffraction, Raman spectroscopy, UV-visible spectroscopy, Electron microscopy and Scanning tunneling microscopy and their application in various engineering fields, and also provides motivation towards innovations. | |
| **Unit – I** | **Introduction to Characterization Techniques and X-Ray Diffraction:** | **9+3** |
| Importance of materials characterization – Classification of characterization techniques – Crystalline materials – Reciprocal lattice – Theory of X-ray diffraction – Powder and Single crystal X-ray diffraction: Instrumentation (qualitative), XRD pattern, systematic procedure for structure determination (qualitative), crystallite size determination (Scherrer equation), strain calculation – Applications. | | |
| **Unit – II** | **Electron Microscopy:** | **9+3** |
| Need of electron microscopy – Electron specimen interaction: Emission of secondary electrons, backscattered electrons, characteristic X-rays, transmitted electrons, specimen interaction volume – Resolution – Scanning electron microscope and transmission electron microscope: Schematic diagram and working – Different types of filaments – Field emission scanning electron microscope –Wavelength dispersive X-ray analysis – Three parameter equation for quantitative composition analysis. | | |
| **Unit – III** | **Scanning Tunneling Microscopy:** | **9+3** |
| Introduction to quantum mechanical tunneling – Basic principles of scanning tunneling microscopy – Two modes of scanning: constant height mode and constant voltage mode – Instrumentation and working – Applications. | | |
| **Unit – IV** | **Raman Spectroscopy:** | **9+3** |
| Introduction – Pure rotational Raman spectra – Vibrational Raman spectra – Polarization of light and Raman effect – Structure determination – Instrumentation and working – Near-Infra-Red Raman Spectroscopy – Applications. | | |
| **Unit – V** | **Ultra Violet &Visible Spectroscopy:** | **9+3** |
| Regions of UV-Visible radiation – Colour and light absorption – Chromophore concept – Beer's and Lambert's laws – Theory of electronic transition – Frank-Condon principle – Instrumentation and working – Applications. | | |
| | | **Lecture: 45, Tutorial: 15, Total: 60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Cullity B. D. and Stock S. R, Elements of X-ray diffraction, 3rd Edition, Pearson Education, India, 2003 (Unit I) |
| 2. | Banwell C. N, McCash E. M, Choudhury H. K, Fundamentals of Molecular Spectroscopy, 5th Edition, Tata McGraw-Hill Publ., New Delhi, 2013 (Unit II-V) |

**REFERENCES:**

| | |
|---|---|
| 1. | Holt D. B. and Joy D. C, SEM micro characterization of semiconductors, 1st Edition, Academic Press, New Delhi, 1989 |
| 2. | Willard H. H., Merritt L. L., John A Dean, and Settle Jr. F. A, Instrumental methods of Analysis 7th Edition, Wadsworth Publishing Company, United States, 1988 |
| 3. | Elton N. Kaufman, Characterization of Materials (Volume1 & 2), 2nd, Wiley-Interscience, New Jersey, 2012 |

| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | apply the concept of X-ray diffraction to determine the crystal structure and related structural parameters of materials. | Applying (K3) |
| CO2 | determine the micro-structural parameters of materials and to perform surface analysis of materials using the concept of matter waves and electron microscopy. | Applying (K3) |
| CO3 | utilize the concept and phenomenon of quantum mechanical tunneling to interpret the surface image recorded at atomic level using scanning tunneling microscopy. | Applying (K3) |
| CO4 | make use of the concept of Raman effect and Raman spectroscopy to determine the crystal structure and related structural parameters of materials. | Applying (K3) |
| CO5 | apply the theory of UV-Vis spectroscopy to comprehend the working of UV-Vis spectrophotometer. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO2 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO3 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO4 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO5 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 40 | 40 | | | | 100 |
| CAT2 | 25 | 35 | 40 | | | | 100 |
| CAT3 | 30 | 30 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

*** ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)**

**22CYO01 - INSTRUMENTAL METHODS OF ANALYSIS**

(Offered by Department of Chemistry)

| **Programme & Branch** | **All BE / BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | Instrumental methods of analysis aim to prepare the students to have all-encompassing knowledge of spectral methods in order to identify the molecules and reaction mechanism for the process to enhance application towards the industries. | |
| **Unit – I** | **Absorption and Emission Spectroscopy** | **9+3** |
| Basic concepts of Absorption and Emission Spectroscopy – representation of spectra – basic elements of practical spectroscopy – signal to noise ratio - techniques for signal to noise enhancement – resolving power – Fourier transform spectroscopy – evaluation of results – basic principles, instrumentation and applications of Atomic Absorption, Atomic Fluorescence and Atomic Emission Spectroscopy. | | |
| **Unit – II** | **IR, Raman and NMR Spectroscopy** | **9+3** |
| Infrared Spectroscopy – correlation of IR Spectra with molecular structure, instrumentation, samplings technique and quantitative analysis.<br>Raman Spectroscopy – Classical and Quantum theory instrumentation, Structural analysis and quantitative analysis.<br>Nuclear Magnetic resonance Spectroscopy – basic principles – pulsed Fourier transform NMR spectrometer – Structural elucidation using NMR spectra and quantitative analysis. | | |
| **Unit – III** | **Surface Studies** | **9+3** |
| Surface Study – X-Ray Emission Spectroscopy (XES), X- Ray Photo Electron Spectroscopy (XPS) - Auger Electron Spectroscopy (AES) - Transmission Electron Microscopy (TEM) - Scanning Electron Microscopy (SEM) - Surface Tunneling Microscopy (STEM) - Atomic Force Microscopy (AFM). | | |
| **Unit – IV** | **Mass Spectroscopy** | **9+3** |
| Mass spectroscopy – Ionization methods in mass spectroscopy – mass analyzer – ion collection systems - correlation of molecular spectra with molecular structure - Instrumentation design and application of Fourier Transform Mass Spectroscopy (FT-MS) and Ion Microprobe Mass Analyzer (IMMA). | | |
| **Unit - V** | **Thermal Analysis** | **9+3** |
| Thermal Analysis: principles and instrumentations and applications of Thermogravimetry (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC), evolved gas detection, Thermo Mechanical Analysis and Thermometric Titration. | | |
| | | **Lecture: 45, Tutorial: 15, Total: 60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Chatwal. G. R., Anand, Sham K., “Instrumental Methods of Chemical Analysis” 5th Edition, Himalaya Publishing House, 2019. |

**REFERENCES:**


| | |
|---|---|
| 1. | B.K. Sharma, Instrumental Method of Chemical Analysis, Krishna Prakashan Media (P) Ltd. 2019. |
| 2. | Willard,H.H, Merritt,L.L, Dean,J.A, and Settle, F.A, “Instrumental methods of analysis” CBS Publishers & Distributors, 7 Ed, 2004. |
| 3. | Kaur. H, “Instrumental Methods of Chemical Analysis”, XII Edition, Pragati prakashan, Meerat, 2018. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | illustrate the basics of spectroscopy to understand the instrumentation of various spectral techniques. | Understanding (K2) |
| CO2 | apply the IR, Raman and NMR for quantitative analysis of the sample. | Applying (K3) |
| CO3 | apply the various techniques for the better understanding of surface morphology. | Applying (K3) |
| CO4 | explain the principle, instrumentation of mass spectroscopy for the analysis of organic sample. | Understanding (K2) |
| CO5 | illustrate the thermal analysis for the identification of thermal stability of the compounds. | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/Pos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO4 | 3 | 1 | | | | | | | | | | | | |
| CO5 | 3 | 1 | | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 35 | 40 | | | | 100 |
| CAT2 | 25 | 35 | 40 | | | | 100 |
| CAT3 | 25 | 35 | 40 | | | | 100 |
| ESE | 25 | 35 | 40 | | | | 100 |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

## 22CYO02 - CHEMISTRY CONCEPTS FOR COMPETITIVE EXAMINATIONS

(Offered by Department of Chemistry)

| **Programme & Branch** | **All BE / BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course aims to refresh the knowledge of chemistry required for competitive examinations and equip the students with a capacity to solve the problems in chemistry while participating various competitive examinations including TNFUSRC-FORESTER (paper-II: General science-chemistry), UPSC-IAS (prelims: General science-chemistry), GATE (thermodynamics concept for chemical & mechanical engineering). | |
| **Unit – I** | **Periodic Classification of Elements** | **9+3** |
| Mendeleev's periodic table-Law and classification of elements- Modern periodic law-Modern periodic table and its characteristics - Periodic properties – important aspects of s, p & d block elements -Reactivity series and Uses - Alloys-Uses of Alloys- Properties of nano metals and oxides. | | |
| **Unit – II** | **Chemical Equations and Bonding** | **9+3** |
| **Chemical Equations:** Types of ions and radicals- oxidation and reduction-redox reactions - balancing ionic equations.<br>**Chemical Bonding:** Octet rule -types of chemical bond -formation of ionic and covalent bond- common properties of ionic and covalent compounds- differences between ionic and covalent compounds-Coordinate covalent bond- Coordination compounds – nomenclature and isomerism - application in analytical chemistry. | | |
| **Unit – III** | **Acids, Bases, Salts and Metallurgy** | **9+3** |
| **Acid- base theory** – Bronsted- Lowry theory- conjugate acid-base- Lewis concept- HSAB- applications- pH scale- Importance of pH in everyday life-salts-classification of salts-uses of salts.<br>**Metallurgy:** introduction-terminologies in metallurgy-differences between minerals and ores-occurrence of metals- metallurgy of aluminum, copper and iron. | | |
| **Unit – IV** | **Carbon and its Compounds** | **9+3** |
| Introduction-compounds of carbon-modern definition of organic chemistry- bonding in carbon and its compounds-allotropy-physical nature of carbon and its compounds-chemical properties of carbon compounds-homologous series-hydrocarbons and their types-functional groups- classification of organic compounds based on functional group-ethanol-ethanoic acid. | | |
| **Unit – V** | **Thermodynamics** | **9+3** |
| Introduction- some important terms in thermodynamics-thermodynamic system, process, properties and energy- first law of thermodynamics: mathematical expression and interpretation- applications of first law of thermodynamics-molar heat capacity-reversible isothermal expansion/compression of an ideal gas-adiabatic expansion of an ideal gas-isobaric and isochoric processes in ideal gases- second laws of thermodynamics: entropy- entropy change for isolated system (system and surroundings)- entropy change for system only (ideal gas)- entropy change for mixing of ideal gases-entropy of physical changes- entropy of chemical changes-Maxwell relations. | | |
| | | **Lecture: 45, Tutorial: 15, Total: 60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Steven S. Zumdahl, Susan A. Zumdahl and Donald J. DeCoste , "Chemistry", 10th Edition, Cengage Learning, 2018., for Units-I, II, III, IV. |
| 2. | Wiley editorial board. "Wiley Engineering Chemistry". 2nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019, for Units- I, II, III, V. |

**REFERENCES:**

| | |
|---|---|
| 1. | B.R. Puri, L.R. Sharma, Principles of Inorganic Chemistry, 33rd Edition, Vishal Publishing Co., 2020. |
| 2. | Paula Bruise, "Organic Chemistry", 8th Edition, Pearson Education, 2020. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | apply the basic concept of periodic classification of elements to explain the periodic properties and reactivity series of s, p & d block elements. | Applying (K3) |
| CO2 | utilize the concepts of chemical equation and bonding to solve the problems in balancing ionic equation and differentiate ionic and covalent compounds. | Applying (K3) |
| CO3 | apply the concept of acid, base, salts and metallurgy to explain HSAB concepts, Importance of pH in everyday life, classification of salts and metallurgy of Al, Cu & Fe. | Applying (K3) |
| CO4 | make use of the concept of carbon and its compounds to explain bonding and classification of carbon compounds. | Applying (K3) |
| CO5 | utilize the important terms and concepts of thermodynamics to explain the first law and second law of thermodynamics with examples. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/Pos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 35 | 40 | | | | 100 |
| CAT2 | 25 | 35 | 40 | | | | 100 |
| CAT3 | 25 | 35 | 40 | | | | 100 |
| ESE | 25 | 35 | 40 | | | | 100 |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

## 22CYO03 – ORGANIC CHEMISTRY FOR INDUSTRY

(Offered by Department of Chemistry)

| **Programme & Branch** | **All BE / BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **5** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | Organic Chemistry for Industry aims to equip the students to have wide-range knowledge on organic chemistry in order to meet the industrial needs. | |
| **Unit – I** | **Basic aspects of Organic Chemistry** | **9+3** |
| Organic intermediates: carbocations, carbanions, free radicals, carbenes and nitrenes, their method of formation, stability and synthetic applications- Nucleophilic uni- and bimolecular reactions (SN1 and SN2)- Elimination reactions (E1 & E2; Hoffman & Saytzeff's rule). | | |
| **Unit – II** | **Molecular Rearrangements** | **9+3** |
| Reactions involving electron deficient, carbon, nitrogen, oxygen centers, emphasis on synthetic utility of the rearrangements - Migration of carbon: Wagner-Meerwein, Pinacol-pinacolone, benzyl-benzilic acid rearrangement – Migration of nitrogen: Beckmann rearrangement, Hofmann, Curtius, Lossen rearrangements- Migration of oxygen: Bayer-Villiger oxidation. | | |
| **Unit – III** | **Synthetic Reagents & Applications** | **9+3** |
| Lithium aluminium hydride- sodium borohydride- selenium-di-oxide- osmium tetroxide- phenyl isothiocyanate- N-bromosuccinamide (NBS)- lead tetraacetate - dicyclohexylcarbodiimide (DCC) – pyridinium chlorochromate (PCC) – Swern oxidation –p-toluenesulphonyl chloride – trifluoroacetic acid- lithium diisopropylamide (LDA) – 1,3- dithiane (reactive umpolung) - crown ethers-Trimethyl silyl iodide - dichlorodicyanobenzoquinone (DDQ) – Gilman reagent– phase transfer catalysts- Wilkinson's catalysts. | | |
| **Unit – IV** | **Unit Operations** | **9+3** |
| **Extraction:** Liquid equilibria-extraction with reflux-extraction with agitation-counter current extraction. **Filtration:** Theory of filtration- pressure and vacuum filtration-centrifugal filtration. **Distillation:** Azeotropic and steam distillation. **Evaporation**: Types of evaporators-factors affecting evaporation. **Crystallization:** Crystallization from aqueous-non- aqueous solutions factors affecting crystallization-nucleation. | | |
| **Unit – V** | **Unit Processes** | **9+3** |
| **Nitration:** Nitrating agents-aromatic nitration-kinetics and mechanism of aromatic nitration- process equipment for technical nitration-mixed acid for nitration. **Halogenation:** Kinetics of halogenations-types of halogenations-catalytic halogenations-Case study on industrial halogenation process. **Fermentation**: Aerobic and anaerobic fermentation. Production of Antibiotics: Penicillin and Streptomycin-Production of Vitamins: B2 and B12. | | |
| | | **Lecture: 45, Tutorial: 15, Total: 60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | P.S.Kalsi," Organic Reactions and their Mechanisms", $5^{th}$ Edition, New Age International publishers, 2020, for Unit-I, II, III, V. |
| 2. | Arun Bahl, B.S.Bahl, "Advanced Organic Chemistry", $6^{th}$ Edition, S Chand, 2022, for Unit-IV, V. |

**REFERENCES:**

| | |
|---|---|
| 1. | V.K.Ahluwalia, Rakesh Parashar, "Organic Reaction Mechanisms" Fourth Edition, 2011 |
| 2. | Jonathan Clayden, Nick Greeves, Stuart Warren, "Organic Chemistry", $2^{nd}$ Edition, Oxford University Press, 2014. |
| 3. | Paula Yurkanis Bruice, "Organic Chemistry",$8^{th}$ Edition, Pearson, 2020. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | illustrate the basic concept of organic intermediates to explain the SN1, SN2, E1 and E2 reactions. | Understanding (K2) |
| CO2 | utilize the concepts of molecular rearrangement to explain reactions involving electron deficient, carbon, nitrogen, oxygen centers, emphasis on synthetic utility of the rearrangements. | Applying (K3) |
| CO3 | select the suitable synthetic regents for various functional group conversions in organic synthesis. | Applying (K3) |
| CO4 | make use of the concept of extraction, filtration, distillation, evaporation, crystallization for the purification of organic compounds. | Applying (K3) |
| CO5 | apply the concept of nitration, halogenations and fermentation to explain the industrial unit process. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 35 | 40 | | | | 100 |
| CAT2 | 25 | 35 | 40 | | | | 100 |
| CAT3 | 25 | 35 | 40 | | | | 100 |
| ESE | 25 | 35 | 40 | | | | 100 |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

| 22MAO05 - GRAPH THEORY AND ITS APPLICATIONS | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Mathematics) | | | | | | | |
| **Programme & Branch** | **All B.E/.BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **6** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | To develop rigorous logical thinking and analytical skills by graph theoretic concepts which helps for solving real time engineering problems in networks, computer architecture, compiling techniques, model checking, artificial intelligence, software engineering, expert systems, software/hardware correctness problem. | |
| **Unit – I** | **Graphs:** | **9+3** |
| Introduction – Definition – Types of graphs – Degree of vertex – Walk, path and cycle – Isomorphism – Connected graph – Hamiltonian graph – Euler graph – Digraph - Shortest paths – Shortest path algorithms: Dijkstra's algorithm – Warshall's algorithm. | | |
| **Unit – II** | **Trees:** | **9+3** |
| Introduction – Properties of trees – Pendant vertices in a tree – Distances and centers in a tree – Rooted and binary trees – Spanning tree – Construction of spanning tree: BFS algorithm – DFS algorithm - Minimum Spanning tree – Minimal spanning tree algorithms: Prim's algorithm – Kruskal's algorithm. | | |
| **Unit – III** | **Graph Coloring:** | **9+3** |
| Vertex coloring – Chromatic number – Chromatic partitioning – Independent sets – Chromatic polynomial – Matching – Covering – Four color problem (statement only) – Simple applications. | | |
| **Unit – IV** | **Matrix Representation and Applications:** | **9+3** |
| Matrix Representation: Incidence matrix – Circuit matrix - Cut-set matrix – Path Matrix – Adjacency matrix – Properties - The Chinese Postman Problem – Fleury's Algorithm – Travelling salesman problem. | | |
| **Unit – V** | **Network Flows and Applications:** | **9+3** |
| Flows and cuts in networks - Max-flow Min-cut Theorem – Transport networks –Residual capacity and Residual network – Ford-Fulkerson Algorithm – Edmonds-Karp Algorithm – Maximal Flow Applications: Multiple sources and sinks – Maximum Bipartite matching. | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**


| | |
|---|---|
| 1. | Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", 1st Edition, Dover Publications, New York, 2016 for Units I, II, III. |
| 2. | S. Saha Ray, "Graph Theory with Algorithms and Its Applications in Applied Science and Technology", 1st Edition, Springer, London, 2013 for Units IV,V. |


**REFERENCES:**


| | |
|---|---|
| 1. | Douglas B West, "Introduction to Graph Theory", 2nd Edition, Pearson Education, New Delhi, 2002. |
| 2. | Jonathan L. Gross and Jay Yellen, "Graph Theory and its Applications", 2nd Edition, CRC Press, New York, 2006. |
| 3. | J.A.Bondy and U.S.R. Murty ,Graph Theory and Applications , 5th Edition, Elsevier Science Publishing Co., Inc., New York,1982. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | apply basic graph theoretic concepts in finding shortest path. | Applying (K3) |
| CO2 | intrepret the concepts of tress and its types. | Applying (K3) |
| CO3 | compute the Chromatic partition, Chromatic polynomial and Matching of a given graph. | Applying (K3) |
| CO4 | apply the concepts of matrix representation of graph structures. | Applying (K3) |
| CO5 | identify the maximal flow in network by means of suitable algorithms. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | | |
| CO2 | 3 | 1 | | | | | | | | | | | | |
| CO3 | 3 | 1 | | | | | | | | | | | | |
| CO4 | 3 | 2 | 2 | | | | | | | | | | | |
| CO5 | 3 | 2 | 3 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 30 | 60 | | | | 100 |
| CAT2 | 10 | 20 | 70 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 20 | 70 | | | | 100 |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

| 22MAX01 - DATA ANALYTICS USING R PROGRAMMING | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Mathematics) | | | | | | | |
| **Programme & Branch** | **All B.E/.BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **6** | **OE** | **3** | **0** | **2** | **4** |

| | | |
|---|---|---|
| Preamble | To impart the basic knowledge in R and develop skills to apply the knowledge of R programming to statistical measures, data handling, probability, testing of hypothesis and design of experiments. | |
| **Unit – I** | **Introduction to R:** | **9** |
| Overview of R programming – Need for R – Installing R – Environment setup with R Studio – Packages: Installing packages – Running and manipulating packages – Basic objects: Vectors – Matrix – Array – Lists – Factors – Data frames. | | |
| **Unit – II** | **R Programming Structures and Functions:** | **9** |
| Basic expressions: Arithmetic expressions – Control Statements: if and if-else statements –– switch statement – Loops: for loop – while loop – Function: Creating a function – calling a function – Default value for function arguments – Logical functions – Math functions – Statistical functions – Apply-family functions – Getting started with strings – Formatting data and time. | | |
| **Unit – III** | **Descriptive Statistics:** | **9** |
| Summary command – Summarizing samples – cumulative statistics – summary statistics for data frames – summary tables – Linear Modeling: Simple linear regression – Multiple regression – Curvilinear regression – Plotting linear models and curve fitting. | | |
| **Unit – IV** | **Working with data:** | **9** |
| Reading and writing data: Text-format in a file – Excel worksheets – Native data files – built-in datasets. Visualizing data: Scatter plots – line plots – bar charts – pie charts – Cleveland dot charts –Histogram and density plots – Box-whisker plots. | | |
| **Unit – V** | **Probability Distributions, Testing of hypothesis and ANOVA:** | **9** |
| Probability Distributions: Binomial Distribution – Poisson Distribution – Normal Distribution.<br>Testing of Hypothesis and ANOVA: Student's t-test – Non-Parametric tests: Wilcoxon U-test – Paired t and U-tests – Correlation and covariance – Tests for association – Analysis of variance: One-way ANOVA – Two-way ANOVA. | | |

**List of Exercises / Experiments:**

| | |
|---|---|
| 1. | Implementation of operations of data objects such as vector, list and matrix. |
| 2. | Implementation and use of array, factors and data frames in R. |
| 3. | Programs using decision making statements and looping structures. |
| 4. | Programs to demonstrate programming concepts using functions (Using built-in and user-defined functions) |
| 5. | Performing various basic statistical measures for the given data. |
| 6. | Calculate the regression coefficient and obtain the lines of regression for the given data. |
| 7. | Creating and reading various types of data files. |
| 8. | Create different charts for visualization of given set of data. |
| 9. | Computation of probability using Binomial, Poisson and Normal distributions. |
| 10. | Perform the t-test for testing significance of mean. |
| 11. | Perform various non-parametric tests for the given sample data. |
| 12. | Perform One way and two way ANOVA. |

**Lecture:45, Practical:30, Total:75**

**TEXT BOOK:**

| | |
|---|---|
| 1. | Kun Ren, "Learning R Programming", 1st Edition, Packt Publishing Ltd, UK, 2016 for Units I, II. |
| 2. | Mark Gardener, "Beginning R-The Statistical Programming Language",1st Edition, John Wiley & Sons,Inc, USA, 2012 for Units III,IV, V. |

**REFERENCES:**


| | |
|---|---|
| 1. | Seema Acharya, "Data Analytics using R", 1st Edition, McGraw Hill Education, Chennai, 2018. |
| 2. | Norman Matloff, "The Art of R Programming", 1st Edition, No Starch Press, San Francisco, 2011. |
| 3. | Paul Teetor, "R Cookbook", 1st Edition, O'Reilly Media, USA, 2011. |
| 4. | Laboratory Manual |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | understand the basics of fundamentals of R. | Understanding (K2)<br>Manipulation (S2) |
| CO2 | apply the concepts of decision, looping structures and functions in real time problems. | Applying (K3)<br>Manipulation (S2) |
| CO3 | apply R programming to descriptive statistics. | Applying (K3)<br>Manipulation (S2) |
| CO4 | apply the libraries for data manipulation and data visualization in R. | Applying (K3)<br>Manipulation (S2) |
| CO5 | use R studio to identify the probability and test statistical hypothesis. | Applying (K3)<br>Manipulation (S2) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | | | | | | | | | | | |
| CO2 | 3 | 1 | 1 | | 2 | | | | | | | | | |
| CO3 | 3 | 2 | 2 | 2 | 2 | | | | | | | | | |
| CO4 | 3 | 3 | 2 | 3 | 2 | | | | | | | | | |
| CO5 | 3 | 2 | 2 | 3 | 2 | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 30 | 60 | | | | 100 |
| CAT2 | 10 | 20 | 70 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 20 | 70 | | | | 100 |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

| 22MAO06 - OPERATIONS RESEARCH | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Mathematics) | | | | | | | |
| **Programme & Branch** | **All B.E/.BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **6** | **OE** | **3** | **1** | **0** | **4** |

| | |
|---|---|
| Preamble | To provide the skills for solving the real time engineering problems involving linear objective functions, transportation models and also impart knowledge in finding optimal solutions to problems involving limited resources, project management techniques and game theoretic concepts. |

| | | |
|---|---|---|
| **Unit – I** | **Linear Programming:** | **9+3** |
| Introduction to Operations research – Applications of OR – Linear Programming – Formation of Linear Programming Problem – Solution of LPP: Basic concepts – Graphical Solution – Simplex method – Artificial techniques: Big M method. | | |
| **Unit – II** | **Transportation and Assignment Problems:** | **9+3** |
| Transportation Problem: Introduction – Mathematical formulation – Solution of transportation problem: Initial basic feasible solution: North-West Corner Rule – Vogel's Approximation Method – Optimal Solution: MODI method.<br>Assignment Problems: Introduction – Mathematical Formulation – Hungarian Algorithm. | | |
| **Unit – III** | **Game Theory:** | **9+3** |
| Introduction – Basic Terminology – Two-Person zero sum games – Pure strategies (Games with saddle point) – Mixed Strategies (Games without saddle points) – Rule of Dominance – Solution of Mixed Strategy games: Algebraic method – Arithmetic method – Graphical method. | | |
| **Unit – IV** | **Sequencing models:** | **9+3** |
| Sequencing problems: Introduction – Johnson's algorithm – Processing of n jobs through two machines – Processing of n jobs through three machines – Processing of 'n' jobs through 'm' machines - Processing of two jobs through 'm' machines. | | |
| **Unit – V** | **Network and Project Management:** | **9+3** |
| Introduction – Basic terminology **–** Rules of Network construction – Fulkerson's Rule for numbering of events – Construction of network – Critical Path Method (CPM) – Programme Evaluation and Review Technique (PERT). | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Sharma J.K, "Operations Research – Theory and Applications", 6th Edition, Trinity Press, India, New Delhi, 2017. |

**REFERENCES:**



| | |
|---|---|
| 1. | Taha, Hamdy A., "Operation Research: An introduction", 9th edition, Pearson Education, 2010. |
| 2. | Hiller, Frederick. S. and Lieberman, Gerald. J., "An introduction to Operations research- concepts and cases", Tata McGraw Hill (SIE) 8th edition, 2005. |
| 3. | Ravindran, A., Phillips, D.J., and Solberg, J.J., "Operations Research- Principles and Practice", John Wiley & Sons, 2005. |
| 4. | Kanti Swarup, P.K. Gupta, Man Mohan, "Operations Research", 15th revised Edition, S. Chand & Sons Education Publications, New Delhi, 2017. |
| 5. | Gupta P.K. and Hira D.S., "Operations Research: An Introduction", 7th Revised Edition, S.Chand and Co. Ltd., New Delhi, 2014. |

| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | formulate and solve linear programming problems. | Applying (K3) |
| CO2 | apply transportation and assignment algorithms in engineering problems. | Applying (K3) |
| CO3 | use game theory concepts in practical situations. | Applying (K3) |
| CO4 | identify the minimum processing times for sequencing problems | Applying (K3) |
| CO5 | apply the concepts of CPM and PERT in scheduling the project networks. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 2 | 3 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 20 | 70 | | | | 100 |
| CAT2 | 10 | 20 | 70 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 20 | 70 | | | | 100 |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

| 22MAO07 - NUMBER THEORY AND CRYPTOGRAPHY | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Mathematics) | | | | | | | |
| **Programme & Branch** | **All B.E/.BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **6** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | To provide the skills for applying various number theoretic algorithms, congruences, primality tests in cryptography and network security and impart knowledge of basic cryptographic techniques. | |
| **Unit – I** | **Divisibility Theory:** | **9+3** |
| Division algorithm – Base-b representations – Number patterns – Prime and composite numbers – GCD – Euclidean Algorithm – Fundamental theorem of Arithmetic – LCM. | | |
| **Unit – II** | **Theory of Congruences:** | **9+3** |
| Basic concepts – Properties of congruences – Linear congruences – Solution of linear congruences – Fermat's Little theorem – Chinese remainder theorem. | | |
| **Unit – III** | **Number Theoretic Functions:** | **9+3** |
| Introduction – Functions $\tau$ and $\sigma$ – Mobius function – Greatest integer function – Euler's Phi function – Euler's theorem – Properties of Euler's function – Applications to Cryptography. | | |
| **Unit – IV** | **Primality testing and Factorization:** | **9+3** |
| Primality testing: Fermat's pseudo primality test – Solvay-Strassen test – Fibonacci test – Lucas test – Integer factorization: Trial division – Pollard's Rho method – Quadratic sieve method. | | |
| **Unit – V** | **Classical Cryptographic Techniques:** | **9+3** |
| Introduction – Substitution techniques – Transposition techniques – Encryption and decryption – Symmetric and asymmetric key cryptography – Steganography. | | |
| | | **Lecture:45, Tutorial:15, Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Thomas Koshy, "Elementary Number Theory with Applications", 2nd Edition, Academic Press, Elsevier, USA, 2007 for Units I ,II, III. |
| 2. | William Stallings, "Cryptography and Network Security: Principles and Practice", 7th Edition, Pearson Education, New Delhi, 2019 for Units IV,V. |

**REFERENCES:**

| | |
|---|---|
| 1. | Ivan Niven, Herbert S. Zukerman, Hugh L. Montgomery, "An Introduction to the Theory of Numbers", Reprint Edition, John Wiley & Sons, New Delhi, 2008. |
| 2. | Bernard Menezes, "Cryptography and Network Security", Cengage Learning India, 1st Edition, New Delhi, 2010. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | understand the concepts of divisibility and canonical decompositions. | Understanding (K2) |
| CO2 | obtain the knowledge in theory of congruences and solution of linear congruences. | Understanding (K2) |
| CO3 | use different number theoretic function suitably in cryptography. | Applying (K3) |
| CO4 | apply Primality test and factorisation algorithms to network security problems. | Applying (K3) |
| CO5 | apply the suitable cryptographic techniques to handle real time security issues. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | | | | | |
| CO2 | 3 | 1 | | | | | | | | | | | | |
| CO3 | 3 | 1 | | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | 2 | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | 2 | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 30 | 60 | | | | 100 |
| CAT2 | 10 | 20 | 70 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 20 | 70 | | | | 100 |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

## 22PHO04 - SYNTHESIS, CHARACTERIZATION AND BIOLOGICAL APPLICATIONS OF NANOMATERIALS

(Offered by Department of Physics)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **All BE/BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **6** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course aims to impart the knowledge on the fundamentals of nanomaterials, synthesis of nanomaterials, analysis of nanomaterials, carbon tubes and biological applications of nanomaterials. | |
| **Unit – I** | **Introduction to nanomaterials** | **9+3** |
| Nanoscience and nanotechnology – Scientific revolution – Nanoscale – Nanosized effects – Surface-to-volume ratio – Quantum confinement effect – Classification of nanomaterials based on dimension – Properties of nanomaterials – Metal nanoparticles – Ceramic nanoparticles – Semiconductor nanoparticles – Polymer nanomaterials. | | |
| **Unit – II** | **Synthesis of nanomaterials** | **9+3** |
| Physical, chemical and mechanical methods of preparation – Top down approaches and bottom up approaches – Physical Vapor Deposition method – Colloidal precipitation method – Sol-Gel method – Chemical precipitation method – Green synthesis method of nanomaterials. | | |
| **Unit – III** | **Characterization of nanomaterials** | **9+3** |
| X-ray diffraction analysis – Grain size calculation – Lattice parameters - Cell volume – Photoluminescence analysis – Emission peak analysis – UV visible spectroscopy analysis – Bandgap estimation – HRTEM & AFM analysis (qualitative) – particle size analysis – BET (qualitative). | | |
| **Unit – IV** | **Carbon nanotubes** | **9+3** |
| Allotropes of carbon – Diamond – Graphite – Graphene – Fullerenes – Carbon nanotubes – Properties – SWCNT – MWCNT – Structure of Carbon nanotubes – Preparation: Laser ablation method – CVD – Applications. | | |
| **Unit – V** | **Biological applications** | **9+3** |
| Antibacterial activity – Mechanism – Antifungal activity – Microorganism – Gram positive bacteria – Gram negative bacteria – Disc diffusion method – Antioxidant activity – DPPH method – Anticancer activity – Cytotoxity – MTT method –Toxicity of nanoparticles. | | |
| | | **Lecture: 45, Tutorial: 15, Total: 60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Charles P Poole Jr., and Frank J. Ownes ,. “Introduction to Nanotechnology”, John Wiley Sons, Inc., 2003. |

**REFERENCES:**

| | |
|---|---|
| 1. | C. Kittel., “Introduction to Solid State Physics”, Wiley Eastern Ltd., (2005). |
| 2. | Tamilarasan K. and Prabu K., “Materials Science”, 1st Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2018. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | describe the properties of nanomaterials using concepts such as surface to volume ratio and quantum confinement and also able to classify nanomaterials. | Applying (K3) |
| CO2 | explain the synthesis of nanomaterials using select physical and chemical methods. | Applying (K3) |
| CO3 | explain the characterization of nanomaterials using XRD, UV-vis, HRTEM & AFM and BET. | Applying (K3) |
| CO4 | Illustrate the preparation of CNT and their applications. | Applying (K3) |
| CO5 | explore the biological applications of nanomaterials such as antibacterial activity, antifungal activity, antioxidant activity and anticancer activity. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO2 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO3 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO4 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO5 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 50 | 30 | | | | 100 |
| CAT2 | 20 | 50 | 30 | | | | 100 |
| CAT3 | 20 | 50 | 30 | | | | 100 |
| ESE | 20 | 50 | 30 | | | | 100 |

*** ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)**

## 22PHO05 - TECHNIQUES OF CRYSTAL GROWTH

(Offered by Department of Physics)

| Programme& Branch | All BE/BTech Branches | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **6** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course aims to impart the knowledge on crystals, physics of crystal growth and crystal growth methods. | |
| **Unit – I** | **Introduction to Crystals** | **9+3** |
| Classification of solids – Crystalline and amorphous – Single and polycrystalline materials – Space lattice – Bravais lattice – Lattice planes – Miller indices – Indices of crystal direction – Symmetry – Symmetry elements in cubic crystal – Physical properties. | | |
| **Unit – II** | **Theories of Crystal Growth** | **9+3** |
| Phase rule – Phase diagrams – Binary phase diagrams – Alloy and compounds – Binary system with complete solid solution and no solid solution (eutectic) – Invariant reactions – Eutectic, peritectic and peritectoid (qualitative) – Nucleation concept – Homogeneous, heterogeneous nucleation – Classical theory – Energy of formation of nucleus – Kinetic theory of nucleation (qualitative) – Atmospheric nucleation. | | |
| **Unit – III** | **Melt growth** | **9+3** |
| Bulk crystal growth methods – Melt growth methods – Bridgman (vertical and horizontal) and Czochralski methods – Liquid encapsulated technique (LEC) for semiconductors – Vermeil growth technique for growing gem crystals – Zone melting. | | |
| **Unit – IV** | **Solution growth** | **9+3** |
| Low temperature solution growth – High temperature solution growth – Electro crystallization – Crystal growth in gel – Growth of biological crystals – Hydrothermal technique. | | |
| **Unit – V** | **Vapour growth** | **9+3** |
| Physical vapour transport – chemical vapour transport. Epitaxial growth techniques – Liquid phase epitaxy – Vapour phase epitaxy: chloride, hydride, metalorganic – Molecular beam epitaxy – Chemical beam epitaxy. | | |
| | | **Lecture: 45, Tutorial: 15, Total: 60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Introduction to Crystallography Philips, Read Books (9 June 2011), India. |

**REFERENCES:**


| | |
|---|---|
| 1. | B. D. Cullity Addison, Elements of X-ray diffraction, Wesley Publishers, 1977. |
| 2. | Santhana Raghavan and Dr. P. Ramasamy, Crystal growth processes and methods, KRU publications, 1999. |
| 3. | Leonid V. Azaroff, Introduction to Solids, Tata McGraw Hill Publishing Company. |
| 4. | C. Kittel Wiley, Introduction to Solid State Physics, Eastern University Edition. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | describe the physical properties of crystals using the concepts of crystalline materials, amorphous material, space lattice, unit cell, Miller indices and crystal symmetry. | Applying (K3) |
| CO2 | explain nucleation in crystal growth using the concepts of phase diagrams and formation energy. | Applying (K3) |
| CO3 | demonstrate the growth of bulk crystals using melt growth techniques. | Applying (K3) |
| CO4 | demonstrate the growth of crystals using solution growth techniques. | Applying (K3) |
| CO5 | comprehend the growth of epitaxy crystal using vapour growth techniques. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO2 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO3 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO4 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |
| CO5 | 3 | 2 | 2 | | | | | | 2 | 2 | | 2 | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 50 | 30 | | | | 100 |
| CAT2 | 20 | 50 | 30 | | | | 100 |
| CAT3 | 20 | 50 | 30 | | | | 100 |
| ESE | 20 | 50 | 30 | | | | 100 |

*** ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)**

**22CYO04 - CORROSION SCIENCE AND ENGINEERING**

(Offered by Department of Chemistry)

| Programme & Branch | All BE / BTech Branches | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **6** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | Corrosion science and engineering aims to equip the students to have a wide-range of knowledge on corrosion and prevention methods in order to meet the industrial needs. | |
| **Unit – I** | **Corrosion and its Units** | **9+3** |
| Introduction- electro chemical mechanism Vs chemical mechanism - emf series and Galvanic series – galvanic corrosion – area effect in anodic and cathodic metal coatings – prediction using emf series and galvanic series - Pilling Bedworth's ratio and it consequences (Problems) – units of corrosion rate: mdd (milligrams per square decimeter per day), mmpy (millie miles per year) and mpy (mils per year) –- importance of corrosion prevention in various industries: direct and indirect effects of determining corrosion rates - weight loss method, weight gain method and chemical analysis of solution. | | |
| **Unit – II** | **Thermodynamics of Corrosion** | **9+3** |
| Electrode potentials, Electrical double layer, Gouy−Chapman model, Stern model, Bockris – Devanathan−Müller model - free energy and oxidation potential - criterion of corrosion (Problems) - basis of Pourbaix Diagrams - Pourbaix diagrams of water, magnesium, aluminium and Iron - limitations and applications. | | |
| **Unit – III** | **Kinetics of Corrosion** | **9+3** |
| Electrochemical polarization – Evan's diagram – activation polarization – concentration polarization - mixed potential theory(Wagner and Traud) – application of mixed potential theory – effect of metal in acid solution – cathodic protection of iron in acid solution – effect of cathodic reaction – effect of cathodic area – passivity – Flade potential – theories of passivity - adsorption theory – oxide film theory – film sequence theory. | | |
| **Unit – IV** | **Types of Corrosion** | **9+3** |
| Introduction - (i) Crevice - differential aeration corrosion (ii) pitting – mechanism and factors (iii) intergranular- chromium depletion theory, weld decay and knife line attack (iv) stress - SCC mechanism, corrosion fatique- Cavitation damage – fretting damage (v) stray current corrosion - causes and its control. | | |
| **Unit - V** | **Prevention of Corrosion** | **9+3** |
| Inhibitors – types of inhibitors, chemisorption of inhibitors, effect of concentration, effect of molecular structure, vapour phase inhibitors – prevention of corrosion at the design stage and in service conditions – control of catastrophic oxidation and hydrogen disease – Langelier saturation index and its uses - corrosion prevention by surface coatings – phosphating and its uses -principles and procedures of cathodic protection: sacrificial anodes and external cathodic current impression- painting, vitreous enamels, plastic lining. | | |
| | | **Lecture: 45, Tutorial: 15, Total: 60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | E. McCafferty, Introduction to Corrosion Science, 2nd Edition, Springer, 2017. |

**REFERENCES:**


| | |
|---|---|
| 1. | R. Winston, Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering, Revised 4th Edition, Wiley publisher, 2008. |
| 2. | Fontanna, "Corrosion Engineering", (Materials Science and Metallurgy series), McGraw Hill international Ed., 2005. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | illustrate the mechanism, expression of rate of corrosion and importance of corrosion studies to familiarize for industrial needs. | Understanding (K2) |
| CO2 | demonstrate the thermodynamics and kinetics of different models of corrosion with respect to the environment. | Applying (K3) |
| CO3 | utilize the theories of corrosion to interpret with the real time applications. | Applying (K3) |
| CO4 | organize the various types of corrosion to understand the corrosion problems. | Applying (K3) |
| CO5 | summarize the corrosion prevention methods to avoid corrosion related issues. | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/Pos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO5 | 3 | 1 | | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 35 | 40 | | | | 100 |
| CAT2 | 25 | 35 | 40 | | | | 100 |
| CAT3 | 25 | 35 | 40 | | | | 100 |
| ESE | 25 | 35 | 40 | | | | 100 |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

## 22CYO05 - CHEMISTRY OF COSMETICS IN DAILY LIFE

(Offered by Department of Chemistry)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Programme & Branch** | **All BE / BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **6** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course aims to provide knowledge on chemistry of cosmetics for engineering students. | |
| **Unit - I** | **Formulation of Cosmetic Product** | **9+3** |
| Introduction - basic sciences of cleansing – surfactant and adsorption, surfactant micelles, surfactants and cleansing, surfactants and foam (foam formation, stability, drainage, rupture and collapse and defoaming) - basics of dispersions - electrical charges associated with surfaces and barriers – basics of emulsion (stability, Ostwald ripening, prevention of creaming and sedimentation). | | |
| **Unit - II** | **Structuring Materials and Regulation for Cosmetics** | **9+3** |
| Introduction - water/hydrophilic base materials, oleaginous/hydrophobic base materials and amphiphilic substances - adding functions and effects - materials that add or improve functional value, emotional value and materials for quality control – cosmetic and personal care product safety – potential contaminants in cosmetics – regulations related to cosmetics – cosmetic regulation in india - future challenges in cosmetics material development. | | |
| **Unit - III** | **Polymers in Cosmetic Products** | **9+3** |
| Polymers in Cosmetics - polymer solubility and compatibility, polymer conformation - polymers that modify surfaces - film-forming polymers in cosmetics and personal care products - hair-conditioning polymers - polymers for the treatment of skin - polymers as controlled release matrices - dendritic polymers - polymeric antimicrobials and bacteriostats. | | |
| **Unit - IV** | **Natural Products and Fragrance in Cosmetics** | **9+3** |
| Introduction – natural products – extraction methods - encapsulation and controlled release - allergens in cosmetics – testing for allergens - aroma chemicals - fragrance creation and duplication - fragrance applications -– malodor – fragrance allergies and sensitivities. | | |
| **Unit - V** | **Preparation of Cosmetics** | **9+3** |
| Cosmetics in day to day life – characteristics, types, formulation, preparation and evaluation methods of lipstick, shampoo, powder, nail lacquer, creams, toothpaste and hair dye. | | |
| | | **Lecture: 45, Tutorial: 15, Total: 60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Kazutami Sakamoto, Robert Y. Lochhead, Howard I. Maibach, Yuji Yamashita, Cosmetic Science and Technology: Theoretical Principles and Applications, Elsevier, 2017 , for Units- I, II, III, IV, V. |
| 2. | Gaurav Kumar Sharma, Jayesh Gadiya, Meenakshi Dhanawat A text book of cosmetic formulation, 2018, for Unit-V. |

**REFERENCES:**


| | |
|---|---|
| 1. | R.K. Nema, K.S. Rathore , B.K. Dubey, Textbook of Cosmetics, CBS Publishers and Distributors, 2017. |
| 2. | Bruno Burlando, Elisa Bottini-Massa, LuisellaVerotta, Laura Cornara, Herbal Principles in Cosmetics: Properties and Mechanisms of Action, CRC Press, 2010. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | outline the formulation of cosmetics products. | Understanding (K2) |
| CO2 | identify the structuring materials and regulation involved in cosmetics development. | Applying (K3) |
| CO3 | interpret the polymers and its role in cosmetics. | Understanding (K2) |
| CO4 | develop knowledge about natural products and Fragrance in Cosmetics. | Applying (K3) |
| CO5 | apply the knowledge of cosmetics to explain the characteristics, formulation, preparation and quality control of different cosmetic products used in day to day life. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/Pos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | | | | | | | | | | | |
| CO3 | 3 | 1 | | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 35 | 40 | | | | 100 |
| CAT2 | 25 | 35 | 40 | | | | 100 |
| CAT3 | 25 | 35 | 40 | | | | 100 |
| ESE | 25 | 35 | 40 | | | | 100 |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

**22CYO06 – NANOCOMPOSITE MATERIALS**
(Offered by Department of Chemistry)

| **Programme& Branch** | **All BE / BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **6** | **OE** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course aims to equip the students to have knowledge on processing, characterization, properties, features and applications of nanocomposites. | |
| **Unit – I** | **Introduction of nanocomposites** | **9+3** |
| Introduction – nanocomposites – nanocomposites past and present – nomenclature – composite materials: introduction to solids - atomic and molecular solids – role of statistics in materials – primary, secondary and tertiary structure – transitions. | | |
| **Unit - II** | **Properties and features of nanocomposites** | **9+3** |
| Properties: physics of modulus – continuum measurements – yield – fracture – rubbery elasticity and viscoelasticity – composites and nanocomposites – surface mechanical properties –diffusion and permeability – features of nanocomposites: basics of polymer nanocomposites - nano reinforcements – matrix materials – hazards of particles. | | |
| **Unit - III** | **Processing of nanocomposites** | **9+3** |
| Viscosity: types of flow, experimental viscosity, non-newtonian flow -low-viscosity processing: solvent processing, particle behavior, in situ polymerization, post-forming, hazards of solvent processing - melt, high shear and direct processing: melting and softening, melt processes with small shears or low-shear rates flow, meltprocesses with large deformations or high-shear rates, thermo-kinetic processes. | | |
| **Unit - IV** | **Characterization of nanocomposites** | **9+3** |
| Introduction to characterization – experiment design – sample preparation – imaging –structural characterization – scales in nanocomposites – texture – electromagnetic energy –visualization – physicochemical analysis – characterization of physical properties. | | |
| **Unit - V** | **Applications of nanocomposites** | **9+3** |
| Nanocomposites – optical, structural applications – nanoparticulate systems with organic matrices – applications – biodegradable protein nanocomposites – applications-polypropylene nanocomposites – application as exterior automatic components – hybrid nanocomposite materials – application for corrosion protection. | | |
| | | **Lecture: 45, Tutorial: 15, Total: 60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Thomas E. Twardowski, “Introduction to Nanocomposite Materials – Properties, Processing, Characterization”, DesTech Publications, April 2007, for Units-I, II, III, IV. |
| 2. | Klaus Friedrich, Stoyko Fakivov, Zhony Shang, “Polymer Composites from Nano – to Macro – scale”, Springer USA, 2005, for Units-I, II, V. |

**REFERENCES:**


| | |
|---|---|
| 1. | Pulickel M. A, Linda S. S, Paul V.B, “Nanocomposite Science and Technology”, Wiley-VCH, 2006. |
| 2. | Vikas Mittal, Characterization techniques for polymer nanocomposites, Wiley-VCH, 2012. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | identify the knowledge of nanocomposites and to explain its structure. | Applying (K3) |
| CO2 | apply the knowledge on various properties and features of nanocomposites. | Applying (K3) |
| CO3 | choose the various concepts involving in the processing of nanocomposites. | Applying (K3) |
| CO4 | apply the acquired knowledge on characterization of nanocomposites. | Applying (K3) |
| CO5 | organize the applications of nanocomposites in various fields. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/Pos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 35 | 40 | | | | 100 |
| CAT2 | 25 | 35 | 40 | | | | 100 |
| CAT3 | 25 | 35 | 40 | | | | 100 |
| ESE | 25 | 35 | 40 | | | | 100 |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

| 22MAO08 - NON-LINEAR OPTIMIZATION | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Mathematics) | | | | | | | |
| **Programme & Branch** | **All B.E/.BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **7** | **OE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | The course focuses on the basic concepts, various techniques and applications of engineering optimization. | |
| **Unit – I** | **Classical Optimization Techniques:** | **9** |
| Introduction to Optimization – Statement of an Optimization problem – Mathematical formulation – Multi variable optimization with equality constraints – Lagrange multipliers method – Multi variable optimization with inequality constraint – Kuhn Tucker conditions. | | |
| **Unit – II** | **Non-Linear Programming: One-Dimensional Minimization Method:** | **9** |
| Introduction – Unimodal function – Elimination Methods: Unrestricted search – Exhaustive search – Dichotomous search – Interval halving method – Fibonacci method – Golden section method – Direct root methods: Newton method – Secant method. | | |
| **Unit – III** | **Non-Linear Programming: Unconstrained Optimization Techniques:** | **9** |
| Introduction to Unconstrained optimization – Direct Search Methods: Grid search method – Univariate method – Hookes and Jeeve's method – Powell's method. | | |
| **Unit – IV** | **Unconstrained Optimization Techniques (Indirect Methods):** | **9** |
| Gradient of a Function – Indirect Search Methods: Steepest descent method – Fletcher-Reeves method – Newton's method – Marquardt method. | | |
| **Unit – V** | **Non-Linear Programming: Constrained Optimization Techniques:** | **9** |
| Introduction – Characteristics of a Constrained Problem – Direct Methods: Random search method – Sequential linear programming – Indirect methods: Transformation techniques – Exterior penalty function method – Interior penalty function method. | | |
| | | **Total:45** |

**TEXT BOOK:**

1. S.S.Rao, Engineering Optimization Theory and Practice, 5th Edition, John Wiley & Sons Ltd, USA, 2020.

**REFERENCES:**

1. David Luenberger and Yinyu Ye, Linear and Nonlinear Programming, 4th edition, Springer-Verlag, 2015
2. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis, Engineering Optimization: Methods and applications, 2nd Edition, Wiley India Pvt. Ltd., 2006.
3. Yang, Xin-She. Optimization Techniques and Applications with Examples. 1st Edition, John Wiley & Sons, United Kingdom, 2018.

| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | solve problems with equality and inequality constraints. | Applying (K3) |
| CO2 | solve nonlinear programming problems of functions of single variable. | Applying (K3) |
| CO3 | use methods of unconstrained optimization to solve non linear problems | Applying (K3) |
| CO4 | solve nonlinear optimization problems in the presence of inequality and equality constraints. | Applying (K3) |
| CO5 | apply several modern methods of optimization for solving engineering problems | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | | | | | | | | | | | |
| CO2 | 3 | 2 | | | | | | | | | | | | |
| CO3 | 3 | 3 | 1 | | | | | | | | | | | |
| CO4 | 3 | 3 | 3 | | | | | | | | | | | |
| CO5 | 3 | 2 | 3 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 10 | 80 | | | | 100 |
| CAT2 | 10 | 10 | 80 | | | | 100 |
| CAT3 | 10 | 10 | 80 | | | | 100 |
| ESE | 10 | 10 | 80 | | | | 100 |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

| 22MAO09 - OPTIMIZATION FOR ENGINEERS | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Mathematics) | | | | | | | |
| **Programme & Branch** | **All B.E/.BTech Branches** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **7** | **OE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | To provide the skills for solving the real time engineering problems involving linear and non-linear objective functions and also impart knowledge in finding optimal solutions to problems involving multi-level decision making and analyzing queuing models. | |
| **Unit – I** | **Linear Programming:** | **9** |
| Introduction to Operations research – Applications of OR – Linear Programming – Formation of Linear Programming Problem – Solution of LPP: Basic concepts – Graphical Solution – Simplex method – Artificial techniques: Big M method. | | |
| **Unit – II** | **Integer Programming:** | **9** |
| Introduction – Types of Integer Programming Problems – Solution of Integer programming problems – Gomory's all integer cutting plane method - Gomory's Mixed-Integer Cutting Plane Method – Branch and Bound method. | | |
| **Unit – III** | **Dynamic programming:** | **9** |
| Introduction – Characteristics – Formulation of Dynamic programming problems –Dynamic programming Algorithm – Solution of Discrete Dynamic programming problem – Solution of LPP by Dynamic programming. | | |
| **Unit – IV** | **Queueing Theory:** | **9** |
| Characteristics of a queueing system – Kendall's notation – Queuing model I ( Infinite capacity single server Poisson queue model) (M/M/1) : (∞/FIFO) – Little's formulae – Queuing model II (Infinite capacity multiple server Poisson queue model (M/M/C): (∞/FIFO) – Queuing model III (Finite capacity single server Poisson queue model) (M/M/1): (N/FIFO) – Queueing model IV (Finite capacity multiple server Poisson model) (M/M/C) : (N/ FIFO).. | | |
| **Unit – V** | **Non-Linear Programming:** | **9** |
| Introduction – Mathematical formulation of Non-linear programing problems – Non-linear programing problem with equality constraints – Lagrange multipliers method – Non-linear programing problem with inequality constraint – Kuhn Tucker conditions. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Sharma J.K, "Operations Research – Theory and Applications", 6th Edition, Trinity Press, India, New Delhi, 2017. |

**REFERENCES:**


| | |
|---|---|
| 1. | Taha, Hamdy A., "Operation Research: An introduction", 9th edition, Pearson Education, 2010. |
| 2. | Hiller, Frederick. S. and Lieberman, Gerald. J., "An introduction to Operations research- concepts and cases", Tata McGraw Hill (SIE) 8th edition, 2005. |
| 3. | Ravindran, A., Phillips, D.J., and Solberg, J.J., "Operations Research- Principles and Practice", John Wiley & Sons, 2005. |
| 4. | Kanti Swarup, P.K. Gupta, Man Mohan, "Operations Research", 15th revised Edition, S. Chand & Sons Education Publications, New Delhi, 2017. |
| 5. | Gupta P.K. and Hira D.S., "Operations Research: An Introduction", 7th Revised Edition, S.Chand and Co. Ltd., New Delhi, 2014. |

| | | |
|---|---|---|
| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
| CO1 | formulate and solve linear programming problems. | Applying (K3) |
| CO2 | solve Integer Programming problems that exist in real time applications. | Applying (K3) |
| CO3 | demonstrate the theoretical workings of dynamic programming method to find shortest path for given network. | Applying (K3) |
| CO4 | use the appropriate queuing model for a given practical application. | Applying (K3) |
| CO5 | apply the concept of non-linear programming for solving the problems involving non-linear constraints and objectives. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 2 | 3 | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 20 | 70 | | | | 100 |
| CAT2 | 10 | 20 | 70 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 20 | 70 | | | | 100 |

* ±3% may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

**22CYO07 - WASTE AND HAZARDOUS WASTE MANAGEMENT**

(Offered by Department of Chemistry)

| Programme & Branch | All BE / BTech Branches | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| Prerequisites | Nil | 7 | OE | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| Preamble | Waste and Hazardous waste management aims to equip the students to have a wide-range of knowledge on waste management. | |
| **Unit – I** | **Solid Waste Management** | **9** |
| **Solid wastes:** definition, sources, types, composition of solid waste- Solid waste management system: collection, separation, processing and transformation of solid waste – combustion, aerobic composting, vermicomposting, pyrolysis, landfill-classification, types, methods and control of leachate in landfills - recycling of material found in municipal solid waste- recycling of paper and cardboard, recycling of plastics, recycling of glass. | | |
| **Unit – II** | **Hazardous Waste Management** | **9** |
| **Hazardous wastes:** definition, nature and sources of hazardous waste, classification and characteristics of hazardous waste- chemical class of hazardous waste, generation, segregation, treatment and disposal: waste reduction, waste minimization, recycling - chemical treatment: acid base neutralization, chemical precipitation, oxidation/reduction, hydrolysis, electrolysis, chemical extraction and leaching, ion exchange, photolytic reaction- thermal treatment methods: incineration – biodegradation of hazardous waste: aerobic, anaerobic, reductive dehalogenations - land treatment and composting. | | |
| **Unit – III** | **E- Waste & Biomedical Waste Management** | **9** |
| **E-Waste Management:** definition, sources, classification, collection, segregation, treatment and disposal.<br>**Biomedical Waste Management :** Introduction-definition –components of biomedical waste-waste generation –waste identification and waste control-waste storage-labeling and color coding-handling and transportation-waste treatment and disposal- autoclave, hydroclave , microwave treatments- chemical disinfection – sanitary and secure landfill. | | |
| **Unit – IV** | **Pollution From Major Industries And Management** | **9** |
| Introduction- sources and characteristics - waste treatment flow sheets for selected industries such as textiles, tanneries, pharmaceuticals, sugar, petroleum refinery, fertilizer and dairy industries. | | |
| **Unit – V** | **Solid Waste Management and Legislation** | **9** |
| Solid waste management plan - solid waste (management and handling) rules - biomedical waste (management and handling) rules- plastic waste management rules - e-waste management rules - hazardous and other wastes (management and transboundary movement) rules - construction and demolition waste management rules. | | |
| | | **Total: 45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | George Tchobanoglous, Hillary Theisen, Samuel a Vigil, Integrated solid waste management (Engineering principle and management issues) McGraw hill Education (India) Pvt. Ltd., 2015, for Unit-I, II, V. |
| 2. | SC Bhatia, Handbook of Industrial pollution and control (Volume-1), CBS Publisher and Distributers, New Delhi, 2002, for Unit-II, III, IV, V. |

**REFERENCES:**

| | |
|---|---|
| 1. | Manual on Municipal Solid Waste management, Central public Health and Environmental Engineering Organization (CPHEEO), Govt. of India, May 2000. |
| 2. | Michael D. LaGrega, Phillip L. Buckingham, Jeffrey C. Evans, Hazardous waste management, MEDTEC, 2015. |
| 3. | Majeti Narasimha Vara Prasad, Meththika Vithanage, Anwesha Borthakur, “Handbook of Electronic Waste Management: International Best Practices and Case Studies” 1st Edition, Butterworth-Heinemann, 2019. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped<br>(Highest Level) |
|---|---|---|
| CO1 | apply the technical points that are required to set up a solid waste management system. | Applying (K3) |
| CO2 | explain the various disposal and treatment methods of hazardous wastes. | Understanding (K2) |
| CO3 | organize the appropriate method for managing e-waste and biomedical waste. | Applying (K3) |
| CO4 | identify the hazards from various industries and apply the waste management techniques for its treatment. | Applying (K3) |
| CO5 | relate the legal legislation to solid waste management. | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/Pos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | | | 3 | | | | | | | |
| CO2 | 2 | 1 | | | | | 3 | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | 3 | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | | | 3 | | | | | | | |
| CO5 | 2 | 1 | | | | | 3 | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 35 | 40 | | | | 100 |
| CAT2 | 25 | 35 | 40 | | | | 100 |
| CAT3 | 25 | 35 | 40 | | | | 100 |
| ESE | 25 | 35 | 40 | | | | 100 |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

**22CYO08 - CHEMISTRY IN EVERY DAY LIFE**
(Offered by Department of Chemistry)

| Programme& Branch | All BE / BTech Branches | Sem. | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|---|
| **Prerequisites** | **Nil** | **7** | **OE** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course aims to prepare the students to have the knowledge on oils, fats, sugar, adulterants in food, creams, milk powder, soil, fertilizer, pesticides, insecticides, fungicides and herbicides in order to know its chemistry in our everyday activities. | |
| **Unit – I** | **Oils, Fats and Sugar** | **9** |
| Distinction between oils and fats – properties – classification – edible oils – vegetable oils –animal oils – manufacture of oils by solvent extraction – refining of crude vegetable oils – processing of animal fats – manufacture of cane sugar – manufacture of sucrose from beet root. | | |
| **Unit – II** | **Adulterants in food** | **9** |
| Food Adulteration and prevention – common food adulterants – food additives – food colorants– preservatives – flavourants – food poisoning – analysis of adulterants in edible oils, coffee powder, chilli powder, turmeric powder, meat , fish, ghee and milk – harmful effects of food adulterants | | |
| **Unit – III** | **Creams and Milk powder** | **9** |
| Creams: Composition-chemistry of creaming process- Factors influencing cream separation (Mention the factors only) - Estimation of fat in cream - Milk powder: Need for making powder-drying process- spraying, drum drying, jet drying and foam drying-principles involved in each. | | |
| **Unit – IV** | **Soil and Fertilizers** | **9** |
| Soil analysis: Composition of soil - Organic and Inorganic constituents-Soil acidity - buffering capacity of soils -Liming of soil - Fertilizers: primary nutrients –role of Nitrogen, potassium and phosphorous on plant growth –Complex fertilizers and mixed fertilizers and its composition - Secondary nutrients – micronutrients and their functions in plants -optimal addition of Fertilizers to obtain estimated yield. | | |
| **Unit – V** | **Pesticides, Insecticides, Fungicides and Herbicides** | **9** |
| Pesticides – Classification – general methods of application and toxicity, Safety measures when using pesticides-Insecticides: Inorganic pesticides – borates - Organic pesticides – D.D.T. and BHC-Plant derivatives: pyrethrin and Nicotine - Synthetic organic pesticides: Endrin and Aldrin (Chemical name - Structure- functions and uses)-Fungicides: Inorganic (Bordeaux mixture) and organic (dithiocarbamate) fungicides - Industrial fungicides: Creosote fractions - Herbicides: Selective and non-selective - 2, 4-dicholorophenoxyacetic acid and 2,4,5-tricholorophenoxyaceticacid (structure and function). | | |
| | | **Total: 45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Sharma B K , Industrial Chemistry, Goel publishing house, New Delhi, 2011, for Units- I, II, IV |
| 2. | Alex V Ramani, Food Chemistry, MJP Publishers, Chennai, 2009, for Units -II, III, V. |

**REFERENCES:**


| | |
|---|---|
| 1. | Dilip Kumar Das, Introductory Soil Science, 1st Edition, Kalyani Publishers, Reprint 2002. |
| 2. | K. Bagavathi Sundari– “Applied Chemistry”, MJP Publishers, Chennai, 2006. |
| 3. | Ashutosh Kar, Medicinal Chemistry, Wiley Eastern limited, New Delhi, 1993. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | outline the importance of oils, fats and sugar. | Understanding (K2) |
| CO2 | identify the harmful effects of adulterants in food. | Applying (K3) |
| CO3 | develop the knowledge on creams and milk powder. | Applying (K3) |
| CO4 | interpret the nature and composition of soil and fertilizers. | Understanding (K2) |
| CO5 | illustrate the difference of pesticides, insecticides, fungicides and herbicides. | Understanding (K2) |

**Mapping of COs with POs and PSOs**

| COs/Pos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO4 | 3 | 1 | | | | | | | | | | | | |
| CO5 | 3 | 1 | | | | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN – THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 25 | 35 | 40 | | | | 100 |
| CAT2 | 25 | 35 | 40 | | | | 100 |
| CAT3 | 25 | 35 | 40 | | | | 100 |
| ESE | 25 | 35 | 40 | | | | 100 |

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

| 22CEO04 - INFRASTRUCTURE PLANNING AND MANAGEMENT | | | | | | | |
|---|---|---|---|---|---|---|---|
| (Offered by Department of Civil Engineering) | | | | | | | |
| **Programme& Branch** | **All BE / BTech branches except Civil Engineering** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **8** | **PE** | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| Preamble | To understand and explain the basic concepts of infrastructure and the challenges to successful infrastructure planning and implementation. | |
| **Unit – I** | **Basic Concepts Related to Infrastructure:** | **9** |
| Introduction to infrastructure, Governing Features, Historical overview of Infrastructure development in India, Infrastructure Organizations & Systems | | |
| **Unit – II** | **Infrastructure Planning:** | **9** |
| Typical infrastructure planning steps, Planning and appraisal of major infrastructure projects, Screening of project ideas, Life cycle analysis, Multi-criteria analysis for comparison of infrastructure alternatives, Procurement strategies, Scheduling and management of planning activities, Infrastructure Project Budgeting and Funding, Regulatory Framework, Sources of Funding | | |
| **Unit – III** | **Private Involvement in Infrastructure:** | **9** |
| Overview of Infrastructure Privatization - Benefits of Infrastructure Privatization - Problems and Challenges in Infrastructure Privatization | | |
| **Unit – IV** | **Challenges to Successful Infrastructure Planning and Implementation:** | **9** |
| Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks - Political Risks - Socio-Environmental Risks - Cultural Risks in International Infrastructure Projects - Legal and Contractual Issues in Infrastructure - Challenges in Construction and Maintenance of Infrastructure. | | |
| **Unit – V** | **Strategies For Successful Infrastructure Project Implementation:** | **9** |
| Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects. | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Neil S Grigg, "Infrastructure Engineering and Management", 1st Edition, John Wiley & Sons, 1988. |

**REFERENCES:**

| | |
|---|---|
| 1. | Ronald Hudson W., Ralph Haas & Waheed Uddin, "Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation", 1st Edition, McGraw-Hill, New Delhi, 1997. |
| 2. | World Development Report: Infrastructure for Development, 1994. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | explain the basic concepts related to Infrastructure | Understanding (K2) |
| CO2 | demonstrate the various analysis techniques in infrastructure planning | Applying (K3) |
| CO3 | explain the role of private sector in infrastructure growth | Understanding (K2) |
| CO4 | explain the challenges in infrastructure planning and management | Understanding (K2) |
| CO5 | carry out strategic planning for successful Infrastructure Project implementation. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | | | 1 | | | | | | | | | |
| CO2 | 3 | 2 | 1 | | 1 | | | | | | | | | |
| CO3 | 2 | 1 | | | 1 | | | | | | | | | |
| CO4 | 2 | 1 | | | 1 | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | 1 | | | | | | | | | |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 30 | 40 | 30 | | | | 100 |
| CAT2 | 30 | 40 | 30 | | | | 100 |
| CAT3 | 30 | 40 | 30 | | | | 100 |
| ESE | 30 | 40 | 30 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE-638060**

**(AUTONOMOUS)**

**BOARD OF COMPUTER SCIENCE AND ENGINEERING**

DEGREE & PROGRAMME : BE & CSE

HONOURS DEGREE TITLE: BE Degree in Computer Science and Engineering with Honours in Data Science

The following courses are identified to earn additional 18 credits to get a Honours degree with specialization in **Data Science**

| S.No | Course Code | Course Title | Credits | Prerequisites | Semester |
|---|---|---|---|---|---|
| 1. | 22CSH01 | Data preparation and Analysis | 4 | Nil | 5 |
| 2. | 22CSH02 | Statistical Learning | 4 | Nil | 5 |
| 3. | 22CSH03 | Text and speech analytics | 4 | Nil | 6 |
| 4. | 22CSH04 | Image and video analytics | 3 | Nil | 6 |
| 5. | 22CSH05 | Real Time Analytics | 3 | Nil | 7 |
| | | **TOTAL** | **18** | | |

| 22CSH01 - DATA PREPARATION AND ANALYSIS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **(Common to CSE, IT and CSD branches)** | | | | | | | |
| **Programme & Branch** | **B.E. – Computer Science and Engineering, Computer Science and Design & BTech – Information Technology** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5/6/7** | **HN** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | This course provides various techniques to prepare data for analysis, perform exploratory data analysis, and develop meaningful data visualizations. | |
| **Unit – I** | **Data Gathering and Preparation** | **9+3** |
| Introduction: Sources of Data - Process for Making Sense of Data. Describing Data: Process for Making Sense of Data - Types of Variables - Central Tendency - Distribution of the Data Confidence Intervals - Hypothesis Tests. Data Loading, Storage and File formats: Reading and Writing Data in Text Format - Binary Data Formats - Interacting with Web APIs - Interacting with Databases. | | |
| **Unit – II** | **Data Cleaning** | **9+3** |
| Preparing Data Tables: Cleaning the Data - Removing Observations and Variables - Generating Consistent Scales Across Variables - New Frequency Distribution - Converting Text to Numbers - Converting Continuous Data to Categories Combining Variables - Generating Groups – Preparing Unstructured Data. Data Cleaning: Handling Missing Data - Data Transformation. | | |
| **Unit – III** | **Exploratory Analysis** | **9+3** |
| Understanding Relationships:Visualizing Relationships Between Variables -Calculating Metrics About Relationships. Identifying and Understanding Groups: Clustering - Association Rules - Learning Decision Trees from Data. | | |
| **Unit – IV** | **Prediction and Data Wrangling** | **9+3** |
| Building Models from Data: Linear Regression - Logistic Regression - k- Nearest Neighbors - Classification and Regression Trees - Other Approaches. Data Wrangling: HierarchicalIndexing - Combining and Merging Datasets - Reshaping and Pivoting. | | |
| **Unit – V** | **Visualization and Data Aggregation** | **9+3** |
| A Brief matplotlib API Primer - Plotting with Pandas and Seaborn - Other Python Visualization Tools - Data Aggregation and Group Operations: Group By Mechanics – Data Aggregation – Apply: General split apply combine - Pivot Tables and Cross Tabulation. | | |
| **Lecture :45 ;Tutorial:15 Total:60** | | |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Glenn J. Myatt, Wayne P. Johnson, "Making Sense of Data I: A practical Guide to Exploratory Data Analysis and Data Mining", 2nd Edition, Wiley Publication, 2014. (UNITS I,II,III,IV) |
| 2. | Wes McKinney, "Python for Data Analysis", 2nd Edition, O'Reilly Media Publication, 2017. (UNITS V) |

**REFERENCES:**

| | |
|---|---|
| 1. | Jake VanderPlas, "Python Data Science Handbook", O'Reilly Media Publication, 2016. |
| 2. | Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence, Analytics, and Data Science: A Managerial Perspective" 4th Edition, Pearson Education, 2017. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | interpret various types of data by gathering from different sources and prepare for processing | Applying (K3) |
| CO2 | apply various methods of data cleaning for a given set of data | Applying (K3) |
| CO3 | use different exploratory analysis methods | Applying (K3) |
| CO4 | build models on real time data | Applying (K3) |
| CO5 | use recent visualization methods for visualizing data in various real life applications | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | 2 | | | | | | | | 3 | 2 |
| CO2 | 3 | 2 | 2 | | 2 | | | | | | | | 3 | 2 |
| CO3 | 3 | 2 | 2 | | 2 | | | | | | | | 3 | 2 |
| CO4 | 3 | 2 | 2 | | 2 | | | | | | | | 3 | 2 |
| CO5 | 3 | 2 | 2 | | 2 | | | | | | | | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 50 | 30 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSH02 - STATISTICAL LEARNING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **(Common to CSE, IT and CSD branches)** | | | | | | | | |
| **Programme & Branch** | **B.E. – Computer Science and Engineering, Computer Science and Design & BTech – Information Technology** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5/6/7** | **HN** | **3** | **1** | **0** | **4** |

| | | |
|---|---|---|
| Preamble | The course provides an overview of statistical learning with various modeling and prediction techniques and implement the techniques using R. | |
| **Unit – I** | **Introduction and Statistical Learning** | **9+3** |
| Introduction: An Overview of Statistical Learning – History - Statistical Learning: Overview – Assessing Model Accuracy – Introduction to R and working with R. | | |
| **Unit – II** | **Linear Regression and Classification** | **9+3** |
| Linear Regression: Simple Linear Regression - Multiple Linear Regression – Other Considerations – Working with Linear Regression using R– Classification: Overview – Logistic Regression – Linear Discriminant Analysis – Working with Logistic Regression using R. | | |
| **Unit – III** | **Resampling Methods and Linear Model Selection** | **9+3** |
| Resampling Methods: Cross-Validation – Bootstrap - Working with Cross-Validation in R– Linear Model Selection: Subset Selection – Dimension Reduction Methods – Working with PCR in R. | | |
| **Unit – IV** | **Non-Linear Modeling and Tree-based Methods** | **9+3** |
| Beyond Linearity: Polynomial Regression – Step Functions – Basis Functions – Regression Splines – Smoothing Splines – Working with Non-Linear Modeling in R – Tree-Based Methods – Basic Decision Trees – Bagging – Random Forests – Boosting – Working with Decision Trees in R | | |
| **Unit – V** | **Support Vector Machines and Unsupervised Learning** | **9+3** |
| Support Vector Machines: Maximal Margin Classifier – Support Vector Classifier – Support Vector Machine – Working with SVM in R – Unsupervised Learning: Clustering Methods – Working with Clustering in R | | |
| | | **Lecture :45 ;Tutorial:15 Total:60** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | James G, Witten D, Hastie T, Tibshirani R, "An Introduction to Statistical Learning with Applications in R", 1st edition, Springer, 2017-ebook-8th printing. |

**REFERENCES:**



| | |
|---|---|
| 1. | Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning”, 2nd edition, Springer 2009. |
| 2. | Douglas C, Montgomery and George C Runger, “Applied Statistics and Probability for Engineers”, 3rd Edition, John Wiley & Sons Inc., 2003. |

| **COURSE OUTCOMES:**<br>**On completion of the course, the students will be able to** | | **BT Mapped (Highest Level)** |
|---|---|---|
| CO1 | understand the basics of statistical methods and use it in R | Applying (K3) |
| CO2 | apply statistical methods for linear regression models | Applying (K3) |
| CO3 | interpret resampling methods and linear model selection process | Applying (K3) |
| CO4 | use data to make work with nonlinear models and tree based methods | Applying (K3) |
| CO5 | apply support vector machine and unsupervised methods for real datasets | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | 2 | | | | | | | | 3 | 2 |
| CO2 | 3 | 2 | 2 | | 2 | | | | | | | | 3 | 2 |
| CO3 | 3 | 2 | 2 | | 2 | | | | | | | | 3 | 2 |
| CO4 | 3 | 2 | 2 | | 2 | | | | | | | | 3 | 2 |
| CO5 | 3 | 2 | 2 | | 2 | | | | | | | | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom’s Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 50 | 30 | | | | 100 |
| CAT2 | 20 | 40 | 40 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSH04 - IMAGE AND VIDEO ANALYTICS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **(Common to CSE, IT and CSD branches)** | | | | | | | |
| **Programme & Branch** | **B.E. – Computer Science and Engineering, Computer Science and Design & BTech – Information Technology** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5/6/7** | **HN** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course aims to provide a broad view on processing and analyzing images and video. | |
| **Unit – I** | **Introduction** | **9** |
| Deep Neural Networks – Introduction to Tensor flow – Keras Deep Learning library – OpenCV Libratry - Hand Written Number Recognition with Keras and OpenCV | | |
| **Unit – II** | **Convolutional Neural Network for Computer Vision** | **9** |
| Convolution Neural Network – CNN architectures and drawbacks of DNN- convolution and pooling operations in tensor flow – training and evaluating CNN – model performance optimization – ImageNet – LeNet – AlexNet – VGGNet – GoogleLENet - TesNet. | | |
| **Unit – III** | **Feature extraction, object detection and segmentation** | **9** |
| Feature extraction approach – transfer learning example – multi-task learning – Auto encoders of CNN – difference between object detection and image classification - Traditional, nonCNN approaches to object detection - R-CNN – Regions with CNN features - Fast R-CNN – fast region-based CNN - Faster R-CNN – faster region proposal network-based CNN -Mask R-CNN – Instance segmentation with CNN | | |
| **Unit – IV** | **Generative Models** | **9** |
| Pix2pix - Image-to-Image translation - GAN – code example – feature matching – applications of generative models – neural artistic style transfer – generative adversarial networks – visual dialogue model. | | |
| **Unit – V** | **Video Classification** | **9** |
| Understanding and classifying videos – exploring video classification dataset – splitting videos in to frames – approaches for classifying videos – extending image based approaches to videos: Regressing the human pose- segmenting videos – generating videos. | | |
| | | **Lecture:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Mohit Sewak, Md. Rezaul Karim and Pradeep Pujari, “Practical Convolutional Neural Networks, Packt Publishing, 2018 (UNITS I,II,III) |
| 2. | Rajalingappaa Shanmugamani, “Deep Learning for Computer Vision”, Packt Publishing, 2018, (UNITS IV,V) |

**REFERENCES/ MANUAL / SOFTWARE:**

| | |
|---|---|
| 1. | D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012. |
| 2. | Jan Erik Solem, “Programming Computer Vision with Python: Tools and algorithms for analyzing images”, O'Reilly Media, 2012. |
| 3. | Windows/Linux |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | Make use of the basic concepts of image processing and its libraries | Applying (K3) |
| CO2 | Interpret the various CNN models used for image analytics | Applying (K3) |
| CO3 | Apply the various levels of segmentation and interpret the results for object detection and feature extraction. | Applying (K3) |
| CO4 | Make use of the GAN model to solve the real world problems. | Applying (K3) |
| CO5 | Predict the more reliable video analytic solutions for real time problems. | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO2 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | 1 | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 20 | 30 | 50 | | | | 100 |
| CAT2 | 20 | 30 | 50 | | | | 100 |
| CAT3 | 20 | 30 | 50 | | | | 100 |
| ESE | 10 | 40 | 50 | | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

| 22CSH05- REAL TIME ANALYTICS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **(Common to CSE, IT and CSD branches)** | | | | | | | |
| **Programme & Branch** | **B.E. – Computer Science and Engineering, Computer Science and Design & BTech – Information Technology** | **Sem.** | **Category** | **L** | **T** | **P** | **Credit** |
| **Prerequisites** | **Nil** | **5/6/7** | **HN** | **3** | **0** | **0** | **3** |

| | | |
|---|---|---|
| Preamble | This course provides a comprehensive knowledge about data analysis technologies to build an effective real-time analytics platform. | |
| **Unit – I** | **Streaming Data and analytics:** | **9** |
| Introduction to Streaming Data: Sources – Why Streaming Data is Different – Infrastructures and Algorithms. Streaming Analytics Architecture: Real-Time Architecture Components – Feature of Real-Time Architecture – Languages for Real-Time programming – A Real-Time Architecture Checklist. | | |
| **Unit – II** | **Processing and Storing Streaming Data:** | **9** |
| Processing Streaming Data: Distributed Streaming Data Processing – Processing Data with Storm: Components, Configuring of a Storm Cluster – Distributed Clusters – Local Clusters – Storm Topologies. Storing Streaming Data : Consistent Hashing – No SQL Storage Systems – Other Storage Technologies – Choosing a Technology – Warehousing. | | |
| **Unit – III** | **Visualization and Aggregation:** | **9** |
| Visualization: Visualizing Data – Mobile Streaming Applications – Exact Aggregation and Delivery: Timed Counting and Summation – Multi –Resolution Time-Series Aggregation – Stochastic Optimization | | |
| **Unit – IV** | **Statistical Approximation of Streaming Data and Sketching:** | **9** |
| Statistical Approximation of Streaming Data: Sampling from a streaming Population – Biased Streaming Sampling. Sketching : Registers and Hash Functions – Working with Sets – The Bloom Filter – Distinct Value Sketches – The Count-Min Sketch – Other Applications | | |
| **Unit – V** | **Real-Time Models, Monitoring and Forecasting:** | **9** |
| Real-Time Models and Monitoring: Simple Time-Series Models – Linear Models – Logistic Regression – Neural Network Models – Forecasting: Exponential Smoothing Methods – Regression Methods - Neural Network Methods. Monitoring: Outlier Detection - Change Detection | | |
| | | **Total:45** |

**TEXT BOOK:**

| | |
|---|---|
| 1. | Ellis, Byron. "Real-time analytics: Techniques to analyze and visualize streaming data", John Wiley & Sons, 1st Edition, 2014 (units I, II, III, IV, V) |

**REFERENCES:**

| | |
|---|---|
| 1. | Goetz, P. Taylor, and Brian O'Neill, "Storm blueprints: patterns for distributed real-time computation", Packt Publishing Ltd, 1st Edition, 2014. |

| COURSE OUTCOMES:<br>On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|---|---|---|
| CO1 | describe the concepts of streaming data and analyze various architectures for streaming data | Applying (K3) |
| CO2 | make use of processing and storage techniques to build real time analytics applications | Applying (K3) |
| CO3 | apply visualization and aggregation techniques for real time analytics | Applying (K3) |
| CO4 | employ statistical approximation and sketching techniques for solving the real world problems | Applying (K3) |
| CO5 | develop models and use it for forecasting and monitoring to solve real time problems | Applying (K3) |

**Mapping of COs with POs and PSOs**

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | | | | | 3 | 2 |
| CO2 | 3 | 2 | 1 | | 2 | | | | | | | | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 3 | 1 |
| CO5 | 3 | 2 | 1 | | 2 | | | | | | | | 3 | 1 |

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

**ASSESSMENT PATTERN - THEORY**

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|---|---|---|---|---|---|---|---|
| CAT1 | 10 | 20 | 30 | 40 | | | 100 |
| CAT2 | 15 | 35 | 50 | | | | 100 |
| CAT3 | 20 | 40 | 40 | | | | 100 |
| ESE | 20 | 20 | 40 | 20 | | | 100 |

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)