KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060

TAMILNADU INDIA

Estd : 1984

REGULATIONS, CURRICULUM & SYLLABI - 2020

(CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION)

(For the students admitted during 2020 - 2021 and onwards)

BACHELOR OF SCIENCE DEGREE
IN
COMPUTER SYSTEMS AND DESIGN

DEPARTMENT OF COMPUTER TECHNOLOGY- UG

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 developing the student as a competent and responsible citizen.
- Contribute to the nation and beyond through the state-of-the-art technology.
- Continuously improve our services.

DEPARTMENT OF COMPUTER TECHNOLOGY –UG

VISION

To become a technologically 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 Computer Systems and Design will:

PEO1: Be successfully employed as Software developer and/or accepted into higher education

PEO2: Engage in professional development with the ability to progress in the organization.

PEO3: Adapt to societal changes of industries, lifelong learning and entrepreneurial endeavors.

MAPPING OF MISSION STATEMENTS (MS) WITH PEOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)

Graduates of Computer Systems and Design 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, 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

PO10 **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large

PO11 **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work

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 Computer System and Design will**:**

PSO1 Analyze, develop and provide solutions to industrial problems in Computer domain using Programming, Data Processing and analytical skill

PSO2 Apply software application oriented skills to innovate solution to meet the ever changing demands of IT industry.

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 2020

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 2020 – 2021 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/industrial 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 Internships

The curriculum enables a candidate to go for full time projects 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 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 projects through internship during sixth semester. Such candidate shall earn the minimum number of credits required to complete sixth semester other than project 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.

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

4.4 Value Added Courses / Online Courses / Self Study Courses

The candidate may optionally undergo Value Added Courses / Online Courses / Self Study Courses as elective courses.

4.4.1 **Value Added Courses:** Value Added courses each with One / Two credits shall be offered by the college with the prior approval from the Board of Studies. A candidate can earn a maximum of six credits through value added 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 respective Board of Studies.

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

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

4.4.5 A candidate can earn a maximum of 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 fourth 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 six.

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, Professional Skills Training / Industrial 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:

<table>
<tr><th>Sl. No.</th><th>Category of Course</th><th>Continuous Assessment Marks</th><th>End Semester Examination Marks</th></tr>
<tr><td>1.</td><td>Theory / Practical</td><td>50</td><td>50</td></tr>
<tr><td>2.</td><td>Theory cum Practical</td><td colspan="2">The distribution of marks shall be decided based on the credit weightage assigned to theory and practical components.</td></tr>
<tr><td>3.</td><td>Professional Skills Training / Industrial Training / Entrepreneurships / Start ups / Mandatory Course</td><td>100</td><td>---</td></tr>
<tr><td>4.</td><td>Project Work-I / Project Work-II / Internships</td><td>50</td><td>50</td></tr>
<tr><td>5.</td><td>Value Added Course</td><td rowspan="2">The distribution of marks shall be decided based on the credit weightage assigned</td><td rowspan="2">---</td></tr>
<tr><td>6.</td><td>All other Courses</td></tr>
</table>

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

7.3 Theory Courses

For all theory courses out of 100 marks, the continuous assessment shall be 50 marks and the end semester examination shall be for 50 marks. However, the end semester examinations shall be conducted for 100 marks and the marks obtained shall be reduced to 50. The continuous assessment tests shall be conducted as per the schedule laid down in the academic schedule. Three tests shall be conducted for 50 marks each and reduced to 30 marks each. 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	30	Average of best two
	Test - II	30	
	Test - III	30	
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	50	Rounded off to the one decimal place

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

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

7.3.3 The end semester examination for theory courses shall be for a duration of three hours and shall be conducted between November and January during odd semesters and between April and June during even semesters 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 50 marks and the end semester examination shall be for 50 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.

7.6 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-II and the Viva-Voce Examination shall be distributed as below.

Continuous Assessment (Max. 50 Marks)						End Semester Examination (Max. 50 Marks)			
Zeroth Review		Review I (Max.. 20 Marks)		Review II (Max. 30 Marks)		Report Evaluation (Max. 20 Marks)	Viva - Voce (Max. 30 Marks)		
Rv. Com	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 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 is to be submitted to the review committee for evaluation for each start up and the marks will be given to Controller of Examinations after getting approval from Principal.

7.11 Projects through Internships

Each candidate shall submit a brief report about the project through internship undergone and a certificate issued from the organization concerned at the time of Viva-voce examination to the review committee. The evaluation method shall be same as that of the Project Work-II as per clause 7.6.

7.12 Value Added Course

Minimum of two assessments shall be conducted during the value added course duration by the offering department concerned.

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 the candidates of other branches can be audited.

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

Candidates registering for an audit course shall meet all the assessment and examination requirements (vide clause 7.3) applicable for a credit candidate of that course. Only if the candidate obtains a performance grade, the course will be listed in the semester Grade Sheet and in the Consolidated Grade Sheet along with the grade SF (Satisfactory). 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 the induction training program of duration three weeks at the beginning of the first semester. It is mandatory for all candidates who have joined in various branches of BSc programme. 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. Since these courses have no grade points 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 twice during the entire duration of the degree programme.

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

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

Range of % of Total Marks	Letter Grade	Grade Point
91 to 100	O (Outstanding)	10
81 to 90	A+ (Excellent)	9
71 to 80	A (Very Good)	8
61 to 70	B+ (Good)	7
50 to 60	B (Average)	6
Less than 50	RA (Reappear)	0
Satisfactory	SF	0
Withdrawal	W	-
Absent	AB	-
Shortage of Attendance in a course	SA	-

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

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

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

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

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

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

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

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

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

16. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be declared to be eligible for the award of the 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 7.00

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**	**5**					**10**	**7.7**
PC	**10**	**10**	**23**	**23**	**16**	**6**	**88**	**67.7**
PE					**6**	**6**	**12**	**9.2**
EC			**2**	**2**			**4**	**3**
Semesterwise Total	**23**	**23**	**25**	**25**	**22**	**12**	**130**	**100**

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

CATEGORISATION OF COURSES							
HUMANITIES AND SOCIAL SCIENCES AND MANAGEMENT STUDIES(HSMS), BASIC SCIENCES (BS),ENGINEERING SCIENCES(ES)							
Sl.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1	20BCC11	Communicative English I	3	0	2	4	I
2	20BCC21	BC201Communicative English II	3	0	2	4	II
3	20BCT11	Mathematics I	3	1	0	4	I
4	20BCT21	Mathematics II	3	1	0	4	II
5	20BCT12	Digital Principles and Logic Design	3	0	0	3	I
6	20BCL11	Digital Principles and Logic Design Laboratory	0	0	4	2	I
7	20BCT22	Basics of Electrical and Electronics Engineering	3	0	0	3	II
8	20BCL21	Electrical and Electronics Engineering Laboratory	0	0	4	2	II
Total Credits to be earned						**26**	

PROFESSIONAL CORE							
Sl.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1	20BCT13	C Programming	3	0	0	3	I
2	20BCT14	Web Programming	3	0	0	3	I
3	20BCL12	C Programming Laboratory	0	0	4	2	I
4	20BCL13	Web Programming Laboratory	0	0	4	2	I
5	20BCT23	Python Programming	3	0	0	3	II
6	20BCT24	Data Structures	3	0	0	3	II
7	20BCL22	Python Programming Laboratory	0	0	4	2	II
8	20BCL23	Data Structures Laboratory	0	0	4	2	II
9	20BCT31	Java Programming	3	0	0	3	III
10	20BCT32	Operating Systems	3	0	0	3	III
11	20BCT33	Database Management Systems	3	0	0	3	III
12	20BCT34	Computer Organization	3	1	0	4	III
13	20BCT35	Software Engineering	3	1	0	4	III
14	20BCL31	Java Programming Laboratory	0	0	4	2	III
15	20BCL32	Operating Systems Laboratory	0	0	4	2	III
16	20BCL33	Database Management Systems Laboratory	0	0	4	2	III
17	20BCT41	Open Source Programming	3	0	0	3	IV
18	20BCT42	Computer Networks	3	1	0	4	IV
19	20BCT43	Graphics and Multimedia	3	0	0	3	IV
20	20BCT44	Data Warehousing and Data Mining	3	1	0	4	IV
21	20BCT45	Object Oriented Analysis and Design	3	0	0	3	IV
22	20BCL41	Open Source Programming Laboratory	0	0	4	2	IV
23	20BCL42	Graphics and Multimedia Laboratory	0	0	4	2	IV
24	20BCL43	Object Oriented Analysis and Design Laboratory	0	0	4	2	IV
25	20BCT51	Artificial Intelligence and Machine Learning	3	0	0	3	V

26	20BCT52	Mobile Application Development	3	0	0	3	V
27	20BCL51	Machine Learning Laboratory	0	0	4	2	V
28	20BCL52	Mobile Application Development Laboratory	0	0	4	2	V
29	20BCP51	Project Work I	0	0	`12	6	V
30	20BCP61	Project Work II/ Internship	0	0	`12	6	VI
Total Credits to be earned						88	

PROFESSIONAL ELECTIVE							
Sl.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
		Elective I					
1	20BCE01	Cloud Computing	3	0	0	3	V
2	20BCE02	Information Security	3	0	0	3	V
3	20BCE03	Microprocessor and Interfacing	3	0	0	3	V
		Elective II					
4	20BCE04	Internet of Things	3	0	0	3	V
5	20BCE05	Distributed Computing	3	0	0	3	V
6	20BCE06	User Interface Technologies	3	0	0	3	V
		Elective III					
7	20BCE07	Deep Learning	3	0	0	3	VI
8	20BCE08	Unix and Shell Programming	3	0	0	3	VI
9	20BCE09	Blockchain Technologies	3	0	0	3	VI
		Elective IV					
10	20BCE10	Big Data Analytics	3	0	0	3	VI
11	20BCE11	Multicore Architecture	3	0	0	3	VI
12	20BCE12	Software Project Management	3	0	0	3	VI
Total Credits to be earned						**12**	

EMPLOYABILITY ENHANCEMENT COURSES (EC)							
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	20GEL31	Professional Skills Training I	2	0	2	2	III
2.	20GEL41	Professional Skills Training II	2	0	2	2	IV
Total Credits to be earned						**4**	

SCHEDULING OF COURSES - B.Sc. COMPUTER SYSTEMS AND DESIGN (Total Credit : 130)

Sem.	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6	Course 7	Course 8	Course 9	Credit
I	20BCC11 Communicative English I (3-0-2-4)	20BCT11 Mathematics I (3-1-0-4)	20BCT12 Digital Principles and Logic Design (3-0-0-3)	20BCT13 C Programming (3-0-0-3)	20BCT14 Web Programming (3-0-0-3)	20MNT12 Student Induction Program (0-0-0-0)	20BCL11 Digital Principles and Logic Design Laboratory (0-0-4-2)	20BCL12 C Programming Laboratory (0-0-4-2)	20BCL13 Web Programming Laboratory (0-0-4-2)	**23**
II	20BCC21 Communicative English II (3-0-2-4)	20BCT21 Mathematics II (3-1-0-4)	20BCT22 Basics of Electrical and Electronics Engineering (3-0-0-3)	20BCT23 Python Programming (3-0-0-3)	20BCT24 Data Structures (3-0-0-3)	-	20BCL21 Electrical and Electronics Engineering Laboratory (0-0-4-2)	20BCL22 Python Programming Laboratory (0-0-4-2)	20BCL23 Data Structures Laboratory (0-0-4-2)	**23**
III	20BCT31 Java Programming (3-0-0-3)	20BCT32 Operating Systems (3-0-0-3)	20BCT33 Database Management Systems (3-0-0-3)	20BCT34 Computer Organization (3-1-0-4)	20BCT35 Software Engineering (3-1-0-4)	20GEL31 Professional Skills Training I (2-0-2-2)	20BCL31 Java Programming Laboratory (0-0-4-2)	20BCL32 Operating Systems Laboratory (0-0-4-2)	20BCL33 Database Management Systems Laboratory (0-0-4-2)	**25**
IV	20BCT41 Open Source Programming (3-0-0-3)	20BCT42 Computer Networks (3-1-0-4)	20BCT43 Graphics and Multimedia (3-0-0-3)	20BCT44 Data Warehousing and Data Mining (3-1-0-4)	20BCT45 Object Oriented Analysis and Design (3-0-0-3)	20GEL41 Professional Skills Training II (2-0-2-2)	20BCL41 Open Source Programming Laboratory (0-0-4-2)	20BCL42 Graphics and Multimedia Laboratory (0-0-4-2)	20BCL43 Object Oriented Analysis and Design Laboratory (0-0-4-2)	**25**
V	20BCT51 Artificial Intelligence and Machine Learning (3-0-0-3)	20BCT52 Mobile Application Development (3-0-0-3)	Elective I (3-0-0-3)	Elective II (3-0-0-3)	20BCL51 Machine Learning Laboratory (0-0-4-2)		20BCL52 Mobile Application Development Laboratory (0-0-4-2)	20BCP51 Project Work I (0-0-12-6)		**22**
VI	Elective III (3-0-0-3)	Elective IV (3-0-0-3)	20BCP61 Project Work II/ Internship (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	PO10	PO11	PO12	PSO1	PSO2
1	20BCC11	Communicative English I				✓		✓		✓	✓	✓		✓	✓	✓
1	20BCT11	Mathematics I	✓	✓	✓	✓	✓							✓	✓	✓
1	20BCT12	Digital Principles and Logic Design	✓	✓	✓	✓		✓							✓	✓
1	20BCT13	C Programming	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓
1	20BCT14	Web Programming	✓	✓	✓	✓	✓	✓			✓				✓	✓
1	20MNT12	Student Induction Program						✓		✓				✓	✓	✓
1	20BCL11	Digital Principles and Logic Design Laboratory	✓	✓	✓	✓									✓	✓
1	20BCL12	C Programming Laboratory	✓	✓	✓	✓									✓	✓
1	20BCL13	Web Programming Laboratory	✓	✓	✓	✓									✓	✓
2	20BCC21	Communicative English II				✓		✓		✓	✓	✓		✓	✓	✓
2	20BCT21	Mathematics II	✓	✓	✓	✓	✓								✓	✓
2	20BCT22	Basics of Electrical and Electronics Engineering	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓
2	20BCT23	Python Programming	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
2	20BCT24	Data Structures	✓	✓	✓	✓									✓	✓
2	20BCL21	Electrical and Electronics Engineering Laboratory	✓	✓	✓	✓									✓	✓
2	20BCL22	Python Programming Laboratory	✓	✓	✓	✓									✓	✓
2	20BCL23	Data Structures Laboratory	✓	✓	✓	✓									✓	✓
3	20BCT31	Java Programming	✓	✓	✓	✓									✓	✓
3	20BCT32	Operating Systems	✓	✓	✓	✓	✓								✓	✓
3	20BCT33	Database Management Systems	✓	✓	✓	✓									✓	✓
3	20BCT34	Computer Organization	✓	✓	✓	✓									✓	✓
3	20BCT35	Software Engineering	✓	✓	✓	✓									✓	✓
3	20GEL31	Professional Skills Training I														
3	20BCL31	Java Programming Laboratory	✓	✓	✓	✓									✓	✓
3	20BCL32	Operating Systems Laboratory	✓	✓	✓	✓									✓	✓
3	20BCL33	Database Management Systems Laboratory	✓	✓	✓	✓									✓	✓
Sem.	**Course Code**	**Course Title**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**

4	20BCT41	Open Source Programming	✓	✓	✓	✓									✓	✓
4	20BCT42	Computer Networks	✓	✓	✓	✓									✓	✓
4	20BCT43	Graphics and Multimedia	✓	✓	✓	✓									✓	✓
4	20BCT44	Data Warehousing and Data Mining	✓	✓	✓	✓	✓	✓			✓				✓	✓
4	20BCT45	Object Oriented Analysis and Design	✓	✓	✓	✓	✓								✓	✓
4	20GEL41	Professional Skills Training –II														
4	20BCL41	Open Source Programming Laboratory	✓	✓	✓	✓									✓	✓
4	20BCL42	Graphics and Multimedia Laboratory	✓	✓	✓	✓	✓								✓	✓
4	20BCL43	Object Oriented Analysis and Design Laboratory	✓	✓	✓	✓									✓	✓
5	20BCT51	Artificial Intelligence and Machine Learning	✓	✓	✓	✓						✓	✓	✓	✓	✓
5	20BCT52	Mobile Application Development	✓	✓	✓	✓									✓	✓
5	20BCL51	Machine Learning Laboratory	✓	✓	✓	✓	✓								✓	✓
5	20BCL52	Mobile Application Development Laboratory	✓	✓	✓	✓									✓	✓
5	20BCP51	Project Work I	✓	✓	✓	✓									✓	✓
6	20BCP61	Project Work II / Internship	✓	✓	✓	✓									✓	✓
		Professional Electives														
5	20BCE01	Cloud Computing	✓	✓	✓	✓									✓	✓
5	20BCE02	Information Security	✓	✓	✓	✓									✓	✓
5	20BCE03	Microprocessor and Interfacing	✓	✓	✓	✓									✓	✓
5	20BCE04	Internet of Things	✓	✓	✓	✓									✓	✓
5	20BCE05	Distributed Computing	✓	✓	✓	✓									✓	✓
5	20BCE06	User Interface Technologies	✓	✓	✓	✓									✓	✓
6	20BCE07	Deep Learning	✓	✓	✓	✓									✓	✓
6	20BCE08	Unix and Shell Programming	✓	✓	✓	✓									✓	✓
6	20BCE09	Blockchain Technologies	✓	✓	✓	✓	✓	✓			✓				✓	✓
6	20BCE10	Big Data Analytics	✓	✓	✓	✓	✓	✓			✓				✓	✓
6	20BCE11	Multicore Architecture	✓	✓	✓	✓									✓	✓
6	20BCE12	Software Project Management	✓	✓	✓						✓	✓	✓		✓	✓

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CURRICULUM UNDER REGULATIONS 2020

(For the candidates admitted from academic year 2020-21 onwards)

Semester I								
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**		**CA**	**ESE**	**Total**
Theory/Theory with Practical								
20BCC11	Communicative English I	3	0	2	4	50	50	100
20BCT11	Mathematics I	3	1	0	4	50	50	100
20BCT12	Digital Principles and Logic Design	3	0	0	3	50	50	100
20BCT13	C Programming	3	0	0	3	50	50	100
20BCT14	Web Programming	3	0	0	3	50	50	100
Practical / Employability Enhancement								
20BCL11	Digital Principles and Logic Design Laboratory	0	0	4	2	50	50	100
20BCL12	C Programming Laboratory	0	0	4	2	50	50	100
20BCL13	Web Programming Laboratory	0	0	4	2	50	50	100
20MNT12	Student Induction Program	-	-	-	-	100	0	100
	Total Credits to be earned				**23**			

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Semester II								
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**		**CA**	**ESE**	**Total**
Theory/Theory with Practical								
20BCC21	Communicative English II	3	0	2	4	50	50	100
20BCT21	Mathematics II	3	1	0	4	50	50	100
20BCT22	Basics of Electrical and Electronics Engineering	3	0	0	3	50	50	100
20BCT23	Python Programming	3	0	0	3	50	50	100
20BCT24	Data Structures	3	0	0	3	50	50	100
Practical / Employability Enhancement								
20BCL21	Electrical and Electronics Engineering Laboratory	0	0	4	2	50	50	100
20BCL22	Python Programming Laboratory	0	0	4	2	50	50	100
20BCL23	Data Structures Laboratory	0	0	4	2	50	50	100
Total Credits to be earned					**23**			

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Semester III								
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**		**CA**	**ESE**	**Total**
Theory/Theory with Practical								
20BCT31	Java Programming	3	0	0	3	50	50	100
20BCT32	Operating Systems	3	0	0	3	50	50	100
20BCT33	Database Management Systems	3	0	0	3	50	50	100
20BCT34	Computer Organization	3	1	0	4	50	50	100
20BCT35	Software Engineering	3	1	0	4	50	50	100
Practical / Employability Enhancement								
20BCL31	Java Programming Laboratory	0	0	4	2	50	50	100
20BCL32	Operating Systems Laboratory	0	0	4	2	50	50	100
20BCL33	Database Management Systems Laboratory	0	0	4	2	50	50	100
20GEL31	Professional Skills Training I *	0	0	0	2	100	0	100
Total Credits to be earned					**25**			

***80 hours of training**

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Semester IV								
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**		**CA**	**ESE**	**Total**
Theory/Theory with Practical								
20BCT41	Open Source Programming	3	0	0	3	50	50	100
20BCT42	Computer Networks	3	1	0	4	50	50	100
20BCT43	Graphics and Multimedia	3	0	0	3	50	50	100
20BCT44	Data Warehousing and Data Mining	3	1	0	4	50	50	100
20BCT45	Object Oriented Analysis and Design	3	0	0	3	50	50	100
Practical / Employability Enhancement								
20BCL41	Open Source Programming Laboratory	0	0	4	2	50	50	100
20BCL42	Graphics and Multimedia Laboratory	0	0	4	2	50	50	100
20BCL43	Object Oriented Analysis and Design Laboratory	0	0	4	2	50	50	100
20GEL41	Professional Skills Training II	0	0	0	2	100	0	100
Total Credits to be earned					**25**			

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(For the candidates admitted from academic year 2020-21 onwards)

Semester V								
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**		**CA**	**ESE**	**Total**
Theory/Theory with Practical								
20BCT51	Artificial Intelligence and Machine Learning	3	0	0	3	50	50	100
20BCT52	Mobile Application Development	3	0	0	3	50	50	100
	Elective I	3	0	0	3	50	50	100
	Elective II	3	0	0	3	50	50	100
Practical / Employability Enhancement								
20BCL51	Machine Learning Laboratory	0	0	4	2	50	50	100
20BCL52	Mobile Application Development Laboratory	0	0	4	2	50	50	100
20BCP51	Project Work I	0	0	12	6	50	50	100
Total Credits to be earned					**22**			

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Semester VI								
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**		**CA**	**ESE**	**Total**
Theory/Theory with Practical								
	Elective III	3	0	0	3	50	50	100
	Elective IV	3	0	0	3	50	50	100
Practical / Employability Enhancement								
20BCP61	Internship / Project Work II	0	0	12	6	50	50	100
Total Credits to be earned					**12**			

Total Credits: 130

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Semester I								
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**		**CA**	**ESE**	**Total**
Theory/Theory with Practical								
20BCC11	Communicative English I	3	0	2	4	50	50	100
20BCT11	Mathematics I	3	1	0	4	40	60	100
20BCT12	Digital Principles and Logic Design	3	0	0	3	40	60	100
20BCT13	C Programming	3	0	0	3	40	60	100
20BCT14	Web Programming	3	0	0	3	40	60	100
Practical / Employability Enhancement								
20BCL11	Digital Principles and Logic Design Laboratory	0	0	4	2	60	40	100
20BCL12	C Programming Laboratory	0	0	4	2	60	40	100
20BCL13	Web Programming Laboratory	0	0	4	2	60	40	100
20MNT12	Student Induction Program	-	-	-	-	100	-	100
Total Credits to be earned					**23**			

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Semester II								
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**		**CA**	**ESE**	**Total**
Theory/Theory with Practical								
20BCC21	Communicative English II	3	0	2	4	50	50	100
20BCT21	Mathematics II	3	1	0	4	40	60	100
20BCT22	Basics of Electrical and Electronics Engineering	3	0	0	3	40	60	100
20BCT23	Python Programming	3	0	0	3	40	60	100
20BCT24	Data Structures	3	0	0	3	40	60	100
Practical / Employability Enhancement								
20BCL21	Electrical and Electronics Engineering Laboratory	0	0	4	2	60	40	100
20BCL22	Python Programming Laboratory	0	0	4	2	60	40	100
20BCL23	Data Structures Laboratory	0	0	4	2	60	40	100
Total Credits to be earned					**23**			

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Semester III								
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**		**CA**	**ESE**	**Total**
Theory/Theory with Practical								
20BCT31	Java Programming	3	0	0	3	100	0	100
20BCT32	Operating Systems	3	0	0	3	40	60	100
20BCT33	Database Management Systems	3	0	0	3	40	60	100
20BCT34	Computer Organization	3	1	0	4	40	60	100
20BCT35	Software Engineering	3	1	0	4	40	60	100
Practical / Employability Enhancement								
20BCL31	Java Programming Laboratory	0	0	4	2	100	0	100
20BCL32	Operating Systems Laboratory	0	0	4	2	60	40	100
20BCL33	Database Management Systems Laboratory	0	0	4	2	60	40	100
20GEL31	Professional Skills Training I *	0	0	0	2	100	-	100
Total Credits to be earned					**25**			

***80 hours of training**

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Semester IV								
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**		**CA**	**ESE**	**Total**
Theory/Theory with Practical								
20BCT41	Open Source Programming	3	0	0	3	40	60	100
20BCT42	Computer Networks	3	1	0	4	40	60	100
20BCT43	Graphics and Multimedia	3	0	0	3	40	60	100
20BCT44	Data Warehousing and Data Mining	3	1	0	4	40	60	100
20BCT45	Object Oriented Analysis and Design	3	0	0	3	40	60	100
Practical / Employability Enhancement								
20BCL41	Open Source Programming Laboratory	0	0	4	2	60	40	100
20BCL42	Graphics and Multimedia Laboratory	0	0	4	2	60	40	100
20BCL43	Object Oriented Analysis and Design Laboratory	0	0	4	2	60	40	100
20GEL41	Professional Skills Training II	0	0	0	2	100	-	100
Total Credits to be earned					**25**			

*** 80 hours of training**

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Semester V								
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**		**CA**	**ESE**	**Total**
Theory/Theory with Practical								
20BCT51	Artificial Intelligence and Machine Learning	3	0	0	3	40	60	100
20BCT52	Mobile Application Development	3	0	0	3	40	60	100
	Elective I	3	0	0	3	40	60	100
	Elective II	3	0	0	3	40	60	100
Practical / Employability Enhancement								
20BCL51	Machine Learning Laboratory	0	0	4	2	60	40	100
20BCL52	Mobile Application Development Laboratory	0	0	4	2	60	40	100
20BCP51	Project Work I	0	0	12	6	50	50	100
Total Credits to be earned					**22**			

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Semester VI								
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**		**CA**	**ESE**	**Total**
Theory/Theory with Practical								
	Elective III	3	0	0	3	40	60	100
	Elective IV	3	0	0	3	40	60	100
Practical / Employability Enhancement								
20BCP61	Project Work II	0	0	12	6	50	50	100
Total Credits to be earned					**12**			

Total Credits: 130

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LIST OF PROFESSIONAL ELECTIVE COURSES

Course Code	Course Title	Hours/Week			Credit
		L	T	P	
	SEMESTER 5				
	Elective I				
20BCE01	Cloud Computing	3	0	0	3
20BCE02	Information Security	3	0	0	3
20BCE03	Microprocessor and Interfacing	3	0	0	3
	SEMESTER 5				
	Elective II				
20BCE04	Internet of Things	3	0	0	3
20BCE05	Distributed Computing	3	0	0	3
20BCE06	User Interface Technologies	3	0	0	3
	SEMESTER 6				
	Elective III				
20BCE07	Deep Learning	3	0	0	3
20BCE08	Unix and Shell Programming	3	0	0	3
20BCE09	Blockchain Technologies	3	0	0	3
	SEMESTER 6				
	Elective IV				
20BCE10	Big Data Analytics	3	0	0	3
20BCE11	Multicore Architecture	3	0	0	3
20BCE12	Software Project Management	3	0	0	3

20BCC11 - COMMUNICATIVE ENGLISH I

Programme & Branch	B.Sc & Computer Systems and Design, Information Systems &Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	I	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		**9**
Grammar and Vocabulary: Identifying and changing parts of speech - Verbs: main and auxiliary, regular and irregular, Finite and non-finite - **Reading:** Prediction and Surveying - **Writing**: Filling an application form - Essays - **Activities**: **Listening:** Types of listening - **Speaking**: Talking about oneself, one's family, friends and favorite persons.		
UNIT –II		**9**
Grammar and Vocabulary: Tenses - 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:** Presentation.		
UNIT– III		**9**
Grammar and Vocabulary: Active and Passive voice - Impersonal Passive - Reported Speech – **Reading:** Reading Comprehension - Paraphrasing - **Writing**: Warnings and Instructions - **Activities: Listening:** Effective listening strategies - **Speaking:** TED talk.		
UNIT– IV		**9**
Grammar and Vocabulary: 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:** Narration of an event - Description of a product		
UNIT– V		**9**
Grammar and Vocabulary: Connectives and Discourse Markers and Text organization - Sentence Patterns in English – Punctuations - **Reading:** Tongue twisters - Rearranging jumbled sentences - **Writing:** E-mails – Preparing the transcript for a speech - **Activities: Listening:** Listening to a lecture and taking notes – **Speaking:** Describing a picture.		

List of Exercises / Experiments :

	Listening/ DVD, podcasts and Authentic Videos	Speaking
1	People saying 'hello' and giving personal information; BBC programme about people around the world	Self-introduction, giving personal information and talking about important people in one's life
2	Listening to celebrity talk	Talking about role models, leaders, thinkers, musicians, singers, actors and people in the news
3	Listening to talks related to leisure, hobbies, travel and life in a country; travel shows	Talking about places one has visited and would like to go
4	Listening to discussions of current topics and social issues; people living on the edge	Presentation on a topic of social relevance
5	Listening to models of welcome address, introduction of guests and proposing vote of thanks in a function	Giving welcome address / introduction / vote of thanks for a given context
6	Listening to real or imaginary stories; The Chilean Miners' rescue	Narrating an event or a story
7	Listening to descriptions of technological gadgets; Days that shook the world	Describing a scientific invention or a piece of technology
8	Stand-up comedy; Mr. Beans; Miranda	Anecdotes and examples of wit and humour
9	Learning a new language; study habits	Talking about various aspects of language
10	Goal-setting; motivation, positive thinking and time management	Understanding and explaining the meaning of famous quotes

Lecture:45, Practical:30, Total:75

TEXT BOOK:

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

REFERENCES:

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 and Authentic Videos

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	understand the pronunciation of the native speakers (English) about their real time experience after listening to the videos	Understanding (K2), Manipulation (S2)
CO7	reconstruct information through writing after effectively listening	Evaluating (K5), Imitation (S1)
CO8	take part in various professional, academic, and cultural and social 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

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	50			30	100
CAT2	10	10	50			30	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)**

20BCT11 - MATHEMATICS I

Programme & Branch	B.Sc & Computer Systems and Design, Information Systems & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	I	BS	3	1	0	4

Preamble	To the course aims to formulate and solve problems using matrices, differential equations and Fitting a best curve to the given data. Eventually the course provides a thorough understanding in 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	**Ordinary Differential Equations:**	**9+3**
Linear differential equations of second order with constant coefficients when the RHS is e^{ax}, sin(ax), cos(ax), x^n (n>0), e^{ax}sin(bx), e^{ax}cos(bx) - Differential equations with variable coefficients (Euler's Cauchy Type only).		
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 - Regula Falsi 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 - Gauss forward and backward interpolation formula - Newton's divided difference method for unequal intervals - Lagrange's interpolation formula.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Veerarajan T., "Engineering Mathematics for first year", 3rd Edition, Tata McGraw-Hill, New Delhi, 2012 for Units I & II.
2. Kandasamy P., Thilagavathy K., Gunavathy K., "Numerical Methods", 3rd Edition, S.Chand & Co, New Delhi, 2016 for Units III, IV, V.

REFERENCES:

1. Kandasamy P., Thilagavathy K., Gunavathy K., "Engineering Mathematics ", S.Chand & Co, New Delhi, 2015.
2. Jain M.K., Iyenkar S.R.K., Jain R.K., "Numerical Methods for Scientific and Engineering Computation", 6th Edition, New Age International, New Delhi, 2004.

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	solve the second order linear differential equations	Analyzing (K4)
CO3	fitting a curve to the given data using different methods	Applying (K3)
CO4	solve polynomial, transcendental equations numerically	Analyzing (K4)
CO5	illustrate interpolation techniques for equal and unequal intervals	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1								1	2	3
CO2	3	3	2	2	1							1	3	3
CO3	3	2	1	1								1	2	3
CO4	3	3	2	2	1							1	3	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	30	30	20			100
CAT2	10	40	30	20			100
CAT3	20	20	40	20			100
ESE	20	30	30	20			100

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

20BCT12 - DIGITAL PRINCIPLES AND LOGIC DESIGN

Programme & Branch	B.Sc & Computer Systems and Design, Information Systems & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	I	ES	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. Mano M. Morris and Ciletti D. Michael**, "**Digital Design", 6th Edition, Pearson India Education Pvt.Ltd., Uttar Pradesh, 2019.

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	analyze the functions of basic flip-flops.	Analyzing (K4)
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											1	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	30	30	10			100
CAT3	30	40	20	10			100
ESE	30	30	30	10			100

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

20BCT13 - C PROGRAMMING

Programme & Branch	B.Sc & Computer Systems and Design, Information Systems & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	I	PC	3	0	0	3

Preamble	This course introduces the c programming and emphasizes on developing c programs using looping and conditional statements, structures, unions, functions, array, pointers and files.	
UNIT –I	**Introduction to C:**	**9**
Introduction – Structure of C Program – Files Used in C Program – Compiling and Executing C Programs – Comments – Tokens- Character Set and Keywords – Identifiers – Basic Data Types – Variables – Constants – Input / Output Statements – Operators – Type Conversion and Typecasting - Decision Control and Looping Statements: Conditional Branching Statements – Iterative Statements – Nested Loops – Break, Continue and goto Statements.		
UNIT –II	**Functions and Array:**	**9**
Functions: Introduction – Using Functions – Function Declaration - Function Definition - Function Call, Return Statement – Passing Parameters to Function – Scope of Variables – Storage Classes – Recursive Functions - Arrays: Introduction - Declaration – Accessing Elements –Storing Values – Passing Arrays to Function – Two Dimensional Arrays – Operations on Two Dimensional Arrays – Passing Two Dimensional Array to Functions.		
UNIT– III	**String, Structure, Union and enum Data Types:**	**9**
Introduction– Reading and Writing Strings – Suppressing Input – String Taxonomy – Arrays of strings – Structure, Union and Enumerated Data Types: Introduction – Nested Structures – Array of Structures - Self-Referential Structures – Unions – Union Inside Structure – Structure Inside Union – Enumerated data types.		
UNIT– IV	**Pointers:**	**9**
Understanding the Computers' Memory – Introduction to Pointers – Declaring Pointer Variables – Pointer Expression and Arithmetic – Null and Generic Pointers – Passing Arguments to Function – Pointers and Arrays – Difference Between Array Name and Pointer – Pointers and Strings – Array of Pointers – Pointers and 2D Arrays – Pointers to Pointers – Memory Allocation in C Programs – Memory Usage – Dynamic Memory Allocation – Drawbacks of Pointers.		
UNIT– V	**Files:**	**9**
Introduction –Using files in C – Read Data From Files – Writing Data to Files – Detecting the End-of-file – Error Handling during File Operations – Accepting Command Line Arguments – Functions for Selecting a Record Randomly – Renaming a File – Creating a Temporary File.		

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	understand the basics of c programming using conditional and iterative statements.	Understanding (K2)
CO2	apply functions to modularize the problem to provide solution to it and develop applications using array.	Applying (K3)
CO3	implement structure, union and enum data structures for handling values of different data types and also perform various string operations.	Applying (K3)
CO4	make use of pointers in functions, array and string.	Applying (K3)
CO5	create text file, store and retrieve data from it.	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					2	3	3	2	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	20	20	60				100
CAT2	10	30	60				100
CAT3	15	25	60				100
ESE	20	20	60				100

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

20BCT14 - WEB PROGRAMMING

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 and scripting. It also emphasizes the client based web design	
Unit– I	**Introduction to Web and HTML:**	**9**
Definitions and History - Uniform Resource Locators - Hypertext Transfer Protocol - Web Servers. HTML: HTML Syntax - Structure of HTML Documents - HTML Elements – HTML5 Semantic Structure Elements.		
Unit – II	**HTML Tables, Forms and Web Media:**	**9**
HTML Tables - Styling Tables – Forms - Form Control Elements - Table and Form Accessibility. Web Media: Digital Representation of Images – Color Models – Image Concepts – File Formats – Audio and Video – HTML5 Canvas.		
Unit – III	**Style Sheet:**	**9**
Introduction to CSS - CSS Syntax - Location of Styles - Selectors - Interaction with Style Sheet - The Box Model – Background- Borders – Margin and Padding – Box Dimensions - CSS Text Styling.		
Unit – IV	**CSS Layouts**:	**9**
Normal Flow - Positioning Elements - Floating Elements – Constructing Multicolumn Layouts - Approaches to CSS Layout - Responsive Design – CSS Frameworks.		
Unit – V	**Client Side Scripting and Dynamic HTML:**	**9**
JavaScript: Introduction to JavaScript - JavaScript Design Principles – Inline, Embedded and External JavaScript - JavaScript Syntax - JavaScript Objects - Document Object Model (DOM) - Nodes - Document Object - Element Node Object - Modifying DOM Element - Additional Properties - JavaScript Events - Forms.		

Total: 45

TEXT BOOK:

1. Randy Connolly and Ricardo Hoar, “Fundamentals of web development”, 1st Edition, Pearson Education, 2015.

REFERENCES:

1. Robert W. Sebesta, “Programming the World Wide Web”, 8th Edition, Pearson Education, 2015.
2. Paul Deitel, Harvey Deitel, Abbey Deitel, “Internet and World Wide Web-How to Program”, 6th Edition, Pearson Education, 2020.

COURSEOUTCOMES: 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	Understanding (K2)
CO2	design web pages using tables, forms and web media	Applying (K3)
CO3	develop web pages and apply styles using CSS	Applying (K3)
CO4	design a web page with various flexible CSS layouts	Applying (K3)
CO5	design dynamic pages and perform client validation using javascript	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
CO2	3	2	1	2	2	2							2	3
CO3	3	2	1	2	3	1							2	3
CO4	3	2	1	3	3	3							2	3
CO5	3	2	1	2	1	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	30	30	36				100
CAT2	20	30	50				100
CAT3	25	35	40				100
ESE	20	30	50				100

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

20MNT21 – STUDENT INDUCTION PROGRAM

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

Preamble	To make the student to understand the meaning of happiness and prosperity for a human being. Also to facilitate the students to understand the harmony of human living and importance of the physical and mental strength through yoga and meditation.	
Unit - I	**Overview of College and Department:**	**5**
General facilities - Autonomous System - Curriculum Overview & Assessment - Outcome Based Education – Placement and Higher Education Opportunities-Entrepreneurship-Value Added Course-Online Course.		
Unit - II	**Universal Human Values:**	**10**
Holistic Development & Role of Education - Understanding Happiness - Understanding the Human Being – Self & Body - Understanding the Human Being – Activities of Self - Prosperity - Understanding Relationship Trust - Understanding Relationship Respect - Understanding Relationship Other Feelings - Understanding Society - Understanding Nature Existence.		
Unit - III	**Yoga and Meditation:**	**5**
Introduction to Yoga – Objective – Physical Exercises: Need and Objectives of Simplified Physical Exercise – Types of Physical Exercises – Meditation: Qualities acquired through Meditation – Mental Health – Simple Meditation – Stress Management – Human Values: Self control - Self confidence – Honesty – Contentment – Humility – Modesty Tolerance – Adjustment – Sacrifice – Forgiveness – Importance of Thought Process – Self Realization.		

Total: 20

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret the values and culture of the Institution	Understanding (K2)
CO2	understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships and explore their role in ensuring a harmonious society.	Understanding (K2)
CO3	know the value holistic vision of life and take steps to develop physical and mental health.	Applying (K3)

Mapping of COs with POs and PSOs

COs /POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1												1		
CO2						3		3				2		
CO3						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 %
CAT	25	75		-	-	-	100

CAT-100 marks

20BCL11 - DIGITAL PRINCIPLES AND LOGIC DESIGN LABORATORY

Programme& Branch	B.Sc - Computer Systems and Design, Information Systems & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	ES	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 Exercises / Experiments:

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 understand their operation.	Understanding (K2), Imitation (S1)
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	2	1											1	2
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3

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

20BCL12 - C PROGRAMMING LABORATORY

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 Exercises / Experiments:

1.	Implementation of conditional and looping statements:- a. Write a C program to display the cube of the number upto given an integer. b. Write a C program to display the number from 1 to 100 leaving the multiples of 5 using continue statement. c. Develop a C program to print the Floyd's Triangle. 1 01 101 0101 10101 d. Write a C program to display Pascal's triangle. 1 1 1 1 2 1 1 3 3 1 1 4 6 4 1
2.	Implementation of conditional and looping statements:- a. Write a C program to display the number in reverse order. b. Write a C program to find the sum of the series [1+x+x^2/2!+x^3/3!+....]. c. Write a C program to read temperature in centigrade and display a suitable message according to temperature state below : Temp 0-10 then Very Cold weather Temp 10-20 then Cold weather Temp 20-30 then Normal in Temp Temp 30-40 then Its Hot Temp >=40 then Its Very Hot d. Write a C program to find the sum of numbers given as input until zero is entered using while loop and break statements.(If zero is entered break the loop.)
3.	Implementation of function: a. Write a program in C to check armstrong and perfect numbers using the functions. b. Write a c program to implement call by value and call by reference to swap the values of two variables. c. Write a C program to implement the recursion for finding the following i. Sum of n numbers ii. Counting the digits of a given number. iii. Calculating the power of any number
4.	Implementation of array: a. Write a program in C to count a total number of duplicate elements in an array. b. Write a program in C to merge two arrays of same size sorted in descending order. c. Write a program in C to count the frequency of each element of an array.
5.	Implementation of array: a. Write a c program to get two matrices as input and perform the matrix multiplication. b. Write a program in C to find a subarray in a given array such that sum of the subarray elements should be equal to n. c. Write a program in C to find the smallest missing element in the given array after sorting.
6.	Implementation of String: a. Write a program in C to count total number of alphabets, digits and special characters in a string. b. Write a program in C to read a sentence and replace lowercase characters by uppercase and vice-versa. c. Write a program in C to Find the Frequency of Characters
7.	Implementation of Structure and Union:- a. Write a C program to calculate the salary of the Employee using Structure. Implement the following structure and create the employees as structure variables and calculate the salary. struct Employee

	{
	int Employee_id ;
	char Employee_name[20];
	char Department[20];
	};
	struct employee_salary
	{
	Float bp,da,hra,pf,np,gp;
	struct Employee e1;
	};
	b. Write a C program to store and retrieve the book details using Union.
	c. Write a C program to implement the student structure and display the student grade. The Structure is given by
	union grade_obtained
	{
	char grade;
	};
	struct student
	{
	int rno;
	char name[20],course[10];
	grade obtained grading;
	};

8.	Implementation of Pointers: a. Write a program in C to demonstrate the use of &(address of) and *(value at address) operator. b. Write a program in C to store n elements in an array and print the elements using pointer. c. Write a program in C to print all permutations of a given string using pointers.
9.	Implementation of Pointers: a. Write a program in C to show how a function returns the result of the function using reference. b. Write a C program to get numbers as input in two arrays of same size and perform their summation using pointers. c. Write a C program to store the games name and the description of the games in two string variables. As the length of the description is not known in advance use the malloc and realloc methods to store the description.
10.	Implementation of file handling operations: a. Write a program in C to create and store information in a text file. b. Write a program in C to replace a specific line with another text in a file. c. Write a program in C to merge two files and write it in a new file.

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	apply conditional statements, iterative statements, functions and array in solving real world problems	Applying(K3), Imitation(S1)
CO2	implement the structure, union, enum data structures based on the application and perform string operations.	Applying(K3), Precision(S3)
CO3	construct programs using pointers and files.	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														

20BCL13 - WEB PROGRAMMING LABORATORY

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 and also in client side scripting.

List of Exercises / Experiments:

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 and internal cascading style sheets.
5.	Design a dynamic web page using external CSS.
6.	Construct a multicolumn layout web page using CSS with a responsive design.
7.	Write a javascript to validate the webpage.
8.	Design a web page to provide alert messages using external and internal javascript.
9.	Using DOM, add various elements and change the attributes of the web page dynamically when mouse event occurs.
10.	Design a complete web application for ticket reservation system.

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 the usage of basic HTML tags, tables, frames and forms	Applying(K3), Imitation(S1)
CO2	implement cascading style sheets and javascript concepts	Applying(K3), Manipulation(S2)
CO3	develop a simple and real time web 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

20BCC21 - COMMUNICATIVE ENGLISH II

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 - Meaning based classification 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**: Presentation		
Unit - II	**Grammar and Vocabulary:**	**9**
Homonyms and homophones - Subject-verb agreement - **Reading:** Gapped-text exercises - **Writing**: Graphic Presentation and Transcoding - Preparing proposals - **Activities: Listening:** Telephone conversations - **Speaking:** Role-Play.		
Unit - III	**Grammar and Vocabulary :**	**9**
Articles and determiners- Structure based classification of sentences: Simple, compound and complex - **Reading:** Multiple-matching - **Writing:** Checklists – Memorandum – Designing brochures. **Activities: Listening:** Group Discussions - Speaking: Group Discussion.		
Unit - IV	**Grammar and Vocabulary:**	**9**
Error detection – Gerunds & Infinitives - **Reading:** Business English Certificate (BEC) type exercises - **Writing**: Technical / Standalone report - **Activities: Listening**: Motivational Talks **- Speaking**: Soft skills.		
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:** Special Reports: Types-Accident / Incident or Event, Trip, Lab and Inspection - **Activities: Listening:** TED Talks - Speaking: Mock-Interviews.		

Lecture:45, Practical:30, Total:75

List of Exercises / Experiments :

	Listening/ DVD, podcasts and Authentic Videos	Speaking
1	Professional Presentation: Preparation	Talking about an unforgettable moment in one's life
2	Professional Presentation: Delivery	Presenting a paper on a topic related to one's area of study
3	Telephone Conversations	Role play or situational dialogues
4	Films / book excerpts	Reviewing a film or a book
5	Group Discussion	Participating in a GD
6	Generation of ideas	Presenting innovative ideas on a given topic
7	Soft Skills	Speaking on goal-setting, motivation, positive thinking, time and stress management, emotional intelligence, working in teams, conflict resolution, negotiation etc.
8	Creative Skills	Presenting a poem or a project
9	Becoming an entrepreneur	Talking about one's business plans or start-ups
10	Job Interview	Answering mock interview questions

TEXT BOOK:

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

REFERENCES:

1.	Raymond Murphy, "Intermediate English Grammar: Reference and Practice for South Asian Students", 2nd Edition, Cambridge: Cambridge University Press, 2011.
2.	GlennisPye, "Vocabulary in Practice, Parts 1 and 2", 1st Edition, Cambridge: Cambridge University Press, 2011.
3.	Globarena, Study skill success, Tense buster, Issues in English.

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 videos through effective listening (Presentation, telephone etiquette, Group Discussion and Soft skills)	Understanding (K2), Manipulation (S3)
CO7	reconstruct information on their own after effectively listening	Evaluating (K5), Imitation (S1)
CO8	take part in Group Discussion, Paper or project presentation, mock interview and acquire knowledge on soft skills	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)**

20BCT21 - MATHEMATICS II

Programme& Branch	B.Sc - Computer Systems and Design, Information Systems & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	BS	3	1	0	4

Preamble	To introductory course which inculcate 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.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Gupta S.C, Kapoor V.K , "Fundamentals of Mathematical Statistics",11th Edition, Sultan Chand & Sons, New Delhi, 2019 for Units I & III.
2. Gupta S.P., "Statistical Methods", 37th Edition, Sultan Chand & Sons, New Delhi, 2018 for Units II, IV and V.

REFERENCES:

1. Kandasamy P., Thilagavathy K., Gunavathy K., "Probability Statistics and Queueing Theory", S.Chand & Co, New Delhi, 2010.
2. Veerarajan T., "Probability, Statistics and Random Processes", 3rd Edition, Tata McGraw-Hill, New Delhi, 2009.

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	Analyzing (K4)
CO2	determine the mean, median and mode for ungrouped and grouped data	Applying (K3)
CO3	identify the relation between two variables	Applying (K3)
CO4	analyze the testing of hypothesis and formulate null and alternative hypothesis	Analyzing (K4)
CO5	prepare control charts to monitor the production process	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1								3	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3
CO4	3	3	2	2	1								3	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	20	20	30	30			100
CAT2	20	20	40	20			100
CAT3	10	30	30	30			100
ESE	20	20	30	30			100

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

20BCT22 - BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

Programme& Branch	B.Sc - Computer Systems and Design, Information Systems & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	ES	3	0	0	3

Preamble	To emphasize the fundamental concepts and overview of Electrical and Electronics Engineering for beginners.	
Unit - I	**Power Generation:**	**9**
Introduction-Conventional Energy: Generating Systems-Schematic arrangements of Steam (Thermal) Power Station, Nuclear power station, Gas turbine power station- Comparison of the power plants. Non-conventional energy: Solar energy.		
Unit - II	**Fundamentals of AC and DC Circuits:**	**9**
Basic concepts of electric field, Electric Current, Electric Potential, Potential Difference, Electric Work, Electric Power & Electric Energy. Ohm's law, Kirchhoff's law: Kirchhoff's Current Law, Kirchhoff's Voltage Law. Alternating Voltage and Current: Waveform, Cycle, Time period and Frequency, Derivation of RMS value, Average value, Form factor and Peak factor for Sine wave only. Wiring Diagram for Fluorescent Lamp and Staircase.		
Unit - III	**Fundamentals of Electronic Devices:**	**9**
Basics concept of Conductors, Insulators, Semiconductors. Construction, Characteristics and Applications: PN Junction diode, Zener diode, Bipolar Junction Transistor.		
Unit - IV	**Converters:**	**9**
Working principles of Half wave rectifier, Full wave Bridge rectifier –Working Operation of Switched Mode Power Supply (SMPS), Uninterrupted Power Supply (UPS) (block diagram only).		
Unit - V	**Electrical Machines:**	**9**
Faraday's laws, Lenz's law, Fleming's left and right-hand rule. Principle, Construction and Applications of: DC Generator, DC Motor, Single Phase Transformer		

Total:45

TEXT BOOK:

1. Prasad P.V., Sivanagaraju S., Prasad R., "Basic Electrical and Electronics Engineering", 1st Edition, Cengage Learning India Pvt. Ltd., India, 2018.

REFERENCES:

1. Salivahanan S., "Electronic Devices", 2nd Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2016.
2. Chakrabarti Abhijit, Debnath Sudipta, "Electrical Machines", McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the different sources of energy and types of power plants	Remembering (K1)
CO2	analyze the Direct and Alternating Circuits	Understanding (K2)
CO3	demonstrate the principles of basic electronic devices	Applying (K3)
CO4	apply the electronic devices principles in the design of converters	Applying (K3)
CO5	demonstrate the working of DC machines and AC transformer	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	1	2	1	1	1
CO2	2	1							1	1	1	1	1	2
CO3	3	2	1	1					1	1	1	2	2	3
CO4	3	2	1	1					1	1	1	2	2	3
CO5	3	2	1	1					1	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	40	60					100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	50	30				100

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

20BCT23 - PYTHON PROGRAMMING

Programme& Branch	B.Sc - Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	PC	3	0	0	3

Preamble	This course introduces the core python programming. It emphasizes on developing python programs with all data types, functions, 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 Methods – 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 - 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, 2017.

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 basics of python programming using nested and control statements.	Understanding (K2)
CO2	apply list, tuple and dictionary to handle variety of data.	Applying (K3)
CO3	apply strings and regular expression for searching in a string.	Applying (K3)
CO4	solve the problems using functions and modules.	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	20	60				100
CAT2	10	30	60				100
CAT3	15	25	60				100
ESE	20	20	60				100

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

20BCT24 - DATA STRUCTURES

Programme& Branch	B.Sc - Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	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	**Algorithms, Arrays and stacks:**	**9**
Introduction: Definition, Structure and Properties of Algorithms – Development of an Algorithm – Data Structures and Algorithms – Data Structure-Definition and Classification **–** Analysis of Algorithms: Efficiency of Algorithms – Apriori Analysis – Asymptotic Notations – Time Complexity of an Algorithm Using O Notation – Polynomial Vs Exponential Algorithms – Average, Best and Worst Case Complexities **-** Arrays: Introduction – Array Operations – Number of Elements in an Array – Representation of Arrays in Memory – Applications of arrays: Sparse matrix- Stacks: Introduction- Stack Operations - Applications of Stacks: Evaluation of Postfix Expressions.		
Unit - II	**Queues and Linked Lists:**	**9**
Queues: Introduction – Operations on Queues – Circular Queues – Other Types of Queues –Application of Linear queues : Time sharing system– Linked Lists: Introduction – Singly Linked Lists - Circularly Linked Lists - Doubly Linked Lists – Application of Linked List: Polynomial Addition		
Unit - III	**Trees:**	**9**
Introduction – Trees Definitions and Basic Terminologies – Representation of Trees - Binary Trees: Basic Terminologies and Types - Representation of Binary Trees – Binary Tree Traversals – Threaded Binary Trees – Application of Tress: Expression trees – Binary Search Trees: Definition and Operations.		
Unit - IV	**Graphs:**	**9**
Introduction **–** Definitions and basic terminologies **-** Representation of Graphs – Graph Traversals: Breadth First Search – Depth First Search – Application of Graphs: Single Source Shortest Path Problem.		
Unit - V	**Searching and Sorting:**	**9**
Searching: Introduction - Linear Search - Binary Search – Internal Sorting: Introduction **-** Bubble Sort – Selection Sort – Merge Sort - Quick Sort – Heap Sort – Radix Sort.		

Total:45

TEXT BOOK:

1. Vijayalakshmi Pai G.A, “Data Structures and Algorithms – Concepts, Techniques and Applications”, 1st Edition, McGraw Hill Education, New Delhi, 2017.

REFERENCES:

1. Tremblay Jean-Paul and Sorensen Paul, “An Introduction to Data Structures with Applications”, 2nd Edition, Tata McGraw Hill, New Delhi, 2017.
2. Brijesh Bakariya, “Data Structures and Algorithms Implementation Through C: Let’s Learn and Apply”, 1st Edition, BPB Publications, 2018.

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 queue and linked list	Applying (K3)
CO3	apply the concept of linked list for trees	Applying (K3)
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	3	2	1	1									2	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	35	30				100
CAT3	35	40	25				100
ESE	25	25	50				100

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

20BCL21 - ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

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

Preamble	To provide the knowledge in the basic concepts of Electrical science. It emphasizes on providing fundamental concepts related to electrical and electronics engineering

List of Exercises / Experiments:

1.	Verification of Ohm's Law.
2.	Verification of Kirchhoff's Current Law.
3.	Verification of Kirchhoff's Voltage Law.
4.	Power Measurement in DC Circuits.
5.	VI characteristics of PN junction diode..
6.	VI characteristics of Zener diode.
7.	Line regulation of voltage regulator using zener diode.
8.	Single phase Power Measurement Using Voltmeter and Ammeter.
9.	Open circuit Test on D.C. Shunt Generator.
10.	Load Test on Single Phase induction Motor.

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	compute parameters in DC and AC circuits.	Applying (K3), Manipulation (S2)
CO2	conduct experiments to learn characteristics of PN junction diode and Zener diode.	Applying (K3), Precision (S3)
CO3	perform suitable test and analyze the performance of transformer and single phase induction motor	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

20BCL22 - PYTHON PROGRAMMING LABORATORY

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

List of Exercises / Experiments:

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 which calculate 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 defines 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 print 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 that creates a list ['a','b','c'] then create a tuple from that 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

20BCL23 - DATA STRUCTURES LABORATORY

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

List of Exercises / Experiments:

1.	Implementation of Stack operations
2.	Conversion of Infix expression to Postfix expression using Stack
3.	Implementation of Queue Operations
4.	Demonstration of Circular Queue Operations
5.	Implementation of Linked List Operations
6.	Polynomial addition using Linked List
7.	Binary Tree Creation and Traversal
8.	Performing Selection Sort and Quick Sort
9.	Performing Linear and Binary Search
10.	Implementation of Graph Representation

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 stack and queue	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

20BCT31 – JAVA PROGRAMMING

Programme & Branch	B.Sc – Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	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	**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 A Primer”, 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	20	30	50				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	20	30	50				100

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

20BCT32– OPERATING SYSTEMS

Programme & Branch	B.Sc & Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	PC	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 Concept”, 10th Edition, Wiley India Pvt. Ltd., New Delhi, 2018.

REFERENCES:

1. William Stallings, “Operating Systems Internals and Design Principles”, 9th Edition, Prentice Hall, 2018.
2. 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	analyze the process synchronization issues and deadlock management	Analyzing(K4)
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	3	2	2	1								1	3
CO4	3	2	1	1	2								2	3
CO5	3	2	1	1	3								2	3

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

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	20	30	30	20			100
CAT3	20	40	40				100
ESE	25	30	30	15			100

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

20BCT33 - DATABASE MANAGEMENT SYSTEMS

Programme& Branch	B.Sc & Computer Systems and Design, Information Systems, and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	PC	3	0	0	3

Preamble	This course interprets the knowledge about various aspects of database design, query languages and concurrency control mechanisms.	
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 – Assertions – 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 Pvt. Ltd., New Delhi, 2020.

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 and explore relational algebra operations	Applying (K3)
CO2	write basic SQL queries for database manipulations	Applying (K3)
CO3	execute intermediate and advanced SQL queries	Applying (K3)
CO4	apply normalization techniques in application development	Applying (K3)
CO5	interpret the transaction and concurrency control 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	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											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	40	40				100
CAT2	20	40	40				100
CAT3	20	50	30				100
ESE	10	40	50				100

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

20BCT34 – COMPUTER ORGANIZATION

Programme& Branch	B.Sc – Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Digital Principles and Logic Design	3	PC	3	1	0	4

Preamble	To provide the basics of organization and architecture of a digital computer. It also emphasis on arithmetic operations, memory system, instruction processing and pipelining.	
Unit– I	**Basic Structure and Machine Instructions:**	**9+3**
Computer Types – Functional Units – Operational Concepts – Bus Structures – Software – Performance – Multiprocessors and Multicomputers. Machine Instructions: Memory Locations and Addresses Memory Operations – Instructions and Instruction Sequencing – Addressing Modes.		
Unit – II	**Input/Output Organization:**	**9+3**
Accessing I/O Devices– Interrupts: Interrupt Hardware – Enabling and Disabling Interrupts – Handling Multiple Devices – Controlling Device Requests – Exceptions – Use of interrupts in Operating Systems – Direct Memory Access – Buses: Synchronous Bus – Asynchronous Bus. Interface Circuits: Parallel Port – Serial Port.		
Unit – III	**Memory System:**	**9+3**
Basic Concepts – Semiconductor RAM Memories – Read–Only Memories – Speed, Size and Cost – Cache Memories: Mapping Functions – Replacement Algorithms – Example of Mapping Techniques – Examples of Caches in Commercial Processors – Virtual Memories		
Unit – IV	**Arithmetic Operations:**	**9+3**
Addition and Subtraction of Signed Numbers – Design of Fast Adders – Multiplication of Positive Numbers – Signed–Operand Multiplication – Fast Multiplication – Integer Division – Floating Point Numbers and Operations.		
Unit – V	**Processing Unit and Pipelining:**	**9+3**
Fundamental Concepts – Execution of a Complete Instruction – Multiple Bus Organization – Hardwired Control – Microprogrammed Control. Pipelining: Basic Concepts – Data Hazards – Instruction Hazards.		

Lecture:45 Tutorial:15 Total:60

TEXT BOOK:

1	Hamacher Carl, VranesicZvonko, ZakySafwat, “Computer Organization”, 5th Edition, McGraw Hill Education, Reprint 2016.

REFERENCES:

1	Stallings William, “Computer Organization and Architecture Designing for Performance”, 10th Edition, Pearson Education, 2016.
2	John P.Hayes “Computer Architecture and Organization”, 3rd Edition, McGraw Hill Education, Indian Edition, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	implement the basic instruction formats and addressing modes	Applying (K3)
CO2	outline the input / output organization of computer	Understanding (K2)
CO3	interpret the different memory types of a system	Understanding (K2)
CO4	compute the various arithmetic operations	Applying (K3)
CO5	illustrate the processing units and pipelining 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	2	1											3	2
CO3	2	1											2	3
CO4	3	2	1	1									2	3
CO5	2	1											3	2

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	50	30				100
CAT2	30	70					100
CAT3	20	50	30				100
ESE	25	45	30				100

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

20BCT35 – SOFTWARE ENGINEERING

Programme& Branch	B.Sc – Computer Systems and Design, Information Systems and 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 Applications.		
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. Component- Level Design: Component – Designing Class-Based Components-Conducting Component-level Design. Case Study: Component-Level Design for Mobile Apps.		
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 – Other Agile Process Models – A Tool set for the Agile Process. Case Study: Testing 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, 2019.

REFERENCES:

1	Ian Sommerville, “Software Engineering”, 10th Edition, Pearson Education, 2016.
2	Pankaj Jalote, “An Integrated Approach to Software Engineering”, 3rd Edition, Narosa Publishing House Pvt. Ltd., Reprint 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (HighestLevel)**
CO1	Illustrate the concepts of software processes and software process models	Understanding (K2)
CO2	describe the scenario-based and class-based models of software systems	Understanding (K2)
CO3	apply design concepts and frame conceptual models for a given project	Applying (K3)
CO4	calculate effort estimation using COCOMO model	Applying (K3)
CO5	explain the testing strategies for ensuring software quality and agile development process	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											2	3
CO2	2	2											2	3
CO3	3	2	2	1									3	3
CO4	3	2	1	1									2	3
CO5	2	1											1	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	40	60					100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	30	40	30				100

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

20BCL31 - JAVA PROGRAMMING LABORATORY

Programme& Branch	B.Sc - Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	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 Exercises / Experiments:

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: 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"sTaxonomy

20BCL32 - OPERATING SYSTEMS LABORATORY

Programme & Branch	B.Sc & Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	PC	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 Exercises / Experiments:

1.	a. Execute the basic Unix commands: b. Execute the Directory and File commands c.. Execute the commands related to file attributes and permission 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 a. shell variables and commands b. branching control structures c. loop control structures
6.	Write the C program to, Implement producer consumer problem.
7.	Implementation of FCFS scheduling.
8.	Implementation of SJF scheduling.
9.	Implementation of FIFO page replacement algorithm.
10.	Implementation of file operations.

Total: 60

REFERENCES/MANUAL/SOFTWARE:

1.	Lab Manual/ Linux OS

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 the page replacement 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

20BCL33 - DATABASE MANAGEMENT SYSTEMS LABORATORY

Programme& Branch	B.Sc – Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	PC	0	0	4	2

Preamble	To provide the knowledge in the basics of database management systems and it focuses on writing SQL queries to design and access the database.

List of Exercises / Experiments:

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 constraints).
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 student and banking database.	Applying (K3), Manipulation (S2)
CO2	execute views and nested sub queries on a database.	Applying (K3), Manipulation (S2)
CO3	manipulate database using PL/SQL functions and procedures.	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

20BCT41 - OPEN SOURCE PROGRAMMING

Programme & Branch	B.Sc - Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Web Programming	4	PC	3	0	0	3

Preamble	To deal with the programming concepts in open source languages like PHP with MySQL and to develop database driven web applications.	
UNIT - I	**Introduction to PHP Programming:**	**9**
Basic HTML and PHP Syntax - Sending Data to The Web Browser - Adding Comments - Variables: Types of Variables – Quotation Marks - HTML Forms: Creating Simple HTML Forms – Receiving Form Data in PHP - Displaying errors.		
UNIT - II	**Strings, Control Structures and Arrays:**	**9**
Strings - Concatenating Strings – Encoding and Decoding Strings – Substrings - Control Structures: If conditional – types – Switch – For Loop – Array: Creating an Array – Adding items to an array – Multidimensional arrays – Sorting – Creating array from a form – Regular Expression.		
UNIT- III	**Creating Web Applications and User-defined Functions:**	**9**
Creating Templates – Using External Files – Constants – Date and Time – Sticky forms – Sending Emails – Understanding HTTP Headers - Functions: Creating and Using simple functions – Function call with arguments – Default arguments – Function with return values.		
UNIT- IV	**Introduction to Database:**	**9**
Introduction to SQL – Connecting to MySQL – Error Handling – Creating Table – Inserting Data to database – Securing Query data – Retrieving data – Deleting data – updating data in a database.		
UNIT- V	**Cookies, Sessions and File Handling:**	**9**
Creating Cookies – Manipulating Cookies – Creating a Session – Manipulating sessions - Files and Directories: File Permissions – Lock Files – File Uploads – Navigating Directories – Reading Files incrementally.		

Total:45

TEXT BOOK:

1. Larry Ullman, “PHP and MySQL for Dynamic Web Sites”, 5th Edition, Pearson Education, 2017.

REFERENCES:

1. David Powers, “PHP Solutions: Dynamic Web Design Made Easy”, 3rd Edition, Apress Publications,2014.
2. Luke Welling and Laura Thomson, “PHP and MySQL Web Development”, 5th Edition, Addison Wesley, 2016.

	COURSE OUTCOMES: On completion of the course, the students will be able to	**BT Mapped (Highest Level)**
CO1	outline the programming constructs of PHP	Understanding (K2)
CO2	create HTML forms using control structures and arrays	Applying (K3)
CO3	design web pages with user-defined functions	Applying (K3)
CO4	develop web applications with database connectivity	Applying (K3)
CO5	Implement various session handling techniques and file manipulations	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									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	40	30				100
CAT2	30	30	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)**

20BCT42 – COMPUTER NETWORKS

Programme& Branch	B.Sc - Computer Systems and Design, Information Systems and 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 Paradigm-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)-Socket Interface Programming.		
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 - State Transition Diagram-Flow Control-Error Control-TCP Congestion Control.		
UNIT -IV	**Network Layer:**	**9+3**
Introduction - Network Layer Services - Network Layer Congestion - Structure of a router - Network Layer Protocols - IPv4 Datagram format - IPv4 Addresses - Next Generation IP - IPv6 Addressing - Unicast Routing - Routing algorithms - Unicast Routing Protocols.		
UNIT - V	**Data Link Layer:**	**9+3**
Introduction - Data Link Control (DLC) - Framing - Flow and Error Control - Error Detection and Correction - Two DLC Protocols - Multiple Access Protocols (MAC) - Random Access -Controlled Access – Link Layer Addressing - Wired LANs Ethernet Protocol - IEEE Project 802 - Standard Ethernet - Virtual LANs.		

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, 2018.

REFERENCES:

1	Kurose F. James, Ross W. Keith, “Computer Networking A Top-Down Approach”, 7th Edition, Pearson Education, 2018.
2	Andrew S.Tanenbaum, Nick Feamster,David J.Wetherall, “Computer Networks”, 6th Edition, Pearson Education, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the overview of the Internet, 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											1	3
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)**

20BCT43 - GRAPHICS AND MULTIMEDIA

Programme & Branch	B.Sc - Computer Systems and Design	Sem.	Category	L	T	P	Credit
Prerequisites	C Programming	4	PC	3	0	0	3

Preamble	This course explores comprehensive introduction to computer graphics, two dimensional and three dimensional transformations. It also provides an exposure multimedia elements.	
UNIT - I	**Computer Graphics Hardware and Software:**	**9**
Computer Graphics Hardware: Video Display Devices- Raster Scan Systems – Graphics Workstations and Viewing Systems - Input devices - Hard Copy Devices - Graphics Networks – Graphics on the Internet - Computer Graphics Software: Coordinate Representation – Graphics Functions – Software Standards –Other Graphics Packages – Introduction to OpenGL.		
UNIT - II	**Graphics Output Primitives and Graphics Primitive Algorithms:**	**9**
Graphics Output Primitives: Coordinate Reference Frames – Specifying a Two Dimensional World Coordinate Reference Frame in OpenGL – OpenGL Point Functions – OpenGL Line Functions – OpenGL Curve Functions – Fill Area Primitives - Implementation Algorithms for Graphics Primitives: Line Drawing Algorithms – Parallel Line Algorithms – Setting Frame Buffer Values - Circle Generating Algorithms.		
UNIT- III	**Two and Three Dimensional Transformations and Viewing:**	**9**
Two Dimensional Geometric Transformations: Basic Two-Dimensional Geometric Transformations – Matrix Representation and Homogeneous Transformations –Inverse Transformations – OpenGL Functions for Two Dimensional Geometric Transformations - Two Dimensional Viewing: Pipeline – Clipping Window – Normalization and Viewport Transformations – OpenGL Two Dimensional Viewing Functions - OpenGL Geometric Transformation Programming Examples - Three Dimensional Geometric Transformations: Three Dimensional Translation – Three Dimensional Rotations - Coordinate Axis Rotation - General Three Dimensional Rotations - Three Dimensional Scaling.		
UNIT- IV	**Multimedia –Images and Sounds:**	**9**
Multimedia: Definitions - Use of Multimedia -Delivering Multimedia - Images: Making Still Images – Color - Image File Formats - Sounds: The Power of Sound – Digital Audio – MIDI Audio – MIDI vs Digital Audio – Multimedia System Sounds – Audio File Formats – Adding Sound to Multimedia Project.		
UNIT- V	**Animation, Video and Multimedia on the Web:**	**9**
Animation: Power of Motion - Principles of Animation - Animation by Computer - Making Animations that Work - Video: Using Video - Working of Video - Digital Video Containers - Obtaining Video Clips - Shooting and Editing Video - Designing for the WWW: Developing – Text – Images – Sound – Animation - Video.		

Total: 45

TEXT BOOK:

1.	Donald Hearn, Baker M, Warren Carithers, “Computer Graphics with OpenGL”, 4th Edition, Pearson Education, 2019 for Units I, II, III.
2.	Vaughan Tay, “Multimedia: Making It Work”, 9th Edition, Tata McGraw Hill Publishing Company, 2014 for Units IV, V.

REFERENCES:

1.	Sumanta Guha, “Computer Graphics Through OpenGL From Theory to Experiments”,3rd Edition, CRC Press , 2019.
2.	Prabhat K. Andleigh, Kiran Thakrar, “Multimedia Systems Design” Ist Edition, Pearson Education, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe the working principles of I/O devices and graphics software	Understanding (K2)
CO2	implement line drawing and clipping algorithms using openGL function	Applying(K3)
CO3	apply the transformation on two dimensional and three dimensional objects	Applying(K3)
CO4	outline the characteristics of images and sounds in multimedia	Understanding (K2)
CO5	develop webpage using multimedia components	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	2
CO3	3	2	1	1									2	3
CO4	2	1											2	3
CO5	3	2	1	1									1	3

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

ASSESSMENT PATTERN - THEORY

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

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

20BCT44 – DATA WAREHOUSING AND DATA MINING

Programme & Branch	B.Sc - Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Database Management Systems	3	PC	3	1	0	4

Preamble	This course imparts the knowledge of data warehousing and data mining concepts and implements the various data mining algorithms.	
UNIT –I	**Data Mining:**	**9+3**
Introduction – Data mining – Evolution – Kinds of Data – Kinds of Patterns – Data Preprocessing: Need for Data Preprocessing – Major Tasks in Preprocessing – Data Cleaning – Data Integration – Data Reduction – Data Transformation and Discretization.		
UNIT –II	**Data Warehousing and Online Analytical Processing:**	**9+3**
Data Warehouse: Basic Concepts – Data Warehouse Modeling – Data Cube and OLAP – Data Warehouse Design and Usage: A Business Analysis Framework for Data Warehouse Design – Data Warehouse Design Process – DataWarehouse Usage for Information Processing – From Online Analytical Processing to Multidimensional Data Mining – Data Warehouse Implementation.		
UNIT –III	**Association Rule Mining:**	**9+3**
Mining Frequent Patterns, Associations and Correlations: Basic Concepts – Frequent Item Set Mining Methods – Apriori Algorithm: Finding Frequent Itemsets by Confined Candidate Generation – Generating Association Rules from Frequent Itemsets – Improving the Efficiency of Apriori – A Pattern–Growth Approach for Mining Frequent Itemsets – Mining Frequent Itemsets Using the Vertical Data Format – Mining Closed and Max Patterns – Pattern Evaluation Methods – Constraint–Based Frequent Pattern Mining.		
UNIT –IV	**Classification:**	**9+3**
Basic Concepts – Decision Tree Induction – Bayes Classification Methods – Bayes' Theorem – Naive Bayesian Classification – Rule–Based Classification – Bayesian–Belief Networks– Classification by Backpropogation.		
UNIT– V	**Clustering:**	**9+3**
Cluster Analysis: Requirements – Partitioning Methods – K-Means, K- Medoids – Hierarchical Methods – Agglomerative versus Divisive Hierarchical Clustering – Distance Measures in Algorithmic Methods – BIRCH: Multiphase Hierarchical Clustering Using Clustering Feature Trees – Chameleon: Multiphase Hierarchical Clustering Using Dynamic Modeling – Probabilistic Hierarchical Clustering – Outlier Detection: Outliers and Outlier Analysis – Outlier Detections Methods – Statistical Approaches.		

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1. Jiawel Han, Micheline Kamber and Jian Pel. "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2016.

REFERENCES:

1. Mehmed Kantardzic, "Data Mining Concepts, Models, Methods and Algorithms", 3rd Edition, Wiley, 2020.
2. Parteek Bhatia, "Data Mining and Data Warehousing: Principles and Practical Techniques", 1st Edition, Cambridge University Press, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret the basic concepts of data mining and preprocessing techniques	Understanding (K2)
CO2	implement the various data warehousing techniques	Applying (K3)
CO3	articulate frequent item sets in association rule mining	Applying(K3)
CO4	analyze the various classification methods	Analyzing(K4)
CO5	demonstrate the clustering methods	Applying(K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1	2	1			3				2	3
CO4	3	3	2	2	1	2			2				3	3
CO5	3	2	1	1	3	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	20	50	30				100
CAT3	10	50	30	10			100
ESE	20	40	30	10			100

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

20BCT45 - OBJECT ORIENTED ANALYSIS AND DESIGN

Programme & Branch	B.Sc - Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	PC	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, 2017

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the basics of object orientation and the system development lifecycle	Understanding (K2)
CO2	illustrate the methodologies using UML diagrams	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	show how user interface design is carried out 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											2	3
CO2	3	2	1	1	3								2	3
CO3	3	2	1	1	2								2	3
CO4	3	2	1	1	2								2	3
CO5	2	1	1	1									1	3

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

ASSESSMENT PATTERN - THEORY

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

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

20BCL41 - OPEN SOURCE PROGRAMMING LABORATORY

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

Preamble	To provide the knowledge in developing integrated web applications using PHP and MySQL.

List of Exercises / Experiments:

1.	Write a PHP program for String Concatenation
2.	Write a PHP code using constants and variables
3.	Design a HTML page for validating form elements
4.	Write a PHP program using arrays
5.	Create a registration form with PHP and MYSQL and apply sticky forms in it
6.	Write a PHP Program to implement user-defined functions
7.	Create a web page to insert records to student table, department table (with key constraints) using database connectivity
8.	Develop a PHP code to retrieve the records from student and department table
9.	Write a PHP code with MYSQL for changing the password in student table
10.	Design a web page for file uploading and handling sessions

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	apply basic functionalities in PHP	Applying (K3), Manipulation (S2)
CO2	validate the web forms and accessing the array elements	Applying (K3), Manipulation (S2)
CO3	connect PHP with data base and manipulate the data base through PHP	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

20BCL42 - GRAPHICS AND MULTIMEDIA LABORATORY

Programme & Branch	B.Sc - Computer Systems and Design	Sem.	Category	L	T	P	Credit
Prerequisites	C Programming Laboratory	4	PC	0	0	4	2

Preamble	This course emphasizes on implementation of computer graphics algorithms and exploring various multimedia tools.

List of Exercises / Experiments:

1.	Implement line drawing algorithm.
2.	Implement circle drawing algorithm.
3.	Write a program to perform 2D Transformation.
4.	Write a program to perform 3D Transformation.
5.	Write a program to perform three dimensional rotation.
6.	Implement image editing and manipulation operations.
7.	Implement sound editing operations.
8.	Implement video editing operations.
9.	Create an interactive animation.
10.	Design a simple web page using multimedia elements.

Total: 60

REFERENCES/MANUAL/SOFTWARE:

1.	Lab Manual / OpenGL Library

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate line and circle drawing algorithms	Applying (K3), Manipulation (S2)
CO2	implementation of 2D and 3D transformations	Applying (K3), Manipulation (S2)
CO3	apply multimedia tools to manipulate image, sound and videos	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			1								2	3
CO2	3	2	1	1	2								2	3
CO3	3	2	1	1	3								2	3

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

20BCL43 - OBJECT ORIENTED ANALYSIS AND DESIGN LABORATORY

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

Preamble	To provide the knowledge in object oriented analysis and design using UML in Rational rose software.

List of Exercises / Experiments:

1.	Identify a software system that needs to be developed, formulate a problem statement and document its Software Requirements Specification (SRS)
2.	Identify use cases and develop the Use Case model
3.	Identify the conceptual classes and derive a Class Diagram from them
4.	Using the identified scenarios, find the interaction between objects and represent them using UML Sequence Diagrams
5.	Draw Collaboration diagrams for the system
6.	Draw relevant State Chart Diagrams for the same system.
7.	Draw Activity diagrams for the system
8.	Draw Component diagrams to depict high level physical components
9.	Draw deployment diagrams to show the configuration of run-time processing elements
10.	Generate a skeleton code structure from class diagram

Total:60

REFERENCES/MANUAL/SOFTWARE:

1.	Lab Manual / Rational rose

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	formulate problem statement and prepare SRS	Understanding (K2), Manipulation(S2)
CO2	draw static UML models	Applying (K3), Precision (S3)
CO3	design dynamic UML models	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											1	2
CO2	3	2	1	1	3								2	3
CO3	3	2	1	1	3								2	3

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

SUGGESTED DOMAINS FOR CASE STUDY:

1. Passport automation system
2. Book bank
3. Exam registration
4. Stock maintenance system
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Credit card processing
9. E-book management system
10. Recruitment system
11. Foreign trading system
12. Conference management system
13. BPO management system
14. Library management system
15. Student information system

20BCT51 – ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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	This is an introductory course in Artificial Intelligence and Machine Learning which focuses on fundamentals of Artificial Intelligence concepts, Machine learning techniques and various machine learning algorithms.	
UNIT– I	**Artificial Intelligence :**	**9**
Introduction to AI – Problem formulation – AI Applications – Problems – State Space and Search – Production Systems – Breadth first and Depth first – Travelling Salesman Problem – 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 – 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, 2017 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	recognize the need of data preprocessing techniques, machine learning model construction and evaluation	Understanding (K2)
CO3	analyze the performance of various classification and regression algorithms in terms of accuracy	Analyzing (K4)
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	1	1	1					1	2	2	1	2	3
CO2	2	1	1	1					1	2	2	1	2	3
CO3	3	3	2	1					2	3	3	2	2	3
CO4	3	2	1	1					2	3	3	2	2	3
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	20	40	20			100
CAT3	20	30	50				100
ESE	20	30	40	10			100

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

20BCT52 – MOBILE APPLICATION DEVELOPMENT

Programme& Branch	B.Sc – Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Java Programming	5	PC	3	0	0	3

Preamble	To explore the fundamental knowledge and to create mobile applications 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 - Interactions 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 ViewGroups - FrameLayout - LinearLayout – TableLayout - RelativeLayout- FrameLayout – ScrollView - Utilizing the Action Bar - Adding Action Items to the Action Bar – Designing User Interface with Views: Using Basic Views - Picker Views - List Views.		
Unit - IV	**Pictures, Menus and Content Providers:**	**9**
Using Images to Display Pictures - ImageView view - ImageSwitcher - GridView- Using Menus with Views - Creating the Helper Methods - Options Menu - Context Menu - Using WebView - WebView - 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	Murat Yener , Onur Dundar ,"Expert Andriod Studio", 1st Edition , John Wiley & Sons, Inc., 2017.
2	John Horton, "Android Programming for Beginners", 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 that handles 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									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	30	40				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)**

20BCL51 – MACHINE LEARNING LABORATORY

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 provides the knowledge 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.	Calculate 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 and gain ratio 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

20BCL52 - MOBILE APPLICATION DEVELOPMENT LABORATORY

Programme& Branch	B.Sc – Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Java Programming Laboratory	5	PC	0	0	4	2

Preamble	This course provides the knowledge in android programming and it emphasizes on the development of simple android applications.

List of Exercises / Experiments:

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 mobile application 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	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

SEMESTER V - ELECTIVE – I

20BCE01 - CLOUD COMPUTING

Programme& Branch	B.Sc – Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Operating Systems & 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:**	**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	**Virtualization:**	**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.		
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.		
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, 2017.

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	discuss the various cloud computing service models	Understanding (K2)
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	2	1											3	2
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	40	60					100
CAT2	40	60					100
CAT3	25	45	30				100
ESE	25	60	15				100

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

20BCE02 - INFORMATION SECURITY

Programme & Branch	B.Sc - Computer Systems and Design	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks	5	PE	3	0	0	3

Preamble	To introduce the fundamental concepts of authentication, authorization and access control mechanisms. The objective is to develop techniques to protect information assets and defend against attacks.	
UNIT -I	**Information Security, Identification and Authentication:**	**9**
Information Security: Definition – Secure System – Models in Security – Attacks – Defense in Depth. Identification and Authentication: Identification – Authentication – Common Identification and Authentication Methods.		
UNIT -II	**Access Controls, Accountability and Regulations:**	**9**
Authorization and Access Controls: Access Controls – Implementation – Access Control Models – Physical Access Controls. Auditing and Accountability: Accountability – Security Benefits – Auditing. Compliance, Laws and Regulations: Compliance – Achieving Compliance – Maintaining Compliance – Laws and Information Security.		
UNIT -III	**Operations, Human element and Physical Security:**	**9**
Operations Security: Process – Laws – Operations Security in Personal Lives – Origin. Human Element Security: Gathering Information for Social Engineering Attacks – Types of Social Engineering Attacks – Building Security Awareness. Physical Security: Identifying Physical Threats – Physical Security Controls – Protecting People – Protecting Data.		
UNIT -IV	**Network, Operating System, Mobile, Embedded, and Internet of Things Security:**	**9**
Network Security: Protecting Networks – Protecting Network Traffic – Network Security Tools. Operating System Security: Operating System Hardening – Protection against Malware – Operating System Security Tools. Mobile, Embedded, and Internet of Things Security: Mobile Security – Embedded Security – Internet of Things Security.		
UNIT- V	**Application Security and Assessing Security:**	**9**
Application Security: Software Development Vulnerabilities – Web Security – Database Security – Application Security Tools. Assessing Security: Vulnerability Assessment – Penetration Testing – Ensuring Security.		

Total:45

TEXT BOOK:

1. Andress Jason, “Foundations of Information Security”, 1st Edition, No Starch Press, San Francisco, 2019.

REFERENCES:

1. Michael E. Whitman and Herbert J. Mattord, “Principles of Information Security”, 7th Edition, Cengage Learning, Boston, 2021.
2. Richard E. Smith, “Elementary Information Security”, 3rd Edition, Jones Bartlett Learning, Burlington, 2021.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the need for identification and authentication mechanisms.	Understanding (K2)
CO2	demonstrate the access control mechanisms and importance of complying with security regulations.	Applying (K3)
CO3	develop security measures to protect processes, human elements and physical aspects of information security.	Applying (K3)
CO4	implement security strategies to protect networks, operating systems, mobile, embedded and IoT devices from attacks.	Applying (K3)
CO5	perform vulnerability assessment and penetration testing to identify security issues in hosts and applications.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		2									1	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	45	45	10				100
CAT2	35	40	25				100
CAT3	35	40	25				100
ESE	30	30	40				100

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

20BCE03 - MICROPROCESSOR AND INTERFACING

Programme& Branch	B.Sc – Computer Systems and Design	Sem.	Category	L	T	P	Credit
Prerequisites	Digital Principles and Logic Design	5	PE	3	0	0	3

Preamble	To introduce the basic concepts of Microprocessor and Microcontroller and to get sufficient knowledge in writing assembly language programs.	
UNIT -I	**Introduction to 8085 Microprocessor:**	**9**
Introduction – Microprocessor Instruction Set and Addressing Modes -Timing Diagram only for Register Addressing Mode- Instruction Classification – Data Format and Storage – Writing, Assembling and Executing a Simple Program.		
UNIT -II	**Microprocessor Architecture and Interfacing:**	**9**
Microprocessor Architecture and its Operations – Memory – Input and Output Devices (I/O) – The 8085 Micro Processing Unit (MPU) –Memory Interfacing – Interfacing I/O Devices using Decoders – Comparison of Memory Mapped I/O and Peripheral Mapped I/O.		
UNIT -III	**Programmable Peripheral Devices:**	**9**
8085 Interrupts - RST (Restart) Instructions - 8085 Vectored Interrupts - TRAP,RST 7.5, 6.5, 5.5 - Block Diagram of 8255A Parallel Peripheral Interfaces- Block Diagram of 8254(8253) Programmable Interval Timer – Block Diagram of 8251 Architecture.		
UNIT -IV	**8051 Microcontroller:**	**9**
Architectures of 8051 – Pin Configuration- Introduction to 8051 Assembly Language Programming-Flag bits and PSW Registers-Register Bank and Stack - Addressing Modes-Unsigned Addition and Subtraction Instructions-Unsigned Multiplication and Divisions Instructions-Logic and Compare Instructions-Rotate and Swap Instructions-Single Bit Instructions.		
UNIT- V	**Real Time Control of Microcontroller:**	**9**
Programming 8051 Timers–Counter Programming - Basics of Serial Communications - 8051 Interrupts - Programming Timer Interrupts - Programming External Hardware Interrupts - Programming Serial Communication Interrupt - Interrupt Priority.		

Lecture:45

TEXT BOOK:

1. Ramesh Gaonkar S, “Microprocessor Architecture, programming and applications with the 8085”, 6th Edition, Penram International Publishing, India, 2013 for UNIT I,II,III.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", 2nd Edition, Pearson Education, New Delhi, 2013 for UNIT IV,V.

REFERENCES:

1. MathurAdithya P, “Introduction to Microprocessor”, 3rd Edition, Tata McGraw Hill, New Delhi, 2017
2. Krishna Kant, "Microprocessors and Microcontrollers: Architecture, programming and system design 8085, 8086, 8051, 8096", 2nd Edition, PHI Learning Pvt. Ltd, New Delhi, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	develop assembly language programming using 8085 microprocessor	Applying (K3)
CO2	interpret the hardware and software components of a microprocessor-based system	Understanding (K2)
CO3	illustrate the basic concepts of interrupts, parallel and serial communication	Understanding (K2)
CO4	develop assembly language programming using 8051 Microcontroller	Applying (K3)
CO5	infer the basic concepts of 8051 timers, counters and interrupts	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	2	1											2	3
CO3	2	1											2	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	10	60	30				100
CAT2	30	70					100
CAT3	10	60	30				100
ESE	20	50	30				100

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

ELECTIVE – II

20BCE04 - INTERNET OF THINGS

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	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 Devises and Endpoints RaspberryPi:**	**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	acquire knowledge on 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	identify some of the core use cases for M2M and IoT	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									3	2
CO5	3	2	1	1									3	2

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

ASSESSMENT PATTERN - THEORY

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

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

20BCE05 - DISTRIBUTED COMPUTING

Programme & Branch	B.Sc - Computer Systems and Design	Sem.	Category	L	T	P	Credit
Prerequisites	Operating Systems	5	PE	3	0	0	3

Preamble	To provide basic principles on which the internet and other distributed systems are based, their architecture, algorithms, design and how they meet the demands of modern distributed applications.	
UNIT -I	**Characterization of Distributed Systems and Models:**	**9**
Characterization of Distributed Systems - Introduction – Examples of Distributed Systems – Trends in distributed systems – Focus on Resource Sharing - Challenges – System Models: Introduction – Physical Models – Architectural Models - Fundamental Models – Interaction Model – Failure Model – Security Model - Case study : World Wide Web – Networking techniques – Ethernet – Wifi – Bluetooth.		
UNIT -II	**Remote Invocation and Distributed File Systems:**	**9**
Remote Invocation **-** Introduction – Request-reply protocols - Remote procedure call - Remote method invocation – Distributed Objects and Components: Introduction – Distributed Objects - Distributed File Systems: Introduction – Characteristics of File systems - Distributed File system requirements - File Service Architecture - Case study : Java RMI File system - Sun Network File system.		
UNIT -III	**Time and Process Coordination:**	**9**
Introduction - Clocks, Events and Process States – Synchronizing Physical Clocks – Logical Time and Clocks - Coordination and Agreement: Introduction - Failure assumptions and Failure detectors - Algorithms for Mutual exclusion - Distributed Mutual Exclusion – Elections.		
UNIT -IV	**Distributed Transactions and Replication:**	**9**
Distributed Transactions **-** Introduction – Flat and Nested Distributed Transactions – The Coordinator of a Distributed Transaction - Atomic Commit Protocols – Two phase Commit Protocol – Two Phase Commit Protocol for Nested Transactions - Replication: Introduction – System Model and the role of Group Communication – Fault Tolerant Services - Passive Replication - Active Replication- Case Study - Highly available services - gossip architecture - Bayou – Coda.		
UNIT- V	**Designing Distributed System:**	**9**
Google Case Study - Introduction - Overall architecture and Design Philosophy - Physical model - Overall system architecture - Underlying Communication Paradigms - Data Storage and Coordination Services - The Google File System (GFS) – Chubby – Bigtable - Summary of Key Design Choices - Distributed Computation Services.		

Total:45

TEXT BOOK:

1. George Coulouris, Jean Dollimore , Tim Kindberg and Gordon Blair, "Distributed Systems Concepts and Design", 5th Edition, Pearson Education, 2017

REFERENCES:

1. Sunitha Mahajan, Seema Shah, "Distributed Computing", 2nd Edition, Oxford University Press, 2018.
2. Andrew S Tanenbaum, Maarten van Steen, "Distibuted Systems Principles and Pardigms", 2nd Edition, Pearson Education, 2015.

	COURSE OUTCOMES: On completion of the course, the students will be able to	**BT Mapped (Highest Level)**
CO1	interpret the different distributed systems and models.	Understanding (K2)
CO2	identify the methods for process communication and distributed file architecture.	Understanding (K2)
CO3	illustrate algorithms for clock synchronization, mutual exclusion and election.	Applying (K3)
CO4	utilize transactions, implement atomic commit protocols and demonstrate replication model.	Applying (K3)
CO5	outline the google architecture and recognize its services.	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	40	60					100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	20	60	20				100

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

20BCE06 - USER INTERFACE TECHNOLOGIES

Programme& Branch	B.Sc - Computer Systems and Design	Sem.	Category	L	T	P	Credit
Prerequisites	Web Programming	5	PE	3	0	0	3

Preamble	This course provides an introduction to HTML, CSS, Bootstrap, Client-side JS and Server Side JS Framework. The course also addresses the application of Angular for developing interactive web applications.	
Unit - I	**UI Design:**	**9**
HTML5: Introduction – Basic tags – HTML Forms Element – Page Structured Elements – Media Tags – Cascading Style Sheet– Types of CSS – Positioning Elements – Backgrounds – Box Model – Dropdown Menus-Responsive Web Design Introduction - RWD Techniques – Fluid Layout, Fluid Images and Media queries - Introduction to RWD Framework.		
Unit - II	**Bootstrap:**	**9**
Web Design – Bootstrap – Bootstrap Background and Features - Getting Started with Bootstrap -Grid basics – Tables – Images – Button – list – Drop down – Navs – Nav Bar – Forms – Input – Input Groups- Demystifying Grids – OffCanvas - Bootstrap Components - JS Plugins – Customization.		
Unit - III	**Server-side JS Framework:**	**9**
Node.js: Introduction - What is Node JS – Architecture – Feature of Node JS - Installation and setup - Creating web servers with HTTP – Event Handling - GET & POST implementation - Connect to NoSQL Database using Node JS – Implementation of CRUD operations.		
Unit - IV	**ReactJS – Part 1:**	**9**
React: Introduction – Installation –create React app - components – state – props - props validation – state vs props – constructor – Component API – Component Life cycle - Forms – controlled and uncontrolled component – Events – conditional rendering.		
Unit - V	**ReactJS - Part 2:**	**9**
list – keys – refs – Fragments - Router – CSS – Animation – Map – Table –Code splitting – hooks – API Integration.		

Total:45

TEXT BOOK:

1	Infosys campus connect material for Unit I, II, III.
2	https://www.javatpoint.com for Unit IV, V.

REFERENCES:

1.	Alex Banks, Eve Porcello., “Learning React”, Ist Edition,O’ Reilly Media USA, 2017.
2.	David Herron, “ Node.js Web Development ” 5th Edition, Packt Publishing, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	design static web pages using HTML, CSS and identify the utility of RWD Framework.	Applying(K3)
CO2	create a web application by using the features of Bootstrap.	Applying (K3)
CO3	develop simple server side applications using Node JS.	Applying (K3)
CO4	experiment with React JS to create single page applications.	Applying(K3)
CO5	utilize client side JS framework to develop web applications and integration.	Applying(K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

SEMESTER VI

ELECTIVE – III

20BCE07 – DEEP LEARNING

Programme& Branch	B.Sc & Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Artificial Intelligence and Machine Learning	6	PE	3	0	0	3

Preamble	To focus on the fundamental concepts, applications and architecture of deep neural networks and open–source framework for Deep Learning.	
Unit – I	**Fundamentals of Neural networks:**	**9**
The Learning Machines – Linear Algebra – Scalars – Vectors – matrices – Tensors – Hyperplanes – Relevant Mathematical Operations – Converting Data into Vectors – Types of Machine Learning – Classification Problem – The Regression Problem – Overfitting and Underfitting – Bias and Variance – Overview of Artificial Neural Networks – Biological Neurons – Types of Artificial Neural Networks – Optimization Techniques – Vanishing Gradient Problem – Exploding Gradient Problem – Weight Initialization – Deep Learning.		
Unit – II	**Convolutional Neural Network:**	**9**
Introduction – Components of CNN Architecture – Convolution Layer – Pooling of Downsampling Layer – Flattening layer – Fully Connected Layer – Rectified Liner Unit Layers – Exponential Linear Unit – Unique Properties of CNN – Architectures of CNN – Applications of CNN.		
Unit – III	**Recurrent Neural Network:**	**9**
Introduction – Simple Recurrent Neural Network – Training an RNN – Backpropagation Through Time Illustration – RNN Topology – Challenges with Vanishing Gradients – Bidirectional and Stateful RNNs – Long Short Term Memory – LSTM Implementation – Gated Recurrent Unit – Deep Recurrent Neural Network.		
Unit – IV	**Autoencoder:**	**9**
Introduction – Features of Autoencoder – Types of Autoencoder – Vanilla Autoencoder – Multilayer Autoencoder – Stacked Autoencoder – Deep Autoencoder – Denoising Autoencoder – Convolutional Autoencoder – Regularization in Autoencoder.		
Unit – V	**Restricted Boltzmann Machine and Open source Frameworks for Deep Learning:**	**9**
Boltzmann Machine – Relation to Hopfield Networks – RBM Architecture – Example – Types of RBM – Environmental Setup – Deep Learning with Python – Scientific Python – Frameworks – Hardware Support for Deep learning.		

Total: 45

TEXT BOOK:

1	Lovely Rose S, Ashok Kumar L and Karthika Renuka, “Deep Learning Using Python”, 1st Edition, Wiley India Pvt. Ltd, New Delhi, 2020.

REFERENCES:

1	Ian Goodfellow, Yoshua Bengio and Aaron Courville, “Deep Learning”, 1st Edition, MIT Press, 2016.
2	Josh Patterson and Adam Gibson, “Deep Learning A practitioner’s Approach”, 1st Edition , O’Reilly Media Inc., 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the fundamentals of neural networks	Understanding (K2)
CO2	design the layers of convolutional neural network	Applying (K3)
CO3	apply the concepts of recurrent neural network	Applying (K3)
CO4	summarize the features and types of autoencoders	Understanding (K2)
CO5	illustrate the open source frameworks for deep learning	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											2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	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	40	50	10				100
CAT2	40	40	20				100
CAT3	40	60					100
ESE	40	40	20				100

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

20BCE08 - UNIX AND SHELL PROGRAMMING

Programme & Branch	B.Sc - Computer Systems and Design	Sem.	Category	L	T	P	Credit
Prerequisites	Operating Systems	6	PE	3	0	0	3

Preamble	To impart the knowledge in basic concepts of Unix Operating System, File organization, Process Management and writing shell scripts in Unix.	
UNIT - I	**Introduction to Unix:**	**9**
Brief History – Salient Features - Components – Kernel - Shell - File System - Using Unix - Shell Prompt - Commands in Unix - Types of Unix Commands - Basic Commands – Getting Help – The manual and the man Command - The info Utility - Command Substitution – Giving Multiple Commands – Aliases.		
UNIT - II	**File Organization, Attributes and Permissions:**	**9**
File organization - Unix files – Categories of files – Hidden files – File system – Path Names – Home Directory Commands – Dot (.) and (..) - File names – File commands – Displaying and Printing Files – Comparing Files - File Attributes and Permissions: File Ownership – Attributes – ls, file, chmod, chown, chgrp, umask Commands.		
UNIT- III	**Standard I/O, Redirection Pipes, Filters and Vi Editor:**	**9**
Standard I/O – Redirection – Pipes and Pipeline – Mixing input – Filter – tee command – Terminal and Trash Files – Database File – Handling Columns and Fields - sort, uniq, tr Commands - The Vi editor: Editing – Moving Cursor - Copying and Moving Text – Pattern Searching – Repeating the Last Editor Command – Undoing Commands – Joining and Writing Lines – Using shell from Vi – Configuring Vi Environment.		
UNIT- IV	**Regular Expressions and Process:**	**9**
Regular Expressions – grep, egrep, fgrep Commands – Stream Editor - The Process: Meaning – Parent and Child Processes – Types – Foreground and Background – Internal and External Commands – ps Command – Process Creation – nohub, nice, time, signals, trap, stty, kill, wait Commands – Job Control – Command History – Scheduling Job Execution.		
UNIT- V	**Shell Programming:**	**9**
Shell Variables – export Command - .profile File – read Command – Positioning Parameters - $ Variables – set, exit Commands – Branching and Control – Loop Control – continue and break Statements – expr Command – Real Arithmetic – here Document – sleep Command – Debugging Scripts – script, eval, exec Commands.		

Total:45

TEXT BOOK:

1. Venkateshmurthy M.G., "Introduction to UNIX & SHELL programming", 1st Edition, Pearson Education, 2015.

REFERENCES:

1. Patrick H. Wood and Stephen G. Kochan, "Shell Programming in Unix, Linux and OS X", 4th Edition, Pearson Education, USA, 2016.
2. Sumitabha Das, "Unix Concepts and Applications", 4th Edition, McGraw Hill Higher Education, India, 2017.

	COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline Unix system structure and introduce basic commands	Understanding (K2)
CO2	examine Unix file organization, attributes and permissions	Understanding (K2)
CO3	inspect standard I/O, redirection pipes, filters and Vi editor	Applying (K3)
CO4	construct regular expressions and illustrate process types	Applying (K3)
CO5	writing and executing shell programs	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	3	2	1	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'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	50	20				100
CAT3	30	40	30				100
ESE	20	40	40				100

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

20BCE09 BLOCKCHAIN TECHNOLOGIES

Programme & Branch	B.Sc - Computer Systems and Design, Information Systems 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 Transactions-Ledger-Concept of trustless system-General elements of blockchain-Types of blockchain-Byzantine generals problem- Components and structure of blockchain: blocks – chain – hashing – digital signatures– 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 – Why bitcoin – 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 – 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.		
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-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 Virtual Machine.	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- 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	70					100
ESE	40	40	20				100

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

SEMESTER VI - ELECTIVE IV

20BCE10 – BIG DATA ANALYTICS

Programme& Branch	B.Sc – Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	DATABASE MANAGEMENT SYSTEMS	6	PE	3	0	0	3

Preamble	This course imparts the knowledge about Big Data, develop 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.		

Total: 45

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	30	70					100
CAT2	30	70					100
CAT3	10	50	40				100
ESE	20	50	30				100

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

20BCE11 - MULTICORE ARCHITECTURE

Programme& Branch	B.Sc- Computer Systems and Design	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Organization	6	PE	3	0	0	3

Preamble	To impart knowledge on multi-core processors and its architecture along with the challenges in parallel and multi-threaded programming.	
UNIT -I	**Fundamentals of Quantitative Design and Analysis:**	**9**
Classes of Computers – Trends in Technology, Power and Energy in Integrated Circuits – Trends in Cost – Dependability – Measuring, Reporting and Summarizing Performance – Quantitative Principles of Computer Design- Fallacies and Pitfalls.		
UNIT -II	**Instruction Level Parallelism:**	**9**
Concepts and Challenges – Basic Compiler Techniques for Exposing ILP – Reducing Branch Costs with Advanced Branch Prediction – Overcoming Data Hazards with Dynamic Scheduling – Dynamic Scheduling: Examples and Algorithms – Hardware-Based Speculation.		
UNIT -III	**DLP in Vector, SIMD and GPU Architectures:**	**9**
Vector Architecture – Vector Execution Time - SIMD Instruction Set Extensions for Multimedia – Graphics Processing Units – Comparisons of Vector Architectures and GPUs - Detecting and Enhancing Loop Level Parallelism – Cross-Cutting Issues.		
UNIT -IV	**TLP and Multiprocessors:**	**9**
Centralized Shared Memory Architectures – Performance of Symmetric Shared Memory Multiprocessors - Distributed Shared Memory and Directory-Based Coherence – Synchronization: The Basics – Models of Memory Consistency – Case studies.		
UNIT- V	**RLP and DLP in Warehouse Scale Architectures:**	**9**
Programming Models and Workloads for Warehouse Scale Computers – Architecture for Warehouse Scale computers – Physical Infrastructure and Costs – Cloud Computing: The Return of Utility Computing.		

Total:45

TEXT BOOK:

1. John L. Hennessy, David A. Patterson, “Computer Architecture – A Quantitative Approach”, 6th Edition, Morgan Kaufmann Publishers, Elsevier, 2019.

REFERENCES:

1. Michael J. Quinn, “Parallel Programming in C with MPI and OpenMP”, 1st Edition, McGraw-Hill Education, 2017.
2. William Stallings, “Computer Organization and Architecture”, 10th Edition, Pearson Education of India, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret the formulae for energy, static power, dynamic power and integrated circuit	Understanding (K2)
CO2	outline the limitations of ILP and the need for multicore architecture	Understanding (K2)
CO3	identify the vector architectures with multimedia SIMD instruction set	Applying (K3)
CO4	implement the principles of symmetric and distributed-memory architectures to applications	Applying (K3)
CO5	summarize the working efficiency of various warehouse-scale computers	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	2	1											1	3
CO3	3	2	1	1									2	3
CO4	3	2	1	1									2	3
CO5	2	1											2	3

1–Slight,2–Moderate, 3–Substantial, BT- BloomsTaxonomy

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	30	50	20				100
CAT3	30	50	20				100
ESE	40	40	20				100

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

20BCE12–SOFTWARE PROJECT MANAGEMENT

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 – 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-Project Termination 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 Model – Stress – 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, 2018.

REFERENCES:

1	Roger S Pressman, “Software Engineering- A practitioners Approach”, 8th Edition, McGraw-Hill, New York, 2019.
2	Gray Clifford F. and Larson Erik W., “Project Management, the Managerial Process”, 7th Edition, McGraw- Hill, New Delhi, 2017.

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 project monitoring and control	Understanding (K2)
CO4	acquire knowledge on project and activity planning	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(K 3)%	Analyzing(K 4)%	Evaluating(K 5)%	Creating(K 6)%	Total %
CAT1	30	30	40				100
CAT2	30	40	30				100
CAT3	20	50	30				100
ESE	30	40	30				100

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