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 SCIENCE DEGREE
IN
SOFTWARE SYSTEMS

DEPARTMENT OF COMPUTER TECHNOLOGY

KONGU
Assuring the Best

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KONGU ENGINEERING COLLEGE
PERUNDURAI ERODE – 638 060
(Autonomous)

INSTITUTE VISION

To be a centre of excellence for development and dissemination of knowledge in Applied Sciences, Technology, Engineering and Management for the Nation and beyond.

INSTITUTE MISSION

We are committed to value based Education, Research and Consultancy in Engineering and Management and to bring out technically competent, ethically strong and quality professionals to keep our Nation ahead in the competitive knowledge intensive world.

QUALITY POLICY

We are committed to

- Provide value based quality education for the development of students as competent and responsible citizens.
- Contribute to the nation and beyond through research and development
- Continuously improve our services

DEPARTMENT OF COMPTER TECHNOLOGY

VISION

To become a technically competent centre in the domain of computer science to take care of the global industrial needs.

MISSION

Department of Computer Technology-UG is committed to:

MS1: Develop inventive, proficient, ethical and quality conscious Software professionals

MS2: Produce stake holders who can contribute to technological development and social upliftment

MS3: Provide students with the state-of-art technologies to excel in academics to meet the IT industrial needs

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduate of Software Systems will:

PEO1: Flourish in Software profession and/or pursue post-graduation

PEO2: Exhibit professional competency and contribute to the intellectual foundation of software engineering discipline.

PEO3: Live and work as contributing, well-rounded member of society.

MAPPING OF MISSION STATEMENTS (MS) WITH PEOs

MS\PEO	PEO1	PEO2	PEO3
MS1	3	3	2
MS2	3	3	2
MS3	2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)	
Graduates of Software Systems will**:**	
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)	
Graduates of Software Systems will**:**	
PSO1	Design, develop and manage the problems in the field of Software engineering using Programming, project management and analysis skills.
PSO2	Create, provide robust solutions for the complex industrial problems using effective project management skills.

MAPPING OF PEOs WITH POs AND PSOs

PEO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	2	3	3	1	1	1	2	3	3	2	2	1	3	2
PEO2	1	2	3	1	1	2	1	1	2	2	1	2	2	3
PEO3	1	1	1	1	1	1	1	3	2	2	1	3	3	2

1 – Slight, 2 – Moderate, 3 – Substantial

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638060

(An Autonomous Institution Affiliated to Anna University)

REGULATIONS 2022

CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

BACHELOR OF SCIENCE (BSc) DEGREE PROGRAMMES

These regulations are applicable to all candidates admitted into BSc 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 Science (BSc) Degree programme

iv. "Branch" means specialization or discipline of BSc Degree Programme, like Computer Systems and Design, Information Systems and Software Systems.

v. "Course" means a Theory / Theory cum Practical / Practical course that is normally studied in a semester like Mathematics, C Programming, 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" means authorized person who is responsible for all examination related activities of the College.

xi. "Head of the Department" means Head of the Department concerned of the College.

2. PROGRAMMES AND BRANCHES OF STUDY

The BSc programmes and branches of study approved by Anna University, Chennai are offered by the College.

Programme	Branch
BSc	Computer Systems and Design
	Information Systems
	Software Systems

3. ADMISSION REQUIREMENTS

Candidates for admission to the first semester of the BSc Programme shall be required to have passed the Higher Secondary Examination (academic / vocational) of the (10+2) curriculum prescribed by the appropriate authority of Govt. of Tamil Nadu or any examination of any other authority accepted by the Anna University, Chennai as equivalent thereto

4. STRUCTURE OF PROGRAMMES

4.1 Categorisation of Courses

The BSc programme shall have a curriculum with syllabi comprising of theory, theory cum practical, practical courses in each semester, professional skills training, project work, internship, etc. that have been approved by the 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

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, Entrepreneurships/Start ups and Internship in Industry or elsewhere

viii. Audit Courses (AC)

ix. Mandatory Courses (MC) like Student Induction Program

4.2 Credit Assignment

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 BSc programme is 130.

4.3 Employability Enhancement Courses

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

4.3.1 Professional Skills Training/Industrial Training/ Entrepreneurships/Start Ups

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 third semester and phase II in fourth 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 third semester vacation period. Such candidate can earn two credits for this training course in place of Professional Skills Training course II in fourth semester. He/She shall attend Professional Skills Training Phase I in third 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 BSc programme. Candidates can set up their start up from third semester onwards either inside or outside of the college. Such student entrepreneurs may earn a maximum of 2 credits per semester for two semesters each in place of either Professional Skills Training I or 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 Full Time Project through Internships

The curriculum enables a candidate to go for full time project through internship during a part of fifth semester and/or entire final semester and can earn credits

through it for his/her academics vide clause 7.6, 7.7 and clause 7.11.

A candidate is permitted to go for full time projects through internship in fifth semester with the following condition: The candidate shall complete a part of the fifth semester courses with a total credit of about 50% of the total credits of fifth semester including Project Work I in the first two months from the commencement of the fifth semester under fast track mode. The balance credits required to complete the fifth semester shall be earned by the candidate through either approved Value Added 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 internship during sixth semester in place of Project Work II. Such candidate shall earn the minimum number of credits required to complete sixth semester other than project/internship through either approved Onealue Added Courses /Online courses / Self Study Courses or Add/Drop courses as per clause 4.4 and clause 4.5 respectively. The number of credits for the internship same as that of Project Work in the final semester.

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

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

The candidate 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 the 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 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. 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 (up to fifth semester).

4.4.5 A candidate can earn a maximum of 24 credits through all value added 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 sixth semesters the candidates have the option of registering for additional elective courses or dropping of already registered additional elective courses within two weeks from the start of the semester. Add / Drop is only an option given to the candidates. Total number of credits of such courses during the entire programme of study cannot exceed eight.

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 BSc Degree programme in 6 consecutive semesters/3 Years, but in any case not more than 10 semesters/5 Years.

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), 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.

7. ASSESSMENT AND EXAMINATION PROCEDURE FOR AWARDING MARKS

7.1 The BSc programmes consist of Theory Courses, Theory cum Practical courses, Practical courses, Project Work, Industrial / Professional Training, Internship 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:

Sl. No.	Category of Course	Continuous Assessment Marks	End Semester Examination Marks
1.	Theory	40	60
2.	Theory cum Practical (The distribution of marks shall be decided based on the credit weightage assigned to theory and	50	50
3.	Practical	60	40
4.	Professional Skills Training / Industrial Training / Entrepreneurships / Start ups / Internships/Mandatory Course	100	---
5.	Project Work I / Project Work II Phase II / Internships	50	50
6.	One / Two credit Course	The distribution of marks shall be decided based on the credit weightage assigned	---
7.	All other Courses		

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 two
	Test - II	20	
	Test - III	20	
2.	Tutorial	15	Should be of Open Book/Objective Type. Average of best 4 (or more, depending on the nature of the course, as may be approved by Principal)
3.	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 (Hospitalised / Sports or any other reason approved by the Principal).

7.3.3 The end semester examination for theory courses shall be for 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.

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 candidate's 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

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 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	Guide	Review Committee (excluding guide)	Guide	Review Committee (excluding guide)	Guide	Ext. Exr.	Guide	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 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 guide 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

The Project Work I shall be evaluated based on continuous assessment and end semester examinations. The evaluation method shall be same as that of the Project Work II as per clause 7.6.

7.8 Industrial Training

After completion of Industrial training, the candidate shall submit a brief report on the training undergone and a certificate obtained from the organization concerned. The evaluation will be made based on this report and a Viva-Voce Examination. A copy of the certificate (issued by the Organization) submitted by the candidate shall be attached to the mark list and sent to Controller of Examinations by the respective Head of the Department.

Continuous Assessment (Max. 100 Marks)		
Report Evaluation (Max. 40 Marks)	Viva - Voce (Max. 60 Marks)	
Review Committee	Guide	Review Committee
40	20	40

7.9 Professional Skills Training

Phase I training shall be conducted for minimum 80 hours in 2nd semester vacation and during 3rd semester. Phase II training shall be conducted for minimum 80 hours in 3rd semester vacation and during 4th semester. The evaluation procedure shall be approved by the board of the offering department and 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 third semester and two credits in fourth semester respectively and shall be evaluated through continuous assessments for a maximum of 100 marks vide clause 7.1. A report about the start ups 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 submit a brief report about the internship 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 candidates 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 other branches candidates 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 Course

A candidate shall attend and complete a three week mandatory course namely Student Induction Program including Universal Human Values and Yoga, etc at the beginning of the first semester. No credits shall be given for such 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.

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 once 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 approval of the recommendation of review committee and 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, but the grade awarded shall be only the lowest passing grade irrespective of the marks secured.

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:

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

The Cumulative Grade Point Average (CGPA) is calculated from first semester to final semester using the formula

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

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 BSc 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 Board of Studies whenever readmitted under regulations other than R-2020 (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 six semesters in the **First Appearance** within six consecutive semesters 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 six semesters in the **First Appearance** within six consecutive semesters excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
- Submission of equivalent course list approved by the 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 six semesters within eight consecutive semesters 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.

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 Kongu Engineering College, reserves the right to modify/amend without notice, the Regulations, Curricula, Syllabi, Scheme of Examinations, procedures, requirements, and rules pertaining to its BSc programme.

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CURRICULUM BREAKDOWN STRUCTURE								
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**		
HS	**4**	**4**					**8**	**6.2**
BS	**4**	**4**					**8**	**6.2**
ES	**5**		**4**				**9**	**6.9**
PC	**10**	**15**	**19**	**23**	**10**		**77**	**59.2**
PE					**6**	**6**	**12**	**9.2**
EC			**2**	**2**	**6**	**6**	**16**	**12.3**
Semesterwise Total	**23**	**23**	**25**	**25**	**22**	**12**	**130**	**100.0**

CATEGORISATION OF COURSES							
HUMANITIES AND SOCIAL SCIENCES AND MANAGEMENT STUDIES(HSMS), BASIC SCIENCES (BS),ENGINEERING SCIENCES(ES)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	22BCC11	Communicative English I	3	0	2	4	I
2.	22BCC21	Communicative English II	3	0	2	4	II
3.	22BCC12	Mathematics I	3	1*	2*	4	I
4.	22BCC22	Mathematics II	3	1*	2*	4	II
5.	22BCT11	Digital Principles and Logic Design	3	0	0	3	I
6.	22BCL11	Digital Principles and Logic Design Laboratory	0	0	4	2	I
Total Credits to be earned						**21**	

S. No.	Course Code	Course Name	L	T	P	C	Sem
1.	22BCT12	Problem Solving and Programming in C	3	0	0	3	I
2.	22BCT13	Web Programming	3	0	0	3	I
3.	22BCL12	C Programming Laboratory	0	0	4	2	I
4.	22BCL13	Web Programming Laboratory	0	0	4	2	I
5.	22BCT21	Advanced C Programming	3	0	0	3	II
6.	22BCT22	Java Programming	3	0	0	3	II
7.	22BCT23	Operating Systems	3	0	0	3	II
8.	22BCL21	Advanced C Programming Laboratory	0	0	4	2	II
9.	22BCL22	Java Programming Laboratory	0	0	4	2	II
10.	22BCL23	Operating Systems Laboratory	0	0	4	2	II
11.	22BCT31	Python Programming	3	0	0	3	III
12.	22BCT32	Data Structures and Algorithms	3	0	0	3	III
13.	22BCT33	Database Management Systems	3	0	0	3	III
14.	22BCT34	Computer Organization	3	1	0	4	III
15.	22BCT35	Software Engineering	3	1	0	4	III
16.	22BCL31	Python Programming Laboratory	0	0	4	2	III
17.	22BCL32	Data Structures Laboratory	0	0	4	2	III
18.	22BCL33	Database Management Systems Laboratory	0	0	4	2	III
19.	22BCT41	User Interface Technologies	3	0	0	3	IV
20.	22BST41	Software Testing	3	0	0	3	IV
21.	22BCT43	Mobile Application Development	3	0	0	3	IV
22.	22BCT44	Computer Networks	3	1	0	4	IV
23.	22BCC41	Big Data Analytics	3	0	2	4	IV
24.	22BCL41	User Interface Technologies Laboratory	0	0	4	2	IV
25.	22BSL41	Software Testing Laboratory	0	0	4	2	IV
26.	22BCL43	Mobile Application Development Laboratory	0	0	4	2	IV
27.	22BCT51	Internet of Things	3	0	0	3	V
28.	22BCT52	Artificial Intelligence and Machine Learning	3	0	0	3	V
29.	22BCL51	Internet of Things Laboratory	0	0	4	2	V
30.	22BCL52	Machine Learning Laboratory	0	0	4	2	V
Total Credits to be earned						**81**	

PROFESSIONAL ELECTIVES (PEs)						
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
Semester - V						
Elective – I						
1.	22BCE01	Cloud Computing	3	0	0	3
2.	22BSE01	Software Quality Assurance	3	0	0	3
3.	22BSE02	User Interface Design	3	0	0	3
Elective – II						
4.	22BCE04	Object Oriented Analysis and Design	3	0	0	3
5.	22BSE03	Ethical Hacking	3	0	0	3
6.	22BSE04	Software Metrics	3	0	0	3
Semester - VI						
Elective - III						
7.	22BCE07	Data Science	3	0	0	3
8.	22BCE08	Blockchain Technologies	3	0	0	3
9.	22BCE09	Software Project Management	3	0	0	3
Elective – IV						
10.	22BCE10	E-Commerce	3	0	0	3
11.	22BSE05	Agile Software Development	3	0	0	3
12.	22BCE12	Augmented and Virtual Reality	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EC)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	22GCL31	Professional Skills Training I	2	0	2	2	III
2.	22GCL42	Professional Skills Training II	2	0	2	2	IV
3.	22BSP51	Project Work I	0	0	12	6	V
4.	22BSP61	Project Work II	0	0	12	6	VI
Total Credits to be earned						**16**	

SCHEDULING OF COURSES - B.Sc. SOFTWARE SYSTEMS (Total Credit : 130)

Sem.	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6	Course 7	Course 8	Course 9	Credit
I	22BCC11 Communicative English I (3-0-2-4)	22BCC12 Mathematics I (3-1*-2*-4)	22BCT11 Digital Principles and Logic Design (3-0-0-3)	22BCT12 Problem Solving and Programming in C (3-0-0-3)	22BCT13 Web Programming (3-0-0-3)	22MNT11 Student Induction Program (0-0-0-0)	22BCL11 Digital Principles and Logic Design Laboratory (0-0-4-2)	22BCL12 C Programming Laboratory (0-0-4-2)	22BCL13 Web Programming Laboratory (0-0-4-2)	**23**
II	22BCC21 Communicative English II (3-0-2-4)	22BCC22 Mathematics II (3-1*-2*-4)	22BCT21 Advanced C Programming (3-0-0-3)	22BCT22 Java Programming (3-0-0-3)	22BCT23 Operating Systems (3-0-0-3)	-	22BCL21 Advanced C Programming Laboratory (0-0-4-2)	22BCL22 Java Programming Laboratory (0-0-4-2)	22BCL23 Operating Systems Laboratory (0-0-4-2)	**23**
III	22BCT31 Python Programming (3-0-0-3)	22BCT32 Data Structures and Algorithms (3-0-0-3)	22BCT33 Database Management Systems (3-0-0-3)	22BCT34 Computer Organization (3-1-0-4)	22BCT35 Software Engineering (3-1-0-4)	22GCL31 Professional Skills Training I (2-0-2-2)	22BCL31 Python Programming Laboratory (0-0-4-2)	22BCL32 Data Structures Laboratory (0-0-4-2)	22BCL33 Database Management Systems Laboratory (0-0-4-2)	**25**
IV	22BCT41 User Interface Technologies (3-0-0-3)	22BST41 Software Testing (3-0-0-3)	22BCT43 Mobile Application Development (3-0-0-3)	22BCT42 Computer Networks (3-1-0-4)	22BCC41 Big Data Analytics (3-0-2-4)	22GCL42 Professional Skills Training II (2-0-2-2)	22BCL41 User Interface Technologies Laboratory (0-0-4-2)	22BSL41 Software Testing Laboratory (0-0-4-2)	22BCL43 Mobile Application Development Laboratory (0-0-4-2)	**25**
V	22BCT51 Internet of Things (3-0-0-3)	22BCT52 Artificial Intelligence and Machine Learning (3-0-0-3)	Elective I (3-0-0-3)	Elective II (3-0-0-3)	22BCL51 Internet of Things Laboratory (0-0-4-2)	22BCL52 Machine Learning Laboratory (0-0-4-2)	22BSP51 Project Work I (0-0-12-6)			**22**
VI	Elective III (3-0-0-3)	Elective IV (3-0-0-3)	22BSP61 Project Work II (0-0-12-6)			-				**12**

MAPPING OF COURSES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO 2
1	22BCC11	Communicative English I				✓		✓		✓	✓	✓		✓	✓	✓
1	22BCC12	Mathematics I				✓	✓							✓	✓	✓
1	22BCT11	Digital Principles and Logic Design				✓		✓							✓	✓
1	22BCT12	Problem Solving and Programming in C	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓
1	22BCT13	Web Programming	✓	✓	✓	✓	✓	✓			✓				✓	✓
1	22MNT11	Student Induction Program						✓		✓				✓	✓	✓
1	22BCL11	Digital Principles and Logic Design Laboratory				✓									✓	✓
1	22BCL12	C Programming Laboratory	✓	✓	✓	✓									✓	✓
1	22BCL13	Web Programming Laboratory	✓	✓	✓	✓									✓	✓
2	22BCC21	Communicative English II				✓		✓		✓	✓	✓		✓	✓	✓
2	22BCC22	Mathematics II	✓	✓	✓	✓	✓								✓	✓
2	22BCT21	Advanced C Programming	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓
2	22BCT22	Java Programming	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
2	22BCT23	Operating Systems	✓	✓	✓	✓									✓	✓
2	22BCL21	Advanced C Programming Laboratory	✓	✓	✓	✓									✓	✓
2	22BCL22	Java Programming Laboratory	✓	✓	✓	✓									✓	✓
2	22BCL23	Operating Systems Laboratory	✓	✓	✓	✓									✓	✓
3	22BCT31	Python Programming	✓	✓	✓	✓									✓	✓
3	22BCT32	Data Structures and Algorithms	✓	✓	✓	✓	✓								✓	✓
3	22BCT33	Database Management Systems	✓	✓	✓	✓									✓	✓
3	22BCT34	Computer Organization	✓	✓	✓	✓									✓	✓
3	22BCT35	Software Engineering	✓	✓	✓	✓									✓	✓
3	22GCL31	Professional Skills Training I	✓	✓				✓	✓		✓		✓	✓	✓	✓
3	22BCL31	Python Programming Laboratory	✓	✓	✓	✓									✓	✓
3	22BCL32	Data Structures Laboratory	✓	✓	✓	✓									✓	✓

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
3	22BCL33	Database Management Systems Laboratory	✓	✓	✓	✓									✓	✓
4	22BCT41	User Interface Technologies	✓	✓	✓	✓									✓	✓
4	22BST41	Software Testing	✓	✓	✓	✓	✓	✓			✓				✓	✓
4	22BCT43	Mobile Application Development	✓	✓	✓	✓									✓	✓
4	22BCT44	Computer Networks	✓	✓	✓	✓									✓	✓
4	22BCC41	Big Data Analytics	✓	✓	✓	✓	✓								✓	✓
4	22GCL42	Professional Skills Training II	✓	✓				✓	✓		✓		✓	✓	✓	✓
4	22BCL41	User Interface Technologies Laboratory	✓	✓	✓	✓									✓	✓
4	22BSL41	Software Testing Laboratory	✓	✓	✓	✓	✓								✓	✓
4	22BCL43	Mobile Application Development Laboratory	✓	✓	✓	✓									✓	✓
5	22BCT51	Internet of Things	✓	✓	✓	✓						✓	✓	✓	✓	✓
5	22BCT52	Artificial Intelligence and Machine Learning	✓	✓	✓	✓									✓	✓
5	22BCL51	Internet of Things Laboratory	✓	✓	✓	✓	✓								✓	✓
5	22BCL52	Machine Learning Laboratory	✓	✓	✓	✓									✓	✓
5	22BSP51	Project Work I	✓	✓	✓	✓									✓	✓
6	22BSP61	Project Work II	✓	✓	✓	✓									✓	✓
		Professional Electives														
5	22BCE01	Cloud Computing	✓	✓	✓	✓									✓	✓
5	22BSE01	Software Quality Assurance	✓	✓	✓	✓									✓	✓
5	22BSE02	User Interface Design	✓	✓	✓	✓									✓	✓
5	22BCE04	Object Oriented Analysis and Design	✓	✓	✓	✓									✓	✓
5	22BSE03	Ethical Hacking	✓	✓	✓	✓									✓	✓
5	22BSE04	Software Metrics	✓	✓	✓	✓									✓	✓
6	22BCE07	Data Science	✓	✓	✓	✓									✓	✓
6	22BCE08	Blockchain Technologies	✓	✓	✓	✓									✓	✓
6	22BCE09	Software Project Management	✓	✓	✓	✓	✓	✓			✓				✓	✓
6	22BCE10	E-Commerce	✓	✓	✓	✓	✓	✓			✓				✓	✓
6	22BSE05	Agile Software Development	✓	✓	✓	✓									✓	✓
6	22BCE12	Augmented and Virtual Reality	✓	✓	✓						✓	✓	✓		✓	✓

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SEMESTER – I									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22BCC11	Communicative English I	3	0	2	4	50	50	100	HS
22BCC12	Mathematics I	3	1*	2*	4	50	50	100	BS
22BCT11	Digital Principles and Logic Design	3	0	0	3	40	60	100	BS
22BCT12	Problem Solving and Programming in C	3	0	0	3	40	60	100	PC
22BCT13	Web Programming	3	0	0	3	40	60	100	PC
22MNT11	Student Induction Program	-	-	-	-	100	-	100	MC
Practical / Employability Enhancement									
22BCL11	Digital Principles and Logic Design Laboratory	0	0	4	2	60	40	100	BS
22BCL12	C Programming Laboratory	0	0	4	2	100	0	100	PC
22BCL13	Web Programming Laboratory	0	0	4	2	60	40	100	PC
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									
22BCC21	Communicative English II	3	0	2	4	50	50	100	HS
22BCC22	Mathematics II	3	1*	2*	4	50	50	100	BS
22BCT21	Advanced C Programming	3	0	0	3	40	60	100	PC
22BCT22	Java Programming	3	0	0	3	40	60	100	PC
22BCT23	Operating Systems	3	0	0	3	40	60	100	PC
Practical / Employability Enhancement									
22BCL21	Advanced C Programming Laboratory	0	0	4	2	100	0	100	PC
22BCL22	Java Programming Laboratory	0	0	4	2	100	0	100	PC
22BCL23	Operating Systems Laboratory	0	0	4	2	60	40	100	PC
Total Credits to be earned					**23**				

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SEMESTER – III									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22BCT31	Python Programming	3	0	0	3	40	60	100	PC
22BCT32	Data Structures and Algorithms	3	0	0	3	40	60	100	PC
22BCT33	Database Management Systems	3	0	0	3	40	60	100	PC
22BCT34	Computer Organization	3	1	0	4	40	60	100	PC
22BCT35	Software Engineering	3	1	0	4	40	60	100	PC
Practical / Employability Enhancement									
22BCL31	Python Programming Laboratory	0	0	4	2	100	0	100	PC
22BCL32	Data Structures Laboratory	0	0	4	2	60	40	100	PC
22BCL33	Database Management Systems Laboratory	0	0	4	2	60	40	100	PC
22GCL31	Professional Skills Training I	2	0	2	2	100	-	100	EC
Total Credits to be earned					**25**				

SEMESTER – IV									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22BCT41	User Interface Technologies	3	0	0	3	40	60	100	PC
22BST41	Software Testing	3	0	0	3	40	60	100	PC
22BCT43	Mobile Application Development	3	0	0	3	40	60	100	PC
22BCT44	Computer Networks	3	1	0	4	40	60	100	PC
22BCC41	Big Data Analytics	3	0	2	4	50	50	100	PC
Practical / Employability Enhancement									
22BCL41	User Interface Technologies Laboratory	0	0	4	2	60	40	100	PC
22BSL41	Software Testing Laboratory	0	0	4	2	60	40	100	PC
22BCL43	Mobile Application Development Laboratory	0	0	4	2	60	40	100	PC
22GCL42	Professional Skills Training II	2	0	2	2	100	-	100	EC
Total Credits to be earned					**25**				

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SEMESTER – V									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22BCT51	Internet of Things	3	0	0	3	40	60	100	PC
22BCT52	Artificial Intelligence and Machine Learning	3	0	0	3	40	60	100	PC
	Elective I	3	0	0	3	40	60	100	PE
	Elective II	3	0	0	3	40	60	100	PE
Practical / Employability Enhancement									
22BCL51	Internet of Things Laboratory	0	0	4	2	60	40	100	PC
22BCL52	Machine Learning Laboratory	0	0	4	2	60	40	100	PC
22BSP51	Project Work I	0	0	12	6	50	50	100	EC
Total Credits to be earned					**22**				

SEMESTER – VI									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
	Elective III	3	0	0	3	40	60	100	PE
	Elective IV	3	0	0	3	40	60	100	PE
Practical / Employability Enhancement									
22BSP61	Project Work II	0	0	12	6	50	50	100	EC
Total Credits to be earned					**12**				

Total Credits : 130

LIST OF PROFESSIONAL ELECTIVES (PEs)						
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
Semester - V						
Elective – I						
1.	22BCE01	Cloud Computing	3	0	0	3
2.	22BSE01	Software Quality Assurance	3	0	0	3
3.	22BSE02	User Interface Design	3	0	0	3
Elective – II						
7.	22BCE04	Object Oriented Analysis and Design	3	0	0	3
8.	22BSE03	Ethical Hacking	3	0	0	3
9.	22BSE04	Software Metrics	3	0	0	3
Semester - VI						
Elective - III						
13.	22BCE07	Data Science	3	0	0	3
14.	22BCE08	Blockchain Technologies	3	0	0	3
15.	22BCE09	Software Project Management	3	0	0	3
Elective – IV						
19.	22BCE10	E-Commerce	3	0	0	3
20.	22BSE05	Agile Software Development	3	0	0	3
21.	22BCE12	Augmented and Virtual Reality	3	0	0	3

22BCC11 - COMMUNICATIVE ENGLISH - I							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme& Branch	**B.Sc& Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**HS**	**3**	**0**	**2**	**4**

Preamble	To employ techniques of active reading, effective speaking and integrate ideas through writing skills. Learners can gain confidence to communicate in formal forum effectively and write long passages independently.	
Unit – I	**Grammar and Vocabulary:**	**9**
Parts of speech - Finite and non-finite verbs -Tenses- Reading: Prediction and Surveying - Writing: Essays- Dialogue writing - Activities: Listening: Types of listening - Speaking: Talking about oneself, one's family, friends and favorite persons.		
Unit – II	**Grammar and Vocabulary:**	**9**
Cause and effect expressions - Prefixes and Suffixes - Synonyms and Antonyms - Reading: Types: Skimming, Scanning, Word-by-word and Speed - Writing: Describing persons, places and products and processes - Activities: Listening: Process of listening - Speaking: Non-technical Presentation.		
Unit – III	**Grammar and Vocabulary:**	**9**
Active and Passive voice - Impersonal Passive - Reported Speech – Reading: Reading Comprehension – Summarizing and Paraphrasing - Writing: Warnings and Instructions - Activities: Listening: Effective listening strategies - Speaking: short talks.		
Unit – IV	**Grammar and Vocabulary:**	**9**
Abbreviations and Acronyms – Structure of captions / slogans - Prepositions - Reading: Intensive reading and Note-making - Writing: Informal and Formal Letters: Enquiry and placing order - Activities: Listening: Gap filling activity while listening - Speaking: Narrating an event/story		
Unit – V	**Grammar and Vocabulary:**	**9**
Connectives and Discourse Markers and Text organization - Sentence Patterns – Punctuations - Reading: Tongue twisters - Rearranging jumbled sentences - Writing: E-mail Writing - Preparing the transcript for a speech - Activities: Listening: Listening to a lecture and taking notes – Speaking: Describing an image/picture.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Self-Introduction
2.	News Reading
3.	Making a non-technical Presentation
4.	Situational dialogues
5.	Speaking about a dream job/company
6.	Reading newspaper articles/magazines
7.	Listening comprehension
8.	Preparing review of a book/movie
9.	Writing about a recent scientific invention/technology
10.	Creative Writing: writing apoem/short story/ personal happenings – unforgettable moment in one's life

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Sanjay Kumar and PushpLata, “Communication Skills”, 2nd Edition, New Delhi: Oxford University Press, 2015.

REFERENCES/ MANUAL / SOFTWARE:

1.	Raymond Murphy, “Essential English Grammar: Reference and Practice for South Asian Students”, 2nd Edition, Cambridge: Cambridge University Press, 2012.
2.	GlennisPye, “Vocabulary in Practice, Parts 1 and 2”, 1stEdition, Cambridge: Cambridge University Press, 2011.
3.	DVD, podcasts, Authentic Videos, and Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify and use content words which carry more meaning	Understanding (K2)
CO2	construct sentences in English	Applying (K3)
CO3	read short, simple messages and texts with complete understanding	Understanding (K2)
CO4	write at the sentence and paragraph level and beyond	Applying (K3)
CO5	speak in a given context	Applying (K3)
CO6	acquire proficiency through effective listening and reading	Understanding (K2), Imitation (S1)
CO7	write coherently without grammatical errors	Creating (K6)
CO8	take part in various professional and academic events	Analyzing (K4), 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				1		2		1	2	3		3	1	1
CO2				1		2		1	2	3		3	1	1
CO3				1		2		1	3	3		3	1	1
CO4				1		2		1	3	3		3	1	1
CO5				1		2		1	3	3		3	1	1
CO6				1		2		1	2	3		3	1	1
CO7				1		2		1	2	3		3	1	1
CO8				1		2		1	2	3		3	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	10	40	-	-	40	100
CAT2	10	10	40	-	-	40	100
CAT3	10	10	50	-	-	30	100
ESE	10	10	50	-	-	30	100

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

22BCC12–MATHEMATICS - I							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme& Branch	**B.Sc& Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**BS**	**3**	**1***	**2***	**4**

Preamble	The course aims to formulate and solve problems using matrices, differential equations and fitting the best curve to the given data. Eventually the course provides a thorough understanding of solving real world problems using numerical methods.

Unit – I	**Matrices:**	**9+3**

Characteristic Equation of a matrix - Eigen values and Eigen vectors of real matrix - Properties of Eigen values and Eigen vectors (statement and problems only) - Cayley-Hamilton Theorem (statement only) - Orthogonal Matrices - Orthogonal Transformation of Symmetric matrix to diagonal form - Quadratic forms - Reduction of Quadratic form to Canonical form by Orthogonal reduction.

Unit – II	**Differential Calculus:**	**9+3**

Statement & simple problems only: Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Applications: Maxima and Minima of functions of one variable. **Ordinary Differential Equations:** Linear differential equations of second order with constant coefficients when the RHS is e^{ax}, sin(ax), cos(ax), x^n (n>0).

Unit – III	**Curve Fitting:**	**9+3**

Evaluation of constants by the method of group averages: Fitting a straight line - Equations involving three constants of the form $y= a+bx+cx^2$, $y= ax^b+c$, $y=ab^x+c$ and $y= ae^{bx}+ c$ - Method of least squares: Fitting a straight line - Fitting a parabola.

Unit – IV	**Solution of Algebraic and Transcendental Equations:**	**9+3**

Bisection method - Newton-Raphson method -RegulaFalsi method - System of Simultaneous Linear Equations: Direct Methods: Gauss elimination method - Gauss Jordan method. Iterative methods: Gauss Jacobi method - Gauss Seidel method

Unit – V	**Interpolation:**	**9+3**

Interpolation with equal intervals: Newton-Gregory forward and backward difference formula - Newton's divided difference method for unequal intervals - Lagrange's interpolation formula - Lagrange's inverse interpolation formula.

LIST OF EXPERIMENTS / EXERCISES:

1.	Introduction to MATLAB
2.	Computation of Eigen values and Eigen vectors
3.	Plotting and visualizing single variable functions
4.	Determination of limits and derivatives
5.	Curve fitting for variable as a function of a predictor variable
6.	Finding positive root by Regula – Falsi method
7.	Solving simultaneous linear equations by Gauss – Seidel Method
8.	Compute intermediate values using Lagrange's interpolation formula

***Alternate week**

Lecture:45, Practical:15, Total:60

TEXT BOOK:

1.	Veerarajan T, "Engineering Mathematics for first year", 3rd Edition, Tata McGraw-Hill, NewDelhi , 2012, for Unit I,II.
2.	Kandasamy P, Thilagavathy K, Gunavathy K, "Numerical Methods", 3rdEdition, S.Chand& Co, New Delhi, 2019 for Unit III,IV,V.

REFERENCES/ MANUAL / SOFTWARE:

1.	Kandasamy P, Thilagavathy K, Gunavathy K, "Engineering Mathematics for first year", S.Chand& Co, New Delhi, 2019.
2.	Jain M.K, Iyenkar S.R.K, Jain R.K, "Numerical Methods for Scientific and Engineering Computation", 8th Edition, New Age International, New Delhi, 2020.
3.	MATLAB Manual.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the basics of matrix and finding the Eigen values and Eigen Vector of a real matrix	Applying (K3)
CO2	apply differential calculus tools in solving various application problems and the second order linear differential equations	Applying (K3)
CO3	fitting a curve to the given data using different methods	Applying (K3)
CO4	apply various numerical techniques to solve algebraic and transcendental equations	Applying (K3)
CO5	illustrate interpolation techniques for equal and unequal intervals	Applying (K3)
CO6	know the basics of MATLAB, compute Eigen vectors of real matrix, plot and determine limits and derivatives of a given real function, fit a curve for a given data, find the roots of algebraic equations and find interpolate unequal data by using MATLAB.	Understanding (K2) 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										1	
CO2	3	3											1	
CO3	3	2	1											
CO4	3	3											1	
CO5	3	2												
CO6					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	30	60	-	-	-	100
ESE	10	25	65	-	-	-	100

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

22BCT11 - DIGITAL PRINCIPLES AND LOGIC DESIGN							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**BS**	**3**	**0**	**0**	**3**
Preamble	To deal with the basic principles of number systems and Boolean algebra and to exemplify the fundamental concepts of combinational and synchronous sequential logic circuits.						
Unit – I	**Digital Systems and Logic Gates:**						**9**
Digital systems - Binary Numbers -Number Base Conversions - Decimal Numbers - Octal and Hexadecimal Numbers - Complement of Numbers: 1's Complement - 2's Complement. Binary codes - Digital logic gates.							
Unit – II	**Boolean Algebra and Minimization Techniques:**						**9**
Introduction to Boolean Algebra - Basic theorems and properties of Boolean Algebra - Boolean Functions - Canonical and Standard Forms. Gate-Level Minimization: The Map method - Two, Three, Four Variable K-Map - Product Of Sums Simplification - Don"t care conditions - NAND and NOR Implementation							
Unit – III	**Combinational Logic:**						**9**
Introduction - Combinational circuits - Analysis of Combinational Circuits - Design: Half Adder - Full Adder - Half Subtractor - Full Subtractor - Decoders - Encoders - Multiplexers - Demultiplexer.							
Unit – IV	**Synchronous Sequential Logic:**						**9**
Introduction -Sequential circuits - Storage Elements - Latches: SR Latch - D latch. Flip-Flops: SR Flip-Flop - D Flip-Flop - JK Flip-Flop - T Flip-Flop. Analysis of Clocked Sequential Circuits: Analysis of D Flip-Flops - Analysis of T Flip-Flops							
Unit – V	**Registers and Counters:**						**9**
Registers - Types of Shift Registers: SISO - SIPO - PISO - PIPO - Universal Shift Register - Binary Synchronous Counters using T and D Flip flops - Ring Counters - Johnson Counter.							
							Total:45

TEXT BOOK:

1.	M. Morris Mano and Michael D. Ciletti**, "**Digital Design", 6th Edition, Pearson, India, 2020.

REFERENCES:

1.	Floyd L.Thomas, "Digital Fundamentals", 11th Edition, Pearson Education, Delhi, 2018.
2.	Givone Donald D., "Digital Principles and Design", Tata McGraw-Hill Education, Delhi, 2017.

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped** **(Highest Level)**
CO1	solve problems related to number base conversions and binary codes.	Understanding (K2)
CO2	apply the concept of Boolean algebra and to implement minimization techniques.	Applying (K3)
CO3	design the basic combinational circuits.	Applying (K3)
CO4	demonst the functions of basic flip-flops.	Applying (K3)
CO5	apply the concepts of registers and counters.	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	2
CO2	3	2	1	1		1							2	3
CO3	3	2	1	1		1							2	3
CO4	3	2	1	1		1							2	3
CO5	3	2	1	1		1							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	30	40	30	-			100
CAT2	30	35	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)

22BCT12 – PROBLEM SOLVING AND PROGRAMMING IN C							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course introduces the fundamentals of computers and programming and emphasizes on developing c programs using looping and conditional statements, functions, and array.	
Unit – I	**Introduction to Problem Solving:**	**9**
Overview of Computers – Applications of Computers – Characteristics of Computer – Basic Computer organization – Problem Solving: Planning the computer program – Algorithms – Flowcharts – Pseudocodes – Structuring the logic. Case Studies: Exchanging the values of two variables – Finding the biggest number – Summation of Numbers- Factorial computation.		
Unit – II	**Introduction to C:**	**9**
Introduction – Characteristics – Program Structure – Files used in C – Compiling and executing programs – Comments – Tokens - character set – keywords – Identifiers – Data Types – Variables – Constants – Input / Output Statements – Operators –Type conversion and typecasting- Preprocessor Directives: Introduction – Types of Preprocessor Directives.		
Unit – III	**Decision Control and Looping Statements:**	**9**
Introduction – Conditional Branching Statements: if, if-else, if-else-if, switch case - Iterative statements: while, do-while and for loop - Nested loops – break and continue statements – goto statement. Case Studies: Roman number representation – day of the week.		
Unit – IV	**Functions:**	**9**
Introduction – Prototype – definition – function call – return statement – passing parameters to function: call by value and call by reference – scope of variables: block, function, program and files – storage classes: auto, static, register and extern- recursive functions – Recursion versus Iteration.		
Unit – V	**Arrays & Strings:**	**9**
Arrays: Introduction – declaration – accessing the elements – storing values –passing arrays to functions – two-dimensional arrays – passing two-dimensional arrays to functions. Strings: Introduction – suppressing input – String manipulation Functions : strcat(), strncat(), strcmp(), strncmp(),strcpy(),strncpy() and strlen() - Arrays of Strings.		
		Total:45

TEXT BOOK:

1.	Reema Thareja, “Programming in C ”, 2nd Edition, Oxford University Press, New Delhi, 2018.

REFERENCES:

1.	Yashavant Kanetkar,"Let us C", 16th Edition, BPB Publications, 2018.
2.	Balagurusamy E., "Programming in ANSI C" , 7th Edition, Mc Graw Hill Education, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	formulate simple algorithms for arithmetic and logical problems	Understanding (K2)
CO2	understand the basics of c programming	Understanding (K2)
CO3	identify the appropriate looping and control statements in C for providing the solution to the given problem	Applying (K3)
CO4	decompose a problem into functions and synthesize a complete program	Applying (K3)
CO5	apply programming to solve problems related to arrays and strings	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	2	2	1	2	3
CO2	2	1							1	2	2	1	2	3
CO3	3	2	1	1					2	3	3	2	2	3
CO4	3	2	1	1					2	3	3	2	3	2
CO5	3	2	1	1					2	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	20	50	30				100
CAT3	20	40	40				100
ESE	20	30	50				100

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

22BCT13 – WEB PROGRAMMING							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**PC**	**3**	**0**	**0**	**3**

Preamble	To impart the basic structure and design of webpage using HTML, CSS, client-side scripting and programming in open source server-side technologies like PHP with MySQL to develop database driven web applications	
Unit – I	**Fundamentals of HTML:**	**9**
Understanding Elements – Describing Data Types –Formatting Text with HTML Elements – Arranging Text – Displaying Lists – Exploring Hyperlinks and URL – Creating Tables – Inserting Images, Exploring Colors and Canvas – Working With Forms.		
Unit – II	**Overview of CSS:**	**9**
Evolution and Syntax – Exploring Selectors – Inserting CSS in HTML – Background and Color Properties – Font and Text Properties – Creating Boxes and Columns.		
Unit – III	**Dynamic HTML and Javascripts:**	**9**
Exploring Features of Javascript – Usage in HTML document – Programming Fundamentals – Functions and Events – Built-in Objects –Document Object Model – Form Validation.		
Unit – IV	**Introduction to PHP:**	**9**
PHP- MySQL- Deciding on a Web Application Platform – PHP Syntax- Comments – Variables – Types in PHP-Simple Datatypes – Output Statements. Control Structures and Functions: Boolean Expressions - Branching:- Looping – Functions and Variables Scope – Passing Information with PHP – Arrays.		
Unit – V	**MySQL Database Integration:**	**9**
Introducing Databases and MySQL: What is Database – Need – PHP Supported Databases – Integrating PHP and MySQL- Performing Database Queries: HTML Tables and Database Tables - Complex Mappings - Creating the Sample Tables - Integrating Web Forms and Databases: HTML Forms - Basic Form Submission to a Database - Self-Submission - Editing Data with HTML Form.		
		Total:45

TEXT BOOK:

1.	DT Editorial Services**, "**HTML5 Black Book Covers CSS3, Javascript, HTML, XHTML, AJAX, PHP and JQuery", 2nd Edition, DreamTech Press, New Delhi, 2020. (for Units I, II, III)
2.	Suehring Steve, Converse Tim, Park Joyce, "PHP 6 and MYSQL6 Bible", 1st Edition, Wiley Publications, New Delhi, 2017. (for Units IV, V)

REFERENCES:

1.	Welling Luke, Thomson Laura, "PHP and MySQL Web Development", 5th Edition, Pearson Education, Uttar Pradesh, 2020.
2.	Nixon Robin, "Learning PHP MySQL and Javascript with Jquery CSS and HTML5", 4th Edition, Shroff Publishers and Distributors Pvt Ltd., Mumbai, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate web technology concepts and web page designing using basic HTML tags.	Applying (K3)
CO2	develop web pages and apply styles using CSS	Applying (K3)
CO3	design dynamic pages and perform client validation using javascript.	Applying (K3)
CO4	outline the programming constructs of PHP	Applying (K3)
CO5	develop web 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	1	1	2								2	3
CO2	3	2	1	1	2								2	3
CO3	3	2	1	1	2								2	3
CO4	3	2	1	1	2								2	3
CO5	3	2	1	1	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	30	40	30	-			100
CAT2	30	30	40	-			100
CAT3	30	30	40	-			100
ESE	30	30	40	-			100

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

22BCL11 - DIGITAL PRINCIPLES AND LOGIC DESIGN LABORATORY							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**BS**	**0**	**0**	**4**	**2**

Preamble	To provide the knowledge in the digital circuit design and implementation and to design the combinational and sequential circuits with the use of digital logic gates.

LIST OF EXPERIMENTS / EXERCISES:

1.	Verification of Logic Gates
2.	Verification of Code Convertor
3.	Verification of Parity Generator
4.	Verification of Adder
5.	Verification of Subtractor
6.	Verification of Encoder and Decoder
7.	Verification of Multiplexer and Demultiplexer
8.	Verification of SR and JK Flip-flops
9.	Verification of T and D Flip-flops
10.	Verification of Binary and BCD counter

Total:60

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate various digital ICs and implement the functionalities.	Applying (K3), Precision (S3)
CO2	design basic combinational circuits and verify their functionalities.	Applying (K3), Precision (S3)
CO3	apply the design procedures to design basic sequential circuits.	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									2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3

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

22BCL12 – C PROGRAMMING LABORATORY

(Common to Computer Systems and Design, Information Systems & Software Systems)

Programme & Branch	B.Sc & Computer Systems and Design, Information Systems, Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	PC	0	0	4	2

Preamble	This course provides the knowledge in c programming. It emphasizes on developing c programs by applying c programming concepts and features.

LIST OF EXPERIMENTS / EXERCISES:

1.	Write an algorithm and draw a flowchart using Raptor tool for the following, 1. Swapping of two variables without using temporary variable 2. Check voting eligibility of the user 3. Find biggest among three numbers
2.	Write an algorithm and draw a flowchart using Raptor tool for the following, 1. Print multiplication table for the given number 2. Print the Fibonacci series
3.	Program to demonstrate the usage of different operators like arithmetic, logical, relational and ternary operators.
4.	Write a C program to demonstrate the usage of conditional statements for the following: 1. Print the multiples of 5 and multiples of 10 in the range of 1 to n. 2. To print the grade for given mark as per the details below
5.	Write a C program to demonstrate the switch construct for the following: 1. Print the month name for the given number 2. Implementation of simple calculator
6.	Implement the looping constructs for the following: 1. Print all the factors of a given number 2. Count the number of digits in a given number
7.	Demonstrate call by value and call by reference using functions.
8.	Develop a code to implement recursion for the following: 1. GCD of two numbers 2. Factorial
9.	Write a C program for the following: 1. Find the sum of elements in an array using a function 2. Print the addition of two matrix using 2D array 3. Print the multiplication of two matrix using 2D array
10.	Create a 2D character array to store the names of students in a class and print the length of each.

Mark	Grade
>=90	A
81<=Mark<90	B
71<=Mark<80	C
61<=Mark<=70	D
50<=Mark<=60	E
<50	RA

Total:60

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	design an algorithm and flowchart for a given problem	Applying(K3), Imitation(S1)
CO2	apply conditional statements and iterative statements in solving real world problems	Applying(K3), Precision(S3)
CO3	construct programs using functions, arrays and strings	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	2	1	1									2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

22BCL13 - WEB PROGRAMMING LABORATORY							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**PC**	**0**	**0**	**4**	**2**

Preamble	To provide knowledge in the core concepts of web designing for developing static as well as dynamic web applications using client-side and server-side scripting with MySQL database connection

LIST OF EXPERIMENTS / EXERCISES:

1.	Develop a static web page for your college using HTML
2.	Design a web page using table formatting and images
3.	Develop a web page using form control elements
4.	Design a dynamic web page using inline, internal and external cascading style sheets
5.	Construct a multicolumn layout web page using CSS with a responsive design
6.	Write a javascript to validate a webpage
7.	Using DOM, add various elements and change the attributes of the web page dynamically when mouse event occurs.
8.	Write a PHP program using arrays and user-defined functions
9.	Develop SQL queries to manipulate a simple table in MySql
10.	Write a PHP code with Mysql connectivity for ticket reservation system
	Total:60

REFERENCES/ MANUAL /SOFTWARE:

1.	Lab Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate the usage of basic HTML tags, tables, frames and forms	Applying (K3) Manipulation (S2)
CO2	implement cascading style sheets and javascript concepts	Applying (K3) Manipulation (S2)
CO3	manipulate the data base with PHP to develop a simple real time application	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									2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3

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

22BCC21 - COMMUNICATIVE ENGLISH II							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme& Branch	**B.Sc& Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2**	**HS**	**3**	**0**	**2**	**4**

Preamble	To construct sentences effectively and facilitate to improve interpersonal skills of the learners. It can also provide good exposure in the field of communication.	
Unit – I	**Grammar and Vocabulary:**	**9**
Analogy - types of sentences - Assertive, Imperative, Interrogative and Exclamatory and Positive, Negative - Reading: Passages focusing on factual details, and features of text organization as well as gist, opinions and attitudes - Writing: Letter Writing: inviting guests, Job application with resume, seeking permission for Industrial Visit. Activities: Listening: Social Conversations - Speaking: Technical Presentation		
Unit – II	**Grammar and Vocabulary:**	**9**
Homonyms and homophones - Subject-verb agreement - Reading: Gapped-text exercises - Writing: Transcoding - Preparing proposals - Activities: Listening: Telephone conversations - Speaking: Role Play		
Unit – III	**Grammar and Vocabulary:**	**9**
Articles and determiners - Simple, compound and complex - Reading: Multiple matching - Writing: Checklist – Memorandum – Designing brochures. Activities: Listening: Telephonic conversation - Mock Group Discussions - Speaking: Group Discussion		
Unit – IV	**Grammar and Vocabulary:**	**9**
Error detection – Gerunds & Infinitives - Reading: Business English Certificate (BEC) type exercises - Writing: Recommendations - Activities: Listening: Motivational Talks - Speaking: Speaking with native accent.		
Unit – V	**Grammar and Vocabulary:**	**9**
Single word substitution - Definitions – Purpose and function – Interpreting news / advertisement - Reading: International English Language Testing System (IELTS) type exercises - Writing: Report Writing: special and technical reports - Activities: Listening: TED Talks - Speaking: Mock Interviews.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Mock Interview
2.	Job Application with resume
3.	Making a presentation on a technical topic/case study
4.	Group Discussion
5.	Reading Aloud
6.	Listening to native speakers' talks and imitating them
7.	Writing about a social issue
8.	Writing for blogs/social media
9.	Writing company profiles
10.	Pronunciation test

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Sanjay Kumar and PushpLata, "Communication Skills", 2nd Edition, New Delhi: Oxford University Press, 2015.

REFERENCES/ MANUAL / SOFTWARE:

1.	Raymond Murphy, "Essential English Grammar: Reference and Practice for South Asian Students", 2nd Edition, Cambridge: Cambridge University Press, 2012.
2.	GlennisPye, "Vocabulary in Practice, Parts 1 and 2", 1st Edition, Cambridge: Cambridge University Press, 2011.
3.	Tense buster, DVD, podcasts, Authentic Videos, and Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	use structural words appropriately in spoken and written texts	Remembering (K1)
CO2	construct different types of sentences	Applying (K3)
CO3	read longer academic and business English texts with maximum understanding	Understanding (K2)
CO4	write beyond the sentence level	Applying (K3)
CO5	communicate effectively in a vast range of personal, professional, academic, and cultural situations	Applying (K3)
CO6	understand the pronunciation of the native speakers (English) about their real time experience after listening to the videos	Understanding (K2), Manipulation (S2)
CO7	write coherently without grammatical errors.	Creating (K6), Precision (S3)
CO8	take part in Group Discussion, Paper or project presentation and mock interview	Analyzing (K4), 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				1		2		1	2	3		3	1	1
CO2				1		2		1	2	3		3	1	1
CO3				1		2		1	3	3		3	1	1
CO4				1		2		1	3	3		3	1	1
CO5				1		2		1	3	3		3	1	1
CO6				1		2		1	2	3		3	1	1
CO7				1		2		1	2	3		3	1	1
CO8				1		2		1	2	3		3	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	10	40	10	-	30	100
CAT2	10	10	50	-	-	30	100
CAT3	10	10	50	-	-	30	100
ESE	10	10	40	10	-	30	100

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

22BCC22 - MATHEMATICS II							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme& Branch	**B.Sc& Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2**	**BS**	**3**	**1***	**2***	**4**

Preamble	To introductory course which inculcates the knowledge of Probability, Statistics and its application in the field of business and also it gives adequate exposure in the basic concepts of test of hypothesis and control charts.	
Unit – I	**Probability:**	**9+3**
Basic Terminology - Mathematical Probability - Axiomatic Approach to Probability - Addition Theorem on Probability - Conditional Probability - Multiplication Theorem on Probability - Independence of Events - Total Probability - Baye's Theorem.		
Unit – II	**Statistical Measures:**	**9+3**
Measures of central tendency: Mean, Median, Mode. Measures of dispersion: Range - Quartile deviation - Mean deviation - Standard deviation.		
Unit – III	**Correlation and Linear Regression:**	**9+3**
Karl Pearson's Coefficient of Correlation - Rank Correlation -Spearman's Rank Correlation Coefficient - Repeated Ranks - Regression Line of Y on X - Regression Line of X on Y.		
Unit – IV	**Test of Significance for Small Samples:**	**9+3**
Introduction to sampling distributions - Types of sampling - Standard Error - Student's t-test: Test of significance between the sample mean and population mean – Test for difference between two sample means - F-test for difference between two population variances - Chi-square Test for Goodness of Fit - Chi-square Test for Independence of Attributes.		
Unit – V	**Statistical Quality Control:**	**9+3**
Control Charts - Control charts for variables: Mean Chart, R-Chart. Control Charts for attributes: c-Chart, p-Chart and np- chart.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Determination of the probability
2.	Compute the measures of central tendency and dispersion
3.	Determine the correlation coefficients and covariance
4.	Compute the linear regression lines for the given data
5.	Testing significance of means using student's t-test
6.	Testing the independence of attributes using Chi-square test
7.	Plot a control chart for variables
8.	Plot a control chart for attributes

***Alternate week**

Lecture:45, Tutorial and Practical:15, Total:60

TEXT BOOK:

1.	Veerarajan T, "Probability and Statistics, Random process with Queueing Theory and Queueing Networks", 4thEdition, McGraw-Hill Education (India), New Delhi, 2017 for Unit I, III, IV, V.
2.	S C Gupta & V K Kapoor, "Fundamental of Mathematical Statistics", 12th Edition, Sultan Chand and Sons, Educational Publishers, New Delhi, 2022 for Unit II.

REFERENCES/ MANUAL / SOFTWARE:

1.	Kandasamy P, Thilagavathy K, Gunavathy K, "Probability Statistics and Queueing Theory",S.Chand& Co, New Delhi, 2016.
2.	Douglas C. Montgomery, George C. Runger, "Applied Statistics and Probability for Engineers" - 6th Edition, New Delhi Wiley, 2020.
3.	MATLAB Manual.

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped** **(Highest Level)**
CO1	make use of the concept of probability to real life scenarios	Applying (K3
CO2	determine the mean, median and mode for ungrouped and grouped data	Applying (K3)
CO3	identify the relation between two variables understand the concepts of two-dimensional regression	Applying (K3
CO4	apply statistical tests for solving problems involving small sample tests	Applying (K3)
CO5	prepare control charts to monitor the production process	Applying (K3)
CO6	know the basis of descriptive statistics and visualization, dispersion standard deviation, variance and compute the correlation coefficients and covariance, test whether the given data is significant by hypothesis testing and obtain the control chart for variables and attributes using MATLAB.	Understanding (K2) 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												
CO2	3	3												
CO3	3	2	2										1	
CO4	3	2	3										2	
CO5	3	2	3										2	
CO6					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	65				100
CAT3	10	30	60				100
ESE	10	25	65				100

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

22BCT21 - ADVANCED C PROGRAMMING							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Problem Solving and Programming in C**	**2**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course provides an introduction to the advanced features of C language, basic concepts and applications of linear data structures like stack and queue.	
Unit – I	**User Defined Data types:**	**9**
Structures: Introduction – Declaration – typedef –Initialization – Accessing the members – Copying and Comparing structures – Nested Structures – Arrays of Structures – Structures and Functions - Self-referential Structures. Union: Declaration – Accessing the members – Initialization. Enumerated Data Types.		
Unit – II	**Pointers to Arrays & Strings:**	**9**
Introduction to Pointer –Declaration – Expressions & Arithmetic – Types of pointers – Pointers and Arrays – Array Name & Pointer – Pointers & Strings – Arrays of pointers – Pointers and 2D arrays – Pointers and 3D arrays.		
Unit – III	**Pointers and Functions:**	**9**
Passing arguments to function using Pointers – Function Pointers: Initialization – Function Call – Comparing Function Pointers – passing a Function Pointer to Function-Array of Function Pointers- Pointers to Pointers- Memory allocation and Usage – Dynamic Memory Allocation- Drawbacks of Pointers.		
Unit – IV	**Files:**	**9**
Introduction to Files - Using Files in C – Read data from Files - Writing data to Files - Detecting End-of-Files - Accepting commandLine arguments – Functions for a selecting a record randomly – remove() – Renaming & Creating Files.		
Unit – V	**Stack & Queue:**	**9**
Stack: Introduction – Array representation – Operations on Stacks – Applications of Stacks- Queues – Array representation – Operations on Queues - Applications of Queues.		
		Total:45

TEXT BOOK:

1.	Reema Thareja, “Programming in C”, 2nd Edition, Oxford University Press, New Delhi, 2020.

REFERENCES:

1.	Yashavant Kanetkar,"Let us C", 16th Edition, BPB Publications, 2018.
2.	Balagurusamy E., "Programming in ANSI C" , 7th Edition, Mc Graw Hill Education, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	implement structure, union and enum for handling values of different data types	Applying (K3)
CO2	write C program using pointers for accessing arrays and strings	Applying (K3)
CO3	develop C program using pointers to access functions	Applying (K3)
CO4	implement file operations like create, store and retrieve data from files	Understanding (K2)
CO5	illustrate the operations on stack & queue and their usage	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					2	3	3	2	2	3
CO2	3	2	1	1					2	3	3	2	2	3
CO3	3	2	1	1					2	3	3	2	2	3
CO4	2	1											1	2
CO5	2	1											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	40	50				100
CAT2	35	40	25				100
CAT3	40	50	10				100
ESE	20	35	45				100

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

22BCT22 - JAVA PROGRAMMING							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course introduces the fundamentals of object-oriented features using java programming. It also emphasizes on developing java programs using packages, multithreading, exception handling and streams.	
Unit – I	**Introduction:**	**9**
Java Evolution: Java History - Features - Java and WWW - Web Browsers - Overview of Java Language: Simple Java Program - Java Program Structure - Java Tokens - Java Statements - Installing and Configuring Java - Implementing a Java Program - Java Virtual Machine - Command Line Arguments - Constants, Variables and Data Types.		
Unit – II	**Operators and Expressions, Decision Making Statements, Classes and Objects:**	**9**
Operators and Expressions - Decision Making and Branching - Decision Making and Looping - Classes, Objects and Methods: Introduction to Class - Defining a Class - Methods Declaration - Creating Objects - Accessing Class Members - Constructors - Method Overloading - Static Members - Nesting of Methods - Inheritance - Overriding methods.		
Unit – III	**Arrays, Strings, Vectors and Interfaces:**	**9**
One Dimensional Array - Creating an Array - Two Dimensional Arrays – Strings – Vectors – Wrapper Classes - Interfaces: Defining Interfaces - Extending Interfaces - Implementing Interfaces - Accessing Interface Variables.		
Unit – IV	**Packages and Multithreaded Programming:**	**9**
Packages: Java API Packages - Using System Packages - Naming Conventions - Creating Packages - Accessing a Package - Using a Package - Adding a Class to a Package - Hiding Classes - Multithreaded Programming: Creating Threads - Extending the Thread Class - Stopping and Blocking a Thread - Life Cycle of a Thread - Using Thread Methods - Implementing the Runnable Interface.		
Unit – V	**Exceptions, Managing I/O files, Collections:**	**9**
Managing Errors and Exceptions: Types of Errors - Exceptions - Syntax of Exception Handling Code - Multiple Catch Statements - Using Finally Statement - Managing I/O files: Concept of Streams – Stream classes – Byte Stream – Character stream - Using Streams - Other useful I/O Classes – Using the File Classes – Creation of Files – Reading /Writing Characters - Reading /Writing bytes - Java Collections: Overview of Interfaces – Overview of classes: ArrayList – Hashtable.		
		Total:45

TEXT BOOK:

1. Balagurusamy E., “Programming with Java”, 6th Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2019.

REFERENCES:

1. Schildt Herbert, “Java: The Complete Reference”, 11th Edition, McGraw Hill Education, New Delhi, 2018.
2. Paul Deitel, Harvey Deitel., “Java How to Program”,11th Edition, Pearson Education,2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the basics of Java and object-oriented programming	Understanding (K2)
CO2	solve the real time problems using classes and objects	Applying (K3)
CO3	apply the concepts of arrays, strings, vectors and interfaces	Applying (K3)
CO4	apply multithreading concepts and create user defined packages	Applying (K3)
CO5	implement exception handling techniques and I/O streams	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											2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3
CO4	3	2	1	1									2	3
CO5	3	2	1	1									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	50	40	-	-	-	100
CAT2	10	40	50	-	-	-	100
CAT3	10	40	50	-	-	-	100
ESE	10	40	50	-	-	-	100

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

22BCT23 - OPERATING SYSTEMS							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2**	**BS**	**3**	**0**	**0**	**3**

Preamble	To impart the role of operating system in managing the process, memory and storage. It also focuses on process synchronization, deadlocks and disk scheduling algorithms.	
Unit – I	**Overview of Operating System and System Calls:**	**9**
Introduction: Role of Operating System – Operating System Operations – Resource Management – Virtualization – Computing Environments – Operating System Structures: Operating System Services – System Calls – Types of System Calls – Building and Booting an Operating System.		
Unit – II	**Process Management:**	**9**
Process: Process Concept – Process Scheduling – Operation on Processes – Inter Process Communication – Threads: Overview – Multicore Programming – Multithreading Models – CPU Scheduling: Basic Concepts – Scheduling Criteria –Scheduling Algorithms.		
Unit – III	**Process Synchronization:**	**9**
Synchronization Tools: Background – Critical Section Problem – Peterson`s Solution – Mutex locks – Semaphores – Synchronization Examples: Classic Problems of Synchronization – The Bounded Buffer Problem – The Readers Writers Problem. Deadlock: System Model – Deadlock Characterization – Methods for handling Deadlock – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery from Deadlock.		
Unit – IV	**Memory Management:**	**9**
Main Memory: Background – Contiguous Memory Allocation – Paging – Structure of Page Table – Swapping – Virtual Memory: Background – Demand Paging – Copy on Write – Page Replacement: FIFO – LRU – Optimal.		
Unit – V	**Storage Management and File System:**	**9**
Mass Storage Structure: Overview – HDD Scheduling – File System Interface: File concept – Access Methods – Directory Structure – File System Implementation: File System Structure – File System Operations – Directory Implementation – Allocation Methods – Free space Management.		
		Total:45

TEXT BOOK:

1.	Silberschatz Abraham., Galvin B Peter and Gagne Greg, “Operating System Concepts”, 10th Edition, Wiley India Pvt. Ltd., New Delhi, 2018.

REFERENCES:

1.	Manish Kumar Singh,Sachin Kumar,Saibal Kumar Pal,” Operating Systems: Concept Building & Problem Solving Approach” 1st Edition ,Cengage Learning India Private Limited, 2022.
2.	William Stallings, “Operating Systems Internals and Design Principles”, 9th Edition, Prentice Hall, 2018.
3.	Remzi H Arpaci Dusseau , Andrea C Arpaci Dusseau , “Operating Systems: Three Easy Pieces”, 1st Edition, Create Space Independent Publishing Platform, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the role and types of operating systems	Understanding (K2)
CO2	implement various process scheduling algorithms	Applying(K3)
CO3	demonstrate different process synchronization solutions and deadlock management	Applying(K3)
CO4	apply the page replacement algorithms for memory management	Applying (K3)
CO5	make use of disk scheduling algorithms in secondary storage management	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											2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3
CO4	3	2	1	1	1								2	3
CO5	3	2	1	1	1								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	20	50	30				100
CAT2	20	45	35				100
CAT3	20	40	40				100
ESE	20	40	40				100

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

22BCL21 - ADVANCED C PROGRAMMING LABORATORY							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Problem Solving and Programming in C**	**2**	**PC**	**0**	**0**	**4**	**2**

Preamble	To study and implement the advanced features of C programming and basics of data structures.

LIST OF EXPERIMENTS / EXERCISES:

1.	Create a structure to implement the banking application to store and retrieve customer detail.
2.	Write a program to demonstrate the usage of enumerated data type.
3.	Develop a code to find the largest element in every row of a matrix by passing it to a function using a pointer.
4.	Develop a code to print the strings containing vowels in a 2D character array by passing it to a function using a pointer.
5.	Implement a function pointer to a function that finds the length of a string.
6.	Write a program to illustrate the dynamic memory allocation.
7.	Write a program in C to create and store information in a text file.
8.	Write a program in C to merge two files and write it in a new file.
9.	Implementation of Stack operations.
10.	Implementation of Queue Operations.

Total:60

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	implement the structure, union, enum data structures.	Applying(K3), Imitation(S1)
CO2	use pointers in handling arrays, strings, functions and files.	Applying(K3), Precision(S3)
CO3	code the operations of stack and queue.	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	2	1	1									2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3

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

22BCL22 - JAVA PROGRAMMING LABORATORY							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2**	**PC**	**0**	**0**	**4**	**2**

Preamble	This course provides knowledge in the core concepts and implementation of object-oriented features in Java programming.

LIST OF EXPERIMENTS / EXERCISES:

1.	Implementation of command line arguments in Java.
2.	Implement the concepts of classes and objects
3.	Write a java program to implement overloading and constructors.
4.	Implementation of inheritance and method overriding.
5.	Implementation of multiple inheritances using interface.
6.	Create and import a user defined package.
7.	Implementation of multithreading concept.
8.	Implementation of exception handling mechanisms.
9.	Perform read and write operations in a text file.
10.	Write a java program to implement collections.

Total:60

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate constructors and method overloading using classes and objects..	Applying(K3), Manipulation(S2)
CO2	implement inheritance and packages for an application.	Applying(K3), Precision(S3)
CO3	experiment with multithreading, exception handling mechanism and collections.	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	2	1											2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3

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

22BCL23 - OPERATING SYSTEMS LABORATORY							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2**	**BS**	**0**	**0**	**4**	**2**

Preamble	This course emphasis on Unix commands and C programming for the implementation of disk scheduling problems, file and process control operations.

LIST OF EXPERIMENTS / EXERCISES:

1.	Execute the basic Unix commands, directory / File commands and File permission commands in UNIX environment
2.	Execute the commands related to Standard I/O, Redirection Pipes and Filters in Unix
3.	Execute the commands related to regular expressions and disk management in Unix
4.	Execute the commands related to process creation in Unix environment
5.	Write a shell script program using shell variables, branching and looping control structures
6.	Write a shell script that accepts the filename as its argument and search for a given word in the file
7.	Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it
8.	Write the C program to Implement producer consumer problem
9.	Implementation of SJF scheduling
10.	Implementation of FIFO page replacement algorithm

Total:60

REFERENCES/ MANUAL /SOFTWARE:

1.	Lab Manual/ Linux OS/ Webminal

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate various Unix commands related to file and process management	Applying(K3), Imitation(S1)
CO2	demonstrate inter process communication with the system calls	Applying(K3), Manipulation(S2)
CO3	perform scheduling and synchronization problems	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	2	1	1									2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3

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

22BCT31 - PYTHON PROGRAMMING							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course introduces the core python programming. It emphasizes on developing python programs with various data types, functions, modules, classes and objects	
Unit – I	**Problem Solving Strategies and Basics of Python Programming:**	**9**
Problem Solving Strategies – Program Design Tools – Types of Errors – Testing and Debugging- Basics of Python Programming: Literals – Variables and Identifiers – Data Types - Input Operation – Comments – Reserved Words – Indentation – Operators and Expressions – Decision Control Statements: Introduction – Conditional Branching Statement – Iterative Statements – Nested Loops – Break, Continue and Pass statements – Else in Loops.		
Unit – II	**Functions and Modules:**	**9**
Functions and Modules: Introduction - Definition – Call – Variable Scope and Lifetime – The return Statement – Function Arguments – Lambda Function – Documentation Strings – Programming Practices - Recursive Functions -Modules – Packages – Standard Library Modules- Globals() , Locals() and Reload() – Function Redefinition.		
Unit – III	**Python String:**	**9**
Introduction -Concatenation, Append, Multiply on Strings – Strings are Immutable – String Formatting Operator – Built-in String Methods and Functions – Slice Operation – ord() and chr() functions – in and not in Operators – Comparing Strings – Iterating String – String Module – Regular Expressions **–** match(), search(), sub(), findall() and finditer () Functions – Flag Options.		
Unit – IV	**Data Structures:**	**9**
Lists- Access Values - Update Values - Nested list - Cloning List - Basic List Operations - List Methods - List Comprehensions - Looping in Lists - Tuple - Create - Utility - Access Values - Update - Delete Elements -Basic Tuple Operations - Tuple Assignments - Returning multiple values - Nested tuples - Checking the Index - Count the Elements –Sets – Creation- Set operations - Dictionary - Create - Access - Add and Modify an Item - Delete an Item - Sorting Item - Looping Over - Nested Dictionary - Built-in Functions and Methods – List vs Tuple vs Dictionary.		
Unit – V	**Introduction to OOP:**	**9**
Classes and Objects: Classes and Objects – Class Method and self Argument – Constructor – Class and Object Variables – Destructor – Public and Private Data Members – Private Methods – Class Method – Static Method - Inheritance:Introduction – Polymorphism and Method Overriding - Types of Inheritance –– Containership – Abstract classes and Interfaces - Metaclass.		
		Total:45

TEXT BOOK:

1.	Reema Thareja, “Python Programming Using Problem Solving Approach”, 3rd Edition, Oxford University Press, New Delhi, 2020.

REFERENCES:

1.	Nageswara Rao, “Core Python Programming”, 2nd Edition, DreamTech Press, New Delhi, 2018
2.	Timothy A. Budd, "Exploring Python", Paperback, McGraw Hill Education India Pvt Ltd., 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand the problem solving strategies and basic building blocks of python	Understanding (K2)
CO2	solve the problems using functions and modules	Applying (K3)
CO3	apply strings and regular expression for searching in a string	Applying (K3)
CO4	apply list, tuple and dictionary to handle variety of data	Applying (K3)
CO5	understand the class and object and apply inheritance in 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	2	1							1	2	2	1	2	3
CO2	3	2	1	1	1				2	3	3	2	3	2
CO3	3	2	1	1	3	2			2	3	3	2	2	2
CO4	3	2	1	1	3	2			2	3	3	2	3	2
CO5	3	2	1	1	2				2	3	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	20	35	45				100
CAT2	10	30	60				100
CAT3	15	25	60				100
ESE	20	30	50				100

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

22BCT32 - DATA STRUCTURES AND ALGORITHMS							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PC**	**3**	**0**	**0**	**3**

Preamble	To impart the knowledge of basic data structure operations and algorithms. This course also discusses the application of the data structures.	
Unit – I	**Overview of data structures**	**9**
Introduction – Basic terminology of data organization – Concept of data type – Data structure defined – Description of various data structures – Common operations on data structures – Program design and development : Introduction – Program development life cycle – Introduction to algorithms – Programming constructs – Algorithm complexity – Big oh notation.		
Unit – II	**Linked list**	**9**
Introduction – Linear linked defined – Linear linked list – Representation – Operations – Doubly linked list – Representation – Operations - Types of lists – Applications of linked lists: Polynomial Manipulation.		
Unit – III	**Trees**	**9**
Introduction – Tree defined – Tree terminology – Binary trees - Binary search trees – Representation – Operations - AVL trees – Representation – Height of an AVL trees – Operations - Threaded binary trees.		
Unit – IV	**Graphs**	**9**
Introduction – Graph terminology – Representation of graphs – Operations on graphs – Applications of graph: Topological Sort– Finding shortest path for given source and destination.		
Unit – V	**Sorting and Searching**	**9**
Introduction – Sorting – Bubble sort – Selection sort – Insertion sort – Radix sort – Merge sort – Quick sort – Heap sort – Searching – Linear search – Binary search.		
		Total:45

TEXT BOOK:

1.	R.S.Salaria, “Data Structures & Algorithms using C”, 5th Edition, Khanna Book Publishing Co (p) Ltd, New Delhi, 2022.

REFERENCES:

1.	Tremblay Jean-Paul and Sorensen Paul, “An Introduction to Data Structures with Applications”, 2nd Edition, Tata McGraw Hill, New Delhi, 2017.
2.	Vijayalakshmi Pai G.A, “Data Structures and Algorithms – Concepts, Techniques and Applications”, 1st Edition, McGraw Hill Education, New Delhi, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	develop an algorithm for a problem statement	Understanding (K2)
CO2	apply the concept of linked list	Applying (K3)
CO3	describe the concept of trees and its operation	Understanding (K2)
CO4	describe the functionalities of graph	Applying (K3)
CO5	demonstrate sorting and searching techniques	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											1	3
CO2	3	2	1	1									2	3
CO3	2	1											1	3
CO4	3	2	1	1									2	3
CO5	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	35	40	25	-	-	-	100
CAT2	35	40	25	-	-	-	100
CAT3	35	35	30	-	-	-	100
ESE	25	40	35	-	-	-	100

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

22BCT33 - DATABASE MANAGEMENT SYSTEMS							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PC**	**3**	**0**	**0**	**3**

Preamble	To interpret the knowledge about various aspects of database design, database languages and database system implementation.	
Unit – I	**Introduction and Database Design Model:**	**9**
Introduction - Database System Applications - View of Data - Database Architecture. Introduction to the relational model – Database Schema – Keys – Relational Algebra – The Select Operation – The project Operation - Database Design and the E-R Model: Overview of the Design Process - The Entity-Relationship Model – Complex Attributes – Mapping Cardinalities – Primary Key - Removing Redundant Attributes in Entity Sets - Reducing E-R diagrams to Relational Schemas - Extended E-R Features.		
Unit – II	**Introduction to SQL:**	**9**
Overview of SQL Query Language - SQL Data Definition - Basic Structure of SQL Queries - Additional Basic Operations - Set Operations - Null Values - Aggregate Functions - Nested Sub Queries - Modification of the Database.		
Unit – III	**Intermediate and Advanced SQL:**	**9**
Intermediate SQL : Join Expressions - Views - Materialized Views - Transactions - Commit - Rollback - Integrity Constraints - SQL Data Types and Schemas - Authorization. Advanced SQL: Functions and Procedures – Triggers.		
Unit – IV	**Relational Database Design:**	**9**
Features of Good Relational Designs - Functional Dependency - Atomic Domains and First Normal Form - Second Normal Form - Third Normal Form - Boyce-Codd Normal Form – Multi-valued Dependency and Fourth Normal Form - Join Dependency and Fifth Normal Form.		
Unit – V	**Transactions and Concurrency Control:**	**9**
Transactions - Transaction Concept - A Simple Transaction Model – Storage Structure - Transaction Atomicity and Durability - Transaction Isolation - Serializability. Concurrency Control: Lock Based Protocols - Timestamp Based Protocols - Validation Based Protocols.		
		Total:45

TEXT BOOK:

1. Silberschatz Abraham, Korth Henry F., and Sudarshan S., “Database System Concepts”, 7th Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2021.

REFERENCES:

1. Elmasri Ramez, Navathe Shamkant B, “Fundamentals of Database Systems”, 7th Edition, Pearson, 2016.
2. Ramakrishnan Raghu, Gehrke Johannes, “Database Management Systems”, 3rd Edition, McGraw Hill Education, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	develop E-R model for database related applications	Applying (K3)
CO2	execute SQL expressions using SET operations and aggregate functions	Applying (K3)
CO3	develop SQL expressions using join operations	Applying (K3)
CO4	apply normalization technique to avoid redundancy in database	Applying (K3)
CO5	interpret the transaction and concurrency control concepts	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									2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3
CO4	3	2	1	1									2	3
CO5	2	1											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	20	40	40				100
CAT2	20	40	40				100
CAT3	20	50	30				100
ESE	20	45	35				100

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

22BCT34– COMPUTER ORGANIZATION							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Digital Principles and Logic Design**	**3**	**PC**	**3**	**1**	**0**	**4**

Preamble	This course deals with the basic concepts of computer architecture and organization that can help the participants to have a clear view as to how a computer system works.	
Unit – I	**Basic Computer Organization:**	**9+3**
Introduction: Digital Computers - Computer Organization and Architecture– Basic Issues-Basic Organization of a computer - Register Transfer: Register Transfer Language – Register Transfer – Bus and Memory Transfer - Basic Computer Organization and Design: Instruction codes- Computer Registers – Computer Instructions – Timing and Control - Instruction cycle - Memory Reference Instructions-Input-output and Interrupt- Complete Computer Description.		
Unit – II	**Computer Design and Arithmetic operations:**	**9+3**
Basic Computer Organization and Design: Design of Basic Computer – Design of Accumulator logic - Computer Arithmetic: Introduction – Addition and Subtraction – Multiplication Algorithms -Division Algorithms – Decimal Arithmetic Unit - Decimal Arithmetic Operations.		
Unit – III	**Input – Output Organization:**	**9+3**
Peripheral Devices – Input-Output Interface – Asynchronous Data Transfer – Modes of Transfer - Programmed I/O – Interrupt Initiated I/O – Priority Interrupt – Direct Memory Access - Bus Arbitration – DMA Controller – DMA Transfer– Input – Output Processor - CPU-IOP Communication – Intel 8089 IOP.		
Unit – IV	**Memory Organization**:	**9+3**
Memory Hierarchy – Main Memory - RAM and ROM Chips – Memory Address Map – Memory Connection to CPU – Memory Technology – ROM – PROM -EEPROM – Flash Memory – RAM Technologies – Auxiliary Memory – Associative Memory –Cache Memory – Virtual Memory.		
Unit – V	**Pipeline and Vector Processing**:	**9+3**
Parallel Processing – Pipelining – Arithmetic pipeline – Instruction Pipeline – RISC Pipeline – Vector Processing - Vector Operations –Matrix multiplications – Memory Interleaving – Super Computers – Array Processor - Attached Array Processor – SIMD Array Processor.		
		Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. M. Morris Mano**, "**Computer System Architecture", 3rd Edition, Pearson India Education Pvt.Ltd., 2021.

REFERENCES:

1. Hamacher Carl, Vranesic Zvonko, ZakySafwat, "Computer Organization", 5th Edition, McGraw Hill Education, 2016.
2. John P.Hayes, "Computer Architecture and Organization", 3rd Edition, McGraw Hill Education, 2017.

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	demonstrate the power of stored program general purpose device and describe the internal operations of the computer.	Understanding (K2)
CO2	illustrate the arithmetic algorithms for addition, subtraction, multiplication and division with the usage of digital hardware.	Applying (K3)
CO3	outline the input – output organization of computer	Understanding (K2)
CO4	to explain the function of each element of a memory hierarchy	Understanding (K2)
CO5	illustrate the concept of pipelining to increase the processing speed	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											1	3
CO2	3	2	1	1									2	3
CO3	2	1											2	3
CO4	2	1											1	3
CO5	2	1											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	30	50	20				100
CAT2	20	50	30				100
CAT3	30	70					100
ESE	20	60	20				100

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

22BCT35 – SOFTWARE ENGINEERING							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PC**	**3**	**1**	**0**	**4**

Preamble	This course introduces the software engineering concepts and software development lifecycle. It focuses on requirement analysis, design, risk management and testing	
Unit – I	**Software Process Models:**	**9+3**
Introduction: Software Engineering – Software Process - A Generic Process Model – Defining a framework activity – Identifying a Task set – Process Patterns – Process Assessment and Improvement – Process Models: Prescriptive Process Models – Specialized Process Models - Unified Process – Case Study: Identification and analysis of process model.		
Unit – II	**Requirements Engineering:**	**9+3**
Requirements Engineering: Requirements Engineering Tasks – Establishing the Groundwork – Eliciting requirements – Developing Use cases – Building the Analysis Model – Negotiating Requirements –Requirements Monitoring – Validating Requirements – Requirements Modeling: Scenario-Based Methods – Class-Based Methods. Case Study: Requirements model for Web/Mobile Apps.		
Unit – III	**Design Engineering:**	**9+3**
Design Engineering: Design Process – Design concepts – The Design Model: Data Design Elements- Architectural Design Elements – Interface Design Elements – Component-level design Elements – Deployment-Level Design Elements.		
Unit – IV	**Risk Management:**	**9+3**
Risk Management: Reactive and Proactive Risk strategies – Software Risks - Risk Identification, Risk Projection and Risk Refinement – Risk Mitigation, Monitoring and Management – RMMM Plan. Estimation for Software Projects: COCOMO Model. Case Study: Effort Estimation using COCOMO model.		
Unit – V	**Software Testing and Agile Development:**	**9+3**
Software Testing: Issues – Unit Testing - Integration Testing – Validation Testing - System Testing - Black Box Testing - White Box Testing – Agile development: Agility – Agile Process – Extreme Programming – Scrum – A Tool set for the Agile Process. Case Study: Writing test cases for Mobile Apps.		
Lecture:45, Tutorial:15, Total:60		

TEXT BOOK:

1.	Roger S.Pressman and Bruce R. Maxim, “Software Engineering- A Practitioner„s Approach”, 8th Edition, McGraw-Hill International Edition, 2019.

REFERENCES:

1.	Ian Sommerville, “Software Engineering”, 10th Edition, Pearson Education, 2016.
2.	Pankaj Jalote, “An Integrated Approach to Software Engineering”, Third Edition, Narosa Publishing House Pvt. Ltd., Reprint 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand the concepts of software processes and software process models	Understanding (K2)
CO2	develop scenario-based models and class-based models for software systems	Applying (K3)
CO3	describe the design concepts and models in Software Engineering	Understanding (K2)
CO4	calculate effort estimation for an application using COCOMO model	Applying (K3)
CO5	explain the testing strategies for ensuring software quality	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		1									3	2
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3
CO4	3	2	1	1									2	3
CO5	3	2	1	1									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	30	60	10				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)

22BCL31 - PYTHON PROGRAMMING LABORATORY							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PC**	**0**	**0**	**4**	**2**

Preamble	This course provides the knowledge in the core concepts of python programming. It emphasizes on developing python programs using core programming features.

LIST OF EXPERIMENTS / EXERCISES:

1.	Implementation of the conditional and looping statements:- a. Write a program to find the greatest among three numbers b. Program to accept any number and prints the number of digits in the given number. c. Write a program to generate square, triangle, diamond pattern using *.
2.	Implementation the conditional and looping statements:- a. Write a program to read two numbers. Then find out whether the first number is a multiple of the second number. b. Write a program to sum the series 1**2/1+2**2/2+….+n**2/n c. Write a program to prints all the prime number for 50 to 1.
3.	Implementation of functions:- a. Write a function is_prime() that returns a1 if the argument passed to it is a prime number and a 0 otherwise. b. Write a program that uses lambda function to multiply two numbers. c. Write a program to concatenate two strings using recursion.
4.	Implementation of functions:- a. Demonstrate the various parameters passing type to the function that accepts three integers and returns True if any of the integers is 0, otherwise it returns False. b. Write a program to swap two variables that are defined as global variable. c. Write a program to print n terms of the Fibonacci series using recursion
5.	Implementation of the various string operations:- a. Write a program to print the mirror of the given string.(„abc'->"cba') and check for palindrome. b. Write a program to count the number of characters, words and lines in the given text. c. Write a program that accepts a comma separated sequence of words as input and prints the unique words of it.
6.	Implementation of the regular expressions:- a. Write a program to check whether a string starts with specified character. b. Write a program to remove leading and trailing spaces from a sting. c. Write a program to match strings which starts with an upper case character followed by a digit and a „-„.
7.	Implementation of the list operations:- a. Make a list of first ten letters of the alphabet, apply slice for the following i. Print the first three letters from the list ii. Print any three letters from the middle of the list. iii. Print the letters from any particular index to the end of the list. b. Write a program that creates a list of numbers from 1 to 75 that are either divisible by 4 or by 5. c. Write a program to create a tuple from the list and do the vice versa.
8.	Implementation of tuple and dictionary concepts:- a. Create a tuple that has just one element which in turn may have three elements „a','b' and „c'. Print the length of the tuple. b. Write a snake and ladder game program using dictionary. c. Write a program that has a dictionary of your friends name(key) and birthday. Print the items in the dictionary in a sorted order. Prompt the user to enter a name and check if it is present in the dictionary. If the name does not exit, then ask the user to enter the birthday and add it to the dictionary.
9.	Implementation of classes and objects:- a. Write a python program to deposit or withdraw money in a bank account using class and object.

	b. Write a python program that has a class student that stores roll number, name and marks(in five subjects) of 10 students. Display all the information stored about 10 students.
10.	Implementation of polymorphism and Inheritance concepts:- a. Write a program to perform polymorphism. b. Write a program to demonstrate Multiple inheritance and Multi-level inheritance.
	Total:60

REFERENCES/ MANUAL /SOFTWARE:	
1.	Laboratory Manual

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	solve problems using core python programming	Applying(K3), Imitation(S1)
CO2	implement function and data types for solving problems	Applying(K3), Manipulation(S2)
CO3	demonstrate polymorphism and inheritance	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									2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3

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

22BCL32 - DATA STRUCTURES LABORATORY							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Problem Solving and Programming in C**	**3**	**PC**	**0**	**0**	**4**	**2**

Preamble	To implement linear and non linear data structure operations, algorithms and its applications.

LIST OF EXPERIMENTS / EXERCISES:

1.	Implementation of singly Linked List Operations
2.	Implementation of Doubly Linked List Operations
3.	Polynomial addition using Linked List
4.	Binary Tree Creation and Traversal
5.	Implementation of different operations on a binary search tree
6.	Implementation of Graph Representation
7.	Implementation of Graph Traversals
8.	Performing Bubble Sort and Insertion Sort
9.	Performing Selection Sort and Quick Sort
10.	Performing Linear and Binary Search

Total:60

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	code the operations of linked list, tree and graph data structures	Applying(K3), Imitation(S1)
CO2	perform sorting and searching on a given dataset	Applying(K3), Manipulation(S2)
CO3	solve the problem by applying programming skills	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									2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3

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

22BCL33 - DATABASE MANAGEMENT SYSTEMS LABORATORY							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**3**	**PC**	**0**	**0**	**4**	**2**

Preamble	

LIST OF EXPERIMENTS / EXERCISES:

1.	Study of DDL commands, DML commands, DCL commands and TCL commands.
2.	Design relations to implement the integrity constraints (primary key, foreign key, unique and check).
3.	Apply aggregate functions to group the values of multiple rows.
4.	Implement group by functions with having clause.
5.	Retrieval of data from one or more relations with nested sub queries.
6.	Apply join operations to retrieve data from multiple relations.
7.	Construct views from a single table/ multiple tables and demonstrate the manipulation of views.
8.	Develop PL/SQL functions with select and update statements.
9.	Develop stored and unnamed PL/SQL procedures to retrieve data from a relation.
10.	Demonstrate the execution of Triggers whenever the insertion or deletion event occurs in the database.
	Total:60

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	design database for student and banking applications.	Applying (K3), Manipulation (S2)
CO2	execute aggregate functions, views, join operations and nested sub-queries on a database.	Applying (K3), Manipulation (S2)
CO3	manipulate database using PL/SQL functions and procedures.	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	2	1	1									2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3

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

22GCL31 - PROFESSIONAL SKILLS TRAINING - I
(Common to BSc – Computer Systems and Design, Information Systems, Software Systems)

Programme & Branch	B.Sc & Computer Systems and Design, Information Systems, Software Systems	Category	L	T	P	Credit
		EC	0	0	80	2

Preamble	This subject is to enhance the employability skills and to develop career competency	
Prerequisites	Nil	
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 & 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	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**30**

Grammar: Parts of speech - Tenses - Articles and Prepositions - Vocabulary: Synonyms & Antonyms - Analogies - Syllogism - Spelling test - Cloze test - Concord - Spotting Errors - Listening: Listening to TED talks, ESL & ESOL Videos - Podcasts - Speaking : Mock Interviews - Personality traits - Better pronunciation - Extempore talk - Reading: Reading with stress, pauses, slurs and fillers - Soft skills - Writing: Job application letter & resume - Video resume – Different types of writing - Jumbled sentences - Professional e-mail writing - Business letters - One page essay - Report writing - Editing & proofreading – Writing skills for IELTS

Total:80

Textbook:

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: 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 individual and as a team	Applying (K3), Precision (S3)
CO2:	solve real time problems using numerical ability and logical reasoning	Applying (K3), Precision (S3)
CO3:	apply English language skills 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	2	

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 %**
CAT1	20	50	30				100
CAT2		50	50				100
CAT3		50	50				100
ESE	**NA**						

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

22BCT41- USER INTERFACE TECHNOLOGIES							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Web Programming**	**4**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course provides an introduction to HTML, CSS, Client-Side JS and Server-Side JS Framework. The course also addresses the application of ReactJS for developing web applications.	
Unit – I	**HTML & CSS:**	**9**
Introduction to HTML: Basic tags – Headings – Links – Images – Tables - HTML Forms input Types – Page-Structure Elements. Cascading Style Sheet: Types of CSS – Positioning Elements – Backgrounds - Box Model and Text Flow- Media Types and Media Queries – Dropdown Menus.		
Unit – II	**Java Script:**	**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.		
Unit – III	**Node JS:**	**9**
Node JS: Introduction – Architecture – Features – Creating Web Servers with HTTP Request – Response – Event Handling - GET & POST implementation - Connect to NoSQL Database using Node JS – Implementation of CRUD operations.		
Unit – IV	**ReactJS Basics:**	**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 Animation and API:**	**9**
ReactJS: list – keys – refs – Fragments - Router – CSS – Animation – Map – Table – Code splitting – hooks – flux concepts.		
		Total:45

TEXT BOOK:

1.	Paul Deitel, Harvey Deitel, Abbey Deitel, “Internet and World Wide Web - How To Program”, 5th Edition, Pearson Education, New Delhi, 2019. For Unit – I, II
2.	Infosys campus connects material for Unit III.
3.	javatpoint.com for Unit IV, V

REFERENCES:

1.	DT Editorial Services, “HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)”, 2nd Edition, Dreamtech Press, New Delhi, 2016.
2.	Randy Connolly, Ricardo Hoar, “Fundamentals of Web Development”, Pearson Education, New Delhi 2015

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	design static web pages using HTML and CSS.	Applying (K3)
CO2	develop interactive and dynamic web pages using JavaScript.	Applying (K3)
CO3	develop a web application using Node JS with database connectivity.	Applying (K3)
CO4	understand the features of React to manage event handling.	Understanding (K2)
CO5	utilize React 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	PSO2
CO1	3	2	1	1									2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3
CO4	2	1											1	2
CO5	3	2	1	1									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	20	30	50	-	-	-	100
CAT2	20	40	40	-	-	-	100
CAT3	20	50	30	-	-	-	100
ESE	20	35	45	-	-	-	100

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

22BST41 – SOFTWARE TESTING							
Programme& Branch	**B.Sc &Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Software Engineering**	**4**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course provides fundamentals of software testing and implements various testing methodologies to develop quality software.	
Unit – I	**SDLC Models and Testing:**	**9**
Phases of Software Project – Quality Assurance and Control – Testing, Verification and Validation – Process model to different phases – Life Cycle Models – White Box Testing: Definition – Static Testing: Static Testing by Human-Static Analysis Tools – Structural testing: Code Functional Testing-Code Coverage Testing-Code Complexity Testing-Challenges.		
Unit – II	**Black Box Testing:**	**9**
Definition – Why and When to do black box testing – How to do black box testing – Integration Testing: Definition – Types – Phase of testing – Scenario Testing – Defect bash.		
Unit – III	**System and Acceptance Testing:**	**9**
Overview – Functional versus Non-functional testing – Functional System Testing – Non Functional Testing – Acceptance Testing – Summary of testing phases.		
Unit – IV	**Performance Testing:**	**9**
Introduction – Factors Governing Performance testing – Methodology – Tools – Process – Challenges – Regression Testing: Definition – Types – When and How to do Regression testing.		
Unit – V	**Test Management and Automation:**	**9**
Test Planning – Test Management – Test process – Test Reporting – Software Test Automation: Definition – Skills – Scope of Automation – Design and Architecture – Generic Requirements – Process model.		
		Total:45

TEXT BOOK:

1.	Srinivasan Desikan and Gopalaswamy Ramesh, “Software Testing: Principles and Practices”, 1st Edition, Pearson Education, 2020.

REFERENCES:

1.	Paul Ammann and Jeff Offutt, “Introduction to Software Testing”, 2nd Edition, Cambridge University Press, 2017.
2.	Ali Mili, FairouzTchier, “Software Testing: Concepts and Operations”, 1st Edition, John Wiley &Sons,Inc, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explore testing involved in each phases of process model and prepare test cases for White Box Testing	Applying (K3)
CO2	apply Black Box testing based on chosen application	Applying (K3)
CO3	illustrate the functional and non functional testing to evaluate the system compliance with specified requirements	Understanding(K2)
CO4	outline the methodologies to carry out performance testing	Understanding(K2)
CO5	summarize the project management aspects of testing and the tools used for test automation	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									2	3
CO2	3	2	1	1									2	3
CO3	2	1											2	3
CO4	2	1											2	3
CO5	2	1											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	20	50	30				100
CAT2	40	50	10				100
CAT3	30	70					100
ESE	30	45	25				100

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

22BCT43 – MOBILE APPLICATION DEVELOPMENT							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Java Programming**	**4**	**PC**	**3**	**0**	**0**	**3**

Preamble	To impart the fundamental knowledge and to create mobile application using Android programming.	
Unit – I	**Introduction:**	**9**
Getting Started with Android Programming: Android: Android versions - Features of Android - Architecture of Android - Android Devices - Android Market - Android Studio - Android SDK - Creating AVDs - Launching the First Android Application - Using Android Studio for Android Development: Exploring the IDE- Using code completion - Debugging the application - Publishing the Application.		
Unit – II	**Activities, Fragments and Intent:**	**9**
Understanding Activities: Applying Styles and Themes to an Activity - Hiding the Activity Title - Dialog Window - Progress Dialog - Linking Activities using Intents- Returning Results from an Intent - Passing Data using Intent Object – Fragments- Adding Fragments Dynamically - Life Cycle of a Fragment - Interaction between fragments - Understanding the Intent Object - Using Intent Filters - Displaying Notifications.		
Unit – III	**Android User Interface:**	**9**
Understanding the Components of a Screen - Views and View Groups – Linear Layout – Table Layout- Relative Layout-Frame Layout-Scroll View-Utilizing the Action Bar - Adding Action Items to the Action Bar –Designing user interface with Views - Using Basic Views – Progress Bar view – Auto Complete Text View - Picker Views - List Views to display long lists.		
Unit – IV	**Pictures, Menus and Content Providers:**	**9**
Using Images to Display Pictures – Image View - Image Switcher – Grid View- Using Menus with Views - Creating the Helper Methods - Options Menu - Context Menu - Using Web View – Web View - Content Providers: Sharing Data in Android - Using a Content Provider - Creating and Using Content Provider.		
Unit – V	**Data Persistence:**	**9**
Saving and Loading User Preferences - Accessing Preferences using an Activity - Programmatically Retrieving and Modifying the Preferences Values - Persisting Data to Files- Saving to internal storage - Saving to External storage - Choosing the Best Storage Option - Creating and Using Databases- Creating the DBAdapter Helper class - Using the Database Programmatically.		
		Total:45

TEXT BOOK:

1. J.F. DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, John Wiley & sons, Inc.,2018

REFERENCES:

1. Pradeep Kothari., " Android Application Development (with KitKat support) Black Book", dreamtech Press,2018.
2. John Horton, " Android Programming for Beginnners", 2nd Edition,Packt Publishing Ltd, 2018.

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped** **(Highest Level)**
CO1	explore the Android Studio Environment and Run the application using emulator	Understanding (K2)
CO2	apply the activities, fragments and Intents in android applications	Applying (K3)
CO3	design the application using Views and view Groups	Applying (K3)
CO4	demonstrate the apps which handle images and menus.	Applying (K3)
CO5	implement the different data storage mechanisms.	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	3
CO2	3	2	1	1		1							2	3
CO3	3	2	1	1		1							2	3
CO4	3	2	1	1		1							2	3
CO5	3	2	1	1		1							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	30	35	35				100
CAT2	20	40	40				100
CAT3	30	30	40				100
ESE	20	30	50				100

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

22BCT44 - COMPUTER NETWORKS							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**4**	**PC**	**3**	**1**	**0**	**4**

Preamble	This course will help the students to gain knowledge in computer network components, models and technologies. It further provides the functionalities of protocols in use at different layers of networks.	
Unit – I	**Introduction:**	**9+3**
Overview of the Internet: Networks- Switching - The Internet- Accessing the Internet- Hardware and Software–Protocol Layering: Scenarios-TCP/IP Protocol Suite-The OSI Model- Standards and Administration: Internet Standards - Internet Administration - Transmission Media: Guided Media-Unguided Media: Wireless.		
Unit – II	**Application Layer:**	**9+3**
Introduction: Providing Services-Application Layer Paradigms - Client-Server Paradigm: Application Programming Interface-Using Services of the Transport Layer-Standard Client-Server Applications: World Wide Web and HTTP-FTP-Electronic Mail-TELNET-Secure Shell (SSH)-Domain Name System (DNS).		
Unit – III	**Transport Layer:**	**9+3**
Introduction: Transport Layer Services- Transport Layer Protocols: Simple Protocol-Stop and Wait Protocol- Go Back N Protocol-Selective Repeat Protocol- Bidirectional Protocols Piggybacking - Internet Transport Layer Protocols-User Datagram Protocol (UDP): User Datagram-UDP Services-UDP Applications- Transmission Control Protocol (TCP): TCP Services – Segment – a TCP connection – State Transition Diagram - Flow Control-Error Control.		
Unit – IV	**Network Layer:**	**9+3**
Introduction: Network Layer Services – Network Layer Performance - Network Layer Congestion - Structure of a router - Network Layer Protocols: IPv4 Datagram format - IPv4 Addresses - Next Generation IP - IPv6 Addressing – Unicast Routing - Routing algorithms.		
Unit – V	**Data Link Layer:**	**9+3**
Introduction: Data Link Control (DLC) - Framing - Flow and Error Control - Error Detection and Correction - Multiple Access Protocols (MAC): Random Access -Controlled Access – Link Layer Addressing - Wired LANs: Ethernet Protocol - IEEE Project 802 - Standard Ethernet- Fast Ethernet – Gigabit Ethernet.		
		Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Forouzan Behrouz A, Moshrraf Firouz, “Computer Networks A Top-Down Approach”, 1st Edition, Tata McGraw Hill Education, 2019.

REFERENCES:

1. Kurose James F. and Ross Keith W., “Computer Networking: A Top-Down Approach”, 8th Edition, Pearson Education, New Delhi, 2020.
2. Andrew S.Tanenbaum, Nick Feamster,David J.Wetherall, “Computer Networks”, 6th Edition, Pearson Education, 2020.
3. Behrouz A. Forouzan, “Data Communications and Networking”, 5th Edition, McGraw Hill Education, 2017.

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	explain the network layered architecture and the data transfer through the Internet.	Understanding (K2)
CO2	interpret the functionalities of network applications like HTTP, FTP, DNS and Email	Understanding (K2)
CO3	outline the end–to-end functionalities of transport layer protocols	Understanding (K2)
CO4	apply IP addressing to construct forwarding and routing solutions	Applying (K3)
CO5	experiment the flow control and error control techniques at data link layer level	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	2
CO2	2	1											2	3
CO3	2	1											2	3
CO4	3	2	1	1									2	3
CO5	3	2	1	1									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	30	70					100
CAT3	30	40	30				100
ESE	20	50	30				100

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

22BCC41 - BIG DATA ANALYTICS							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**DATABASE MANAGEMENT SYSTEMS**	**4**	**PC**	**3**	**0**	**2**	**4**

Preamble	This course imparts the knowledge about Big Data, develops skill set in analyzing of Big data and get insights on data streaming.	
Unit – I	**Digital Data and Big Data:**	**9**
Types of Digital Data: Classification of Digital Data – Introduction to Big Data: Characteristics of Data – Evolution – Definition – Challenges – Volume, Velocity and Variety – Other Characteristics of Big Data – Need for Big Data – Information Consumer or We Produce Information – Traditional BI vs Big Data – Typical Data Warehouse Environment – Hadoop Environment – New Today – Changing in Realms of Big Data.		
Unit – II	**Big Data Analytics and Technology Landscape:**	**9**
Big Data Analytics: Introduction – Sudden Hype – Classifications of Analytics – Greatest Challenges – Top Challenges Facing Big Data – Importance of Big Data Analytics – Kind of Technologies – Data Science – Data Scientist – Terminologies Used in Big Data Environment– Base – Top Analytical Tools – Big Data Technology Landscape: NoSQL – Hadoop.		
Unit – III	**Hadoop and Map Reduce:**	**9**
Hadoop: Introduction – Need for Hadoop – Why not RDBMS – RDBMS vs Hadoop – Distributed Computing Challenges – History – Hadoop Overview – Use Case of Hadoop – Hadoop Distributors – Hadoop Distributed File System – Processing Data with Hadoop – Managing Resources and Applications with Hadoop Yarn – Interacting with Hadoop Eco System – Map Reduce Programming: Introduction – Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression.		
Unit – IV	**Cassandra:**	**9**
Apache Cassandra – Features of Cassandra – CQL Data Types – CQLSH – Keyspaces – Crud – Collections – Using a Counter – Time to Live –Alter Commands – Import and Export – Querying System Tables – Practice Examples.		
Unit – V	**Spark and Streaming:**	**9**
Spark and Big data analytics: Introduction – Spark – Introduction to data analysis with Spark – Programming using RDD and MLIB – Data ETL – Analyting, Reporting and Visualizing – Spark Streaming: Introduction – Data stream concept and Management – Stream computing aspects – Frequent Itemset – Real – Time Analytics platform.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Perform file management tasks using Hadoop commands.
2.	Write a Map Reduce program to count the frequency of each word in a text file
3.	Write a Map Reduce Program to analyse time-temperature statistics and generate report with max/min temperature.
4.	Implement Cassandra CRUD operation in database
5.	Perform the following operations in Cassandra collections • Creating sets, maps and lists • Adding elements to the collections • Removing elements from list
6.	Apply the commands to import and export data from/to CSV file in Casandra.
7.	Implement the RDD Transformation functions in spark
8.	Implement the RDD Action functions in spark.

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Seema Acharya , Subhashini Chellapan, “Big Data And Analytics”, 2nd Edition, Wiley, 2019 (for Unit I,II,III,IV).
2.	Raj Kamal, Preeti Saxena , “Big Data Analytics, Introduction to Hadoop, Spark, and Machine–Learning”,1st Edition, McGraw Hill Education Private Limited,2019 (for Unit V).

REFERENCES:

1.	Bill Franks, “Taming the Big Data Tidal Wave”, 1st Edition, Wiley Reprint, 2014.
2.	DJ Editorial Services, “Big Data Black Book”, 1st Edition, Dreamtech Press, 2016.

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	outline the concepts of digital data and big data	Understanding (K2)
CO2	interpret the big data analytics and technology landscape	Understanding (K2)
CO3	illustrate Hadoop and map reduce framework	Understanding (K2)
CO4	design Cassandra query expressions	Applying (K3)
CO5	apply Spark tool to process real time data from various sources	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											2	3
CO2	2	1	3										2	3
CO3	2	1	2	1	3	2			2				2	3
CO4	3	2	2	2	2	3			1				3	3
CO5	3	2	1	1	1	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	40	60					100
CAT2	40	60					100
CAT3	20	40	40				
ESE	20	50	30				100

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

22BCL41 - USER INTERFACE TECHNOLOGIES LABORATORY							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Web Programming Laboratory**	**4**	**PC**	**0**	**0**	**4**	**2**

Preamble	This course is designed to impart the knowledge to design and implement static and dynamic websites for real time applications.

LIST OF EXPERIMENTS / EXERCISES:

1.	Design a web page of your bio-data using HTML tags.
2.	Create an attractive webpage about our department using style sheets.
3.	Apply box model and drop-down menus to prepare your semester mark sheet.
4.	Design a webpage to create simple interactive CGPA calculator using Event Handling.
5.	Prepare a web application using HTTP Request and HTTP Response
6.	Develop simple login page of customer registration by performing event handling using GET and POST method
7.	Develop a simple calculator using “Modules” in Node.js
8.	Design a webpage to maintain personal information using CRUD operations in MongoDB
9.	Create a web application using components and forms in React.
10.	Prepare a reactive form to maintain personal information and perform validation using React.

Total:60

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	develop interactive web pages using HTML, CSS, 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 ReactJS to design 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							2	3	2	3
CO2	3	2	1	1							2	3	2	3
CO3	3	2	1	1							2	3	2	3

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

22BSL41 - SOFTWARE TESTING LABORATORY							
Programme& Branch	**B.Sc&Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Java Programming Laboratory**	**4**	**PC**	**0**	**0**	**4**	**2**

Preamble	To provide practical knowledge in testing of software and understand the automation test approach

LIST OF EXPERIMENTS / EXERCISES:

1.	Perform testing in the context sensitive mode using WinRunner
2.	Perform testing in the analog sensitive mode using WinRunner
3.	Implement insertion sorting in java to arrange array elements and do the following • draw the control flow graph • find the cyclomatic complexity • derive different test cases, execute these test cases and discuss the test results.(Ascending, descending, one, two and three elements,min/max as pivot element)
4.	Implement the binary search algorithm, determine the independent paths using this derive the test cases and analyze the test case results.
5.	Introduction to Selenium and its installation
6.	Implement positive and negative test cases for registration page.
7.	Construct a java program and perform the following testing • Code coverage • Path coverage • Condition coverage • Loop coverage
8.	Write a java program to Open a Web Page using Chrome, Firefox browser and fetch the webpage details.
9.	Implement the Browser Navigation Commands and identify the web elements using tag name, link text, id and Xpath.
10.	Design a simple test script to validate each field of the registration page

Total:60

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual / Selenium

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	experiment with user navigations and test the program flow.	Applying (K3), Precision(S3)
CO2	test the web sites using selenium tool.	Applying (K3), Manipulation(S2)
CO3	validate the web elements of a web page.	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	2								2	3
CO2	3	2	1	1	1								2	3
CO3	3	2	1	1	1								2	3

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

22BCL43 – MOBILE APPLICATION DEVELOPMENT LABORATORY							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Java Programming Laboratory**	**4**	**PC**	**0**	**0**	**4**	**2**

Preamble	This course provides the knowledge in the basic concepts of android programming and it emphasis on the development of simple android applications

LIST OF EXPERIMENTS / EXERCISES:

1.	Explore the android studio environment and display the "Hello World" Message.
2.	Implementation of simple activity.
3.	Implementation of fragments within the activity.
4.	Create Intents to establish connection between the Activities.
5.	Implementation of dialogs to interact with the users.
6.	Design the application with different views
7.	Develop a simple calculator application
8.	Create application to handle images using Grid view and image switcher.
9.	Implementation of option menu and Context Menu
10.	Create a SQLite Database application.

Total:60

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	develop application using activities, fragments and intents.	Applying (K3), Manipulation (S2)
CO2	design the need based applications using views, viewgroups and images.	Applying (K3), Precision (S3)
CO3	create applications to handle menus and data storage.	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									2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3

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

22GCL42 PROFESSIONAL SKILLS TRAINING – II						
(Common to BSc – Computer Systems and Design, Information Systems, Software Systems)						
Programme & Branch	**B.Sc & Computer Systems and Design, Information Systems, Software Systems**	**Category**	**L**	**T**	**P**	**Credit**
		EC	**0**	**0**	**80**	**2**
Preamble	This subject is to enhance the employability skills and to develop career competency					
Prerequisites	Nil					

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 & 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	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**30**

Grammar: Direct & Indirect Speeches - Active & Passive voice - Vocabulary: Technical vocabulary - Unscrambling words - Spotting errors - Assertion and Reason - Verbal puzzle - Pair words - Logical sequence of words - Listening: Short extracts - Structured talks - classroom lectures - Speaking: Telephonic conversations - Technical project presentations - Effective public speaking - Role Play - Negotiation skills - Mock Interview - Sharing of real time experience - Pair discussion - Life skills - Team Management - Leadership skills - Group Discussion - Reading: Stress & Intonation - Effective reading strategies - Reading News articles - Notices & book reviews - GATE type reading comprehension - Newspaper reading - Writing: Summary Writing - Review of real time interviews/Competitive examinations

Textbook:

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. Edgar Thorpe and Showick Thorpe, “Winning at Interviews,” 5th Edition, Pearson Education India, 2013.

COURSE OUTCOMES: 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 individual and as a team	Applying (K3), Precision (S3)
CO2:	solve real time problems using numerical ability and logical reasoning	Applying (K3), Precision (S3)
CO3:	apply English language skills 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	0	0	0	3	3	0	3	0	3	2		
CO2	3	2	0	0	0	3	3	0	3	0	3	2		
CO3		2					3	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	40	40				100
CAT2		50	50				100
CAT3		50	50				100
ESE							

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

22BCT51 - INTERNET OF THINGS							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc - Computer Systems and Design, Information Systems and Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Networks**	**5**	**PC**	**3**	**0**	**0**	**3**

Preamble	To provide an in-depth introduction to IoT and to start off with a hands on approach towards building and analyzing IoT applications.	
UNIT -I	**Introduction to IoT:**	**9**
Introduction – IoT Ecosystem – IoT Reference Model – Level 1 Physical Devices and Controllers – Level 2 Connectivity – Level 3 Edge Computing – Level 4 Data Accumulation – Level 5 Data Abstraction – Level 6 Application – Level 7 Collaboration and Processes – Security in the IoT.		
UNIT- II	**Transducers, Sensors and Actuators:**	**9**
Defining Transducers, Sensors and Actuators – Introduction to Transducers – Introduction to Sensors – Introduction to Actuators – Interfacing Concepts to Embedded Systems – Wireless Sensor Networks and its Technologies – Network Topologies in Wireless Sensor Networks – Issues and Challenges of a Wireless Sensor Networks – Participating Wireless Sensing Technologies – RFID – LoRa.		
UNIT- III	**IoT Protocols, Domains and Platform Design:**	**9**
IoT Protocols – Protocol Classification – MQTT – XMPP – DDS – AMQP – COAP – Representational State Transfer – Comparison of the Protocols - Domain Specific IoT: Introduction – Home Automation – Smart Cities – Environment – Retail – Logistics – Agriculture – Health and Lifestyle - IoT Platform Design methodology.		
UNIT- IV	**IoT Physical Devices and Endpoints Raspberry Pi:**	**9**
Introduction to RaspberryPi – Exploring the RaspberryPi Learning Board – RaspberryPi Operating Systems – Operating System Setup on RaspberryPi – RaspberryPi Commands – Programming RaspberryPi with Python.		
UNIT- V	**IoT Use Cases:**	**9**
Asset Management – Introduction - Expected Benefits – Electronic Maintenance in the M2M Era - Hazardous Goods Management in the M2M Era - The Smart Grid – Introduction - Smart Metering - Smart House - Smart Energy City - Commercial Building Automation - Smart Cities.		
		Total:45

TEXT BOOK:

1. Srinivasa K.G,Siddesh G.M. and Hanumantha Raju R. “Internet of Things”, Cengage Learning India, Delhi, 2019 for UNIT I,II,III,IV.
2. Jan Holler.,Vlasios Tsiatsis.,Catherine Mulligan.,Stamatis Karnouskos.,Stefan Avesand.,David Boyle.” From Machine-to-Machine to the Internet of Things Introduction to a New Age of Intelligence”, Academic Press, Elsevier, USA, 2014 for UNIT V.

REFERENCES:

1. Arshdeep Bahga and Vijay Madisetti“Internet of Things: A Hands-on Approach”, Universities Press, Hyderabad, 2020
2. Jamil Y.Khan and Mehmet R.Yuce.”Internet of Things (IoT) Systems and Applications”, Jenny Stanford Publishing, Singapore, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret the basics of Internet of Things and its recent trends.	Understanding (K2)
CO2	illustrate how to initiate, activate, collect data using Transducers, Sensors and Actuators.	Understanding (K2)
CO3	summarize IoT protocols, domains and higher level design platforms for developing IoT applications.	Understanding (K2)
CO4	develop prototypes of IoT using Raspberry Pi.	Applying (K3)
CO5	apply IoT strategies for core M2M use cases	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											2	3
CO2	2	1											2	3
CO3	2	1											2	3
CO4	3	2	1	1	2	2							3	2
CO5	3	2	1	1	2	2	2						3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Blooms Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	80					100
CAT2	20	80					100
CAT3	20	50	30				100
ESE	10	60	30				100

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

22BCT52 – ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc – Computer Systems and Design, Information Systems and Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**PC**	**3**	**0**	**0**	**3**

Preamble	To focus on fundamentals of Artificial Intelligence concepts, Machine learning techniques and various machine learning algorithms.	
UNIT– I	**Artificial Intelligence :**	**9**
Introduction to AI – Problems- Underlying Assumptions- AI Techniques – AI Applications –Tic-Tac-Toe – Question Answering – Problems, Problem Spaces and Search: Defining the problem- Production Systems – Breadth first and Depth first – Heuristic Search –Problem Characteristics – Heuristic search techniques: Generate and Test – Types of Hill Climbing.		
UNIT – II	**Introduction to Machine Learning, Model Preparation and Evaluation:**	**9**
Human Learning –Types – Machine Learning – Types – Problems not to be solved – Applications – Languages/tools in Machine Learning – Issue –.Machine Learning Activities –Types of data – Exploring structure of data – Data quality and remediation – Data Preprocessing – Selecting a model – Training a model – Model representation and interpretability– Model Evaluation – Improving performance of a model.		
UNIT – III	**Supervised Learning - Classification and Regression:**	**9**
Classification: Introduction – Example – Classification model – Learning steps– Common classification algorithms– K-Nearest Neighbor – Decision Tree – Random Forest- Support Vector Machines – Regression: Introduction – Example – Simple Linear Regression – Assumptions and Problems in Regression Analysis – Improving the Accuracy.		
UNIT – IV	**Unsupervised Learning-Clustering:**	**9**
Introduction – Unsupervised Learning Vs Supervised Learning – Applications – Clustering as a machine learning task – K-means Centroid-based Approach – K-medoids – Hierarchical clustering – Density based methods – DBSCAN.		
UNIT– V	**Artificial Neural Network and other Learning methods**	**9**
Introduction – Biological neuron – Artificial Neuron – Types of activation function – Architectures of NN – Learning process in ANN– Back propagation – Representation Learning – Ensemble learning algorithms – Regularization algorithm.		
		Total:45

TEXT BOOK:

1. Elaine Rich, Kevin Knight and Shivashankar B. Nair, “Artificial Intelligence”, 3rd Edition, Tata McGraw–Hill, 2019 for Unit I.
2. Saikat Dutt, Subramanian Chandramouli and Amit Kumar Das, "Machine Learning", 1st Edition, 2019 Pearson Education, India, (for Units II,III,IV and V.)

REFERENCES:

1. Deepak Khemani, "A First Course in Artificial Intelligence", 1st Edition, McGraw Hill Education, India, 2017.
2. Tom M. Mitchell, “Machine Learning”, Indian Edition, McGraw–Hill Education (India), 2017.
3. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", 2nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	describe the fundamentals of artificial intelligence concepts and searching techniques	Understanding (K2)
CO2	explore the data preprocessing techniques for machine learning model construction and evaluation	Understanding (K2)
CO3	compute the performance of various classification and regression algorithms in terms of accuracy	Applying (K3)
CO4	implement various data clustering algorithms to cluster the given dataset	Applying (K3)
CO5	apply artificial neural network model for real life problems and describe other various learning 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	2	2	2	2					1	2	1	1	2	3
CO2	2	1	1	1					1	2	1	1	2	3
CO3	3	2	1	1					2	2	1	2	2	3
CO4	3	2	1	1					2	2	1	2	2	3
CO5	3	2	1	1					2	2	1	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	20	50	30				100
CAT3	20	30	50				100
ESE	10	50	40				100

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

22BCL51 INTERNET OF THINGS LABORATORY							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme& Branch	**B.Sc – Computer Systems and Design, Information Systems and Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Python Programming**	**5**	**PC**	**0**	**0**	**4**	**2**

Preamble	To provide familiarization with Arduino/Rasberry Pi and development of simple python applications to manipulate sensor data.

List of Exercises / Experiments:

1.	Arduino based LED turn on for 1 second after every 2 seconds.
2.	Arduino based LED on/off using movement sensor
3.	Arduino based temperature and humidity monitoring
4.	Raspberry pi based LED On/Off using push button
5.	Raspberry pi based distance measuring using ultrasonic sensor
6.	Raspberry pi based weather monitoring
7.	Raspberry pi based rain fall detection using rain sensor
8.	Raspberry pi based obstacle detection using IR sensor
9.	Raspberry pi based object color detection using camera sensor
10.	Raspberry pi based turn LED ON/OFF when „1'/'0' is received from Smartphone using Bluetooth Low Energy 3.0

Total:60

REFERENCES/MANUAL/SOFTWARE:

1	Laboratory Manual/Python

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	develop applications for handling LED/Movement/Humidity sensor data.	Applying (K3), Manipulation(S2)
CO2	design applications using Ultrasonic/Weather/Rain sensors.	Applying (K3), Manipulation(S2)
CO3	create applications to handle data received through IR/Camera/Bluetooth.	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	2	1											2	3
CO2	2	1											2	3
CO3	3	2	1	1									2	3

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

22BCL52 – MACHINE LEARNING LABORATORY							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc – Computer Systems and Design, Information Systems and Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Python Programming**	**5**	**PC**	**0**	**0**	**4**	**2**

Preamble	This course enhances skill in Machine Learning platform and emphasizes on developing real time applications by applying Machine Learning algorithms.

List of Exercises / Experiments:

1.	Study of IDE and Cloud platform Spyder, Jupyter Notebook and Data repositories UCI and Kaggle
2.	Demonstrate preprocessing methods and calculation of mean, median, variance and standard deviation of the given numerical data.
3.	Demonstrate plotting techniques and explore the relationship between variables of numerical data
4.	Implement k–NN algorithm for the given data.
5.	Write a program to find the attribute with maximum information gain for the given data
6.	Apply support vector machines algorithm
7.	Implement simple Linear regression algorithm
8.	Implement k–means clustering algorithm for the given data
9.	Explore various activation functions used in ANN
10.	Implement multi–layer Artificial Neural Network

Total: 60

REFERENCES/MANUAL/SOFTWARE:

1	Jupyter Notebook/Spyder/ Google Colab Cloud platform/Scikit–learn package

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	perform various data processing and plotting techniques	Applying (K3), Imitation (S1)
CO2	apply classification and clustering algorithms on the given data set	Applying (K3), Precision (S3)
CO3	develop a real time application using artificial neural network.	Applying (K3), Precision(S3)

Mapping of COs with POs anPSOs

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

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

22BCE01 CLOUD COMPUTING							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme& Branch	**B.Sc – Computer Systems and Design, Information Systems and Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Networks**	**5**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course covers comprehensive and fundamental concepts of distributed computing and virtualization. It imparts the foundations and technologies related to the applications and services of cloud computing.	
Unit - I	**Distributed System Models and Enabling Technologies**	**9**
Scalable Computing over the Internet – Technologies for Network Based Systems – System Models for Distributed and Cloud Computing – Software Environments for Distributed Systems and Clouds.– Performance, Security, and Energy Efficiency.		
Unit - II	**Virtual Machines and Virtualization of Clusters and Data Centers**	**9**
Implementation levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU, Memory, I/O devices – Virtual Clusters and Resource Management – Virtualization for Data Center Automation-Case Study.		
Unit - III	**Cloud Platform Architecture over Virtualized Data Centers:**	**9**
Cloud computing and Service models – Data Center Design and Interconnection Networks – Architectural Design of Compute and Storage Clouds – Public Cloud Platforms - Google App Engine – AWS – Microsoft Windows Azure – Inter cloud Resource Management. Case study : Configuring Compute and Storage Services		
Unit - IV	**Cloud Programming and Software Environments:**	**9**
Features of Cloud and Grid Platforms – Parallel and Distributed Programming Paradigms – Programming Support of Google App Engine– Programming on Amazon AWS and Microsoft Azure– Emerging Cloud Software Environments: Open Stack.		
Unit - V	**Ubiquitous Clouds and the Internet of Things:**	**9**
Cloud Trends in supporting Ubiquitous Computing – Performance of Distributed Systems and the Cloud – Enabling technologies for the Internet of Things – Innovative Applications of the Internet of Things.		
		Total:45

TEXT BOOK:

1. Kai Hwang, Geoffrey C Fox & Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", 1st Edition, Morgan Kauffmann, 2021.

REFERENCES:

1. Daniel Kirsch, Judith Hurwitz, "Cloud Computing", 2nd Edition, Wiley, 2020.
2. Marinescu, “Cloud Computing : Theory And Practice” , 2nd Edition, Elsevier India, 2020

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the concepts, characteristics and benefits of Distributed System Models	Understanding (K2)
CO2	summarize the different virtualization technologies	Understanding (K2)
CO3	experiment the various cloud computing service models	Applying (K3)
CO4	demonstrate the use of cloud platforms and software environments	Applying (K3)
CO5	explain the cloud trends that supports ubiquitous clouds and Internet of Things	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	2
CO2	2	1											3	2
CO3	3	2	1	1									2	3
CO4	3	2	1	1									2	3
CO5	2	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	20	80					100
CAT2	20	60	20				100
CAT3	20	60	20				100
ESE	20	60	20				100

22BSE01 – SOFTWARE QUALITY ASSURANCE							
Programme& Branch	**B.Sc – Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Software Engineering**	**5**	**PE**	**3**	**0**	**0**	**3**

Preamble	To provide an overview of standards used to ensure software quality and define the ways to maximize the performance of software.	
Unit - I	**Introduction and Role of Software Quality:**	**9**
Introduction-Meaning of Quality -Challenge-Importance of Quality as a Business Driver – Software Quality Assurance Role in an Organization: Introduction – Organizational Framework for Software Quality Assurance – Understanding the Difference between Quality Assurance and Quality Control – Quality Assurance during SDLC Phases – Understanding the SQA Function		
Unit - II	**Planning and Managing software Quality:**	**9**
Introduction – Quality Policy, Quality Manual and the Quality Management System - Quality Management System and the Role of Management – QMS Expectations from Stakeholders View Point – Understanding Quality Assurance from SOX Compliance Perspective – Establishing the Quality Assurance Function – People's issues in Managing Software Quality Assurance – Quality Planning Dilemmas and Observations.		
Unit - III	**Managing Software Quality Assurance Operations:**	**9**
Introduction – Contents of the Quality Assurance Plan – Software Quality Assurance Organizational Level Initiatives – Defect Prevention – Quality Assurance Important Dimensions for the QA Analyst – New Technology Pilots and Change Management – Managing Process Changes – SQA Tools, Technologies, Methods and Integration.		
Unit - IV	**ISO and Capability Maturity Models:**	**9**
Introduction – Understanding the Constitution of ISO 9001 – Origin of ISO 9000 – ISO Function as an Organization – ISO Standards Development Process – ISO 9000 Family of Standards – ISO 9001:2008 – Organizational Need for ISO 9000 – ISO 9001 and Software Development – Capability Maturity Model: Introduction – Software Process Improvement (SPI) Models – Understanding High Maturity Practices – CMMI Version 1.3 overview.		
Unit - V	**IT Service Quality, People Issues and Careers:**	**9**
Introduction – Fundamental Concepts Related to Service – Service Quality Perceptions, Expectations and Measuring the Gaps – Measuring Service Quality – Quality Assurance People Issues and Careers: Introduction – Professional Growth – People Issues – Enhancing SQA Competency – Finding a Mentor – Roles for Quality Professions – Quality Certifications.		
		Total:45

TEXT BOOK:

1.	Nina S. Godbole, "Software Quality Assurance: Principles and Practice for the New Paradigm", 2nd Edition, Narosa Publishing House, New Delhi, 2017.

REFERENCES:

1.	Pressman Roger S, "Software Engineering: A Practitioner"s Approach", 7th Edition, McGraw-Hill, 2017.
2.	Stephan Goericke, "The Future of Software Quality Assurance", 1st Edition, Springer International Publishing, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret software quality and its role in an organization	Understanding (K2)
CO2	outline planning and managing of software quality	Understanding (K2)
CO3	make use of software quality assurance operations	Applying (K3)
CO4	review of ISO standards and capability maturity models	Understanding (K2)
CO5	inspect service quality and point out careers in software quality	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	3
CO2	2	1											3	2
CO3	3	2	1	1									2	3
CO4	2	1											3	2
CO5	3	2	1	1									2	3

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

ASSESSMENT PATTERN - THEORY

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

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

22BSE02 –USER INTERFACE DESIGN							
Programme& Branch	**B.Sc–Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5**	**PE**	**3**	**0**	**0**	**3**

Preamble	To impart the common principles of user interface design and focus on maximizing usability with the user-friendly interfaces.	
UNIT –I	**Introduction to User Interfaces, Graphical and Web User Interfaces:**	**9**
Importance of User Interface -Interaction Styles-Graphical User Interface – Web User Interface – Merging of Graphical Business Systems and The Web – Principles of User Interface Design - The User Interface Design Process: Obstacles and Pitfalls in Development Path – Usability.		
UNIT –II	**System Menus and Navigation Schemes:**	**9**
Structures of Menus – Functions of Menus – Content of Menus – Formatting of Menus – Phrasing the Menu – Selecting Menu Choices – Navigating Menus – Kinds of Graphical Menus – Graphical Menu Examples.		
UNIT –III	**Screen–Based Controls:**	**9**
Operable Controls – Text Entry/Read – Only Controls – Selection Controls – Combination Entry/Selection Controls – Other Operable Controls – Custom Controls – Presentation Controls – Selecting the Proper Controls – Examples.		
UNIT –IV	**Windows:**	**9**
Window Characteristics – Components of Window – Window Presentation Styles – Types of Windows– Window Management – Organizing Window Functions –Web and the browser.		
UNIT- V	**Feedback, Guidance, Assistance and Accessibility:**	**9**
Providing the Proper Feedback – Guidance and Assistance – International Considerations: Localization – Cultural Considerations- Words and text – Images and symbols- Color, Sequence, and Functionality- Requirement's determination and testing- Accessibility: Types of Disabilities - Accessibility design.		
		Total:45

TEXT BOOK:

1.	Galitz O. Wilbert, "The Essential Guide to User Interface Design : An Introduction to GUI Design Principles and Techniques", 3rd Edition, Wiley Publications, New Delhi, 2015.

REFERENCES:

1.	ShneidermanBen,PlaisantCatherine,CohenMaxineandJacobsSteven,"Designing the User Interface Strategies for Effective Human- Computer Interaction",6thEdition, Pearson Education, NewDelhi, 2017.
2.	Cooper Alan,"The Essentials of UserInterface Design",4thEdition,WileyDreamTechLtd.,NewDelhi,2014.

COURSEOUTCOMES: On completionof thecourse, the studentswillbe ableto		**BT Mapped (HighestLevel)**
CO1	interpret the principles and importance of user interface design	Understanding (K2)
CO2	illustrate user interface with menus and navigation menu	Understanding (K2)
CO3	elaborate screen based and custom controls	Understanding (K2)
CO4	demonstrate window presentation styles and its types	Applying (K3)
CO5	apply the principles of screen design and technological considerations in interface design	Applying (K3)

MappingofCOswith POsandPSOs

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

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

ASSESSMENTPATTERN–THEORY

Test / Bloom'sCategory*	**Remembering(K1)%**	**Understanding(K2)%**	**Applying(K3)%**	**Analyzing(K4)%**	**Evaluating (K5)%**	**Creating (K6)%**	**Total %**
CAT1	30	70					100
CAT2	30	70					100
CAT3	20	50	30				100
ESE	20	50	30				100

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

22BCE04 OBJECT ORIENTED ANALYSIS AND DESIGN							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc - Computer Systems and Design, Information Systems and Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**PE**	**3**	**0**	**0**	**3**

Preamble	To focus on analysis and design of objects and classes based on object oriented techniques and methodologies using UML.	
UNIT - I	**Introduction:**	**9**
An overview – Object basics: Object state and properties – Behavior – Methods – Messages – Information hiding – Class hierarchy – Polymorphism - Relationships – Associations – Aggregations- Identity – Dynamic binding – Persistence – Meta classes – Object oriented system development life cycle.		
UNIT - II	**Methodologies and UML:**	**9**
Introduction – Survey – Rumbaugh, Booch, Jacobson methods – Patterns - Frameworks – Unified Approach - Unified modelling language: Static and Dynamic models – UML diagrams – Class diagram – Use case diagrams – Interaction diagram – State chart diagram – Activity diagram - Component diagram – Deployment diagram – Dynamic modelling – Model organization – Extensibility – Case study.		
UNIT- III	**Object Oriented Analysis:**	**9**
Identifying Use case – Business object analysis – Use case driven object oriented analysis – Use case model – Documentation – Classification – Identifying object, relationships, attributes, methods: Associations - Super-sub class – A part of relationships - Identifying attributes and methods – Object responsibility – construction of class diagram for generalization, aggregation.		
UNIT- IV	**Object Oriented Design:**	**9**
Introduction - Design Process - Design Axioms – Corollaries – Design patterns - Designing Classes: Object oriented design Philosophy - UML object constraint language – Process - Class Visibility – Refining Attributes – Designing Methods and Protocols – Packages and Managing classes – Case study.		
UNIT- V	**View Layer:**	**9**
Introduction – UI design as a creative process – Designing view layer classes – Macro-level process - Micro-level process – Purpose of a view layer interface – Prototyping the UI – Case Study.		
		Total:45

TEXT BOOK:

1	Bahrami Ali, “Object Oriented Systems Development”, 1st Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017

REFERENCES:

1	Martin Fowler, “UML Distilled: A Brief Guide to the Standard Object Modeling Language” , 3rd Edition, Pearson Education, 2018
2	Bhuvan Unhelkar, “Software Engineering with UML”, 1st Edition, CRC Press, 2018

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret the basics of object oriented concepts and the system development lifecycle	Understanding (K2)
CO2	Implement UML diagrams in different applications	Applying (K3)
CO3	demonstrate object oriented analysis by identifying usecases, classes and their relationships	Applying (K3)
CO4	develop object oriented systems using axioms, corollaries	Applying (K3)
CO5	illustrate user interface design in view layer	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	1	2	2								2	3
CO2	3	2	1	1	3	1							2	3
CO3	3	2	1	1	2								2	3
CO4	3	2	1	1	2	1							2	3
CO5	2	1	1	1									1	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Blooms Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	**Rememberin g(K1) %**	**Understandin g(K2) %**	**Applyin g(K3) %**	**Analyzin g(K4) %**	**Evaluatin g(K5) %**	**Creating (K6) %**	**Total %**
CAT1	10	60	30				100
CAT2	10	50	40				100
CAT3	10	60	30				100
ESE	10	50	40				100

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

22BSE03 ETHICAL HACKING							
Programme & Branch	**B.Sc – Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Software Engineering, Computer Networks**	**5**	**PE**	**3**	**0**	**0**	**3**

Preamble	To impart the security fundamentals, networking concepts and technical foundation related to ethical hacking. The course discloses all the methodology and issues related to hacking and threats	
Unit - I	**Introduction to Ethical Hacking:**	**9**
Security Fundamentals : Goals – Risk, Assets, Threats, and Vulnerabilities – Backing Up Data – Exploit – Risk Assessment – Security Testing : Black Box, White Box, Gray Box – Types- Hacker and Cracker Descriptions- Ethical Hackers : Required Skills – Modes of Ethical Hacking		
Unit - II	**Technical Foundations of Hacking:**	**9**
The Attacker"s Process : Performing Reconnaissance and Footprinting – Scanning and Enumeration – Gaining Access – Escalation of Privilege – Maintaining Access- Covering Tracks and Planting Backdoors – Ethical Hacker's Process – Security and the Stack : OSI Model – Anatomy of TCP/IP Protocols		
Unit - III	**Footprinting and Scanning:**	**9**
Information Gathering: Documentation – Organization's Website – Job Boards – Employee and People Searches – EDGAR Database – Google Hacking – Usenet – Registrar Query – DNS Enumeration – Determining the Network Range – Identifying Active Machines – Finding Open Ports and Access Points.		
Unit - IV	**Fingerprinting and System Hacking:**	**9**
OS Fingerprinting – Fingerprinting Services– Mapping the Network Attack Surface – System Hacking: Password Attacks – Guessing – Sniffing –key logging- Owning the Box – Windows and Linux Authentication Types – Cracking Passwords – Rootkits -File Hiding and Covering Tracks		
Unit - V	**Malware Threats:**	**9**
Viruses and Worms –Types – Payloads – well-known viruses –Tools – Trojans- Types - Goals – Infection Mechanisms- Tools–Convert Communication – Keystroke Logging and Spyware- Hardware – Software- Malware Countermeasures- Detecting Malware – Antivirus - Analyzing Malware		
		Total:45

TEXT BOOK:

1.	Michael Gregg, "Certified Ethical Hacker (CEH) Version 9 Cert Guide", 2 Edition, Pearson Publication, 2018.

REFERENCES:

1.	Dr. Allen Harper, Stephen Sims, MichealBaucom, "Gray Hat Hacking The Ethical Hacker"s Handbook", 5 Edition, 2018.
2.	Patrick Engebretson, "The Basics of Hacking and Penetration Testing", 2 Edition, Elsevier Syngress Publications, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the security fundamentals and testing	Understanding (K2)
CO2	examine hacking using technical foundations	Understanding (K2)
CO3	discriminate the foot printing and scanning	Applying(K3)
CO4	investigate finger printing and scanning	Applying (K3)
CO5	categorize malware threats like viruses and worms	Analyzing (K4)

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	2
CO2	2	1											1	2
CO3	2	1											1	2
CO4	3	2	1	1									2	3
CO5	3	3	2	2	1								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	50	50					100
CAT2	20	50	30				100
CAT3	15	25	40	20			100
ESE	15	40	30	15			100

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

22BSE04 - Software Metrics							
Programme & Branch	**B.Sc & Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Software Engineering**	**5**	**PE**	**3**	**0**	**0**	**3**

Preamble	To impart knowledge about assessing software development projects with basic measurements and data collection techniques.	
UNIT -I	**Basics of Measurement :**	**9**
Measurement in Everyday life – Measurements in Software Engineering – Scope of Software metrics – Basics of Measurement: Representational theory of measurement – Measurement and models – Measurement Scales and Scale Types.		
UNIT -II	**Goal based framework for software measurement:**	**9**
A Goal based Framework for software Measurement – Classifying Software Measures – Determining What to Measure – Empirical investigation: Principles of Empirical studies – Planning Experiments – Process Model for Performing Experiments – Key Experimental design concepts –Types of experiment design – Selecting an experiment design.		
UNIT -III	**Software metrics data collection:**	**9**
Defining good data – Data collection for incident reports – Problem with problems – Failures – Faults – Changes – How to collect data – Data collection Forms – Tools – Reliability of Data Collection Procedures.		
UNIT -IV	**Measuring Internal Product Attributes:**	**9**
Size – Properties of software size – Code size – Design size – Requirements analysis and specification size – Functional size measures and Estimators – Measuring internal product attributes: Structure – Aspects of structural measures – Control flow structure of program units.		
UNIT- V	**Measuring External Product attributes:**	**9**
Modeling software quality – Early models – Define your own Models – ISO standard quality models – Measuring aspects of quality – Usability measures – Maintainability measures – Security measures – External view of security – Internal attributes affecting security.		
		Total: 45

TEXT BOOK:

1.	Norman Fenton, James Bieman, "Software Metrics: A Rigorous and Practical Approach", 3rd Edition, CRC Press, Florida, 2015.

REFERENCES:

1.	Ravindranath Pandian . C “Software Metrics – A guide to Planning ,Analysis and Application “ AUERBACH Publications 2011 Special Edition
2.	Pressman Roger S, "Software Engineering: A Practitioner"s Approach", 7th Edition, McGraw-Hill, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline the fundamentals of software measurement	Understanding (K2)
CO2	illustrate the framework of measurement and empirical investigation	Understanding (K2)
CO3	interpret the data collection for software measurements	Understanding (K2)
CO4	apply the size and structural measures in software analysis	Applying (K3)
CO5	make use of the external product attributes	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											2	3
CO2	2	1											2	3
CO3	2	1											2	3
CO4	3	2	1	1									2	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Blooms 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	30	40	30				100
ESE	20	60	20				100

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

22BCE07 DATA SCIENCE							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc - Computer Systems and Design, Information Systems and Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides an introduction to data science, its process with focus on big data and text mining.	
UNIT - I	**Introduction:**	**9**
Benefits of Data Science – Facets of Data – Data Science Process –Big Data Ecosystem and Data Science–An Introductory working example of Hadoop - The Data Science Process: Overview – Defining Research Goals – Retrieving Data – Cleansing, Integrating, and Transforming Data – Exploratory Data Analysis – Building Models – Presenting Findings and Building Applications.		
UNIT - II	**Machine learning and handling big data:**	**9**
Introduction to Machine Learning and its Applications – The Modeling Process. Handling Large Data: Problems in Handling Large Data – General Techniques for Handling Large Volumes of Data– Programming Tips for Dealing with Large Datasets– Case Studies.		
UNIT- III	**Distributed data storage and processing:**	**9**
Distributing Data Storage and Processing with Frameworks: Hadoop – Spark – Case Study: Assessing Risk when Loaning Money.		
UNIT- IV	**NoSQL and graph database:**	**9**
Introduction: ACID– CAP Theorem – The BASE Principles of NoSQL Databases – NoSQL Database Types – Case Study: Disease Prediction– Graph Database: Introducing Connected Data and Graph Databases – Connected Data Example.		
UNIT- V	**Text Mining and Text Analytics:**	**9**
Text Mining in the Real World – Text Mining Techniques: Bag of Words – Stemming and Lemmatization – Decision Tree Classifier – Case Study: Classifying Reddit Posts.		
		Total: 45

TEXT BOOK:

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, “Introducing Data Science – Big Data, Machine Learning and more, using Python Tools”, First Edition, Manning Publications, 2021.

REFERENCES:

1. Joel Grus, “Data Science from the Scratch”, 2 nd Edition, O’Reilly Publications, 2019
2. http://education.EMC.com/academicalliance, “Data Science and Big data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, 1 st Edition, EMC Education Services, 2015

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret the usage of data science in building models and applications	Understanding (K2)
CO2	illustrate the machine learning process and techniques for handling large volume of data	Understanding (K2)
CO3	apply Hadoop and Spark platform for data science applications	Applying (K3)
CO4	design NoSQL database for real world problems	Applying (K3)
CO5	demonstrate the text mining 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	2	1	2			1							2	3
CO2	2	1	2			2							2	3
CO3	2	1	2	2	3	2							3	3
CO4	2	2	2	2	3	3							3	3
CO5	2	2	2	2	3	3							3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Blooms Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	**Rememberin g(K1) %**	**Understandin g(K2) %**	**Applyin g(K3) %**	**Analyzin g(K4) %**	**Evaluatin g(K5) %**	**Creatin g(K6) %**	**Total %**
CAT1	20	80					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)**

22BCE08 BLOCKCHAIN TECHNOLOGIES							
(Common to Computer Systems and Design & Software Systems)							
Programme & Branch	**B.Sc - Computer Systems and Design and Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Networks**	**6**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course covers the conceptual application aspects of blockchain, fundamental design and architectural primitives along with various use cases from different application domains.	
UNIT -I	**Introduction to Blockchain:**	**9**
Processing a financial Transaction -Ledger-Concept of a trustless system-General elements of blockchain-Types of blockchain-Byzantine generals problem- Components and structure of blockchain: Blocks – Chain – Hashing – Digital Signatures–Block Data-Miners – Validators – Smart Contracts - Speed – Decentralization Vs Distributed Systems		
UNIT -II	**Cryptography and Mechanics Behind Blockchain:**	**9**
Principles of security– Historical perspectives – Classical Cryptography- Types of Cryptography: Symmetric – Asymmetric – Signatures – Hashing. Bitcoin: History – Volatile – Keys and addresses – Transactions – Blocks – Bitcoin network – Wallets.		
UNIT- III	**Consensus, Cryptocurrency wallets, Hyperledger:**	**9**
Practical Byzantine fault tolerance algorithm – Proof of Work - Proof of Stake - Proof of Authority - Proof of Elapsed time. Cryptocurrency Wallets: Introduction to cryptocurrency wallets: Transactions - Types of cryptocurrency wallets – Currency Support-Tenancy. Hyperledger and Enterprise Blockchains: Hyperledger Sawtooth - Hyperledger Fabric.		
UNIT- IV	**Ethereum:**	**9**
Introducing Ethereum - Components of Ethereum: Ethereum accounts - Ethereum network - Ethereum clients - Ethereum gas - Ethereum virtual machine - Ethereum block. Ether: Procuring – Trading. Ethereum Accounts and Ether Tokens: Introduction-Ethereum State Transition Function – Genesis Block – Transaction Receipts – Transaction Subset- Messages – Calls – Ethereum Block Validations- Disadvantage of Ethereum based Tokens.		
UNIT- V	**Solidity & Smart Contracts:**	**9**
Basics of solidity- Programming in solidity: Laying out a solidity file- Importing Files- Commenting-Tags-Structure of a contract: State variables-Functions Modifiers-Events-Types-Reference Type- Mapping- Ethereum Development.		
		Total:45

TEXT BOOK:

1. Brenn Hill, Samanyu Chopra, Paul Valencourt, “Blockchain Quick Reference: A guide to exploring decentralized blockchain application development”, 1st Edition, Packt Publishing, 2018

REFERENCES:

1. Andreas Antonopoulos, “Mastering Bitcoin: Programming the open blockchain”, 2nd Edition, O"Reilly Media, 2017
2. Melanie Swan, “Blockchain: Blueprint for a New Economy”, 1st Edition, O"Reilly Media, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	illustrate the workings of blockchain	Understanding (K2)
CO2	explain various cryptographic algorithms in blockchain	Understanding (K2)
CO3	outline cryptocurrency and consensus used in blockchain.	Understanding (K2)
CO4	describe the working principle of Ethereum and transactions in Ethereum	Understanding (K2)
CO5	develop a distributed application using Ethereum and Solidity	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											2	3
CO2	2	1	3										2	3
CO3	2	1	2	1	3	2			2				2	3
CO4	2	1	2	2	2	3			1				2	3
CO5	3	2	1	1	1	2			3				2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Blooms 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	30	70					100
CAT3	25	55	20				100
ESE	30	50	20				100

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

22BCE09 SOFTWARE PROJECT MANAGEMENT							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme& Branch	**B.Sc – Computer Systems and Design, Information Systems and Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Software Engineering**	**6**	**PE**	**3**	**0**	**0**	**3**

Preamble	To apply the managerial aspects of software and focus on planning, monitoring and controlling various activities in a project.	
Unit- I	**Introduction:**	**9**
Introduction to Software Project Management – Project Evaluation and Programme Management: Introduction – A Business Case – Project Portfolio Management - Evaluation of Individual Projects - Cost benefit Evaluation Techniques - Risk Evaluation - Programme Management - Managing the Allocation of Resources - Strategic Programme Management - Creating a Programme - Aids to Programme Management - Some Reservation about Programme Management - Benefits Management.		
Unit - II	**Project and Activity Planning:**	**9**
An Overview of Project Planning - Activity Planning: Introduction – The Objectives of Activity Planning – When to Plan - Project Schedules - Projects and Activities – Sequencing and Scheduling Activities - Network Planning Models – Formulating a Network Model – Adding the Time Dimensions – The Forward and Backward Pass – Identifying Critical Path – Activity Float – Shortening the Project Duration - Identifying Critical Activities – Activity on Arrow Networks.		
Unit - III	**Resource Allocation and Progress Monitoring:**	**9**
Resource Allocation: Introduction – Nature of Resources – Identifying Resource Requirements – Scheduling Resources – Creating Critical Paths – Counting the Cost – Publishing the Resource Schedule – Cost Schedules – Scheduling Sequence - Monitoring and Control: Introduction - Creating the Framework - Collecting the Data – Review - Visualizing Progress - Cost Monitoring - Earned Value Analysis - Prioritizing Monitoring - Getting the Project Back to Target - Change Control.		
Unit - IV	**Managing Contracts and People in Software Environment:**	**9**
Managing Contracts: Introduction - Types of Contract - Stages in Contract Placement - Typical Terms of a Contract - Contract Management – Acceptance – Managing People in Software Environments: Introduction - Understanding Behaviour – Organizational Behaviour - Selecting Right Person – Instruction – Motivation – Oldham Hackman Job Characteristics Model – Stress and its Management– Healthy and Safety - Ethical and Professional Concerns.		
Unit - V	**Working in Teams:**	**9**
Introduction – Becoming a Team - Decision Making – Organization and Team Structures - Coordination Dependencies – Dispersed and Virtual Teams – Communication Genres – Communication Plans – Leadership.		
		Total:45

TEXT BOOK:

1 Hughes Bob, Cotterell Mike and Mall Rajib, “Software Project Management”, 6th Edition, Tata McGraw- Hill, New Delhi, 2019.

REFERENCES:

1 Roger S Pressman, “Software Engineering- A practitioners Approach”, 9th Edition, McGraw-Hill, New York, 2019.

2 Jack Lead, “Project Management: The Ultimate Guide for Managing Projects, Productivity, Profits of Enterprises, Startups and Planning with Lean, Scrum, Agile.”, 6th Edition, Kindle Bosses Ltd, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	evaluate projects and their characteristics in software development	Applying (K3)
CO2	apply basic steps in project management and construct network planning models	Applying (K3)
CO3	describe the issues in resource allocation, project monitoring and control	Understanding (K2)
CO4	acquire knowledge on how to manage contracts and people in software environment	Understanding (K2)
CO5	summarize different roles in team work	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								2		2	3
CO2	3	2	1								2		2	3
CO3	2	1									2		2	3
CO4	2	1									2		2	3
CO5	2	1							2	2	2		2	3

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

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	30	50	20				100
CAT3	30	70					100
ESE	20	45	35				100

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

22BCE10 E-COMMERCE							
(Common to Computer Systems and Design, Information Systems & Software Systems)							
Programme & Branch	**B.Sc - Computer Systems and Design, Information Systems and Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**PE**	**3**	**0**	**0**	**3**

Preamble	To impart the knowledge in various business models and electronic commerce technologies for business.	
UNIT -I	**Business models for E-commerce:**	**9**
Business models for E-commerce: Business Model – E-Business Models Based on the Relationship of Transaction Parties: Business to Consumer – Business to Business – Consumer to Consumer – Consumer to Business – E-Business Models Based on the Relationship of Transaction Types: Aggregator model – Brokerage model – Infomediary model – Advertising Model – Affiliate model.		
UNIT -II	**eMarketing:**	**9**
eMarketing: Traditional Marketing – Identifying Web Presence Goals – The Browsing Behavior Model – Online Marketing – E- Advertising – E-Branding – Marketing Strategies – Permission Marketing Strategies – Brand-leveraging Strategies – Affiliate-marketing Strategies – Viral-marketing Strategies – Content Marketing – Social Media Marketing – Marketing Strategy on the Web.		
UNIT -III	**ePayment Systems:**	**9**
ePayment systems: Digital Payment Requirements – Online Payment Categories – Digital Token-based ePayment Systems – Benefits to Buyers – Benefits to Sellers –Transition to digital payment in India – Bitcoin-As a crypto currency – Designing ePayment Systems – Digital Signatures – Online Financial Services in India.		
UNIT -IV	**eSupply Chain and Value Chain Management:**	**9**
eSupply Chain Management: Supply Chain – eLogistics of UPS – Smart Chains Smarter Gains- eSCM Realtime Benefits – eSCM advantages – eSupply Chain Components – eSupply Chain Architecture – Major Trends in eSCM – New Trends in Supply Chain Management – Case Study: Supply Chain Management in WalMart World – SCM in Dell – Marico Industries Limited – Mahindra Mahindra Ltd – Amul Dairy. Virtual Value Chain – Seven Dimensions of E-Commerce Strategy – Value Chain and E-Strategy – Planning the E-Commerce Project.		
UNIT- V	**eSecurity, Legal and Ethical Issues:**	**9**
eSecurity: Information System Security – Security on the Internet – E-Business Risk Management Issues – Information Security Environment in India – Legal and Ethical Issues – Ethical Issues in Digital Economy – Cyber stalking – Cyberquatting – Phishing – Application Fraud – Skimming – Copyright Violations – Internet Gambling – Threats to Children – Loss of Privacy – Cookies and Privacy.		
		Total: 45

TEXT BOOK:

1. Joseph P.T and S.J., — “E-Commerce An Indian Perspective”, 6th Edition, PHI Learning Pvt. Ltd., New Delhi, 2019.

REFERENCES:

1. Sudeshna Chakraborty, Priyanka Tyagi, “E-Commerce for Entrepreneurs”, 1st Edition, BPB Publications, 2020.
2. Kalakota Ravi, Whinston Andrew B, "Frontiers of Electronic Commerce", 1st Edition, Pearson Education, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret the different business models for electronic commerce	Understanding (K2)
CO2	develop the browsing behavior model for a website	Applying (K3)
CO3	illustrate the different e-payment systems	Understanding (K2)
CO4	implement supply chain management in various businesses	Applying (K3)
CO5	elucidate how to provide security for electronic commerce world	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										1	2	3
CO2	3	2	1	1								1	2	3
CO3	2	1										1	2	3
CO4	3	2	1	1								1	2	3
CO5	2	1										1	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Blooms 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	70	20				100
CAT3	10	60	30				100
ESE	20	60	20				100

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

22BCE05 AGILE SOFTWARE DEVELOPMENT							
Programme & Branch	**B.Sc - Software Systems**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Software Engineering**	**6**	**PE**	**3**	**0**	**0**	**3**

Preamble	To implement agility anywhere that enables to cope with changes in our life, in our team and in our organizations. Agility focuses on change, trust, quality measures, globalization and leadership in software development.	
Unit - I	**Introduction to Agile Software Development and Teamwork:**	**9**
Perspectives on Software Engineering - Agile Manifesto – Applications of Agile Software Development - Data about Agile Software Development –Agile Software Development in Learning Environments-Teamwork: Role Scheme in Agile Teams - Dilemmas in Teamwork - Teamwork in Learning Environments.		
Unit - II	**Scrum, Self Organizing Teams and Planning**	**9**
Introduction to Scrum - The Roles of Scrum – Members of the Scrum Project – Scrum Values – Feedback, Visibility, Inspection and Adaptation Cycle – Holding an Effective Daily Scrum – Sprints, Planning and Retrospectives – Scrum planning – User Stories, Velocity and Generally Accepted Scrum Practices, Scrum Values Revisited.		
Unit – III	**Measures, Quality, Learning and Abstraction:**	**9**
Measures – Quality: The Agile Approach to Quality Assurance – Test Driven Development – Measured TDD –Learning- Abstraction: Abstraction Levels in ASD.		
Unit – IV	**Trust, Globalization and Reflection:**	**9**
Software Intangibility and Process Transparency – Game Theory Perspective in Software Development – Ethics in Agile Teams – Diversity – Globalization: The Agile Approach in Global Software Development – Application of Agile Principles in Non-Software Projects – Reflection: Reflective Practitioner Perspective – Retrospective		
Unit – V	**Change, Leadership, Delivery and Cyclicality:**	**9**
Conceptual Framework for Change Introduction – Transition to an Agile Software Development Environment – Leadership: Leaders – Coaches – Delivery – Cyclicality.		
		Total:45

TEXT BOOK:

1.	Hazzan Orit, Dubinsky Yael, “Agile Software Engineering”, 1st Edition, Springer, 2014. (Unit – I,III,IV and V)
2.	Andrew Stellman, Jennifer Greene, “Learning Agile”, 1st edition(Fifth Indian Reprint), O"Reilly, 2021. (Unit II)

REFERENCES:

1.	Mark S, Merkow, “ Secure, Resilient and Agile Software Development”,1st Edition, Auerbach Publications, 2023
2.	James Shore, Diana Larsen, Gitte Klitgaard and Shane Warden , “ The Art of Agile Development”, 2nd Edition, O'Reilly, 2022.

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COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the perspectives of software engineering, applications and teamwork of agile software development	Understanding (K2)
CO2	explain Project team organization and planning using Scrum framework	Understanding (K2)
CO3	compute the quality measures and abstraction levels of agile software development	Applying (K3)
CO4	elucidate the perspective, ethics, diversity and globalization of agile software development	Understanding (K2)
CO5	apply conceptual framework , development environment and leadership of Agile software engineering	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	2
CO2	2	1							2		2	1	1	3
CO3	3	2	1	1	2				1		3	2	2	3
CO4	2	1							3		3	3	3	2
CO5	3	2	1	1	2				2		2	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	30	70					100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	20	40	40				100

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