

Academic Regulations

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Undergraduate Programs



GMR Institute of Technology
Rajam 532 127, AP
Accredited by NAAC & NBA
www.gmr.it.edu.in

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The Vision of GMRIT

- ❖ To be among the most preferred institutions for engineering and technological education in the country
- ❖ An institution that will bring out the best from its students, faculty and staff – to learn, to achieve, to compete and to grow – among the very best
- ❖ An institution where ethics, excellence and excitement will be the work religion, while research, innovation and impact, the work culture

The Mission of GMRIT

- ❖ To turnout disciplined and competent engineers with sound work and life ethics
- ❖ To implement outcome based education in an IT-enabled environment
- ❖ To encourage all-round rigor and instill a spirit of enquiry and critical thinking among students, faculty and staff
- ❖ To develop teaching, research and consulting environment in collaboration with industry and other institutions

Academic Regulations for B. Tech. Program

(For all the candidates admitted from the Academic Year 2023 onwards)

1. Eligibility for Admission

The total seats available as per the approved intake are grouped into two categories viz. category A and Category B with a ratio of 70:30 as per the state government guidelines

- a. The admissions for category A and B seats shall be as per the guidelines of Andhra Pradesh State Council for Higher Education (APSCHE) in consonance with government reservation policy
- b. Admission eligibility-Under Lateral Entry Scheme

Students with diploma qualifications have an option of direct admission into 2nd year B. Tech. (Lateral entry scheme). Under this scheme 10% seats of sanctioned intake will be available in each course as supernumerary seats. Admissions to this three-year B Tech later entry Programme will be through APECET. The maximum period to complete B. Tech. under lateral entry scheme is six consecutive academic years from the date of joining

2. Duration of the Programme

The course duration for the award of the Degree in **Bachelor of Technology** will be four academic years, with two semesters in each year. However, if a student is unable to complete the course within 4 years, he/she can do so by giving more attempts but within 8 consecutive academic years from the date of admission.

2.1 Academic Calendar

For all the eight semesters a common academic calendar shall be followed in each semester by having sixteen weeks of instruction, one week for the conduct of practical exams and with three weeks for theory examinations and evaluation. Dates for registration, sessional and end semester examinations shall be notified in the academic calendar of every semester. The schedule for the conduct of all the curricular, co-curricular and extra-curricular activities shall be notified in the semester planner.

3. Award of the Degree

A student will be declared eligible for the award of B. Tech. degree if he/she fulfills the following:

1. Pursues a course of study in not less than four and not more than eight academic years
2. After eight academic years from the year of their admission, he/she shall forfeit their seat in B. Tech. course and their admission stands cancelled
3. Registers for 160 credits and must secure all the **160** credits
4. A student shall be eligible for the award of B.Tech degree with Honours or Minors if he/she earns 20 credits in addition to the 160 credits
5. A student shall be permitted to register for Honors or Minors and not for both.

4. Branches of Study

B. Tech. Programmes

1. Civil Engineering (CE)
2. Computer Science and Engineering (CSE)
3. CSE (Artificial Intelligence & Data Science)
4. CSE (Artificial Intelligence & Machine Learning)
5. Electrical and Electronics Engineering (EEE)
6. Electronics and Communication Engineering (ECE)
7. Information Technology (IT)
8. Mechanical Engineering (ME)

5. Program Structure & Curriculum Framework

The curriculum of B.Tech. program has different categories of courses. For a total of 160 credits the indicative credit distribution among these categories is listed in table below for all the programs.

No.	Categories of Courses	Credits
1	Basic Science & Humanities	26
2	Engineering Science	25
3	Professional Core	37.5
4	Professional Core Electives	12
5	Open Electives	11
6	Skill Oriented	30.5
7	Internships and Project	18
8	Audit Courses	Non-Credit

The curriculum and its structure is designed based on the philosophy of Outcome Based Education with a composition of courses spread out in the various categories listed above and syllabi is prescribed by the respective Boards of Studies from time to time. The students have an option of taking nine electives based on their interest/career path spanned across 5th to 8th semesters from the list of electives prescribed in the curriculum. Under Choice Based Credit System (CBCS) the students also have the flexibility to choose one elective from the list of open electives offered by the other programs of study in consultation with their respective department. The following are some of the distinct courses that are being offered in the curriculum.

- a. **Skill Oriented Courses:** Skill Oriented Courses are offered in the form of Integrated courses that are exclusively designed to provide a unique learning experience of layered learning where in the students have the chances to practice while learning. These courses are designed by blending both theory and laboratory components one over the other.
- b. **Mini project:** The curriculum offers Mini Project for the students during 6th semester. They will be divided into batches and the report will be evaluated by a committee as nominated by CoE constituted with internal and external members.
- c. **Term paper:** The term paper is a self-study report with an objective enhancing the students' written technical-communication and shall be carried out in 5th semester. Every student will take up this either individually or as a batch of a maximum of four members and submit a report. The scope of the term paper could be an exhaustive literature review choosing any engineering concept with reference to standard research papers or an extension of the concept of earlier course work in consultation with the term paper supervisor. The report will be evaluated by a committee nominated by HoD with the approval of the Controller of Examinations (CoE).
- d. **Project work:** Project work shall be carried out during the 7th or 8th semester. Students shall take up the capstone project at the industries along with the full semester internship (FSI) in the same industry. However, students should take prior permission if he/she is interested to take up both the above said courses and shall submit separate report. Projects shall be taken up either as a team or as an individual.

Internal evaluation will be done by the Project Review Committee (PRC), comprising of HOD and two senior members of faculty along with the project supervisor. Semester end evaluation will be done by Project Evaluation Committee (PEC) comprising of three members including HOD, project guide and an external examiner nominated by the office of the CoE.

- e. **Audit courses:** Audit courses are those courses which do not carry any credits and are not accounted for the calculation of CGPA. Students shall take three audit courses in the beginning of **3rd semester** and shall complete those courses in self-study mode. One of the audit courses will be by the choice of the students from the list of the courses notified at the beginning of the third semester. The second and third audit course is common to all the students and is viz. “Environmental Studies” and “Professional Ethics and Human values”. All the students (regular and lateral entry students) shall complete the audit course before the announcement of 6th semester results by taking all the chances provided along with the regular/supplementary examinations scheduled. Multiple attempts to clear the audit courses before the 6th semester will not affect the eligibility for the award of distinction. The results will be indicated with “Satisfactory” (40% of the total marks) or “Not Satisfactory” performance and will be reflected in the 6th Semester Grade Memo.
- f. **MOOCs and Self-Study Courses:** Massive Open Online Courses (MOOCs) are free online courses available for anyone to enroll. MOOCs provide an affordable and flexible way to learn new skills in self-learning mode. The Curriculum provides adequate flexibility for the students to take up MOOCs through self-study mode enabling them to learn the courses on independent mode with minimal guidance of faculty mentor to earn credits for the award of the degree B. Tech. (Regular) and B. Tech. (Honours) and B. Tech. (Minors). Elective Courses are offered in two modes

1) Self Learning through MOOCs. 2) Direct Teaching as like Regular Courses

If the students opted for Elective Courses through NPTEL/SWAYAM: Each BoS, for its UG program, shall approve a list of around 2 to 15 (number as per their suitability) courses with minimum 8-weeks (45 Hours) duration and shall be announced in the beginning of the 3rd semester. These courses shall be offered as an alternative to “Elective Courses” of the respective branch offered in any semester from 5th to 8th semesters. Courses offered through NPTEL should not have similar or overlapping contents vis-à-vis the core subjects offered in the department in any of the semesters. Students opted for Elective Courses in self-learning mode (NPTEL/SWAYAM /MOOCs) need not attend the regular classes in the respective subject.

Students opting for Elective Courses through NPTEL/SWAYAM, shall submit the certificate before the beginning of the respective offering semester for the award of credits equal to Elective Courses. The conversion from percentage of marks given by NPTEL to the corresponding grades shall be similar to regular courses. If the student fails to submit the NPTEL certificate, he/she will have an option to choose either “self-learning through MOOCs with proctored assessment” or “a regular Elective Course”.

The evaluation and assessment pattern for such courses which are part of the curriculum for the B. Tech. (Regular) Degree shall be carried out as similar to other regular theory courses. However, for B. Tech. (Honours) and B. Tech. (Minors) the grade/marks offered by the NPTEL-SWAYAM is considered for the calculation of grade point.

g. Summer Internships (I and II)

Summer Internship-I: As a part of curriculum in all UG programmes, it is mandatory for all students to undergo summer internship-I at industries (core or allied) / R & D organization to get practical insight of their subject domain or community engagement during summer break after the 4th semester. This summer internship programme shall be for a period of 6 weeks duration and the assessment shall be carried out during the 5th semester and the credits will be reflected along with grade point in the 5th semester Grade memo.

If any student is unable to take up summer internship-1 in the physical mode due to any functional challenges, the respective BoS may suggest substitute online courses (MOOCS)/Online internship as approved by AICTE.

Further, in case of students who could not successfully complete the allotted Summer Internship-I in the specified duration, he/she will be given substitute online courses (MOOCs)/Online internship as suggested by BoS chairman and schedule notified by the CoE and will be treated as second attempt.

Summer Internship-II: Will be deployed in the form of skill bridge training for a duration of 6 weeks during summer break after the 6th semester, wherein the students will be trained on Problem Solving and Computer Coding Skills to enhance the employability skills. The assessment shall be carried out during the 7th semester and the credits will be reflected along with grade point in the 7th semester Grade memo.

In case students fail to attend the Summer Internship-II regularly and could not secure the required percentage of attendance he/she will be allowed to take the assessment only after attending the make-up classes and will be treated as second attempt.

h. Co-Curricular and Extra Curricular (ECA & CCA) Activities:

Students shall acquire 1 credit in 1st & 2nd semesters at 0.5 credit per semester based on the various activities conducted on Health & Wellness, Yoga & Sports, NSS & NCC and Community Service. Assessment will be based on the level of participation/performance of the students in the various activities.

- i. Employability Skills:** It is mandatory for all students to take a course on Employability Skills from 3rd Semester to 6th Semester. The Employability Skills are covered under three broad streams viz. **Aptitude Skills, Soft Skills and Domain Specific Knowledge**. The credits earned through these courses will be indicated in the grade memos of 4th and 6th semester and will be taken into account for CGPA calculation. The End semester assessment for all the four semesters will be done independently by an internal examiner(s) nominated by CoE.

- j. Industry Driven One Credit Courses (IDC):** Meeting with the industry requirements/research organizations as well as to reduce the gap between industry-academia-research organizations, the one credit (15 hours.) course has been introduced. The credits earned through these courses will be indicated in the grade memo over and above the graduation requirements and will not be considered for CGPA calculation.

k. Full Semester Internship (FSI):

Students shall undergo mandatory FSI either in India or abroad at industries/R&D Institutions/Premier Institutions during 7th or 8th semester to get practical insights relevant to their core branch of engineering or in allied branches of study under the guidance of expert members from the institution and at industries.

All the students shall register their choice of interest either in 7th or 8th semester for FSI in the beginning of 6th semester with Career Development Cell. However, the Institute shall allow the students to pursue FSI during the 7th semester or 8th semesters based on the availability of the opportunities.

The students opting for FSI bundle (FSI plus two theory courses) in 7th or 8th semesters shall take up the respective bundled theory courses offered on self-study mode during the internship period. Students opting for Project work bundle (Project work plus Three theory courses) during the 7th or 8th semester shall take up the respective theory courses in offline mode.

However, the self-study courses offered for FSI bundle will be supplemented by delivering the course either by ONLINE or OFFLINE. Attendance for these classes is not mandatory.

FSI bundle completed in 7th semester and got PPO in the 8th semester. (Double FSI):

If the students completed FSI bundle in 7th semester and got preplacement offer (PPO) before the beginning of the 8th semester shall be allowed to pursue FSI in the industry where he/she got PPO. Work carried out at Industry during the 8th semester can be submitted as Project Work report. Respective theory class teachers will conduct the classes for the three theory courses in virtual mode and attendance is mandatory. Students need to maintain a minimum of 75% attendance (Attendance for three theory courses (ONLINE) and FSI attendance at Industry put together). However, 10 % of attendance is condoned on medical grounds.

If the student/s got preplacement offer (PPO) after the commencement of 8th semester classwork shall also be allowed to pursue FSI during the balance period in the industry where he/she got PPO. The respective supervisor for project work will continue as Internal supervisor for the FSI. Project work carried out on the campus and work carried out in Industry shall be presented to the Project Review Committee periodically (PRC) and upon ratification from PRC he/she will be allowed for assessment of Project Work.

Respective teacher/s will conduct the classes for the three theory courses in virtual mode for the balance period. Students need to maintain a minimum of 75% attendance (Attendance for three theory courses (ONLINE and OFFLINE), Project work and FSI attendance at Industry put together). However, 10 % of attendance is condoned on medical grounds. However, students must attend to all the continuous assessment and end semester assessment along with all other students to fulfill the academic requirements.

Change of FSI industry in 8th semester due to PPO after commencement:

Students pursuing FSI in 8th semester at Industry and got preplacement offer (PPO) at other industry after the commencement of 8th semester shall also be allowed to relocate

to the industry where he/she got PPO. The same FSI supervisor will continue to review the performance of the students in the second industry. Work carried out in the first Industry and work carried out in PPO-Industry shall be presented to the Project Review Committee periodically (PRC) and upon ratification from PRC he/she will be allowed for assessment. Students need to maintain a minimum of 90% attendance at FSI (Sum of attendance in first Industry and at PPO Industry) However, 15% of attendance is condoned on medical grounds.

In the above cases the students shall attend to all the continuous assessments and end semester assessment along with all other students to fulfill the academic requirements.

If the student is unable to continue FSI for sixteen weeks in the allotted industry and wishes to move to another industry for continuing FSI, he/she will be allowed with prior approval from the principal. In all such cases all the above guidelines need to be followed.

Permission for double FSI and Moving from one Industry to another industry during FSI with above said reasons shall be availed only once.

In case of those students who could not appear/fail in the semester end assessment for FSI, he/she will be given chance to appear during the immediate supplementary exam conducted and will be treated as second attempt.

I. Career Path Electives (CPE):

- The curriculum provides opportunities to the students to gain expertise in the emerging technologies in the form of Career path with expertise by offering elective courses in a sequential mode from 5th semester onwards. The students can choose any one of these career paths during the 5th semester and shall continue in the same career path by selecting specific electives in the 6th and 7th semesters in a sequence and finally leading to a Capstone project aligning with the career path in the 7th /8th semester.
- All the students who successfully complete the elective course aligned as per the CPE will have their Consolidated Grade Memos mentioning the title of the career path. Further, they will also receive a certificate/citation issued by the college.
- After choosing CPE during 5th semester and if any student fails to take up the specific elective courses as per the sequence in the subsequent semesters and select the electives from the general pool of electives, the student will be automatically gets out of the CPE.
- All those students who don't take up the Capstone project in the CPE domain will also get out the CPE
- In case of the students who are going for FSI/SAP in 7th semester shall take the respective elective course on self-study mode and further, complete the Capstone project in the 8th semester on campus
- In case of the students who are going for FSI in 8th semester shall take the respective elective course on self-study mode and further, complete the Capstone project in the 7th semester itself
- In case of the students going for FSI as a preplacement offer during 8th semester, he/she shall take up the elective courses on self-study mode and complete the Capstone project in the industry.
- The assessment pattern pertaining to the career path courses will be similar to those of other theory and integrated courses.
- The students who are not interested in any of these career paths can choose any of the other core electives as furnished in the respective list of the electives in the curriculum

5.1. Basis for Credit Allotment for Courses Offered

No	Course	L	T	P	Credits
1	Theory Course (Regular)	1	0	0	1.0
2	Integrated Course (Theory +Lab)	1	0	1	1+0.5
3	Laboratory/Drawing Course	0	0	1	0.5
4	Elective Courses	1	0	0	1
5	Elective Courses (Integrated)	1	0	1	1+0.5
6	Term Paper	0	0	1	0.5
7	Mini Project	0	0	1	0.5
8	Project work	0	0	1	0.5
9	ECA and CCA	0	0	1	0.5
10	Employability Skills (ES)	0	0	1	0.5
11	Audit /Mandatory Courses	0	0	0	0
12	Theory Course (Honours/Minors)	1	0	0	1
13	MOOCs/ Industry Driven courses /Self Study (For every 15hrs of Duration)				1
14	Summer Internship (6 Weeks: Offline/Online)				1
15	Full Semester Internship (16 Weeks)				8

5.2. Semester-wise Curriculum Structure**Course Pattern for Four Year Regular and Three-Year Lateral Entry Programme**

Sem.	No. of Theory Courses	No. of Lab Courses, Internship, Term Paper, Project	Total Credits (4-Year)	Total Credits (3-Year Lateral Entry)
I	5 Theory /5 Theory	4 Labs/4Labs+ECA+CCA	20/20	-
II	5 Theory/ 5 Theory	4Labs+ECA +CCA /4Labs	20/20	-
III	6 (4 Theory + 2 Integrated)	2 Labs + Employability Skills - I	23	23
IV	5 (4 Theory + 1 Integrated)	2 Labs + Employability Skills - I	21	21
V	6 (2 Theory + 2 Integrated + 1 Professional Elective +1 Open Elective)	1 Lab + Term Paper + Employability Skills-II + Summer Internship -I	24	24
VI	8 (3 Theory + 1 Professional Integrated Elective +1 Open Elective + 3Audit Course)	1 Lab + Mini Project + Employability Skills -II	21	21
VII	3 (2 Professional Elective + 1 Open Elective)/ 2 (1 Professional Elective + 1 Open Elective)	Project/FSI + Summer Internship-II	18/14	18/14
VIII	2 (1 Professional Elective + 1 Open Elective)/ 3 (2 Professional Elective + 1 Open Elective)	FSI/ (Project)	12/18	12/18
Total Credits			160	120

The credit requirement for three-year programme i.e. students admitted through lateral entry will be as per the sum of credits from third semester through eighth semester as above i.e. 120.

5.3 Credit Break-up for Various Category of Courses

For Four Year/Three Year Regular Programme

S. No.	Category	Total No. of Credits and Courses					
		Four Years			Three-Year Lateral Entry		
		Credits	Courses	Total Credits	Credits	Courses	Total Credits
1	Theory courses	3/2	22/1(23)	68	3	13	39
2	Integrated course	4	5	20	4	5	20
3	Laboratory course	1.5/1	10/4(14)	19	1.5	6	9
4	Professional elective	3/4	4/1 (5)	16	3/4	4/1 (5)	16
5	Open Elective	3/2	3/1(4)	11	3/2	3/1(4)	11
6	Employability Skills	2	2	4	2	2	4
7	CCEC Activities (ECA & CCA)	0.5	2	1	-	-	-
8	Internship (Summer Internship/FSI)	1/8	2/1 (3)	10	1/8	2/1 (3)	10
9	Term paper	1.5	1	1.5	1.5	1	1.5
10	Mini Project	1.5	1	1.5	1.5	1	1.5
11	Project	8	1	8	8	1	8
Total		-	61	160	-	41	120

5.4 Division of Marks for Continuous and Semester End Assessment

Course	Marks for Continuous Assessment	Marks for Semester end Assessment
Theory	30	70
Integrated Course	40 (30T+10L)	90 (70T+20L)
Drawing Courses	30	70
Laboratory	30	70
Term Paper	30	70
Audit Courses	--	50
Mini Project	30	70
Industry Driven Courses	--	25
ECA and CCA	--	100
Employability Skills (AS+SS+DSS)	20+20+20	30+30+30
Summer Internship (I & II)	--	50
Full semester Internship	100	100
Project Work	100	100

A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. In case of a Audit/mandatory course, he/she should secure 40% of the total marks.

6. Evaluation Methodology

- The assessment will be based on the performance in the semester-end examinations and /or continuous assessment, carrying marks as specified
- At the end of each semester, final examinations will normally be conducted during October/November and during April / May of each year. Supplementary examinations shall be conducted as per the schedule announced
- Continuous Assessment Marks will be awarded based on Continuous Evaluation made during the semester as per the scheme
- The letter grade and the grade points are awarded based on the absolute grading system having earned grades based on the marks scored. Grading is done based on the percentage of marks secured by a candidate in individual course (Theory & Laboratory) as detailed below:

Range of Percentage of Marks -Theory	Qualitative Meaning	Letter Grade	Grade Point
90 to 100	Superior	S	10
80 to 89	Excellent	A	9
70 to 79	Very Good	B	8
60 to 69	Good	C	7
50 to 59	Average	D	6
40 to 49	Pass	E	5
< 40	Fail	F	0
	Absent	AB	0

- After completion of the programme, the Cumulative Grade Point Average (CGPA) from the I Semester to VIII Semester (from III to VIII semester for lateral entry) is calculated using the formula:

$$CGPA = \frac{\sum_{i=1}^n (c_i \times g_i)}{\sum_{i=1}^n c_i}$$

Where n is the number of courses registered for, 'c_i' is the credits allotted to the given course and 'g_i' is the grade point secured in the corresponding course

- In view that grading system is adopted for the award of the grade points in each of courses, for the benefit of the students and other stakeholders who wish to have an equivalence for the CGPA secured for the graduation, the following empirical relation is provided.
Equivalent Percentage: (CGPA-0.5) x 10

7.1 Continuous Assessment Pattern for all courses

a. Theory Course:

Out of 30 marks allotted for continuous assessment 20 marks will be awarded based on two tests (Each test will be conducted for 40 marks and scale down to 20 marks) conducted and 10 marks shall be awarded based on Open book examination/ Assignment test enabling to assess Higher Order Thinking skills (HOT)

For finalization of the 20 marks, 80 % of marks secured in 1st best internal tests and 20% marks secured in 2nd best internal test will be considered.

The duration of each internal test will be 90 minutes addressing predominantly on lower order thinking skills and shall cover two units of syllabus in each test.

All the students will be notified with the marks secured within one week after the completion of the sessional exams.

Students are permitted for reconciliation within a period of two working days after the notification of marks.

The evaluation methodology of Design and Drawing courses coming under theory will be given in their respective course handouts which will be approved by the respective chairperson of the BoS.

Open book Examination is an assessment process providing the students a realistic environment to assess the higher order learning/thinking skills with the questions that mimic professional ability to demonstrate Creating, analyzing, and evaluating skills. Open Book Examination carries 1/3rd weightage in the continuous assessment and the exam will be conducted for 30 marks at the end of every semester and will be scaled down to 10 marks. The duration of each test will be 120 minutes predominantly focusing on Higher Order Thinking Skills. In case the course has limited scope of HOTs, the assessment shall be carried out with LOTs. In this assessment, the students are allowed to use any printed and handwritten material of their choice.

In the case of the course that has limited scope for Open Book Examinations, Assignment Test is preferred. However, BoS chairmen shall ensure that OBE system is followed for a min of 50% of the courses in each of the semesters.

For the conduct of assignment test Eighteen questions will be given one week in advance to the students. These eighteen questions shall address all the six COs at three questions for each CO. Further, the question preferably shall be from Old GATE/IES question papers, and each question carries 5Marks. The question paper shall not have any choice and the students need to answer all Six questions covering all the six COs. The marks secured will be scaled down to 10 Marks.

b. Laboratory Course:

30 marks are awarded for continuous assessment and following is the pattern for the award of 30 marks.

- Preparation, Observation & Result : 05 Marks
- Record : 05 Marks
- Viva – Voce : 05 Marks
- Internal Test : 15 Marks

c. Integrated Course (Theory Component +Lab Component):

40 marks are allotted for continuous assessment as given below

Theory part:

30 marks will be awarded based on two tests conducted similar to theory. Each Test will be conducted for 40 marks and scale down to 30 marks. 80 % of marks secured in 1st best internal test and 20% marks secured in 2nd best internal test for the final award of the marks

Laboratory Part:

10 marks are awarded for continuous assessment and following is the pattern for the award of 10 marks

- Preparation, Observation & Result and Record : 05 Marks
- Internal Test : 05 Marks

d. Engineering graphics

30 marks are awarded for continuous assessment and following is the pattern for the award of 30 marks.

- Day-to-day assessment of drawing sheets :15 marks
- Internal test* :15 marks

Out of 15 marks allotted for internal tests, there shall be two internal tests for 15 marks each. 80 % of marks secured in 1st best test and 20% marks secured in 2nd best test will be considered for the award of 15 marks.

e. Term Paper:

30 marks are awarded for continuous assessment and following is the pattern for the award of 30 marks.

- Literature Survey : 05 Marks
- Review 1 : 05 Marks
- Review 2 : 05 Marks
- Publication/Presentation of paper: 05 Marks
- Presentation : 10 Marks

f. Mini Project:

30 marks are awarded for continuous assessment and following is the pattern for the award of 30 marks.

- Review 1 : 10 Marks
- Review 2 : 10 Marks
- Final Presentation : 10 Marks

g. Project Work:

100 marks are awarded for continuous assessment and following is the pattern for the award of 100 marks.

- Innovativeness of the Project : 05 Marks
- Literature Survey : 10 Marks
- Experimentation / Simulation : 15 Marks
- Result Analysis : 05 Marks
- Review 1 : 10 Marks
- Review 2 : 10 Marks
- Product development : 25 Marks
- Publication/Presentation of Paper: 05 Marks
- Final Presentation : 05 Marks
- Project Report : 10 Marks

h. Full Semester Internship:

100 marks are awarded for continuous assessment and following is the pattern for the award of 100 marks.

- Internship Progress Report : 10 Marks
- On Site Assessment : 15 Marks
- Assessment by Industry : 50 Marks (Intern Assessment Tool)
- Final Assessment on Campus : 25 Marks

i. Employability Skills:

Students shall take this course during from 3rd – 6th semesters and will have three components 1) Aptitude Skills AS 2) Soft Skills_SS and 3) Domain Specific Skills_DSS having equal weightage. The course content for AS and SS will be common for all the programs whereas the course content for DSS will be program specific and shall be notified before the commencement of every semester based on the demand and need.

The students will be assessed in all the three components in each of the semesters with equal weightage. For the two components AS & DSS the students are assessed based on the marks secured in continuous assessment. For SS, the students are assessed based on the performance in various activities. A minimum of 16 periods shall be allotted for each stream per semester.

Assessment for Aptitude Skills

For continuous assessment, tests will be conducted along with midterm examinations. 20 marks will be awarded by taking into account 80% of marks secured in 1st best assessment test and 20% marks secured in 2nd best assessment test

Assessment of Soft Skills

Minimum of six activities are conducted for SS training in a semester. Assessment for Soft Skills is done based on the participation and performance of the students under different SS activities. Students are expected to perform in at least four activities to get qualified in each semester out of six activities.

Under continuous assessment, the students will be assessed for the four activities based on this performance for 20M.

Assessment of Domain Specific Skills

The Domain specific skill training will be preferably a training program on branch specific Application Software tool. For continuous assessment, tests will be conducted along with midterm examinations. 20 marks will be evaluated by taking into account 80% of marks secured in 1st best assessment test and 20% marks secured in 2nd best assessment test.

The sum of the marks scored in all the three components put together is considered as a continuous assessment of the Employability course.

7.2 Semester End Assessment

After the completion of the course work as per the academic calendar, semester assessment will be done for all courses as per the curriculum. A common schedule will be notified by the controller of examinations for all the semester end examinations. All the students who fulfill the attendance requirements shall be eligible to appear for the semester end examinations.

All the students who could not clear the semester end examinations for those courses that carry credits will be given an opportunity to appear for the supplementary examinations conducted subsequently.

a. Theory Course:

For all the theory courses students shall appear for subjective examination of three hours duration and the assessment will be done for Max of 70 Marks. Students shall score a min of 25 marks **(35% of 70 marks rounded off to higher integer)** and score a min of 40 marks (40% of 100 Marks) in continuous and end semester assessment both put together to clear the course and acquire the credits.

b. Laboratory Course

Students are assessed for a Max of 70 marks during the semester end assessment and the assessment will be done by an internal and external examiner appointed by CoE.

- Procedure : 20 marks
- Experimental work & Results : 30 marks
- Viva voce : 20 marks.

Students shall score min of 25 marks (35% of 70 marks) and score a min of 40 marks (40% of 100 marks) in continuous and end semester assessment both put together to clear the course and acquire the credits.

c. Integrated Course**Theory part:**

For the theory part students shall appear for a subjective examination of three hours duration and the assessment will be done for Max of 70 Marks.

Laboratory Part:

For the Laboratory part students shall appear for the examination of three hours duration and the assessment will be done for Max of 20 Marks.

Students shall score a min of 25 marks (35% of 70 marks) in the theory part and a min of 7 marks (35% of 20 marks) in the semester end examination. However, the students shall score a min of 52 marks (40% of 130 marks) in total both semester end and continuous assessment put together.

In case the students fails to secure min of 35% marks in the semester end theory part and lab part, he/she shall appear for both theory and lab supplementary examinations.

d. Engineering Graphics:

Students are assessed for a Max of 70 marks during the semester end assessment and the assessment will be done along with theory examination as per the schedule. Students shall score min of 25 marks (35 % of 70 marks) and score a min of 40 marks (40% of 100 marks) in continuous and end semester assessment both put together to clear the course.

e. Term Paper:

Students are assessed for a Max of 70 marks during the semester end assessment and the assessment will be done by an internal and external examiner appointed by CoE. Students shall score min of 25 marks (35% of 70 marks) and score a min of 40 Marks (40% of 100Marks) in continuous and end semester assessment both put together to clear the course and acquire the credits.

f. Audit Courses:

Students are assessed for a Max of 50 marks by an MCQ test conducted on Moodles platform and score a min of 20 Marks (40% of 50 marks) to clear the course. The assessment will be conducted along with semester end examinations from 3rd semester onwards for both the opted and common audit courses. The students shall clear the course by the end of 6th semester.

g. Mini Project:

Students are assessed for a Max of 70 marks during the semester end assessment and the assessment will be done by an internal and external examiner appointed by CoE. Students shall score min of 25 marks (35% of 70 marks) and score a min of 40 Marks (40% of 100Marks) in continuous and end semester assessment both put together to clear the course and acquire the credits.

h. Project Work:

Students are assessed for a Max of 100 marks during the semester end assessment and the assessment will be done by the project evaluation committee appointed by the Chief controller of examination. Assessment will be based on the project report submitted and presentation given by the project team.

Students shall score a min of 35 marks (35% of 100 Marks) in the end semester assessment and score a min of 80 marks (40% of 200 Marks) in continuous and end semester assessment both put together to clear the course and acquire the credits.

i. Full Semester Internship:

Students are assessed for a Max of 100 marks during the semester end assessment and the assessment will be done by evaluation committee appointed by Chief controller of examination. Assessment will be based on the internship report submitted and presentation given by the students.

Students shall score a min of 35 marks (35% of 100 Marks) in the end semester assessment and score a min of 80 marks (40% of 200 Marks) in continuous and end semester assessment both put together to clear the course and acquire the credits

j. Summer Internship

In Summer internship I & II Students are assessed for a maximum of 50 marks during the 5th and 7th semesters respectively and the assessment will be done by two examiners appointed by CoE. For both summer internships I & II, the students shall clear the assesment by securing min of 20 marks (40% of 50 Marks) and acquire credits. These credits will be reflected in 5th and 7th semester grade memos.

Summer Internship- I:

- Report : 25 Marks
- Oral Presentation : 25 Marks

In case of the students who have taken MOOCS/Online internship as a substitute to summer internship-I, the assessment will be based on the marks/Grade secured in the courses/Online Internship. In case the students fail to clear the summer internship-I, the student shall appear for the subsequent supplementary examinations

Summer Internship-II:

- Assessment1 (Cognitive MCQs): 20 Marks
- Assessment2 (Technical MCQs): 20 Marks
- Comprehensive Test (Cognitive& Technical- MCQs and Programs): 30 Marks

For finalization of the 50 marks, highest marks secured among the two assessments and Marks secured in the Comprehensive test will be considered. In case the students fail to clear the summer internship-II, the student shall appear for the subsequent supplementary examinations.

k. ECA &CCA (Health and Wellness, Yoga and Sports, NSS/NCC, Community Service):

Students are assessed for a Max of 100 marks. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

l. Employability Skills (ES):

The students will be assessed in all the three components i.e 1) Aptitude Skills-AS 2) Soft Skills-SS and 3) Domain Specific Skills-DSS at the end of 3rd, 4th, 5th and 6th semesters with equal score of 30 marks each. Assessment will be by an MCQ based question paper having 90 questions with equal weightage to the three components.

Students shall score a min 32 marks in the MCQ test **(35% of 90 marks rounded off to higher integer)** in the end semester assessment and score a min of 60 Marks (40% of 130 Marks) in continuous and end semester assessment both put together to clear the course.

The total marks secured by the student in both 3rd and 4th semesters will be scaled down to 100 marks for the calculation of the overall grade point and will be reflected in the 4th semester grade memo. Similarly, the grade point for the 5th and 6th semesters will be reflected in the 6th semester grade memo.

Student who fails to score a min of 32 marks (35% of 90 marks) in the semester end assessment and a min of 60 Marks (40% of 150 Marks) in continuous and semester end assessment both put together shall appear for the subsequent supply exams

8. Credit Transfer Policy for MOOCs

The curriculum shall allow up to a maximum of 20% of the total courses being offered in a particular programme i.e. maximum of 32 credits through MOOCs platform.

9. Attendance Requirements:

If his/ her academic progress and conduct have been satisfactory...

- a. It is desirable for a candidate to put on 100% attendance in all the subjects. However, a candidate shall be permitted to appear for the semester end examination by maintaining at least 75% of attendance on an average in all the courses in that semester put together.
- b. The shortage of attendance on medical grounds can be condoned to an extent of 10% provided a medical certificate is submitted to the Head of the Department when the candidate reports back to the classes immediately after the leave. Certificates submitted afterwards shall not be entertained. Upon the payment of the Condonation fee as fixed by the college, students who put on attendance between $\geq 65\%$ and $<75\%$ shall be permitted to appear for the semester end examinations. Attendance may also be condoned as per the State Government rules for those who participate in sports, co-curricular and extra-curricular activities provided their attendance is in the minimum prescribed limits for the purpose and recommended by the concerned authority.
- c. In case of the students having overall attendance less than 65% after condonation shall be declared detained and has to repeat semester again.
- d. During the Summer Internship -I, Summer internship-II and Full semester Internship it is required for the candidate to put on 90% of attendance. The shortage of attendance on medical grounds can be condoned to an extent of 15% and permitted to appear for the final assessment by maintaining at least 75% of attendance.
- e. If the candidate failed to maintain 75% of attendance during FSI he /she shall be declared detained and has to repeat FSI, however the student will be allowed to appear for semester end examinations of two self-study courses.
- f. If the candidate detained in FSI in the 8th semester, he/she will be allowed to repeat the FSI immediately after completing the 8th semester. If the candidate could not complete FSI in the 7th semester, he/she will be allowed to continue in the 8th semester course work and needs to repeat the FSI, with immediately after completing the 8th semester.
- g. For the students repeating the FSI, with regard to two self-study courses, student have an option of taking the continuous and end semester assessments together either in the regular slot or while repeating FSI.

- h. If the candidate failed to maintain 75% of attendance during Project Work bundle either in 7th or 8th semester, he/she shall repeat the same in the next year.
- i. In case of the student having less than 65% of attendance in any of the theory/lab courses/ECA & CCA activities/Employability skills during a particular semester and less than 75% in Summer Internship-I/Summer Internship-II, he/she will not be permitted to appear for the semester end examination in the that particular course.
- j. In all such cases, the students need to register for the makeup classes which will be notified by the CoE office at appropriate time. The students shall secure 90% of the attendance in the make-up classes to appear for the semester end assessment and will be treated as a second attempt. The number of makeup classes to be conducted will be at least 35% of the regular class work taken in a particular course.

10. Promotion Policies:

- a. In four-year, B. Tech. Programme, a student shall be promoted from 2nd year to 3rd year only if he/she fulfils the academic requirements and earning of minimum 50% of credits up to 2nd year
- b. In four-year, B. Tech. Programme, a student shall be promoted from 3rd year to 4th year only if he/she fulfils the academic requirements and earning of minimum 50% credits up to 3rd year
- c. In three-year, lateral entry B. Tech. Programme, a student shall be promoted from 3rd year to 4th year only if he/she fulfils the academic requirements and earning of minimum 50% credits up to 3rd year

11. Graduation Requirements:

a) Academic Requirements:

The following academic requirements shall be met for the award of the B. Tech. degree:

- ❖ Students shall secure 160 credits for the regular B. Tech. Programme and 120 credits for the students who entered in second year through lateral entry scheme and CGPA is calculated accordingly for the award of Grade/Class/Division.
- ❖ A student of a regular Programme who fails to earn 160 credits within eight consecutive academic years from the year of his/her admission shall forfeit his/her degree and his/her admission stands cancelled.
- ❖ A student of a lateral entry Programme who fails to earn 120 credits within six consecutive academic years from the year of his/her admission shall forfeit his/her Degree and his/her admission stands cancelled.

b. Grading:

As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed.

Each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

A student obtaining Grade 'F' or Grade 'AB' in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

For non-credit audit courses, “Satisfactory” or “Unsatisfactory” shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Structure of Grading of Academic Performance

Range of Percentage of Marks	Qualitative Meaning	Letter Grade	Grade Point
90 & above	Superior	S	10
80 - 89	Excellent	A	9
70 - 79	Very Good	B	8
60 - 69	Good	C	7
50 - 59	Average	D	6
40 - 49	Pass	E	5
< 40	Fail	F	0
Absent	Absent	AB	0

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

SGPA: Semester Grade Point Average is the ratio of sum of the product of the number of credits with the grade point scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student.

CGPA: Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses undergone by a student over all the semesters of a program.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.
Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

c. Award of degree:

Classification of degree will be as follows:

- I. CGPA ≥ 8.0 + No history of arrears +20 addl. Credits : Degree with Honours
(20 credits shall be earned through core domain courses)
- II. CGPA ≥ 8.0 + No history of arrears +20 addl. Credits : Degree with Minors
(20 credits shall be earned through inter-disciplinary courses)
- III. CGPA ≥ 7.5 : Degree with Distinction
- IV. CGPA ≥ 6.5 and < 7.5 : Degree with First Class
- V. CGPA ≥ 5.5 and < 6.5 : Degree with Second Class
- VI. CGPA ≥ 5.0 and < 5.5 : Degree with Pass Class

- ❖ **First Class with Distinction:** A candidate who acquires credits for the award of the Degree (vide clause 11(a)) having passed all the courses of study of all the eight semesters (six semesters for lateral entry candidates) in the first attempt (without appearing for supplementary exams), within eight consecutive semesters (six consecutive semesters for lateral entry candidates) after the commencement of his/her study and securing a CGPA of 7.5 and above shall be declared to have passed in **First Class with Distinction**.
- ❖ **First Class:** A candidate who acquires credits for the award of the Degree (vide clause 11 (a)) having passed all the courses of study of all the eight semesters (six semesters for lateral entry candidates) and securing a CGPA of 6.5 and above shall be declared to have passed in **First Class**
- ❖ **Second Class:** A candidate who acquires credits for the award of the Degree (vide clause 11 (a)) having passed all the courses of study of all the eight semesters (six semesters for lateral entry candidates) and securing a CGPA of 5.5 and above shall be declared to have passed in **Second Class**
- ❖ **Pass Class:** A candidate who acquires credits for the award of the Degree (vide clause 11 (a)) having passed all the courses of study of all the four semesters and securing a CGPA of 5.00 and above shall be declared to have passed in **Pass Class**
- ❖ **Degree with Honour/Minors:** The students can register for Honours/Minors by earning additional 20 credits over and above the credit requirement of B. Tech. (Regular) Degree Programme and also maintain minimum of 6.5 CGPA in Honours/Minors courses clearing the courses in single attempt.

CGPA to Percentage conversion Formula – (CGPA – 0.5) x 10

d. Grafting:

In order to extend the benefit to the students with one/ two backlogs after either 6th semester or 8th semester, a GRAFTING option is provided to the students enabling their placements and fulfilling graduation requirements. Following are the guidelines for the Grafting:

- ❖ Grafting of the marks will be done among the courses within the semester. A maximum of 10% of max marks in semester end examinations shall be drawn from any one of the cleared courses in the semester and will be grafted to the maximum of any two failed courses in the same semester.
- ❖ Students shall be given a choice of grafting only once in the 4 years Programme, either after 6th semester (Option#1) or after 8th semester (Option#2)
- ❖ Option#1: Applicable to students who have maximum of TWO theory courses in 5th and/or 6th semesters.
- ❖ Option#2: Applicable to students who have maximum of TWO theory courses in 7th and/or 8th semesters.
- ❖ Students can opt for grafting only after declaration of the results for regular examinations conducted for 6th or 8th semesters.
- ❖ Eligibility for grafting:
 - i. He/she must appear in all regular or supplementary examinations as per the provisions laid down in regulations for the courses, he/she appeals for grafting
 - ii. The marks obtained by her/him in latest attempt shall be taken into account for grafting of marks in the failed course(s)
 - iii. Grafting is applicable only for theory courses.
- ❖ Students having no backlog history till 5th semester /7th semester and would like to avail grafting in 6th/8th semester respectively are eligible for the award of a B.Tech degree first class with distinction. Further, students who clears the courses will also be eligible for Honours/Minors

- e. **Betterment Chance:** Student who clears all the subjects up to 6th semester and wishes to improve their CGPA can register and appear for one betterment chance for maximum of any five theory courses up to 6th semester. Betterment chance can be availed along with 7th and 8th semester examinations by paying the registration and examination fee. Students who opt the "Betterment Chance" will also be eligible for the award of a B.Tech degree first class with distinction and will also be eligible for Honours/Minors.
- f. **Quick Supplementary Examination:** The supplementary examinations for the 8th semester will be conducted as a Quick Supplementary Examination (immediately after the completion of 8th semester) to clear the failed courses of 8th semester.
- g. **Memorandum of marks:** All the candidates who register for the semester end examination will be issued a memorandum of marks by the Institute. Apart from the semester wise grade memos, the institute will issue the consolidate grade memo subject to the fulfillment of all the academic requirements.

12. Eligibility for Degree with Honours or Degree with Minors

The curriculum provides flexibility to enable the competent students to register for B. Tech. degree with Honours or B.Tech Degree with Minors by earning additional 20 credits which are over and above 160 credits for the award of B. Tech. (Regular) degree. He/She shall register Honours/Minors by paying registration fee during the 4th semester provided he/she secures ≥ 8 CGPA clearing all the courses in single attempt till 3rd semester. In case of students admitted through lateral entry, the CGPA compliance will be considered from 3rd semester performance and diploma CGPA.

The students shall have scope to earn these additional 20 credits from 4th semester onwards and at any point of time if he/she wishes to withdraw from B. Tech. (Honours) program, the additional credits acquired till that time will get lapsed and cannot be used to compensate with those 160 credits needed for the award of the degree. A separate grade sheet will be issued to the students who register for the Honours and minors degree program indicating the domain name for Honours and Minor degree title name for Minors along with the GPA.

All the students who maintain ≥ 8 CGPA are eligible to enrollment for B. Tech. with Honours, However, registration for Minors degree will be limited to maximum of 35% of the total intake in a particular batch of students.

These additional courses offered by the program may change from time to time based on the demand and resources availability. The courses may be offered in different modes i.e. guided learning/taught courses/Blended mode or combination.

To acquire 20 additional credits, the students shall register for four 4-credit courses under the list of the courses offered by the respective departments and acquire the balance 4 credits by taking One course on self-study mode (MOOCs) course as per the prescribed syllabus

For the award of **B. Tech. degree with Honours** an additional 20 credits shall be earned by taking the courses offered by the respective department of study in one domain. A set of five courses are offered under each of the four different domains, preferably from the new emerging areas as recommended by the BoS.

For the award of **B. Tech degree with Minors** an additional 20 credits shall be earned by taking the inter-disciplinary courses offered preferably from the new emerging areas by the other departments. Minors degree will be awarded with a Title among the pool of titles recommended by the various BoS.

The students who acquire 20 additional credits and maintain 8.0 CGPA at the time of registration and graduation clearing all the courses in single attempt and acquiring 160/120(lateral Entry) credits will be awarded the B.Tech degree Honours or Minors.

The students shall register for the courses related to additional 20 credits as per the calendar released by the respective departments and clear them in a single attempt. All the students who maintain 8.0 CGPA at the time of registration and graduation in regular B.Tech courses and acquire GPA of minimum of 6.5 in Honour/Minor courses are eligible for the award of B. Tech. (Honours)/B.Tech (Minors). Any student who fails to fulfill these conditions will automatically get deregistered for B. Tech. (Honours)/B.Tech (Minors) without any notification. A separate grade memo will be issued for B. Tech. (Honours)/B.Tech (Minors) along with the CGM.

13. Withdrawal from the Examination

Candidates opting for withdrawal from the examination shall not have backlogs by the date of application.

- A candidate for valid reasons which could be due to the overlap of the schedule of the events (Participation in state/national/international sports and games events; NSS or NCC camps; National/international competitions of high repute) with the semester end examination schedule, may be granted permission with prior approval to withdraw from appearing for the examination in any course or courses of only one semester examination during the entire duration of the Degree Programme.
- Withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination and if it is made two weeks prior to the commencement of the examination in that course or courses and recommended by a committee nominated by the principal.
- The candidate opting out of examinations shall appear for all the courses in the next immediate examinations that are scheduled (regular/supply) and will be treated as first attempt.

14. With-holding of Results

If the candidate did not clear all the tuition fee dues or if any case of indiscipline or malpractice is booked against him/her, the result of the candidate shall be withheld in such cases.

15. Multiple Entry / Exit Option

(a) Exit Policy:

The students can choose to exit the four-year programme at the end of first/second/third year.

- UG Certificate in (Field of study/discipline)** - Programme duration: First year (first two semesters) of the undergraduate programme, 40 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.
- UG Diploma (in Field of study/discipline)** - Programme duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.
- Bachelor of Science (in Field of study/discipline) i.e., B.Sc. Engineering in (Field of study/discipline)**- Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits.

(b) Entry Policy:

Modalities on multiple entry by the student into the B.Tech. programme will be provided in due course of time.

Note: The Institute shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE and State government.

16. Gap Year Concept:

The curriculum provides flexibility for the students to take a break of one year at any time after the end of I/II/III year of study to pursue entrepreneurship full time. This period of gap shall be counted within the maximum time of graduation. The student shall apply for the gap year before the commencement of the respective academic year.

17. Semester Away Programme (SAP): Interested students can have the option of undergoing Semester Away Programme during 7th or 8th semester with Higher Learning Institutions at Foreign Countries or Institutions of National Repute or Research Organizations in India, by earning necessary credits as per the curriculum subject to the terms and conditions as prescribed by the respective host organization. The student shall acquire 8 credits at the host institution to compensate the 8 credits required for the Project and take up the other three courses in self-study mode as per the curriculum. The students who are interested in opting for SAP shall register at the beginning of 6th semester and initiate the process with the host institute.

18. Transitory Regulations:

To enable the students to get into GMRIT either by Re-admission, Admission, or Transfer from other Autonomous and Non-Autonomous Engineering colleges affiliated to JNTUK/Academic regulation within GMRIT, the following transitory regulations will be applicable based on the situation and the case of transfer following are possible cases that may arise in transitory regulations

- Transfer of a student from a non-autonomous engineering college affiliated to JNTUK
- Transfer of a student from an Autonomous engineering college affiliated to JNTUK
- A student within the Institution gets transferred from one regulation to the other regulation

a. Transfer of candidates from Non-Autonomous Engineering College affiliated to JNTUK:

A student who wishes to transfer from a non-autonomous engineering college affiliated to JNTUK either in the 3rd semester or thereafter, shall acquire the credits required for graduation as per the GMRIT regulations and the following two cases may arise.

Students getting admission into 3rd semester shall be treated at par with the lateral entry students and shall complete all the course works in the 1st & 2nd semester before joining as per the JNTUK regulations. The credits acquired per course during 1st & 2nd semester will be calculated as per the GMRIT regulations. In case of any credit mismatch for the 1st & 2nd semester when compared with JNTUK regulations, the student shall take the additional courses approved by the concern Board of Studies and Academic council during 3rd semester at GMRIT.

Students getting admission into 5th or 7th semesters, the students shall clear all the earlier courses under JNTUK regulations and curriculum before joining and acquiring the required credits. The credits acquired per course at JNTUK regulation will be calculated as

per the GMRIT regulations. After joining at GMRIT the students shall follow the GMRIT regulations and in case of credits mismatch, students will take up additional courses approved by the concern Board of Studies and Academic council at GMRIT

After getting necessary approvals from the concerned Board of Studies & Academic council the details of the transferred students will be forwarded to the University.

b. Transfer of candidates from an Autonomous college affiliated to JNTUK:

A student who wishes to transfer from an Autonomous engineering college affiliated to JNTUK either in the 3rd semester or thereafter, shall acquire the credits required for graduation as per the GMRIT regulations and the following two cases may arise:

Students getting admission into 3rd semester shall be treated at par with the lateral entry students and shall complete all the course works in the 1st & 2nd semester before joining as per the other Autonomous regulations of the earlier college. The credits acquired per course at the earlier autonomous college will be calculated as per the GMRIT regulations. In case of any credit mismatch for the 1st & 2nd semester when compared with the previous Autonomous college regulations, the student shall take the additional courses approved by the concern Board of Studies and Academic council during from 3rd semester at GMRIT.

Students getting admission into 5th or 7th semesters, the students shall clear all the earlier courses under the earlier college regulations and curriculum before joining and acquire the required credits. The credits acquired per course at the earlier autonomous college will be calculated as per the GMRIT regulations. After joining at GMRIT the students shall follow the GMRIT regulations and in case of credits mismatch, students will take up additional courses approved by the concern Board of Studies and Academic council at GMRIT.

After getting necessary approvals from the concerned Board of Studies & Academic council the details of the transferred students will be forwarded to the University.

c. Students getting readmitted within GMRIT moving from one regulation to another regulation.

A student who gets admission into one regulation in the first year shall continue with the same graduation requirements in terms of total credits required for the award of Degree.

However, in case the students get readmitted into a subsequent new regulation, and if the readmission is in the 1st semester, the student shall follow the new regulations and secure the required number credits in the new regulations.

In case the students getting readmitted into a subsequent new regulation, and if the readmission is into any of the semesters from 2nd to 4th semester, the student shall follow the regulations applicable to the ongoing batch to which he/she gets admitted and continue in the same regulation till graduation. The substitute courses will be offered, and number of credits/ semesters shall be compensated and balanced between the old and new regulations on case-to-case basis. Necessary approvals from the concern Board of Studies and Academic council shall be taken

In case the students getting readmitted into a subsequent new regulation, and if the readmission is into any of the semesters from 5th to 8th semester, the student shall follow the regulations applicable as per the regulations existing at the time of his/her admission and will clear all the subjects and acquire the credits for graduation. For all the common courses he/she will continue along with the students in the new regulations. Necessary approvals from the concern Board of Studies and Academic council shall be taken.

After getting necessary approvals from the concerned Board of Studies & Academic council the details of the transferred students will be forwarded to the University.

19. Minimum Instruction Days for a Semester:

The minimum instruction days including exams for each semester shall be checked mistakes if any 90 days.

20. Medium of Instruction:

The medium of instruction of the entire B. Tech undergraduate programme in Engineering & Technology (including examinations and project reports) will be in English only.

21. General Instructions:

- The academic regulations should be read as a whole for purpose of any interpretation.
- Malpractices rules-nature and punishments are appended.
- Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.
- The Institute may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified.
- In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Head of the institution is final.

**Curriculum
2023**

**B. Tech.
Information Technology**
(Duration of Study : 4 years)



Department of Information Technology
GMR Institute of Technology
Rajam, Andhra Pradesh
(An Autonomous Institute Affiliated to JNTUGV Vizianagaram, AP)
NBA Accredited and NAAC Accredited



Vision of GMRIT

- ❖ To be among the most preferred institutions for engineering and technological education in the country
- ❖ An institution that will bring out the best from its students, faculty and staff – to learn, to achieve, to compete and to grow – among the very best
- ❖ An institution where ethics, excellence and excitement will be the work religion, while research, innovation and impact, the work culture

The Mission of GMRIT

- ❖ To turnout disciplined and competent engineers with sound work and life ethics
- ❖ To implement outcome based education in an IT-enabled environment
- ❖ To encourage all-round rigor and instill a spirit of enquiry and critical thinking among students, faculty and staff
- ❖ To develop teaching, research and consulting environment in collaboration with industry and other institutions

Department Vision

To be a preferred department of learning for students and teachers alike, with a commitment towards Academics & Research, serving the students in an atmosphere of innovation, critical thinking and making them Industry ready.

Department Mission

M1: To provide adaptable education in a collaborative and innovative environment in skilling the graduates to solve real world problems in the field of Information Technology Engineering

M2: To prepare the students as critical thinking professionals with multidisciplinary research orientation and Innovation

M3: To instil ethical values and nurture the graduates who will be able to contribute to society

Program Educational Objectives

PEO1: Employ logical and analytical skills in solving complex real-world engineering problems in the area of computer Science and allied fields

PEO2: Adaptable to emerging technologies with enhanced professional skills and ability towards continuous learning, facilitating higher studies and research

PEO3: Demonstrate professional ethics, leadership qualities and promote inclusive and collaborative growth with human values towards societal interest

Program Outcomes

Engineering graduate will be able to

- PO1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. (Engineering knowledge)
- PO2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. (Problem analysis)
- PO3: 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. (Design/development of solutions)
- PO4: 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. (Conduct investigations of complex problems)
- PO5: 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. (Modern tool usage)
- PO6: 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. (The engineer and society)
- PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. (Environment and sustainability)
- PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. (Ethics)
- PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. (Individual and team work)
- PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. (Communication)
- PO11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. (Project management and finance)
- PO12: 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. (Life-long learning)

Programme Specific Outcomes (PSOs):

- PSO1:** Implementation of Scientific Computing applications for secure environment to support contemporary services. (Program Specific)
- PSO2:** Construct software solutions to deliver quality products for Future Enterprise mobility. (Program Specific)

Department of Information Technology

Minimum Credits to be earned: 160 (for Regular Students)

127 (for Lateral Entry Students)

First Semester(Pattern-I/Pattern-II)							
No	Course Code	Course	POs	Contact Hours			
				L	T	P	C
1	23PYX01/ 23CYX01	Engineering Physics/Chemistry	1,2,7,10,12/1, 2,6,7,12	3	0	0	3
2	23MAX01/ 23MA02	Linear Algebra/Calculus/Differential Equations and Vector calculus	1,2,3,4,12/1,2, 3,4,12	3	0	0	3
3	23BEX01/ 23BEX02	Basic Electrical and Electronics Engineering/ Basic Civil & Mechanical Engineering	1,3,6,7,9,12/1, 2,3,6,7,8,12	3	0	0	3
4	23BEX03	Introduction to Programming	1,2,3,12	3	0	0	3
5	23BEX04/ 23KS01	Engineering Graphics/Communicative English	1,5,10,12/1,9, 10,11	2	0	2	3/2
6	23PYX02/ 23CYX03	Engineering Physics Lab/Chemistry	4,6,9,11/1,2,6, 7,9,12	0	2	2	1
7	23BEX05/ 23BEX06	Electrical & Electronics Engineering workshop/Engineering Workshop	4,5,6,9/12/1, 9,12	0	3	3	1.5/1.5
8	23BEX07	Computer Programming Lab	2,3,4,12	0	3		1.5
9	23HSX11	-/ECA (Yoga / Sports)	-	-	-	-	-0.5
10	23HSX12	-/CCA (NSS/NCC/Community)	-	-	-	-	-0.5
11	23BEX08	IT Workshop/-	1,2,3,4,9,12	0	2		-1
12	23HSX02	-/Communicative English Lab	1,9,10,11,12	0	2		-1
Total				14/14	0	12/12	20/20
Second Semester(Pattern-I/Pattern-II)							
1	23HSX01/ 23BEX04	Communicative English/Engineering Graphics	10,12/1,5,10	2/2	0	0	2/3
2	23MAX02/ 23MAX01	Differential Equations and Vector calculus/Linear Algebra & Calculus	1,2,3,4/12/1, 2, 3,4,12	3	0	0	3
3	23CYX01/ 23PYX01	Chemistry/Engineering Physics	1,2,6,7/12/1, 7,10,12	3	0	0	3
4	23BEX02/ 23BEX01	Basic Civil & Mechanical Engineering/Basic Electrical and Electronics Engineering	1,2,3,6,7,8/12 /1,3,6,7,9,12	3	0		3
5	23CS201	Data Structures (CSE, CSE-AI&DS, CSE-AI&ML, IT)	1,2,3,12, PS01	3	0	0	3
6	23CYX03/ 23PYX02	Chemistry Lab/Engineering Physics Lab	1,6,7,9/12/4, 6, 9,11,12	0	2	2	1
7	23BEX06/ 23BEX05	Engineering Workshop/Electrical & Electronics Engineering workshop	9,12/1,4,5	0	3	3	1.5/1.5
8	23BEX08	IT Workshop/-	1,2,3,4,9,12	0	2		-1
9	23BEX02	Communicative English Lab/-	1,9,10,11,12	0	2		-1
10	23CS202	Data Structures Lab (CSE, CSE-AI&DS, CSE-AI&ML, IT)	2,3,4,12,PS01	0	3	3	1.5/1.5
11	23HSX11	-/ECA (Yoga / Sports)	-	-	-	-	-0.5
12	23HSX12	-/CCA (NSS/NCC/Community Service)	-	-	-	-	-0.5
Total				14/14	0	12/12	20/20

Third Semester							
1	23IT301	Python Programming and Applications	1,2,3,4,5,12, PS01, PS02	3	0	-	3
2	23CS304	Digital Logic Design	1,2,3,5	3	-	2	4
3	23CS305	Discrete Mathematical Structures	1,2,3,12, PS01	3	0	-	3
4	23IT304	Database Management Systems	1, 2, 3, 4,12, PS02	3	0	-	3
5	23IT305	Data Communication Systems	1, 2, 3,4,7, 12, PS01	3	0	-	3
6	23IT306	Object Oriented Programming through Java	1,2,3,4,5, 12, PS01, PS02	3	-	2	4
7	23IT307	Python Programming and Applications Laboratory	1,2,3,4,5,9,12, PS01, PS02	-	-	3	1.5
8	23IT308	Database Management Systems Laboratory	1, 2, 3, 4, 5, 9, PS02	-	-	3	1.5
9	23ESX01	Employability Skills I	1,2,5,8,10,12	-	-	2	-
Total				19	0	12	23
Fourth Semester							
1	23MA405	Probability and Statistics	1,2	3	0	-	3
2	23CS403	Computer Organization and Architecture	1,2,12, PS01	3	0	-	3
3	23IT403	Operating Systems	1,2,3,4, 7,12	3	0	-	3
4	23CS303	Design and Analysis of Algorithms	1,2,3,PS01	3	-	-	3
5	23IT405	Web Technologies	1,2, 3, 5, PS01, PS02	3	-	2	4
6	23CS307	Design and Analysis of Algorithms Lab	2,3,4,12,PS01	-	-	3	1.5
7	23IT407	Operating Systems Laboratory	1,2, 3, 5, 9	-	-	3	1.5
8	23ESX01	Employability Skills I	1,2,5,8,10,12	-	-	2	2
Total				15	0	10	21
Fifth Semester							
1	23IT501	Computer Networking	1,2,4, 5, 12, PS01	3	-	2	4
2	23IT502	Artificial Intelligence	1, 2,3,4, PS01, PS02	3	0	-	3
3	23IT503	Cloud Computing	1,2,3,4 5, 6, 7, 8, PS02	3	0	-	3
4	23IT504	Software Engineering Principles	1,2,3,4,5, PS02	3	-	2	4
5		Elective I(Professional Elective)		3	0	-	3
6		Elective II (Open Elective I)		3	0	-	3
7	23IT507	Cloud Computing Lab	1, 2,3, 4, 5, 9, PS01	-	-	3	1.5
8	23TPX01	Term Paper	1, 4, 10, 12	-	-	3	1.5
9	23ESX02	Employability Skills II	1,2,5,8,10,12	-	-	2	-
10	23SIX01	Summer Internship #I	1, 2, ,8, 10, 12				1
Total				19	0	12	24
Sixth Semester							
1	23HSX10	Engineering Economics and Project Management	1,10,11	3	0	-	3
2	23IT602	Automata and Compiler Design	1,2,3,4, 12	3	0	-	3
3	23IT603	Machine Learning	1, 2,3,4, PS01, PS02	3	0	-	3
4		Elective III (Professional Elective)		3	-	2	4
5		Elective IV (Open Elective II)		3	0	-	3

List of Electives

1	23IT017	Social Network Analysis	2,4,5,12	3	0	-	3
2	23IT011	Real Time Operating Systems	2,3,12	3	0	-	3
3	23IT012	Digital Image Processing	3,5,6	3	0	-	3
4	23IT014	Distributed Systems	2, 7, 12	3	0	-	3
5	23CS012	Wireless Ad hoc Networks	1,2,3,6,7,10	3	0	-	3
6	23CS015	Software Project Management	1,2,3,11,12, PS02	3	0	-	3
7		MOOCs		-	-	-	3
8	23BS004	Advanced Materials of Renewable Energy	1,7	3	0	-	3
9	23BS005	Applied Linear Algebra for Engineers	1,12	3	0	-	3
Elective VIII: Professional Elective							
1	23CS014	Green Computing	2,3,6,7	-	-	-	3
1	23IT013	Design Patterns	2,3,5	-	-	-	3
3	23IT016	Professional Ethics	1, 6,8,12	-	-	-	3
4		MOOCs	-	-	-	-	3
Open Elective I, II, III, and IV (Elective II, IV, VII, and IX)							
1	23CE001	Disaster Management	2,7	3	-	-	3
2	23EE001	Electrical Installation, Safety and Auditing	2,3,6,8	3	-	-	3
3	23ME001	Fundamentals of Optimization Techniques	1,2,5,3	3	-	-	3
4	23EC001	Sensors for Engineering Applications	1,2	3	-	-	3
5	23CS001	Fundamentals of Artificial Intelligence	1,2,3	3	-	-	3
6	23CH001	Energy Conversion and Storage Devices	1,3,6,7	3	-	-	3
7	23IT001	Fundamentals of Multimedia	3,5,7	3	-	-	3
8	23BS001	Nano Materials and Technology	1,2	3	-	-	3
9	23DS001	Fundamentals of Data Science	1,2	3	-	-	3
10	23CE002	Air Pollution and Environmental Impact Assessment	6,7,12	3	-	-	3
11	23EE002	Renewable Energy Sources	2,7	3	-	-	3
12	23ME002	Principles of Entrepreneurship	1,5,8,11	3	-	-	3
13	23EC002	Electronics for Agriculture	1,2	3	-	-	3
14	23CS002	Fundamentals of Machine Learning	2,5	3	-	-	3
15	23CH002	Industrial Safety and Hazard Management	1,2,3,6,8	3	-	-	3
16	23IT002	Fundamentals of Cloud Computing	2,6,7,8,12	3	-	-	3
17	23BS002	Advanced Numerical Techniques	1,2	3	-	-	3
18	23BS003	Functional Materials and Applications	1,7	3	-	-	3
19	23CE003	Solid Waste Management	3,7,12	3	-	-	3
20	23EE003	Fundamentals of Electrical Vehicle Technology	2,3,12	3	-	-	3
21	23ME003	Industrial Engineering and Management	1,5,8	3	-	-	3
22	23CS003	Interfacing and Programming with Arduino	1,4	3	-	-	3
23	23DS003	Data Science for Engineering Applications	2,3,4	3	-	-	3
24	23CH003	Industrial Ecology for Sustainable Development	2,6,7	3	-	-	3
25	23IT003	Fundamentals of Mobile Computing	1,7	3	-	-	3
26	23BS004	Advanced Materials for Renewable Energy	1,2	3	-	-	3
27	23BS005	Applied Linear Algebra for Engineers	1,2	3	-	-	3
28	23CE019	Green Buildings	1,7,12	3	-	-	3
29	23EE017	Sustainable Energy	2,3,12	3	-	-	3
30	23ME019	Total Quality Management	1,2,5,8	3	-	-	3
31	23EC011	Communication Technologies	1,2	3	-	-	3
32	23CS020	Applications of Artificial Intelligence	2,3,6,7	3	-	-	3
33	23CH016	Green Technologies	2,6,7	3	-	-	3
34	23IT015	Human Computer Interaction	1,7	3	-	-	3
35	23BS006	Handling of Industrial waste and waste water	3,7	3	-	-	3
36	23OE001	Robotics and Automation	5,6,7	3	-	-	3
37	23OE002	Introduction to IoT	1,2	3	-	-	3
38	23OE003	Fundamentals of Image Processing	1,2	3	-	-	3
39	23OE004	Fundamentals of Data Acquisition Systems	1,2	3	-	-	3
40	23OE005	Airport Operations Management	2,4,11,12	3	-	-	3
41	23OE006	Fundamentals of Embedded Systems	1,2,10	3	-	-	3
42	23OE007	Remote Sensing and GIS	1,2,5,7,10	3	-	-	3
43	23OE008	Big Data Analytics	1,7	3	-	-	3

44	23OE009	Fundamentals of Cyber Security	3,6,8	3	-	-	3
45	23OE010	Smart Cities	1,7,12	3	-	-	3
46	23OE011	Nano Materials and Thin Film Technology	1,2	3	-	-	3
47	23CSMC1	Cloud Computing	1,2,3	3	-	-	3
48	23CSMC2	Ethical Hacking	1,2,3	3	-	-	3
49	23CSMC3	Fundamentals of Web Development	1,2,3	3	-	-	3
50	23OE012	Business Intelligence & Analytics	1,2	3	-	-	3
51	23OE013	Introduction to Industry 4.0 and Industrial IoT	2,3	3	-	-	3
52	23OE014	Natural Language Processing	2,3	3	-	-	3
53	23OE015	Affective Computing	1,2,3,4	3	-	-	3
54	23OE016	Principles of Data Science	1,2	3	-	-	3
Audit Course							
1	23AT001	Communication Etiquette in Workplaces					
2	23AT002	Contemporary India: Economy, Policy and Society					
3	23AT003	Design The Thinking					
4	23AT004	Ethics and Integrity					
5	23AT005	Indian Heritage and Culture					
6	23AT006	Intellectual Property Rights					
7	23AT007	Introduction to Journalism					
8	23AT008	Mass Media Communication					
9	23AT009	Science, Technology and Development					
10	23AT010	Social Responsibility					
11	23AT011	The Art of Photography and Film Making					
12	23AT012	Gender Equality for Sustainability					
13	23AT013	Women in Leadership					
14	23AT014	Introduction to Research Methodology					
15	23AT015	Climatic Change and Circular Economy					
B. Tech. (Honors)							
Domain – I: Modern Computing							
01	23ITH11	Advanced Computer Architecture	2, 3	4	-	-	4
02	23ITH12	Micro Processors and Micro Controllers	2, 3	4	-	-	4
03	23ITH13	Embedded Systems	1, 2, 7,12	4	-	-	4
04	23ITH14	High Performance Computing	2, 3	4	-	-	4
Domain – II: Data Engineering							
01	23CSH11	Advanced Data Structures	2, 3, 4	4	-	-	4
02	23CSH12	Advanced Databases	2, 3, 4	4	-	-	4
03	23CSH13	Programming, Data Structures and Algorithms Using Python	2, 3, 4, 5	4	-	-	4
04	23CSH14	Bio-Informatics	1, 2, 5	4	-	-	4
Domain – III: Modern Software Engineering							
01	23CSH23	DevOps	1, 3, 5, 8, 10	4	-	-	4
02	23CSH22	Design Patterns	2, 3, 5	4	-	-	4
03	23CSH23	Advanced Software Engineering	1, 2, 3, 4, PSO1	4	-	-	4
04	23CSH24	Robotic Process Automation	3, 5, 8, PSO2	4	-	-	4
Domain – IV: Security							
01	23CSH31	Computer Systems Security	1, 2	4	-	-	4
02	23CSH32	Python Programming for Security	1, 3, 4	4	-	-	4
03	23CSH33	Management of Information Security	3, 6, 7	4	-	-	4
04	23CSH34	Computer Forensics	2, 3, 5	4	-	-	4
B. Tech. (Minors)							
Energy Science & Technology							
1	23CHM11	Foundation of Energy Science and Technology	1, 2, 3, 5, 7, 12	4	-	-	4
2	23CHM12	Energy Generation from Waste	1, 2, 3, 4, 5	4	-	-	4
3	23CHM13	Energy Storage Systems	1, 2, 3, 6, 7	4	-	-	4
4	23CHM14	Hydrogen Energy and Fuel Cells	1, 2, 3, 7	4	-	-	4
Nano Science & Technology							
5	23CHM23	Introduction and Characterization of Nano Materials	1, 2, 3, 7	4	-	-	4
6	23CHM22	Carbon Nanostructures and Applications	1, 3, 4, 5	4	-	-	4

7	23CHM23	Energy, Environment & Biomedical Nanotechnology	1, 2, 3, 7	4	-	-	4
8	23CHM24	Industrial Applications of Nano Technology	2, 3, 5, 7	4	-	-	4
Environmental Engineering							
9	23CEM11	Watershed Management	6,7	4	-	-	4
10	23CEM12	Industrial Pollution Control and Engineering	3,6,7	4	-	-	4
11	23CEM13	Solid and Hazardous Waste Management	1,3,6,7	4	-	-	4
12	23CEM14	Ecology and Environmental Assessment	1,3,6,7	4	-	-	4
Artificial Intelligence & Machine Learning							
13	23CSM11	Fundamentals of AI & Machine Learning	1,12	4	-	-	4
14	23CSM12	Feature Engineering for Machine Learning	1,2,3	4	-	-	4
15	23CSM13	Exploratory Data Analytics	1,4	4	-	-	4
16	23CSM14	Deep Learning	1,2, 4	4	-	-	4
Cyber Security							
17	23CSM23	Fundamentals of Security	1,2	4	-	-	4
18	23CSM22	Management of Information Security	3,6,7	4	-	-	4
19	23CSM23	Cyber Security	1,3,4	4	-	-	4
20	23CSM24	Cloud Security	2,3	4	-	-	4
Data Science & Analytics							
21	23CSM31	Data Cleaning	2,3,4	4	-	-	4
22	23CSM32	Data Engineering	1,2,3,4	4	-	-	4
23	23CSM33	Text Analytics	1,2,4	4	-	-	4
24	23CSM34	Social Network and Semantic Analysis	2, 4	4	-	-	4
Computer Systems Programming							
25	23CSM41	Programming Fundamentals	1,2,3	4	-	-	4
26	23CSM42	Data Structures & Algorithms	1,2,3,4	4	-	-	4
27	23CSM43	Fundamentals of Databases	1,4	4	-	-	4
28	23CSM44	Fundamentals of Computer Networks & Operating Systems	1,2,3	4	-	-	4
Digital IC Design							
29	23ECM11	Fundamentals of VLSI Design	1, 2, 3	4	-	-	4
30	23ECM12	Digital Design using HDL	1, 2, 3	4	-	-	4
31	23ECM13	FPGA Technology	1, 2	4	-	-	4
32	23ECM14	Analog and Mixed Signal Design	1, 2	4	-	-	4
Industrial Automation							
33	23ECM23	Microcontrollers and Interfacing	1, 2, 3	4	-	-	4
34	23ECM22	Sensors and Data Acquisition System	1, 2	4	-	-	4
35	23ECM23	Fundamentals of Labview	1, 2	4	-	-	4
36	23ECM24	Medical Robotics	1, 2, 3	4	-	-	4
Communications and Networking							
37	23ECM31	Principles of Communications	1, 2	4	-	-	4
38	23ECM32	Coding Theory and Practice	1, 2	4	-	-	4
39	23ECM33	Ad-hoc and Wireless Sensor Networks	1, 2, 3	4	-	-	4
40	23ECM34	Fundamentals of Multimedia Networking	1, 2, 3	4	-	-	4
Avionics							
41	23ECM41	Principles of Aerodynamics	1, 2	4	-	-	4
42	23ECM42	Aircraft Electrical Systems	1, 2	4	-	-	4
43	23ECM43	Aircraft Instrument Systems	1, 2	4	-	-	4
44	23ECM44	Aircraft Communication and Navigational Systems	1, 2	4	-	-	4
Geographic Information System							
45	23ECM51	Sensors and Sensing Technology	1, 2	4	-	-	4
46	23ECM52	Geographic Information Systems	1, 2	4	-	-	4
47	23ECM53	Digital Image Processing	1, 2	4	-	-	4

48	23ECM54	Lidar Systems	1, 2	4	-	-	4
Electric Vehicles Technology							
49	23EEM11	Introduction to Electric Vehicles Technologies	2, 3	4	-	-	4
50	23EEM12	Electrical Drives and Controllers for Electric Vehicles	2, 3	4	-	-	4
51	23EEM13	Charging Technology in Electric Vehicles	2, 3	4	-	-	4
52	23EEM14	Computer Vision in Electric Vehicles	2, 3	4	-	-	4
Smart City Management							
53	23EEM23	Fundamentals of Smart City	2, 3	4	-	-	4
54	23EEM22	Smart City Infrastructure	2, 3, 5, 6, 7, 11	4	-	-	4
55	23EEM23	Computational Methods for Smart City Management	3, 5	4	-	-	4
56	23EEM24	Communication Technologies and Mobility for Smart City	2, 3	4	-	-	4
Industrial Applications and Control							
57	23EEM31	Modelling and Simulations of Industrial Applications	2, 3	4	-	-	4
58	23EEM32	Industrial Sensors and Actuators	2, 3	4	-	-	4
59	23EEM33	Programmable Logic Controllers	2, 3	4	-	-	4
60	23EEM34	Control Design for Industrial Applications	2, 3	4	-	-	4
Robotics and Automation							
61	23MEM11	Introduction to Robotics	1,2,3	4	-	-	4
62	23MEM12	Drives and Sensors	1,2,3,4	4	-	-	4
63	23MEM13	Control Systems for Robotics	1,2,3,4	4	-	-	4
64	23MEM14	Machine Learning for Robotics	2,5	4	-	-	4
Industrial Systems Engineering							
65	23MEM23	Industrial Management	1,10,11,12	4	-	-	4
66	23MEM22	Fundamentals of Operations Research	1,2,3,5	4	-	-	4
67	23MEM23	Enterprise Resource Planning	1,2,3,5,11,12	4	-	-	4
68	23MEM24	Production Planning and Control	1,2,3,5,11,12	4	-	-	4

23PYX01 - ENGINEERING PHYSICS
(Common to all branches of Engineering)

3 0 0 3

Course Outcomes

1. Comprehend the basic principle of diffraction and observe the diffraction pattern in various cases
2. Illustrate the concepts of Interference and polarisation and their applications
3. Understand the space lattices and crystal symmetry
4. Summarize the fundamental concepts of quantum mechanics
5. Explore the properties and applications of dielectric and magnetic materials
6. Demonstrate the conduction process of charge carriers in semiconductors

COs – POs Mapping

COs	PO1	PO2	PO7	PO10	PO12
1	3	2	1	1	1
2	3	2	1	1	1
3	3	2	1	1	1
4	3	2	1	1	1
5	3	2	1	1	1
6	3	2	1	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit: I Wave Optics

13 Hours

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton’s Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol’s Prism -Half wave and Quarter wave plates

UNIT II Crystallography and X-ray diffraction

10 Hours

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC – Miller indices – separation between successive (hkl) planes. *X- ray diffraction:* Bragg’s law - X-ray Diffractometer – crystal structure determination by Laue’s and powder methods

UNIT III Dielectric and Magnetic

12 Hours

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector –Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius-Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials

Unit: IV Quantum Mechanics, Free electron theory and Semiconductors

13 Hours

Quantum Mechanics: Dual nature of matter – Heisenberg’s Uncertainty Principle – Significance and properties of wave function – Schrodinger’s time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy.

Semiconductors: Semiconductors: Formation of energy bands – classification of crystalline solids – Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications

Total: 48 hours

Textbooks:

1. A Text book of Engineering Physics - M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).
3. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning

Reference Books:

1. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
2. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
3. Engineering Physics - D.K.Bhattacharya and PoonamTandon, Oxford press (2015).

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	
Understand	50	50	
Apply	10	10	70
Analyze			30
Evaluate			
Create			
Total (%)	100	100	100

Sample Question (s)

Remember

1. Define Polarization of light
2. State Bragg's law of x-ray diffraction
3. Define Bohr magneton
4. List any two merits of classical free electron theory

Understand

1. Draw and explain the variation in intensity in diffraction due to single slit
2. Explain with diagram the Powder method of X-ray diffraction
3. Explain hysteresis behavior of ferromagnetic materials
4. Derive Schrodinger's time dependent wave equation

Apply

1. A parallel beam of light of wavelength $6000 \text{ \AA}$ is incident on a thin glass plate of refractive index 1.5 such that the angle of refraction into the plate is 50° . Find the least thickness of the glass plate which will appear dark by reflection.
2. Draw and label (1 0 0), (0 2 0), (0 2 2) crystallographic planes.
3. Draw and compare soft and hard magnetic materials based on their hysteresis loops.
4. An electron is confined to a one dimensional potential box of length $2 \text{ \AA}$. Calculate the energies corresponding to the second and fourth quantum states in eV.

Course Outcomes

1. Illustrate the Molecular Orbital diagrams for simple diatomic and polyatomic molecules.
2. Identify the applications of super conductors, semi conductors and super capacitors & nano materials.
3. Explain the working of spectroscopy and Chromatography.
4. Explain the properties and applications of polymers & fibres.
5. Estimate the analytes using potentiometric & conductometric titrations and electrochemical sensors
6. Describe the construction and working of electrochemical cells.

COs – POs Mapping

COs	PO1	PO2	PO6	PO7	PO12
1	3	1	1	3	1
2	3	1	1	2	1
3	3	1	1	3	1
4	3	1	1	2	1
5	3	1	1	3	1
6	3	1	1	2	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I**Structure and Bonding Models, Modern Engineering materials:**

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ (psi) and Ψ^2 (psi square), particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O₂ and CO, etc. π -molecular orbitals of butadiene and benzene, calculation of bond order.

Semiconductors – Introduction, basic concept, application-Super conductors-Introduction basic concept, applications. Supercapacitors: Introduction, Basic Concept-Classification – Applications

13**Hours****Unit II****Nano materials & Instrumental methods & applications**

Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphene nanoparticles.

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

10**Hours****Unit III****Polymer Chemistry & Applications**

Introduction to polymers, functionality of monomers, chain growth and step growth, polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of –PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications. Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Polylactic Acid (PLA)

Fuel cells, hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

16 Hours**Unit IV**

Electrochemistry & Applications

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples. Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions. Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

09 Hours
Total: 48 Hours

Textbooks:

1. A Text book of Engineering Physics - M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).
3. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning

Reference Books:

1. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
2. Engineering Physics” - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
3. Engineering Physics - D.K.Bhattacharya and PoonamTandon, Oxford press (2015).

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam
Remember	39	40	
Understand	53	53	
Apply	08	07	50
Analyze			50
Evaluate			
Create			
Total (%)	100	100	100

Sample Question (s)

Remember

1. Write the Schrodinger wave equation?
2. Define nanomaterial with an example
3. Define functionality
4. Write any two applications of PVC

Understand

1. Illustrate the molecular orbital energy level diagram of O₂ molecule
2. Write the classification and applications of carbon nanotubes
3. Illustrate construct and working of Li ion battery
4. What is fuel cell? Explain construction and working of hydrogen-oxygen fuel cell

Apply

1. By using MO rules, draw the π -molecular orbital energy level diagram of 1,3-butadiene
2. Calculate emf of the following cell at 25°C. Given the standard reduction potentials of zinc and copper –0.76 V and +0.37 V respectively. $\text{Zn(s)} | \text{Zn}^{2+} (0.1\text{M}) || \text{Cu}^{2+} (0.001\text{M}) | \text{Cu(s)}$.

Course Outcomes

1. CO1: Assess the quality of water and its treatment methods
2. CO2: Estimate the potentials for electrochemical cells
3. CO3: Describe corrosion factors and implement prevention methods.
4. CO4: Illustrate the types of polymers and Fuels with applications
5. CO5: Describe the concepts of colloids, micelle and nanomaterials
6. CO6: Explain the uses of refractory materials, lubricants and cements.

COs – POs Mapping

COs	PO1	PO2	PO6	PO7	PO12
1	3	1	1	3	1
2	3	1	1	2	1
3	3	1	1	3	1
4	3	1	1	2	1
5	3	1	1	3	1
6	3	1	1	2	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

UNIT I: Water Technology

Soft and hardwater, Estimation of hardness of water by EDTA Method, Estimation of dissolved Oxygen -Boiler troubles –Priming, foaming, scale and sludge, Caustic embrittlement, Industrial water treatment – Specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO)standards, Ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis

10 Hours

UNIT II: Electrochemistry and Applications

Electrodes –electrochemical cell, Nernst equation, cell potential calculations. Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad),and lithium ion batteries- working principle of the batteries including cell reactions; Fuel cells-Basic Concepts, the principle and working of hydrogenoxygen Fuel cell. Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

12 Hours

UNIT III: Polymers and Fuel Chemistry

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growthpolymerization. Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications ofpoly styrene. PVC Nylon 6,6 and Bakelite. Elastomers – Preparation, properties and applications of BunaS, Buna N, Thiokol rubbers. Fuels – Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis ofcoal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octane and Cetanenumberalternativefuels- propane, methanol, ethanol and bio fuel-bio diesel.

10 Hours

UNIT IV: Surface Chemistry and Modern Engineering Materials

Surface Chemistry- Introduction to surface chemistry, colloids, nanometals and nanometal oxides, micelleformation, synthesis of colloids (Braggs Method), adsorption isotherm (Freundlich and Longmuir), BETequation (no derivation).Nano Materials- Chemical and biological methods of preparation of nanometals and metal oxides,stabilization of colloids and nanomaterials by stabilizing agents, applications of colloids and

nanomaterials– catalysis, medicine, sensors, etc. Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications
Refractories and lubricants- Classification, Properties, Factors affecting the refractory materials and Applications. Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils– Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and Applications. Building materials- Portland cement, constituents, Setting and Hardening of cement.

16 Hours
Total: 48 Hours

Textbook (s)

1. P.C. Jain and Monica Jain, Engineering Chemistry, 16th Ed., Dhanpat Rai Publishing Company, New Delhi, 2015.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.
3. C.N.R. Rao, A. Muller and A.K. Cheetham, Nanomaterials Chemistry: Recent Developments and New Directions, 2010.

Reference (s)

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heinemann, 1992.
3. Textbook of Polymer Science, Fred W. Billmeyer Jr, 3rd Edition

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book/ Assignment Exam(%)
Remember	40	40	--
Understand	50	50	-
Apply	10	10	50
Analyze	-	-	50
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample Question (s)

Remember

1. Define hardness
2. Differentiate between primary and secondary battery
3. Define Octane and cetane number
4. What are the good characteristic properties of good refractory material?

Understand

1. Explain in detail how the hardwater is purified by ion exchange process
2. How the underground buried pipeline is protected by sacrificial anodic protection?
3. Explain the preparation of Nano metal oxide by chemical precipitation method
4. Explain the chemistry involved in setting and hardening of cement

Apply

1. What are different treatment methods for removal of hardness and compare their merits and demerits
2. What are the points to be taken into account in the construction of a good battery with life?
3. How to get commercial products obtaining from crude oil and list out the byproducts with carbon content, Boiling point and its uses

Course Outcomes: At the end of the course, the student will be able to

1. Solve the system of linear equations
2. Construct the eigenvectors of a matrix, use the applications of Cayley Hamilton theorem
3. Identify the nature of the quadratic form using matrix theory
4. Apply Mean value theorems to solve single variable problems.
5. Make use of partial derivatives to solve multivariable problems
6. Utilize multiple integrals to find the area and volume of solids

COs – POs Mapping

COs	PO1	PO2	PO3	PO4	PO12
1	3	3	2	2	1
2	3	2	3	3	1
3	3	3	3	2	1
4	3	2	2	1	1
5	3	3	2	1	1
6	3	3	3	2	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT – I

Matrices

Rank of a matrix by echelon form, normal form. Cauchy –Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

12 Hours

UNIT – II

Linear Transformation and Orthogonal Transformation:

Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

12 Hours

UNIT – III

Single and Multi-Variable Calculus

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

Partial differentiation: Partial derivatives, total derivatives, chain rule, change of variables, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

14 Hours

UNIT – IV

Multiple Integrals

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

10 Hours

Total: 48 Hours

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
3. Glyn James, Advanced Modern Engineering Mathematics, 5/e, Pearson publishers, 2018.
4. Michael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
5. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand, 2021.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test (%)
Remember	10	10	-
Understand	40	40	20
Apply	50	50	50
Analyze	-	-	30
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample Question (s)

Remember

1. Define rank of a matrix
2. State Cayley-Hamilton theorem
3. State Rolle's theorem
4. State Taylor's theorem

Understand

1. Find the rank of the matrix $A = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$ by reducing it to echelon form.
2. Using Cayley-Hamilton theorem find A^4 , for $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$
3. Verify Lagrange's mean value theorem for $(x)^{\frac{3}{4}}$ in $[-1, 2]$
4. Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} \sqrt{a^2-x^2-y^2} dx dy$

Apply

1. Utilise Gauss-Jordan method, to find the inverse of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$
2. Find the eigen values and the corresponding eigen vectors of $A = \begin{bmatrix} 1 & 2 & -1 \\ 0 & 2 & 2 \\ 0 & 0 & -2 \end{bmatrix}$
3. If $a < b$, prove that $\frac{b-a}{1+b^2} < \tan^{-1} b - \tan^{-1} a < \frac{b-a}{1+a^2}$ using Lagrange's mean value theorem. Deduce that $\frac{5\pi+4}{20} < \tan^{-1} 2 < \frac{\pi+2}{4}$
4. Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx dy$ by change into polar coordinates

23BEX01 BASIC ELECTRICAL & ELECTRONICS ENGINEERING
(Common to all branches of Engineering)

3 0 0 3

Course Outcomes

1. Demonstrate the electrical parameters of DC & AC circuits.
2. Illustrate the operation of electrical machines and power plants.
3. Summarize electrical measurements and safety measures
4. Explain the operation of semiconductor devices and their characteristics.
5. Illustrate the operation of rectifiers.
6. Illustrate the number systems, binary codes, and combinational circuits using logic gates.

COs – POs Mapping

COs	PO1	PO3	PO6	PO7	PO9	PO12
C01	3	2	1	1	1	1
C02	3	2	1	1	1	1
C03	3	2	1	1	1	1
C04	3	2	1	1	1	1
C05	3	2	1	1	1	1
C06	3	2	1	1	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I: ELECTRICAL CIRCUITS AND MACHINES

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: AC Fundamentals: Equation of AC Voltage and current, waveform, time-period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor. (Simple Numerical problems).

Electrical Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer and (iv) Three Phase Induction Motor, Applications of electrical machines.

(12 Hours)

UNIT II: ELECTRICAL MEASURING INSTRUMENTS AND SAFETY MEASURES

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB) Personal safety measures: Electric Shock, Safety precautions to avoid shock, Earthing and its types.

(12 Hours)

PART B: BASIC ELECTRONICS ENGINEERING

UNIT III: SEMICONDUCTOR DEVICES AND ELECTRONIC CIRCUITS

Introduction - Evolution of electronics – Vacuum tubes to nanoelectronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

Rectifiers and power supplies: Block diagram description of a DC power supply, working of a half wave rectifier, full wave rectifier.

(12 Hours)

UNIT IV: DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits– Minterm, Maxterm, SOP, Standard SOP, POS, Standard POS, 3-Variable K-Map, Half and Full Adders.

(12 Hours)

Textbooks:

1. R. L. Boylestad & Louis Nashlesky, "Electronic Devices & Circuit Theory," Pearson Education, 2nd Edition 2021.
2. D. C. Kulshreshtha "Basic Electrical Engineering" Tata McGraw Hill, 1st Edition, 2019
3. Ramana Pilla, N.V.Lalitha & G.Suresh, "Basic Electrical and Electronics Engineering", S Chand and Company Ltd., 1st Edition, 2024.

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. T. K. Nagsarkar & M. S. Sukhija, "Basic Electrical Engineering" Oxford University Press, 1st Edition, 2017
3. R. P. Jain, "Modern Digital Electronics" Tata Mc Graw Hill, 4th Edition, 2009.
4. Rajendra Prasad, "Fundamentals of Electrical Engineering," PHI publishers, 3rd Edition. 2014

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test (%)
Remember	20	20	30
Understand	50	50	50
Apply	30	30	20
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample Question (s)**Remember**

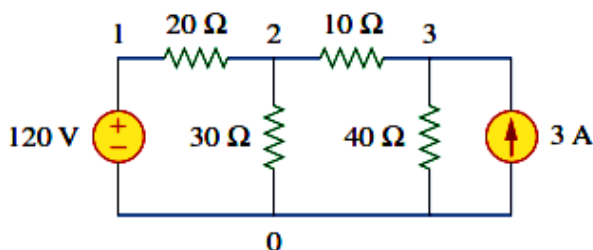
1. Define KVL and KCL
2. Define Units
3. Define amplifier
4. Define Rectifier

Understand

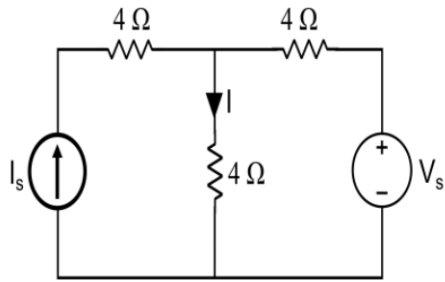
1. List out energy sources and explain anyone with a neat diagram
2. Illustrate the operation instruments with a neat diagram
3. List any three applications of Zener diode
4. Illustrate the CE amplifier circuit diagram.

Apply

1. Find currents in each branch using nodal analysis for the given circuit.



2. Find I by using the superposition theorem for the below circuit with $V_s=20V$, $I_s= 4A$.



3. Solve these conversions

- i) $(10101)_2$ to $(?)_{gray}$
- ii) $(23B)_{10}$ to $(?)_{10}$
- iii) $(45)_{10}$ to $(?)_8$

4. Minimize the given switching function using k-map $f(A, B, C) = \sum m(2,6,7)$

23BEX02 - BASIC CIVIL & MECHANICAL ENGINEERING

(Common to All branches of Engineering)

3 0 0 3

Course Outcomes:

1. Describe the basics of civil engineering streams, water resources and environmental engineering
2. Outline the concepts of surveying
3. Demonstrate the pavements and the concept of Airport, Harbour, Tunnel & Railway Engineering
4. Understand the different Engineering Materials, Manufacturing process and the role of mechanical Engineering in different sectors.
5. Understand the basic concepts of thermal engineering and working principles of different power plants
6. Describe the working of different mechanical power transmission systems and basic configurations and applications of robots

COs – POs Mapping

CO	PO ₁	PO ₂	PO ₃	PO ₆	PO ₇	PO ₈	PO ₁₂
1	3	-	-	2	2	2	2
2	3	3	3	1	2	-	2
3	3	-	-	1	2	-	2
4	3	-	-	2	2	-	2
5	3	-	-	2	2	-	2
6	3	-	-	2	2	-	2

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

UNIT I Basics of Civil Engineering

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering- Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to prefabricated construction techniques.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

12 Hours

UNIT II Surveying and Transportation Engineering

Surveying: Objectives of Surveying - Horizontal Measurements- Angular Measurements- Introduction to Bearings, Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

Transportation Engineering: Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering

12 Hours

UNIT III

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society-Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Material: Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

Manufacturing Processes: Principles of Casting, Forming, joining processes, Introduction to CNC machines, 3D printing, and Smart manufacturing.

11 Hours

UNIT IV

Thermal Engineering: working principle of Boilers, Otto cycle, Diesel cycle, Refrigerator and air-conditioner, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

Power plants: working principle of Steam, Diesel, Hydro, Nuclear power plants.

Mechanical Power Transmission: Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics: configurations and applications of robots.

13 Hours

Textbooks:

1. Basics of Civil and Mechanical Engineering, O. Srikanth and M. Sreenivasa Reddy, S. Chand and company limited, first edition, 2024.
2. Basic Civil Engineering, M. S. Palanisamy, Tata McGraw Hill publications (India) Pvt. Ltd. Fourth Edition.
3. Introduction to Civil Engineering, S. S. Bhavikatti, New Age International Publishers. 2022. First Edition.
4. Basic Civil Engineering, SatheeshGopi, Pearson Publications, 2009, First Edition.
5. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
6. A Text book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
7. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, cengage learning India pvt. Ltd.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016.
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S. K. Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.
6. AppuuKuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
7. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
8. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
9. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Assessments
Remember	9	9	9
Understand	63	63	63
Apply	28	28	28
Analyze			
Evaluate			
Create			
Total (%)	100	100	

Sample Question (s)**Remember**

1. What is Portland cement? Write the Cement composition?
2. Define surveying. What are the principles of surveying?
3. Outline the key elements of railway engineering?
4. Write the purpose of tunnels?

Understand

1. Describe the key characteristics of contour mapping?
2. Discuss the fundamental differences between flexible pavements and rigid pavements.
3. What are the various types of transportation system? How the transportation is contributing the economy of the country India?
4. What is the importance of construction materials such as brick, cement, aggregates, concrete and steel in building construction?

Apply

1. The following readings were taken with a level in sequence as follows 1.625, 1.535, 2.365, 1.355, 1.465, 1.105, 1.925, 2.015, 2.350, 1.815, 1.985, 2.115 and 2.560. The elevation of B.M at 1st reading is 210m. Find the reduced levels at each and every station using rise and fall method.

2. In a closed traverse the following bearings were observed with a compass. Calculate the included angles with sketch?

Line	Fore bearing
AB	$65^{\circ} 00'$
BC	$125^{\circ} 30'$
CD	$200^{\circ} 00'$
DE	$265^{\circ} 15'$
EA	$330^{\circ} 00'$

3. Convert the following whole circle bearings into reduced (quadrantal) bearings?

(i) 65° (ii) $143^{\circ} 15'$ (iii) $252^{\circ} 30'$ (iv) $320^{\circ} 42'$ (v) $181^{\circ} 12'$ (vi) $270^{\circ} 42'$

4. The following fore bearings were observed for lines, AB, BC, CD, DE, FE and FG respectively. Determine their back bearings.

- i) FB of AB $310^{\circ} 30'$
- ii) FB of BC $145^{\circ} 15'$
- iii) FB of CD $210^{\circ} 30'$
- iv) FB of DE $60^{\circ} 45'$
- v) FB of EF $39^{\circ} 50'$
- vi) FB of FG $289^{\circ} 30'$

23BEX03 - INTRODUCTION TO PROGRAMMING
(Common to all branches of Engineering)

3 0 0 3

Course Outcomes:

At the end of the Course, Student should be able to:

1. Illustrate the Algorithms for programming and problem solving.
2. Formulate sequential and iterative programming.
3. Implement Basic Dynamic Data structures
4. Develop Modular program aspects in solving complex problems.
5. Apply the concepts for optimal utilization of memory
6. Understand the techniques of storage and processing the data.

COs – POs Mapping:

COs	PO ₁	PO ₂	PO ₃	PO ₁₂
1	3	3	3	2
2	3	2	2	2
3	3	2	2	2
4	3	3	3	2
5	3	2	2	2
6	2	1	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

UNIT I

Introduction to Computer Problem Solving:

Programs and Algorithms, Computer Problem Solving Requirements, Phases of Problem Solving, Problem Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

Introduction, Structure of a C Program, Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements. Operators, Type Conversion Relational Expressions

UNIT II

Introduction to C Programming:

Control Flow, Conditional Branching Statements: if, if-else, if-else—if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, goto statement.

Arrays:

Introduction, Operations on Arrays, Arrays as Function Arguments, Two Dimensional Arrays, Multidimensional Arrays.

Strings: String Fundamentals, String Processing with and without Library Functions, Pointers and Strings.

UNIT- III

Functions: Introduction Function: Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Variable Storage Classes, Recursion.

Pointers: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers as Function Arguments, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer, Command Line Arguments.

UNIT-IV

Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type —Enum variables, Using Type def keyword, Bit Fields. Data Files: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

Textbook(s)

1. A Structured Programming Approach Using C, Forouzan, Gilberg, 3rd Edition, Cengage.
2. How to solve it by Computer. G. Dromey, 12th Edition, Pearson Education.
3. Programming In C-A Practical Approach. Ajay Mittal, 1st Edition Pearson

References:

1. Byron Gottfried, Schaum's Outline of Programming with C, 4th Edition, 2020, McGraw-Hill.
2. Computer Programming. Reema Thareja, 3rd Edition, 2023, Oxford University Press
3. The C Programming Language, Dennis Richie And Brian Kernighan, 2nd Edition, Pearson Education.
4. Programming In C, Ashok Kamthane, 2nd Edition, Pearson Publication.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Assessments
Remember	20	10	100
Understand	50	40	
Apply	30	30	
Analyze	--	20	
Evaluate			
Create			
Total (%)			

Sample Question (s)**Remember**

1. Define an algorithm.
2. List out the types of operators.
3. Define a function.
4. List any 5 file handling functions.

Understand

1. What is a 2D array? Explain the process of creating, initializing and accessing the elements of a 2D array.
2. Explain the 4 categories of functions.
3. Explain the difference between structure and union.
4. Explain the modes of opening a file.

Apply

1. Write a program to generate the Fibonacci sequence using recursion.
2. Write a program to perform matrix multiplication.
3. Write a program to copy the contents of

23BEX04 - ENGINEERING GRAPHICS
(Common to All branches of Engineering)

2 0 2 3

Course Outcomes

1. Understand the principles of engineering drawing, including engineering curves, scales.
2. Draw and interpret orthographic projections of points, lines, planes in front, top and side views.
3. Construct Ortho-graphic projections of planes inclined to both reference planes and Projections of Solids in simple positions.
4. Understand and apply concepts of projections of solids inclined to a reference plane and sectional views of solids in simple positions using CAD software.
5. Gain a clear understanding of the principles behind development of surfaces and to understand how to unfold basic geometric shapes into flat patterns using CAD software.
6. Develop the ability to draw isometric views and orthographic views and convert isometric views to orthographic views and vice versa using CAD software.

COs – POs Mapping

CO	PO ₁	PO ₅	PO ₁₀	PO ₁₂
1	3	-	3	3
2	3	-	3	3
3	3	-	3	3
4	3	3	3	3
5	3	3	3	3
6	3	3	3	3

3 – Strongly linked | 2 – Moderately linked | 1 – Weakly linked

UNIT I

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general and special methods – Arcs of circle method, concentric circles method, Oblong method, Rectangle method, Normal and tangent to Curves. **Scales:** Introduction to scales, Plain scales, Diagonal scales. **9 Hours**

UNIT II

Projections of Points & Straight Lines: Projections of points, Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes.

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes. **Projections of Solids:** Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane.

(Conventional drawing up to this)

9 Hours

(Using CAD)

UNIT III

Projections of Solids

Introduction to AUTOCAD, Projection of Solids with axis inclined to one reference plane and parallel to other, Projection of Solids with axis parallel to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone. **10 Hours**

UNIT IV

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views. **10 Hours**

Total: 48 Hours

Textbook:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016. **Reference**

Books:

1. Engineering Drawing, K.L. Narayana and P. Kanniah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc, 2009.

23HSX01 COMMUNICATIVE ENGLISH
(Common to all branches of Engineering)

2 0 0 2

Course Outcomes

1. Understand the context, topic, and specific information from social or transactional dialogues
2. Speak clearly using discourse markers on a specific topic in formal as well as informal discussions
3. Comprehend and appreciate literary texts by reading
4. Write summaries, coherent paragraphs, essays, letters/e-mails and resume
5. Apply grammatical structures to formulate sentence and use them appropriately
6. Improve communicative competence with enhanced vocabulary in formal and informal contexts

COs – POs Mapping

COs	PO1	PO09	PO10	PO11	PO12
1	1	1	3	1	2
2	1	1	3	1	2
3	1	1	3	1	1
4	1	1	3	1	2
5	1	1	3	1	1
6	1	1	3	1	1

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Unit I

Lesson : The power of plate of Rice- Ifeoma Okoye

Listening: Identifying the topic, the context and specific pieces of information by listening to Short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words

Unit 2

Lesson: Night of the Scorpion by Nissim Ezekiel, Steve Jobs

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts. Listening for global comprehension and summarizing what is listened

Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks and reporting what is discussed

Reading: Identifying sequence of ideas; verbal techniques that connect ideas in a paragraph, reading a text by making inferences-using context clues for comprehension.

Writing: Structure of a paragraph - Paragraph writing (specific topics), summarizing

Grammar: Cohesive devices -linkers, use of articles and zero article, prepositions.

Vocabulary: Homonyms, Homophones, Homographs.

Unit 3

Lesson: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Note-making, paraphrasing Letter Writing: Official Letters, Resumes

Grammar: Verbs – tenses, subject-verb agreement Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Compound words, Collocations

Unit 4

Lesson: The Power of Interpersonal Communication

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic on texts

Reading: Reading comprehension.

Writing: Writings structured essays on specific topics.

Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject-verb agreement)

Vocabulary: Jargons, Technical vocabulary

Textbook (s)

1. *Pathfinder*: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023.
2. *Empowering English* by Cengage Publications, 2023

Reference Books:

1. Dubey, Sham Ji& Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20%	20%	
Understand	29%	29%	
Apply	51%	51%	50%
Analyse			50%
Evaluate			
Create			
Total (%)			

Sample Question (s)

Remember

1. Explain the role of body language in inferential listening.
2. What announcement by the national peace council does Eleanor show her brother?
3. Reflect on the role of intrapersonal communication in personal growth, how can engaging in self-reflection and self-talk contribute in enhancing one's character and decision-making abilities?
4. Explain the role of body language in inferential listening.

Understand

1. What do you mean by listening for main ideas and supporting ideas?
2. What are the qualities of a good listener?
3. You recently have purchased a smartphone that has unexpectedly poor battery life. Compose a letter to the customer service department of the store where you bought it, explaining the issue and politely requesting a replacement or repair.
4. Explain briefly some situations that require inferential listening.

Apply

1. Write a short talk on 'memorable incident in your life'
2. Develop a conversation between two friends on positive impact that regular physical exercise can have on both physical and mental well-being.
3. Summarize the central idea of the poem *Night of the Scorpion* by Nissim Ezekel.
4. Imagine you are a customer support representative dealing with a dissatisfied customer. Create a role-playing scenario to address the customer's concerns and resolve the issue to their satisfaction.

23PYX02 - ENGINEERING PHYSICS LAB
(Common to all branches of Engineering)

0 0 2 1

Course Outcomes

1. Infer the knowledge from the scientific methods and learn the process of measuring different physical parameters
2. Develop the laboratory skills in handling of electrical and Optical instruments
3. Demonstrate the interference and diffraction phenomena of light
4. Inspect and experience physical principles of Magnetic fields and optical fiber communications
5. Apply the principles of physics and measure the solid state properties of materials
6. Design and analyze experiment based on physics concepts

COs - POs Mapping

COs	PO4	PO6	PO9	PO11	PO12
1	3	2	2	2	1
2	3	2	2	2	1
3	3	2	2	2	1
4	3	2	2	2	1
5	3	2	2	2	1
6	3	2	2	2	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

List of Experiments:

1. Study of variation of magnetic field along the axis of current-carrying circular coil-Stewart and Gee's Method.
2. Determination of wavelengths of spectral line of mercury spectrum using diffraction grating.
3. Determination of radius of curvature of convex lens by forming Newton's rings.
4. Study of series and parallel Resonance in LCR circuit.
5. Measurement of thickness of a thin paper using wedge method.
6. Calculation of Numerical Aperture (NA) and bending losses of a given fiber.
7. Determination of frequency of an electrically vibrating tuning fork in Transverse and longitudinal modes - Melde's Experiment.
8. Determination of wavelength of Laser by diffraction grating.
9. Determination of Hall Coefficient and charge carrier density of semi-conductor.
10. Determination of Band gap of a semiconductor.
11. Determination of Rigidity modulus of a given wire using torsional pendulum.
12. Determination of size of particle using diffraction pattern.
13. Verification of Malu's law.
14. Determination of temperature coefficients of a thermistor.
15. Determination of dispersive power of the material of a prism.
16. Determination of Time constant of an R-C circuit.

List of Augmented Experiments¹

1. To study the magnetization (M) of a ferromagnetic material in the presence of a magnetic field B and to plot the hysteresis curve (M vs. B)
 2. Study the Thermoemf of the thermo couple
 3. LCR Series and Parallel-Design of circuit for various resonance frequencies
 4. Determination of characteristics of Laser beam
 5. Determination of Horizontal component of earth's magnetic field
-
6. Study of double refraction in calcite crystals

¹ Students shall opt any one of the Augmented Experiments in addition to the regular experiments

7. Dispersive power of various liquids using spectrometer
8. Photo cell-Characteristics and determination of Planks constant
9. Michelson's interferometer.

References:

1. Physics Lab manual-Department of Physics, BS & H, GMRIT, Rajam, 2019
2. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017
3. Y. Aparna and K. Venkateswararao, Engineering Physics-I and II, VGS Techno series, 2010
4. S. Panigrahi and B. Mallick, Engineering Practical Physics, Cengage learning, Delhi, 2015
4. <http://www.amrita.vlab.co.in> Virtual Labs, Amrita University.
5. <http://www.iitk.vlab.co.in>

Course Outcomes:

At the end of course student will be able to

- CO1: Determine the concentration of acids by Conductometry.
- CO2: Prepare the Bakelite polymer and ZnO nanomaterial
- CO3: Estimate the strength of an acid present in secondary battery by pH metry
- CO4: Identify the organic compounds by IR Spectroscopy.
- CO5: Verify the Beer- Lamberts law and measure the wavelength
- CO6: Estimate concentration of ferrous iron by potentiometry and dichrometry

COs – POs Mapping

COs	PO1	PO6	PO7	PO9	PO12
1	3	1	3	1	1
2	3	1	3	1	1
3	3	1	3	1	1
4	3	1	2	1	1
5	3	1	3	1	1
6	3	1	3	1	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

LIST OF EXERCISES:

1. Introduction to qualitative analysis- Demonstration
2. Measurement of 10Dq by spectrophotometric method
3. Conductometric titration of strong acid vs. strong base
4. Conductometric titration of weak acid vs. strong base
5. Determination of cell constant and conductance of solutions
6. Potentiometry - determination of redox potentials and emfs
7. Determination of Strength of an acid in Pb-Acid battery
8. Preparation of a Bakelite
9. Verify Lambert-Beer's law
10. Wavelength measurement of sample through UV-Visible Spectroscopy
11. Identification of simple organic compounds by IR
12. Preparation of nanomaterials by precipitation method
13. Estimation of Ferrous Iron by Dichrometry
14. Determination of acid number of lubricating oil
15. Determination of Hardness of a groundwater sample.
16. Determination of Viscosity of lubricating oil by Redwood Viscometer 1

List of Augmented Experiments1

1. Assessment of synthesis of carbon fibers by polymerization
2. Synthesis of nanomaterials by other nanomethodlogy
3. Identification of simple organic compounds by IR
4. Making a battery of required potential
5. Calculation of Ferrous Iron by Dichrometry.
6. Find the acid number of various industrial oils or edible oils

Reference Books

1. Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar

Course outcomes:

At the end of course student will be able to

CO1: Asses the percentage moisture of a solid fuel

CO2: Prepare the Bakelite polymer and ZnO nanomaterial

CO3: Determine acid number and viscosity of lubricating oil

CO4: Estimate the Iron and Calcium in cement.

CO5: Estimate the hardness and dissolved oxygen in water.

CO6: Determine the Strength of an acid in lead acid Battery

COs – POs Mapping

COs	PO1	PO6	PO7	PO9	PO12
1	3	1	3	1	1
2	3	1	3	1	1
3	3	1	3	1	1
4	3	1	2	1	1
5	3	1	3	1	1
6	3	1	3	1	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

LIST OF EXERCISES:

1. Introduction to Quantitative Analysis - Demonstration
2. Determination of Hardness of a groundwater sample.
3. Estimation of Dissolved Oxygen by Winkler's method
4. Determination of Fluoride in water sample
5. Determination of nitrite in water sample by spectrometric method
6. Determination of percentage of Iron in Cement sample by colorimetry
7. Estimation of Calcium in Portland cement
8. Determination of Strength of an acid in Pb-Acid battery
9. Preparation of a polymer (Bakelite)
10. Preparation of nanomaterials by precipitation method
11. Adsorption of acetic acid by charcoal
12. Determination of percentage Moisture content in a coal sample
13. Determination of acid number of lubricating oil
14. Determination of Viscosity of lubricating oil by Redwood Viscometer 1
15. Determination of Viscosity of lubricating oil by Redwood Viscometer 2
16. Determination of Calorific value of gases by Junker's gas Calorimeter

List of Augmented Experiments1

1. Assessment of ground water quality of your village/Mandal (by taking min. 6 locations and determining min. 4 parameters – Fluoride, Chloride, Hardness, TDS etc.)
2. Preparation of a desired quality of Viscosity Index lubricating oil
3. Proximate analysis of coal – Ultimate analysis of coal
4. Making a battery of required potential
5. Energy scenario in India- Various sources, % consumption, solutions to meet future demand etc.
6. Find the viscosity of various edible and non-edible lubricating oils

Reference Books

1. Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar
2. Waste Water Engineering Treatment and Reuse, 4th Edition, Metcalf and Eddy, Inc
3. Engineering chemistry laboratory manual & record By Srinivasulu D. Parshva publications

23BEX05 - ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP
(Common to All branches of Engineering)

0 0 3 1.5

Course Outcomes

1. Apply fundamental electrical principles to resolve complex circuit problems.
2. Develop proficiency in conducting electrical measurements and studying machine characteristics for practical applications.
3. Demonstrate skills in measuring power parameters and calculate energy consumption for residential applications.
4. Analyze the characteristics of semiconductor devices
5. Find the frequency response of amplifiers using BJT
6. Verify the truth tables of logic gates and basic flip flops

CO-PO Mapping

COs	PO4	PO5	PO6	PO9	PO12
CO1	3	2	1	1	1
CO2	3	2	1	1	1
CO3	3	2	1	1	1
CO4	3	2	1	1	1
CO5	3	2	1	1	1
CO6	3	2	1	1	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
 - Provide some exercises so that hardware tools and instruments are learned to be used by the students.
2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
 - Provide some exercises so that measuring instruments are learned to be used by the students.
3. Components:
 - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
 - Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises **Note:** Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING LAB List of

Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers Plot Input & Output characteristics of BJT in CE and CB configurations

4. Frequency response of CE amplifier.
5. Simulation of RC coupled amplifier with the design supplied
6. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
7. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs. Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

List of Augmented Experiments.

1. Connections of Tube Light wiring
2. Connections of Godown Wiring
3. Connections of stair case wiring
4. Generate fixed positive 5V using IC7405
5. Generate fixed Negative 5V using IC7905
6. Generate sinusoidal wave form using function generator

Reference Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.
4. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
5. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
6. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

23BEX06 - ENGINEERING WORKSHOP
(Common to all branches of Engineering)

0 0 3 1.5

Course Outcomes:

At the end of this course a student will be able to

1. Demonstrate the simple wooden components like Cross Lap joint, T-Lap joint, Dovetail Joint.
2. Develop the simple house hold items like Taper Tray, Square box, Open Scoop using sheet metal.
3. Build the V- Fit, Square fit, Dovetail fit using mild steel.
4. Understand simple house wiring circuits like Parallel/Series connection of three bulbs, Stair Case Wiring, Godown Wiring.
5. Create the Green Sand Mould for given the patterns like rectangular shape, circular shape.
6. Construct the metal joint using Arc Welding like: Lap joint, Butt joint.

COs – POs Mapping:

COs	PO ₁	PO ₉	PO ₁₂
1	3	3	2
2	3	3	2
3	3	3	2
4	3	3	2
5	3	3	2
6	3	3	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Demonstration: Safety practices and precautions to be observed in workshop.

Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints: a) Cross Lap joint, b) T-Lap joint, c) Dovetail Joint.

Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets: a) Taper Tray, b) Square box, c) Open Scoop.

Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises: a) V- Fit, b) Dovetail fit, c) Half Round Fit.

Electrical Wiring: Familiarity with different types of basic electrical circuits and make the following connections: a) Parallel/Series connection of three bulbs, b) Stair Case Wiring, c) Godown Wiring
Foundry: Demonstration of Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns: a) rectangular shape mould, b) circular shape mould

Welding Shop: Demonstration and practice on Arc Welding. Preparation of a) Lap joint and b) Butt joint.

LIST OF EXPERIMENTS:

Wood Working:

1. Cross Lap joint,
 2. T-Lap joint,
 3. Dovetail Joint
- Sheet Metal Working:**
4. Taper Tray,
 5. Square box,
 6. Open Scoop

Fitting:

1. V- Fit,
 2. Square fit,
 3. Dovetail fit,
- Electrical Wiring:**
4. Parallel/Series connection of three bulbs,
 5. Stair Case Wiring,
 6. Godown Wiring

Foundry Trade:

1. Mould cavity for rectangular shape
 2. Mould cavity for a straight pipe
- Welding Shop:**
3. Lap joint

4. Butt joint.

Any two jobs from each trade must be performed by the student.

AUGMENTED EXPERIMENT / MINI PROJECT: An innovative and creative useful house hold product/model should be prepared by the group of 6-10 students using the knowledge gathered from the all shops in workshop.

TEXTBOOKS:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

REFERENCE BOOKS:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

23BEX07 - COMPUTER PROGRAMMING LAB
(Common to all branches of Engineering)

0 0 3 1.5

Course Outcomes:

At the end of the Course, Student will be able to:

1. Read, understand, and trace the execution of programs.
2. Select the proper control structure for solving the problem.
3. Construct programs using homogenous data types.
4. Develop modular programming using functions
5. Formulate programs for optimal utilization of memory.
6. Develop programs using files.

COs – POs Mapping:

COs	PO2	PO3	PO4	PO12
1	2	2	3	2
2	2	3	3	2
3	2	3	3	2
4	2	3	3	2
5	2	3	3	2
6	2	3	3	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

List of Experiments:

UNIT-I

WEEK 1:

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with the programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc. ii)

Exposure to Turbo C, gcc iii) Writing simple programs using printf(), scanf()

WEEK 2:

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps using textual and graphic notation.

Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab 1: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs i) Sum and average of 3 numbers ii) Conversion of Fahrenheit to Celsius and vice versa iii)

Simple interest calculation

WEEK 3:

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions. i) Finding the square root of a given number ii) Finding compound interest

iii) Area of a triangle using Heron's formulae iv)

Distance traveled by an object

UNIT-II

WEEK4

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression, and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:

Lab4: Simple computational problems using the operator's precedence and associativity i) Evaluate the following expressions.

- a. $A+B*C+(D*E) + F*G$
- b. $A/B*C-B+A*D/3$
- c. $c. A+++B---A$
- d. $d. J= (i++) + (++i)$

ii) Find the maximum of three numbers using the conditional operator iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5:

Objective: Explore the full scope of different variants of —if construct||, namely if-else, null-- else, if-else if*-else, switch, and nested-if, including in what scenario each can be used and how to use them. Explore all relational and logical operatorswhile writing conditionals for —if construct||.

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions: Lab 5:

Problems involving if-then-else structures.

- i) Write a C program to find the max and min of four numbers using if-else.
- ii) Write a C program to generate electricity bill. iii) Find the roots of the quadratic equation. iv) Write a C program to simulate a calculator using a switch case.
- v) Write a C program to find whether the given year is a leap year.

WEEK 6:

Objective: Explore the full scope of iterative constructs, namely while loop, do-while loop, and for loop in addition to structured jump constructs like break and continue, including when each of these statements is more appropriate. Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

Lab 6: Iterative problems, e.g., the sum of series

- i) Find the factorial of a given number using any loop. ii) Find whether the given number is a prime or not. iii) Compute sine and cos series iv) Checking whether a number is palindrome
- v) Construct a pyramid of numbers.

UNIT-III

WEEK7:

Objective: Explore the full scope of the Arrays construct, namely defining and initializing 1-D and 2-D and, More generically, n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching. Lab 7:1D Array manipulation, linear search

- i) Find the min and max of a 1-D integer array.
- ii) Perform linear search on the 1D array.
- iii) The reverse of a 1D integer array iv) Find 2's complement of the given binary number. v) Eliminate duplicate elements in an array.

WEEK 8:

Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null characters and get comfortable with strings by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort i)

Addition of two matrices ii) Multiplication two matrices iii)

Sort array elements using bubble sort iv) Concatenate two strings without built-in functions

v) Reverse a string using built-in and without built-in string functions

UNIT-IV

WEEK9:

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation value initialization, resizing, changing, and reordering the contents of an array, and memory deallocation using malloc (), calloc (),realloc () and free () functions. Gain experience

processing command-line arguments received by C Suggested

Experiments/Activities:

Tutorial 9: Pointers, structures, and dynamic memory allocation Lab 9:

Pointers and structures, memory dereference.

i) Write a C program to find the sum of a 1D array using malloc() ii) Write a C program to find the total average of n students using structures iii) Enter n students data using calloc() and display failed students list iv) Read student name and marks from the command line and display the student details along with the total.

v) Write a C program to implement realloc()

WEEK 10:

Objective: Experiment with C Structures, Unions, bit fields self-referential structures(Singlylinked lists), and nested structures Suggested Experiments/Activities:

Tutorial 10: Bitfields, Self-Referential Structures, Linked lists

Lab10: Bitfields

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bitfields

i) Create and display a singly linked list using self-referential structure.

ii) Demonstrate the differences between structures and unions using a C program. iii) Write a C program to shift/rotate using bitfields. iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT-V

WEEK 11:

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by Parameter passing using call by value. Basic methods of numerical integration Suggested

Experiments/Activities:

Tutorial 11: Functions, call by value, scope and extent,

Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

i) Write a C function to calculate NCR value.

ii) Write a C function to find the length of a string.

iii) Write a C function to transpose of a matrix. iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12:

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

i) Write a recursive function to generate Fibonacci series. ii) Write a recursive function to find the lcm of two numbers. iii) Write a recursive function to find the factorial of a number. iv) Write a C Program to implement Ackermann function using recursion. v) Write a recursive function to find the sum of series.

WEEK 13:

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers. i) Write a C program to swap two numbers using call by reference.

ii) Demonstrate Dangling pointer problem using a C program. iii) Write a C program to copy one string into another using pointer. iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK14:

Objective: To understand data files and file handling with various file I/O functions.Explore the differences Between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

- i) Write a C program to write and read text into a file. ii) Write a C program to write and read text into a binary file using fread() and fwrite() iii) Copy the contents of one file to another file. iv) Write a C program to merge two files into the third file using command-line arguments. v) Find no. of lines, words and characters in a file

List of Augmented Experiments:

1. Employee's Management System
2. Library management system
3. Automation of department store
4. Personal Dairy Management
5. Telecom Billing Management
6. Bank Management System
7. Contacts Management

Text books:

1. Ajay Mittal, Programming in C: A practical approach, 1 st Edition, Pearson.
2. Byron Gottfried, Schaum's Outline of Programming with C, 4th Edition, 2020, McGraw Hill.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice- Hall of India. C Programming,
2. A Problem-Solving Approach, Forouzan, Gilberg, Prasad, 3rd Edn, CENGAGE.

23BEX08 - IT WORKSHOP
(Common to all branches of Engineering)

0 0 2 1

Course Outcomes:

At the end of the Course, Student will be able to:

1. Demonstrate the process of Assembling and disassembling the PC.
2. Illustrate the steps involved in installations of various operating systems.
3. Understand the process of Configuring IP address and perform virus free downloads.
4. Create projects using Latex/ Word and organize data and spreadsheets.
5. Design basic and interactive Power Point Presentations.
6. Improve Conversational abilities using AI-Tools.

COs – POs Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₉	PO ₁₂
1	3	2	3	2	3	3
2	2	3	2	3	3	2
3	3	2	2	2	3	2
4	2	3	2	2	3	2
5	3	3	3	2	3	2
6	2	2	2	2	3	2

3 - Strongly Linked | 2 - Moderately Linked | 1 - Weakly Linked

PC Hardware

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor. **Task 2:** Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also, students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there are no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN. **Task 2:** Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop-up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using LaTeX and Word to create a project certificate. Features to be covered: - Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colours, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Task 3: Creating project abstract Features to be covered: -Formatting Styles, inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered: - Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources. **Task 1:** Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function.

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWERPOINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI TOOLS – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

Ex:Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:

1. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dream tech
2. The Complete Computer upgrade and repair book, 3rd edition Cheryl A Schmidt, WILEY Dream tech
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education. 4. PC Hardware - A Handbook – Kate J. Chase PHI (Microsoft)
5. LaTeX Companion – Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfins on and Ken Quamme. – CISCO Press, Pearson Education.
7. IT Essentials PC Hardware and Software Labs and Study Guide Third Edition by PatrickRegan– CISCO Press, Pearson Education.

23HSX02 - COMMUNICATIVE ENGLISH LAB
(Common to all branches of Engineering)

0 0 2 1

Course Outcomes

1. Acquire knowledge of the English sound system and get practice to gain accuracy in pronunciation
2. Apply the patterns of accent and intonation for better listening and speaking comprehension
3. Write emails, resume and statement effectively for the purpose for professional communication
4. Evaluate and exhibit professionalism in participating in debates and group discussions
5. Demonstrate the necessary verbal and non-verbal communication in technical presentations
6. Perform different roles and practice interpersonal communication in formal situations

COs – POs Mapping

COs	PO01	PO09	PO10	PO11	PO12
1	1	1	3	1	2
2	1	1	3	1	1
3	1	1	3	1	2
4	1	1	3	1	1
5	1	1	3	1	2
6	1	1	3	1	1

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

List of Experiments

1. Letters and Sounds of English
2. Role play/ Conversation Practice-1
3. Jam
4. E-Mail Writing
5. Pronunciation Rules
6. Role play/ Conversation Practice-II
7. Accent rules and Intonation
8. Presentation Skills
9. Resume Writing
10. Debating
11. Group Discussion
12. Interviews
13. Poster Presentation
14. Statement of Purpose
15. Role play/ Conversation Practice-3 16. Role play/ Conversation Practice-4

Augmented Experiment

List of Augmented Experiments²

1. Common Errors in English
2. Listening Skills
3. Writing Skills
4. Reading Skills
5. Public Speaking
6. Interview Skills
7. Business Communication
8. Functional English
9. Preparation for GRE/TOEFL
10. Preparation for IELTS/CAT/GMAT

¹Students shall opt any one of the Augmented Experiments in addition to the regular experiments

Reading Material (s)

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.
2. Taylor Grant: English Conversation Practice, Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. J. Sethi& P.V. Dhamija. A Course in Phonetics and Spoken English, (2nd Ed), Kindle, 2013
5. K. Nirupa Rani, Jayashree Mohan Raj, B. Indira, (Ed) Speak Well (C.D) Orient Black Swan Pvt Ltd, Hyderabad, 2012

Web Resources:

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. <https://www.britishcouncil.in/english/online>
5. <http://www.letstalkpodcast.com/>
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. <https://www.youtube.com/c/ArnelsEverydayEnglish/featured>
8. <https://www.youtube.com/c/engvidAdam/featured>
9. <https://www.youtube.com/c/EnglishClass101/featured>
10. <https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists>
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. <https://www.youtube.com/user/letstalkaccent/videos>
2. <https://www.youtube.com/c/EngLanguageClub/featured>
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

23HSX11 - HEALTH AND WELLNESS, YOGA AND SPORTS
(Common to All branches of Engineering)

0 0 1 0.5

Course Objectives:

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

Course Outcomes: After completion of the course the student will be able to

CO1: Understand the importance of yoga and sports for Physical fitness and sound health.

CO2: Demonstrate an understanding of health-related fitness components.

CO3: Compare and contrast various activities that help enhance their health.

CO4: Assess current personal fitness levels. **CO5:** Develop Positive Personality

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

- i) Organizing health awareness programmes in community ii) Preparation of health profile
- iii) Preparation of chart for balance diet for all age groups

UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

- i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
- Practicing general and specific warm up, aerobics ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc. 2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

1. Evaluated for a total of 100 marks.
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

Course Objectives:

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

Course Outcomes: After completion of the course the students will be able to **C01:** Understand the importance of discipline, character and service motto.

C02: Solve some societal issues by applying acquired knowledge, facts, and techniques.

C03: Explore human relationships by analyzing social problems.

C04: Determine to extend their help for the fellow beings and downtrodden people. **C05:** Develop leadership skills and civic responsibilities.

UNIT I Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

- i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
- ii) Conducting orientations programs for the students –future plans-activitiesreleasing road map etc. iii) Displaying success stories-motivational biopics- award winning movies on societalissues etc.
- iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II Nature Care Activities:

- i) Best out of waste competition.
- ii) Poster and signs making competition to spread environmental awareness. iii) Recycling and environmental pollution article writing competition. iv) Organising Zero-waste day.
- v) Digital Environmental awareness activity via various social media platforms.
- vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
- vii) Write a summary on any book related to environmental issues.

UNIT III Community Service Activities:

- i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities-experts-etc.
- ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS, iii) Conducting consumer Awareness. Explaining various legal provisions etc. iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
- v) Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., –Introduction to Environmental Engineering||, McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. –Introduction to Environmental Engineering and Science||, Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

1. Evaluated for a total of 100 marks.
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

Course Outcomes:

At the end of the course, the student will be able to

1. Model and solve the first order differential equations
2. Experiment with the practical importance of solving first and higher order differential equations in engineering.
3. Solve higher order differential equations and understand about initial value problems
4. Identify methods for solving linear partial differential equations.
5. Make use of central concepts in partial differential equations and vector differentiation
6. Apply vector calculus in the context of estimating the work done, circulation, flux and vector integral theorems

COs	PO1	PO2	PO3	PO4	PO12
1	3	3	2	2	1
2	3	2	3	3	1
3	3	3	3	2	1
4	3	2	2	1	1
5	3	3	2	1	1
6	3	3	3	2	1

COs – POs Mapping

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT- I :**Differential equations of first order and first degree**

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form.

Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits

UNIT – II :**Linear differential equations of higher order (Constant Coefficients)**

Definitions, homogenous and non-homogenous, complimentary function, general particular integral, Wronskian, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT – III : Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT - IV : Vector Calculus**Vector differentiation:**

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions - Divergence and Curl, vector identities

Vector integration:

Line integral- circulation- work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Books:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Michael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
5. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2017

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Assessments
Remember	10	10	
Understand	60	60	40
Apply	30	30	60
Analyze			
Evaluate			
Create			
Total (%)	100	100	100

Sample Question (s)**Remember**

1. State Newton's Law of Cooling
2. Find the Wronskian for the functions $\cos x$ and $\sin x$
3. Form the PDE by eliminating the arbitrary constants a and b from $z = ax + by + \frac{a}{b} - b$
4. State Gauss divergence theorem.

Understand

1. Solve $(1 + e^{x/y})dx + e^{x/y} \left(1 - \frac{x}{y}\right)dy = 0$
2. Solve $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 2e^{3x}$
3. Form the PDE by eliminating the arbitrary functions from $Z = f(x) + e^y g(x)$

Apply

1. A bacterial culture, growing exponentially, increases from 200 to 500 grams in the period from 6 a.m. to 9 a.m. Find the number of grams which will be present at noon.
2. If a voltage of $20 \cos 5t$ is applied to a series circuit consisting of 10 ohm resistor and 2 Henry inductor, determine the current at any time t .
3. Find the work done in moving a particle in the force field $F = 3x^2\bar{i} + (2xz - y)\bar{j} + z\bar{k}$ along the straight line from $(0,0,0)$ to $(2,1,3)$.

23ME201 ENGINEERING MECHANICS
(Common to MECH & CIVIL)

3 0 0 3

Course Outcome:

1. Compute the resultant force in concurrent and coplanar force systems.
2. Analyze the equilibrium condition for different force systems with and without friction.
3. Determine the forces and their nature in the members of trusses.
4. Determine the centroids, centre of gravity and moment of inertia of different geometrical shapes.
5. Analyze the kinematics of rectilinear and curvilinear motions.
6. Assess the kinetics of rectilinear, curvilinear and rigid body motion.

CO-PO Mapping

COs	PO1	PO2	PO3	PSO ₁
1	3	2	2	2
2	3	2	2	2
3	3	2	2	2
4	3	2	2	2
5	3	3	2	2
6	3	3	2	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

UNIT I: Introduction to Engineering Mechanics – Basic Concepts, Scope and Applications, Systems of Forces: Coplanar Concurrent Forces– Components in Space–Resultant– Moment of Force and its Application –Couples and Resultant of Force Systems.

Friction: Introduction, limiting friction and impending motion, Coulomb's laws of dry friction, coefficient of friction, Cone of Static friction. **12 hours**

UNIT II: Equilibrium of Systems of Forces: Free Body Diagrams, Lami's Theorem, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Analysis of plane trusses by method of joints and sections. **12 hours**

UNIT III: Centroid and Centre of Gravity: Centroids of simple figures (from basic principles)–Centroids of Composite Figures. Centre of gravity of composite bodies,

Area Moments of Inertia: Definition– Polar Moment of Inertia, Parallel and perpendicular axis theorems, Moments of Inertia of Composite Figures. **12 hours**

UNIT IV: Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics –D'Alembert's Principle - Work Energy method and applications to particle motion-Impulse Momentum method.

Rigid body Motion: Kinematics and Kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse Momentum method. **12 hours**

Total: 48
hours

Textbooks:

1. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.
2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022

Reference Books:

1. Engineering Mechanics, Statics and Dynamics, Rogers and M A. Nelson., McGraw Hill Education.
2. Engineering Mechanics, S.S Bhavikatti, 8th Edition, New Age International, 2022.
3. Engineering Mechanics, A.K Tayal, Statics and Dynamics, 14th Edition, Umesh Publishers, 2021
4. Engineering Mechanics: Principles of Statics and Dynamics, R.C. Hibbler., Pearson Press, 2006.
5. Introduction to Statics and Dynamics, Andy Ruina and Rudra Pratap., Oxford University Press, 2011.

Sample Questions(s)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examinations (%)
Remember	15	15	-
Understand	30	30	-
Apply	55	55	70
Analyze	-	-	30
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Remember

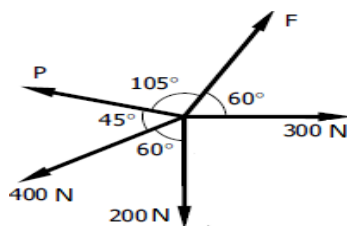
1. Name different types of system of forces
2. Define centroid
3. Define area moment of inertia
4. State the laws of friction
5. List the assumptions of perfect frame
6. Define Rectilinear and Curvilinear motions

Understand

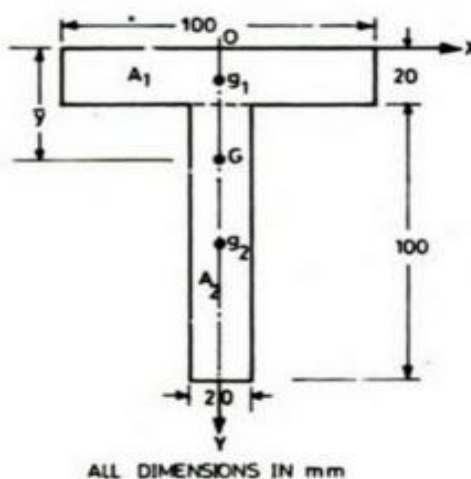
1. Explain Lami's theorem
2. Compare centroid and centre of gravity
3. Explain about area moment of inertia
4. How will you distinguish between static friction and dynamic friction?
5. Explain the difference between frame and truss
6. Explain the D'Alembert's principle

Apply

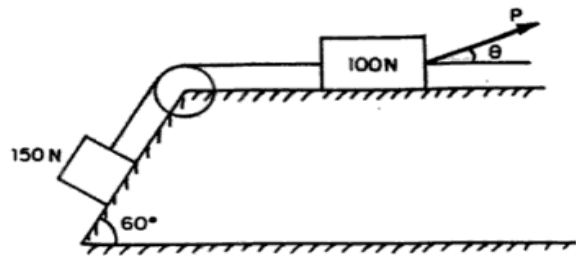
1. Figure represents the concurrent force system acting at a joint of a bridge truss. Determine the value of P and E to maintain equilibrium of the forces



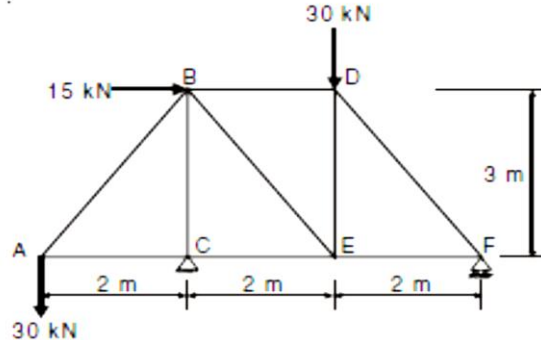
2. Identify the centroid of T-section shown in below Fig.



3. Determine the moment of inertia of the areas of Triangle about its base by first principle
4. Determine the least value of force P to cause motion to impend rightwards. Assume the co-efficient of friction under the blocks to be 0.2 and pulley to be frictionless.



5. Determine the forces in all the members of the truss shown in Fig.



6. A stone is dropped into a well and the splash is heard two seconds later. If sound travels 335 m/s, what is the depth of the well?
7. An 1800 kg Toyota Innova travels down the 10° inclined road at a speed of 6 m/s. If the driver jams on the brakes, causing his wheels to lock, solve how far the tires skid on the road using: a. Equation of the motion b. Principles of work-Energy The coefficient of kinetic friction between the wheels and the road is 0.5 **(For Open Book Examination and not for semester end examination)**

Analyze

1. A uniform ladder 3 m long weighs 200 N. It is placed against a wall making an angle of 60° with the floor as shown in Fig. The coefficient of friction between the wall and the ladder is 0.25 and that between the floor and ladder is 0.35. The ladder, in addition to its own weight, has to support a man of 1000 N at its top at B. Calculate: i) The horizontal force P to be applied to ladder at the floor level to prevent slipping. ii) If the force P is not applied, what should be the minimum inclination of the ladder with the horizontal, so that there is no slipping of it with the man at its top?
2. Compare the location of the centroids of an arc of circle and a sector of a circle subtending the same angle at the centre of the circle
3. A car A is travelling on a straight level road with a uniform speed of 60 km/hr. it is followed by another car B moving at a speed of 70 km/hr. when the distance between them is 2.5 km, the car B is decelerated at 20 km/hr^2 . will the car be catch up with A? if not, why not? If yes, at what distance and time?
4. Analyze the ability of a hook (used by a crane) to raise prefabricated walls upright. The hook was approximately J-shaped, with a lip. The hook would grip one end of the wall and lift, while the other end of the wall remained in contact with the ground **(For Open Book Examination and not for semester end examination)**
6. The car A has a forward speed of 18 km/h and is accelerating at 3 m/s^2 Determine the velocity and acceleration of the car relative to observer B, who rides in a nonrotating chair on the Ferris wheel. The angular rate $\omega = 3 \text{ rev/min}$ of the Ferris wheel is constant **(For Open Book Examination and not for semester end examination)**

Course Outcomes

At the end of the course, Student will be able to

1. Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
2. Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
3. Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
4. Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between dequeues and priority queues, and apply them appropriately to solve data management challenges.
5. Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees
6. Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

CO-PO Mapping

COs	PO1	PO2	PO3	PO12	PSO1
1	3	2	2	1	3
2	3	3	3	1	3
3	3	3	3	1	3
4	3	3	3	1	3
5	3	3	3	1	3
6	2	3	3	1	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I

Introduction to Linear Data Structures: Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures.

Searching Techniques: Linear & Binary Search, **Sorting Techniques:** Bubble sort, Selection sort, Insertion Sort

11Hours

Unit II

Linked Lists and Stacks: Singly linked lists, representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists. **Stacks:** Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists,

13

Hours

Unit III

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists. **Dequeues:** Introduction to dequeues (double-ended queues), Operations on dequeues and their applications. **Applications of Stack and Queue:** Applications of stacks in expression evaluation, backtracking, reversing list etc., Applications of queues in breadth-first search, scheduling, etc.

12

Hours

Unit IV

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversals Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

12 Hours

Total: 48 Hours

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.

2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Assessments
Remember	25	25	
Understand	38	38	
Apply	37	37	
Analyze	--		30
Evaluate	--		25
Create	--		45
Total (%)	100	100	100

Sample Question (s)**Remember**

1. Compute the time complexity of insertion in a linked list.
2. Define Abstract Data Type (ADT)?
3. Define a linear data structure and give one example.

Understand

1. How does the implementation of ADTs benefit software development?
2. What is the time complexity of a linear search in the worst case?
3. Differentiate between stack and queue.

Apply

1. Describe the process of implementing an ADT for a stack.
2. Draw the logical structure of a doubly linked list.

Course Outcomes

At the end of the course, Student will be able to

1. Summarize the V-I relations of electrical circuit elements.
2. Outline magnetic and couple circuits
3. Apply network reduction techniques to DC circuits
4. Summarize the behaviour of AC circuits
5. Apply network theorems to AC and DC circuits.
6. Outline the characteristics of series/parallel resonant circuits

COs – POs Mapping

COs	PO1	PO2	PO3	PO6	PO7	PO9	PO12	PSO1	PSO2
CO1	3	1	2	1	1	1	1	3	3
CO2	3	1	2	1	1	1	1	3	3
CO3	3	1	2	1	1	1	1	3	3
CO4	3	1	2	1	1	1	1	3	3
CO5	3	1	2	1	1	1	1	3	3
CO6	3	1	2	1	1	1	1	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

UNIT-I: Introduction to Electrical Circuits

Basic circuit elements R, L, C and their V-I relations, dependent and independent sources, Kirchoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta-to-star transformation, source transformation), nodal and mesh analysis to DC networks with dependent and independent voltage and current sources *supernode and supermesh analysis*

(12 Hours)

UNIT-II: Magnetic Circuits

Terminology used in magnetic circuits, series, parallel and composite magnetic circuits, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention – coefficient of coupling.

Conductively coupled equivalent circuit

(10 Hours)

UNIT-III: Single Phase Circuits

Characteristics of periodic functions, Average value, R.M.S. value, form factor, peak factor, and representation of a sine function, concept of phasor, phasor diagram.

Steady state analysis of R, L and C circuits to sinusoidal excitations-response of pure resistance, inductance, capacitance, series RL, RC and RLC circuits, parallel RL, RC and RLC parallel circuits, power and power factor

Resonance: Series Resonance-Characteristics of a series resonant circuit, Q-factor, selectivity and bandwidth, expression for half power frequencies; Parallel resonance- Q-factor, selectivity and bandwidth.

Locus diagram: RL, RC, RLC series circuits with R, L and C variables.

Comparison between series and parallel resonance, applications of resonant circuits

(15 Hours)

UNIT-IV: Network theorems (DC & AC Excitations)

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem and Millman's theorem and compensation theorem.

Tellegen's theorem

(11 Hours)

(Total: 48 Hours)

Textbook (s)

1. W.H.Hayt, J.E.Kimmerly, and S.M.Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 8th Edition, 2015.
2. Charles K Alexander and Mathew N.O Sadiku, "Fundamentals of Electric Circuits", Tata McGraw Hill, 5th Edition, 2013.

3. M.E Van Valkenburg, "*Network Analysis*", Prentice Hall of India, 4th Edition, 2018.
4. P. Ramana, G.T.Chnadra Sekhar, G.Suresh, "*Network Theory*", SChand and Company Ltd., 1st Edition, 2024.

Reference (s)

1. Abhijit Chakrabarti, "*Circuit Theory Analysis and Synthesis*", Dhanpat Rai & Co., 6th Edition, 2014.
2. A Sudhakar, and Shyammohan S. Palli, "*Circuits and Networks: Analysis and Synthesis*", McGraw Hill Higher Education, 5th Edition, 2015.
3. M Nahvi, Joseph Edminister, K Uma Rao, "Electric Circuits, (Schaum's Outline Series)", McGraw Hill Higher Education, 7th Edition, 2017.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test(%)
Remember	20	20	-
Understand	20	20	-
Apply	60	60	60
Analyze	-	-	40
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample Question (s)

Remember

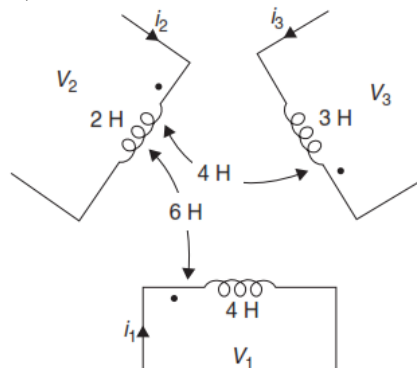
1. When a 25 Ω resistor, 100 Ω resistor, 75 Ω resistor and 50 Ω resistor are connected in parallel, then find the total resistance of the circuit.
2. Define statically induced emf.
3. List the limitations of Millman's theorem
4. State superposition theorem.
5. Define Quality factor and bandwidth.

Understand

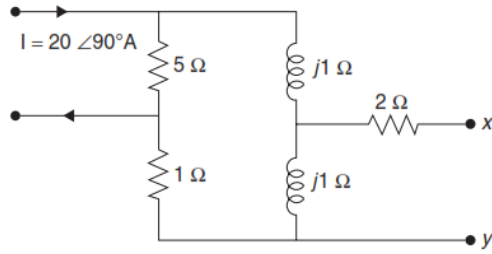
1. Find the two elements in a series circuit, given that the current and total voltage are $i = 10 \cos(5000 t - 23.13^\circ) \text{ A}$, $v = 50 \cos(5000 t + 30^\circ) \text{ V}$
2. When two coils are connected in series their effective inductance is found to be 10 H. When the connection of one coil is reversed, the effective inductance is 6 H. If the coefficient of coupling is 0.6, calculate the self inductance of each coil and the mutual inductance.
3. State dot rule for coupled coils and explain its significance.

Apply

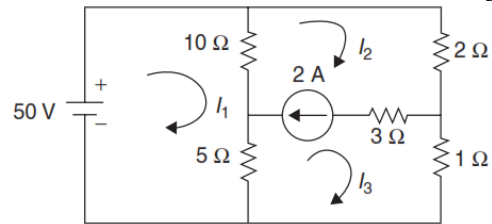
1. For the circuit as shown in the figure, write the inductance matrix.



2. Find the power consumed by a load of $5\angle 60^\circ \Omega$ connected between terminals x and y in the circuit as shown in the figure, using Thevenin's theorem.



3. Determine the current in the 5Ω resistor in the network shown in the figure.



Course Outcomes

At the end of the course, Student will be able to

1. Apply network reduction techniques to DC circuits.
2. Apply network theorems to simplify complex networks.
3. Summarize the behavior of AC circuits.
4. Explain series and parallel connected coupled circuits.
5. Interpret various parameters for a given two-port network.
6. Illustrate the transient response of R, L, C circuits for DC and AC excitations.

COs – POs Mapping

COs	PO1	PO2	PO3	PO6	PO7	PO9	PO12	PSO1	PSO2
CO1	3	1	2	1	1	1	1	1	1
CO2	3	1	2	1	1	1	1	1	1
CO3	3	1	2	1	1	1	1	1	1
CO4	3	1	2	1	1	1	1	1	1
CO5	3	1	2	1	1	1	1	1	1
CO6	3	1	2	1	1	1	1	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

UNIT-I**Introduction to Electrical Circuits and Network theorems**

Introduction to Electrical Circuits: Types of circuit elements, types of sources, ohm's law, Kirchoff's laws, source transformation, star-delta conversion, mesh and nodal analysis, problem solving with resistances, principal of duality with examples.

Network Theorems: Superposition, Thevenin's, Norton's, Millman's, Reciprocity, Compensation, Substitution, Max Power Transfer, Tellegen's theorems.

13 Hours

UNIT-II**Steady state AC analysis and Resonance**

Steady State AC Analysis: Impedance concept, j-operator, phasor notation, RL, RC, RL C circuits problem solving, calculation of different powers and power factor.

Resonance: Definition of resonance, series resonance, parallel resonance, bandwidth, quality factor of series and parallel resonance.

11 Hours

UNIT-III**Coupled Circuits and Two Port Networks**

Coupled Circuits: Faraday's laws of electromagnetic induction, self-inductance, mutual inductance, coefficient of coupling, dot rule of coupled circuits, conductively coupled equivalent circuits- problem solving.

Two-port Networks: Z-parameters, Y-parameters, Transmission line parameters, h- parameters, Interrelationship between parameters, Interconnection of two port networks.

12 Hours

UNIT-IV**Transient Analysis**

Transients: First order differential equations, Definition of time constants, RL circuit, RC circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, problem-solving using RLC elements with DC excitation and AC excitation, Response of second order circuit as related to location of poles in s-plane.

Laplace transforms: introduction to Laplace transformation, problem solving using Laplace transform,

12 Hours

Total: 48 Hours

Textbook (s)

1. W.H.Hayt, J.E.Kimmerly, and S.M.Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 8th Edition, 2015.
2. Charles K Alexander and Mathew N.O Sadiku, "Fundamentals of Electric Circuits", Tata McGraw Hill, 5th Edition, 2013.
3. M.E Van Valkenburg, "Network Analysis", Prentice Hall of India, 4th Edition, 2018.
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3. M Nahvi, Joseph Edminister, K Uma Rao, "Electric Circuits, (Schaum's Outline Series)", McGraw Hill Higher Education, 7th Edition, 2017.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book/Assignment Exam(%)
Remember	10	10	
Understand	30	30	
Apply	60	60	70
Analyze			20
Evaluate			10
Create			
Total (%)	100	100	100

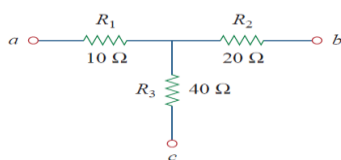
Sample Question (s)

Remember

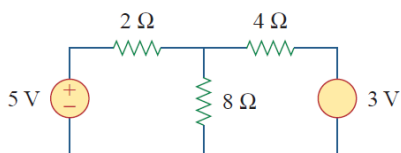
1. Define Kirchhoff of current law
2. Define Thevenin Theorem
3. Define Superposition theorem
4. Define time constant of a RL circuit

Understand

1. Convert the below Star network to Delta network.



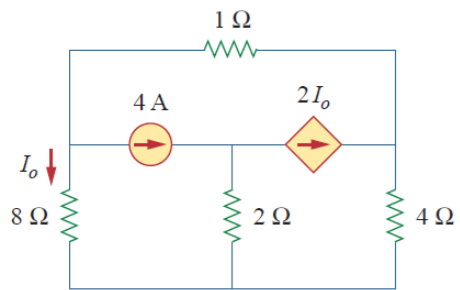
2. What is the Voltage across $8\ \Omega$ resistor



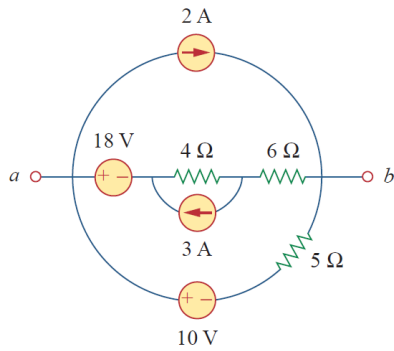
3. An incandescent lamp draws 2 A at 100 V . Find its resistance

Apply

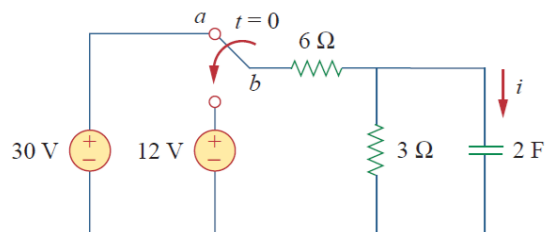
1. Find the value of voltage across $2\ \Omega$ resistor by using Thevenin's theorem.



2. Find the Thevenin equivalent circuits at terminals ***a-b***.



3. The switch in circuit has been in position *a* for a long time. At $t=0$, it moves to position *b*. Calculate $i(t)$ for all $t > 0$.



Course Outcomes

At the end of the course, Student will be able to

- Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
- Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
- Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
- Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between dequeues and priority queues, and apply them appropriately to solve data management challenges.
- Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees
- Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

CO-PO Mapping

COs	PO2	PO3	PO4	PO12	PSO1
1	2	3	2	1	3
2	2	3	2	1	3
3	2	3	2	1	3
4	2	3	2	1	3
5	2	3	2	1	3
6	2	3	2	1	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments:

1. Array Manipulation
 - a. Write a program to reverse an array.
 - b. Basic Array Programs
2. Searching Techniques
 - a. C Programs to implement the Searching Techniques – Linear
 - b. C Programs to implement the Searching Techniques - Binary Search
3. Sorting Techniques
 - a. C Programs to implement Sorting Techniques – Bubble Sort
 - b. C Programs to implement Sorting Techniques - Insertion Sort
4. Linked List Implementation
 - a. Implement a singly linked list and perform insertion and deletion operations.
 - b. Develop a program to reverse a linked list iteratively and recursively.
5. Linked List Applications
 - a. Create a program to detect and remove duplicates from a linked list.
 - b. Implement a linked list to represent polynomials and perform addition.
6. Double and Circular Linked List Implementation
 - a. Implement a doubly linked list and perform various operations to understand its properties and applications.
 - b. Implement a circular linked list and perform insertion, deletion, and traversal.
7. Stack Operations
 - a. Implement a stack using arrays
 - b. Implement a stack using linked lists
8. Queue Operations
 - a. Implement a queue using arrays
 - b. Implement a queue using linked lists
9. Queue Types
 - a. Implement a circular queue
 - b. Implement a double-ended queue (deque) with essential operations.

10. Stack Applications -I
 - a. Use a stack to convert an infix expression to postfix
 - b. Write a program to evaluate a postfix expression using a stack.
11. Stack Applications -II
 - a. Implement a program to check for balanced parentheses using a stack.
 - b. Create a program to determine whether a given string is a palindrome or not.
12. Queue Applications
 - a. Develop a program to simulate a simple printer queue system.
 - b. Implement a stack or queue to perform comparison and check for symmetry
13. Binary Search Tree
 - a. Implementing a BST using Linked List.
 - b. Traversing of BST.
14. Closed Hashing: Implement a hash table with open Addressing techniques.
15. Open Hashing: Implement a hash table with Separate chaining techniques.
16. Hashing- Application: Write a program to implement a simple cache using hashing.

Indicative list of applications-based experiments

1. **Integer to Roman**
 Problem Description: Given an integer, convert it to a Roman numeral. Input is guaranteed to be within the range from 1 to 3999.
 Implementation: You can create a function that iteratively subtracts the largest possible Roman numeral values from the given integer and appends the corresponding symbols until the integer becomes zero.
2. **Merge Two Sorted Linked Lists**
 Problem Description: Merge two sorted linked lists and return it as a new sorted list.
 Implementation: Create a function that takes two sorted linked lists as input and iteratively compares the nodes, merging them into a new sorted linked list.
3. **Task Scheduler**
 Problem Description: Given a character array representing tasks, each task is represented by a character. Tasks could be done without the original order. Each task is done in one unit of time. For each unit of time, any CPU can execute at most one task. Given the character array, find the minimum time required to finish all the tasks.
 Implementation: Implement a function that schedules the tasks efficiently based on their frequencies and calculates the minimum time required.
4. **Find the kth Smallest or Largest Element in a BST**
 Problem Description: Given a binary search tree, find the kth smallest or largest element in it.
 Implementation: Write a function that performs an in-order traversal of the BST while keeping track of the count of visited nodes. Return the kth element when the count matches k.
5. **Construct BST from Preorder or Postorder Traversal**
 Problem Description: Given an array representing either the preorder or postorder traversal of a binary search tree, construct the tree.
 Implementation: Create a function that recursively builds the binary search tree using the given traversal order.
6. **Binary Tree Level Order Traversal**
 Problem Description: Given a binary tree, return the level order traversal of its nodes' values. (i.e., from left to right, level by level).
 Implementation: Implement a function that performs a level order traversal using a queue to keep track of each level.
7. **Checking for Anagram Pairs using Hash Table**
 Problem Description: Given an array of strings, group anagrams together.
 Implementation: Create a function that uses a hash table to group anagrams. Anagrams will have the same sorted characters, which can be used as keys in the hash table.
8. **Check if the Tree is Balanced**
 Problem Description: Given a binary tree, determine if it is height-balanced.
 Implementation: Write a function that calculates the height of each subtree and checks if the difference in heights between left and right subtrees is within one.

Course Outcomes:

1. Demonstrate knowledge of the principles governing the Law of forces and validate them through experimental setups
2. Execute the experiments to achieve equilibrium in coplanar-concurrent force system
3. Assess the significance of friction in mechanical systems.
4. Check the equilibrium of objects subjected to diverse forces, delve into rotational dynamics, and apply principles of conservation laws
5. Apply the principles of static equilibrium to analyse coplanar non-concurrent, parallel force systems
6. Apply the principle of mechanics to system of pulleys, compound pendulum and Bell-crank lever

COs – POs Mapping

CO	PO ₁	PO ₄	PO ₆	PO ₉	PO ₁₀	PSO ₁
1	3	2	2	3	2	2
2	3	2	2	3	2	2
3	3	2	2	3	2	2
4	3	2	2	3	2	2
5	3	2	2	3	2	2
6	3	2	2	3	2	2

Students have to perform any 10 of the following Experiments:**List of Experiments:**

1. Verification of Law of Parallelogram of Forces.
2. Verification of Law of Triangle of Forces.
3. Verification of the Law of polygon for coplanar-concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium using universal force table.
4. Determination of coefficient of Static and Rolling Frictions
5. Determination of Centre of Gravity of different shaped Plane Lamina.
6. Verification of the conditions of equilibrium of a rigid body under the action of coplanar non- concurrent, parallel force system with the help of a simply supported beam.
7. Study of the systems of pulleys and draw the free body diagram of the system.
8. Determine the acceleration due to gravity using a compound pendulum.
9. Determine the Moment of Inertia of the compound pendulum about an axis perpendicular to the plane of oscillation and passing through its centre of mass.
10. Determine the Moment of Inertia of a Flywheel.
11. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever.

References:

1. Engineering Mechanics Lab manual.
2. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.
3. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022.

List of Augmented Experiments

1. Prepare a couple for any engineering application
2. Prepare a truss and draw a FBD for it
3. Find the centroid of a composite plane
4. Prepare a demonstrative model for different force systems
5. Analysis of Projectile Motion: Launch projectiles at different angles and measure their range, height, and time of flight. With an Objective: Verify the equations of motion for projectiles and determine the effect of launch angle on range and maximum height.

Course Outcomes:

At the end of the course, Student will be able to

- 1 Analyze the DC Transients of RL & RC circuits
- 2 Make use of network theorems to simplify the electrical circuits
- 3 Analyze the DC Transients of RL & RC circuits
- 4 Demonstrate the characteristics of series RL, RC circuits
- 5 Demonstrate the characteristics of series RLC circuits and resonant circuit for given specifications
- 6 Characterize and model the network in terms of all network parameters: Illustrate Kirchhoff's laws, mesh, and nodal analysis for DC circuits

COs – POs Mapping

COs	PO4	PO5	PO6	PO9	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	1
CO2	3	2	1	1	1	1	1
CO3	3	2	1	1	1	1	1
CO4	3	2	1	1	1	1	1
CO5	3	2	1	1	1	1	1
CO6	3	2	1	1	1	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

SYLLABUS:

The following experiments need to be performed using Simulation Software.

1. Verification of KCL and KVL for DC circuits.
2. Verification of mesh and nodal analysis for DC circuits
3. Verification of Superposition theorems for DC circuits
4. Verification of Thevenin's and Norton's theorems for DC circuits
5. Verification of Maximum power transfer theorem for DC circuits
6. Determination of Impedance and Power factor of Series RL & RC circuits
7. Determination of Active, reactive, and apparent power of Series RL & RC circuit
8. Determination of Impedance, Power factor, Active, Reactive, and Apparent power of a series RLC circuit
9. Construct a Series Resonance circuit to find the Q Factor and Bandwidth
10. Construct a Parallel Resonance circuit to find the Q Factor and Bandwidth
11. Determination of open circuit (Z) and short circuit (Y) parameters
12. Determination of hybrid (H) and transmission (ABCD) parameters
13. Analysis of DC transients in Series RL and Parallel RL circuits
14. Analysis of DC transients in Series RC and Parallel RC circuits
15. Analysis of DC transient and steady-state response of a 2nd order circuit by varying its various parameters and studying their effects on responses.

Textbook (s):

1. M.E Van Valkenburg, Network Analysis, Prentice Hall of India, 3rd Edition, 2015
2. W.H.Hayt, J.E.Kimmerly, and S.M.Durb, Engineering circuit analysis, McGraw Hill Education private limited, 8th Edition, 2013

Software requirements:

Multisim/ Pspice/Orcad Equivalent simulation software tool, Computer Systems with required specifications

References:

1. Network Analysis ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
- Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020

Course Outcomes:

At the end of the course, Student will be able to

1. Demonstrate network reduction techniques using basic laws.
2. Compute the parameters of electrical equipment
3. Compute the parameters of magnetic circuit
4. Analyse series and parallel resonant circuits
5. Analyse maximum Power transfer from source to load
6. Apply network theorems to solve electrical circuits

COs – POs Mapping

COs	PO4	PO5	PO6	PO9	PO12	PSO1	PSO2
C01	3	2	1	1	1	2	2
C02	3	2	1	1	1	2	2
C03	3	2	1	1	1	2	2
C04	3	2	1	1	1	2	2
C05	3	2	1	1	1	2	2
C06	3	2	1	1	1	2	2

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

List of Experiments

S.No	Name of Experiment	COs
CYCLE 1 (Hardware)		
1	Verification of Kirchhoff's circuit laws.	C01
2	Determination of self, mutual inductances, and coefficient of coupling.	C03
3	Determination of Parameters of a choke coil.	C02
4	Verification of Superposition theorem	C06
5	Series and parallel resonance	C04
CYCLE 2 (Simulation)		
1	Verification of node and mesh analysis	C01
2	Verification of Thevenin's and Norton's Theorems	C06
3	Verification of Maximum power transfer theorem	C05
4	Verification of Compensation theorem	C06
5	Verification of Reciprocity and Millman's Theorems	C06

List of Augmented Experiments:

1. Locus diagrams of R-L(L Variable) and R-C (C Variable) series circuits
2. Verification of network reduction techniques.
3. Determination of cold and hot resistance of an electric lamp
4. Determination of resonance frequency for a parallel tank circuit.
5. Verification of tellegan's theorem.

Reference Books:

1. W.H.Hayt, J.E.Kimmerly, and S.M.Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 8th Edition, 2015.
2. Charles K Alexander and Mathew N.O Sadiku, "Fundamentals of Electric Circuits", Tata McGraw Hill, 5th Edition, 2013.
3. M.E Van Valkenburg, "Network Analysis", Prentice Hall of India, 4th Edition, 2018.
4. P. Ramana, G.T.Chnadra Sekhar, G.Suresh, "Network Theory", SChand and Company Ltd., 1st Edition, 2024.

Course Outcomes:

At the end of the course, the student will be able to

1. Evaluate the coefficient of friction between two different surfaces and between the inclined plane and the roller.
2. Verify Law of Parallelogram of forces and Law of Moment using force polygon and bell crank lever.
3. Determine the Centre of gravity different configurations
4. Understand the Quality Testing and Assessment Procedures
5. Understand the principles of Non- Destructive Testing.
6. Exposure to safety practices in the construction industry.

COs – POs Mapping

COs	PO1	PO6	PO8	PO9	PO10
CO1	3	2	3	3	2
CO2	3	2	3	3	2
CO3	3	2	3	3	2
CO4	3	2	3	3	2
CO5	3	2	3	3	2
CO6	3	2	3	3	2

3–Strongly linked | 2–

Moderately linked | 1–Weakly linked

Students have to perform any 10 of the following Experiments:**List of Experiments:**

1. To study various types of tools used in construction.
2. Forces in Pin Jointed Trusses
3. Experimental Proof of Lami's Theorem
4. Verification of Law of Parallelogram of Forces.
5. Determination of Center of Gravity of different shaped Plane Lamina.
6. Determination of coefficient of Static and Rolling Friction.
7. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever
8. Study of Alternative Materials like M-sand, Fly ash, Sea Sand etc.
9. Field-Visit to understand the Quality Testing - report.
10. Safety Practices in Construction industry
11. Demonstration of Non-Destructive Testing - using Rebound Hammer & UPV
12. Study of Plumbing in buildings.

References:

1. Engineering Mechanics and Building Practices Lab manual.
2. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.
3. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022.

23IT301 Python Programming and Applications**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Understand the concepts of control flow statements and python data structures
2. Apply object-oriented programming approach to python
3. Apply exception handling mechanism in Python
4. Make use of Python libraries for data manipulation and preprocessing tasks
5. Design various visualization techniques on data files for effective data presentation.
6. Choose appropriate web scraping methods while adhering to legal and ethical standards

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO12	PSO1	PSO2
1	2	2	2	2	2	2	2	2
2	3	3	3	2	2	2	2	2
3	3	3	3	2	2	2	2	2
4	2	2	2	3	2	3	3	3
5	3	3	3	3	3	3	3	3
6	3	3	2	2	3	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT-I**12 Hours**

Introduction: Need of Python Programming, Flow Control Statements, **Manipulating Strings** - Working with Strings, Useful String Methods. **Functions:** def Statements with Parameters. **Lists:** Working with Lists, Dictionaries, Tuples and Sets

*REPL, lambda function***UNIT-II****12 Hours**

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, The Polymorphism. Generators and Iterators, Modules

Exceptions & Error Handling-Syntax errors, Logical errors, try/except/finally.

*User-defined functions,***UNIT-III****12 Hours**

Data analysis & Packages: Creating Packages, importing modules from the package, Types of Data in Statistics: Numerical Data, categorical data, Data Preprocessing, Introduction to NumPy, Creation of vectors and matrices, Matrix manipulation. Introduction to Pandas, Reading and Writing CSV Files, Pandas data structures – Series and Data Frame, Introduction to Matplotlib

UNIT-IV**12 Hours**

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module

Web Scraping: Introduction to Web Scraping, Overview of web scraping, Legal and ethical considerations. Setting Up the Environment for web scraping, installing requests in python using Requests module, Essential libraries: BeautifulSoup, Scrapy, Selenium, Using virtual environments

Total: 48 Hours**Textbook (s)**

1. Kenneth A. Lambert. "Fundamentals of Python: First Programs", 2nd Edition, Publisher: Cengage Learning 2018
2. Willaim Mckenny, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" 2nd Edition, O'Reily 2017.

Reference (s)

1. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson 2017 Learning Python, Mark Lutz, Orielly, 5th Edition.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination¹ (%)
Remember	14	14	--
Understand	28	28	--
Apply	28	28	60
Analyze	30	30	20
Evaluate	--	--	20
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. What is the purpose of Python programming?
2. What is the role of the constructor method in class creation??
3. How do you work with lists in Python?
4. List the methods available for reading files in Python.

Understand

1. Illustrate the use of flow control statements in Python with examples.
2. Explain the concept of encapsulation in object-oriented programming.
3. Explain the purpose of data preprocessing in data analysis
4. Compare and contrast the use of tuples, and sets in Python, including characteristics & use cases.
5. How does the Pickle module work for serializing and deserializing Python objects? Explain.

Apply

1. Develop a simple Python program to display the use of flow control statements
2. Make use of Python's list, set data structures to develop a program that tracks and displays the frequency of words in a given text.
3. Write a Python script that demonstrates reading from and writing to a text file.
4. Write a Python script that uses try/except/finally to handle a potential file I/O error.

Analyze

1. Compare the performance of generators and iterators in Python
2. Analyze the potential challenges and limitations of web scraping.

Sample Questions for Open Book Examination**Apply**

1. Write a program which accepts a sequence of comma-separated numbers from console and generate a list and a tuple which contains every number. Suppose the following input is supplied to the program: 34, 67, 55, 33, 12, 98.
Then, the output should be:
['34', '67', '55', '33', '12', '98']
('34', '67', '55', '33', '12', '98')
2. Design a Python program to simulate a Music Player with songs that are linked to the previous and next songs. The player should allow playing songs from either the beginning or the end of the list. Choose an appropriate data structure to implement this and justify your choice.

¹Open book Examination should contain only questions related to Higher Order Thinking (HOT) Skills

23CS304 Digital Logic Design**3 0 2 4****Course Outcomes**

At the end of the course, students will be able to

1. Understand different number systems, its conversions and binary arithmetic. (Understand)
2. Classify logic circuits using basic Logic gates and simplify logic expressions using theorems, K-map. (Understand)
3. Design and implement logical devices using combinational circuits. (Apply)
4. Demonstrate and compare the construction of programmable logic devices and different types of ROM (Understand)
5. Understand and Analyze Sequential circuits like latches and flip-flops. (Understand)
6. Analyze and Design sequential circuits like Registers and Counters. (Analyze)

CO-PO Mapping

CO	PO1	PO2	PO3	PO5
1	3	3	-	-
2	3	3	1	1
3	3	1	1	2
4	2	1	-	2
5	3	2	2	2
6	3	3	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT- I**12+6 Hours****Number systems and Boolean algebra**

Review of Number Systems, Conversion of Numbers from One Radix to Another Radix, Complements, Representation of Negative Numbers, Binary Arithmetic, Binary Codes, Error detecting & correcting codes, Basic Theorems and Properties of Boolean Algebra, Digital Logic Gates, Universal Gates.

IC specifications and pin diagram of gates

Practical Components

1. Realization of Logic gates and verification of Truth tables
2. Realization of basic gates using Universal gates (NOR)
3. Realization of basic gates using Universal gates (NAND)

UNIT- II**12+12 Hours****Boolean Function Minimization**

Minimization of Switching Functions using K-Map up to 4- combinations, Minimal SOP and POS forms

Combinational Arithmetic Logic Circuits-1

Adders, Subtractors, Binary Multiplier-*parity bit Generator*, Ripple carry adder, Multiplexer, De-Multiplexer, Encoder, Priority encoder, Decoder, MUX Realization of switching functions.

Code Converters, Magnitude Comparator

Practical Components

1. Implementation of Half Adder
2. Implementation of Full Adder
3. Implementation and verification of Encoder
4. Implementation and verification of Decoder
5. Implementation and verification of MUX
6. Implementation and verification of DE-MUX

Unit III**12+6 Hours****Programmable Logic Devices and Sequential Logic Circuits-1**

Basic PLD's-ROM-PROM-PLA-PAL - Realization of Switching functions using PLD's Classification of Sequential Circuits (Synchronous and Asynchronous): Latches and Basic Flip-Flops-Truth Tables and Excitation Tables

Conversion of flip-flops

Practical Components

1. Realization of Flip-Flops using ICs (SR Flip Flop)
2. Realization of Flip-Flops using ICs (JK Flip Flop)
3. Realization of Flip-Flops using ICs (D and T Flip Flop)

Unit IV**12+8 Hours****Sequential Logic Circuits - II**

Design of Registers - Buffer Register - Control Buffer Registers - Bidirectional Shift Registers - Universal Shift Register - Design of Synchronous Counters – Ripple counter, Up-down Counters, Design of Asynchronous Counters-Variable Modulus Counters (Mod-2,4,6,10 & 16), Ring Counter, Johnson Counter, Sequence generator.
Sequence detector

Practical Components

1. Verification of SISO and SIPO Shift Registers
2. Verification of PIPO and PISO Shift Registers
3. Implementation of Synchronous Counter
4. Implementation of Asynchronous Counter

Total: 48+32 Hours**Textbook (s)**

1. Digital Design 6th Edition by M Morris Mano, PEARSON INDIA, 2018.
2. Charles H. Roth, Fundamentals of Logic Design, 3rd Edition, Thomson Publications, 2014
3. John F. Wakerly, Digital Design Principles & Practices, 4th Edition, PHI/ Pearson Education Asia, 2008

Reference (s)

1. Zvi Kohavi, Switching & Finite Automata theory, 2nd Edition, TMH, 2008
2. R P Jain, Modern Digital Electronics, 3rd Edition, TMH, 2003
3. A. Anand Kumar, Switching Theory and Logic Design, 3rd Edition, PHP, 2016.

Internal Assessment Pattern

Cognitive Level	Int. Test 1	Int. Test 2 (%)	Assignment Test (%)
Remember	20	10	--
Understand	50	40	--
Apply	30	30	--
Analyze	--	20	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	--

Sample Question (S)**Remember**

1. Retrieve the decimal value of the fractional binary number 0.1011
2. List any two postulates of Boolean algebra
3. List the four uses of Multiplexer.
4. Define Flip flop and Latch
5. Define Synchronous sequential circuit

Understand

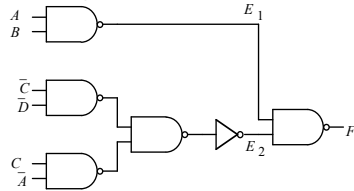
1. Explain working functionality of Programmable Logic Devices (PLD).
2. Represent the following Boolean expression to SOP and POS form: $A+BC'+ABD'+ABCD$
3. Represent the Boolean function $T=F(w, x, y, z) = \sum m(0,1,2,4,5,7,8,9,12,13)$ by using 8 to 1 mux.
4. Illustrate a half adder using NAND – NAND
5. Represent a T flip flop using JK flip flop.
6. Differentiate between Bi-directional and Universal Shift Registers.

Apply

1. Find a circuit that has no static hazards and implements the Boolean function $F(A,B,C,D) = \Sigma (0,2,6,7,8,10,12)$
2. Construct a four input NAND gate using gates with 2 inputs. Write down the truth table. Do the same for a 4 input NOR gate.
3. Implement MOD-6 and Johnson Counter.
4. Construct a combinational circuit to convert BCD to EX-3 code.
5. Implement a combinational logic circuit, which can compare two bits binary numbers.

Analyse

1. Analyze the following in two ways to get sums of product and product of sums equations. Then show how you can get one from the other using DeMorgan's Theorem



2. Why the input variables to a PAL are buffered
3. Why the fixed format is not used and floating format is used
4. What happens when an electric signal is grounded?
5. Design a Sequence detector to detect 10111001

23CS305 Discrete Mathematical Structures**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Construct and Verify the Correctness of Statements using Propositional and Predicate Logic.
2. Illustrate the Operations on Discrete Structures such as Relations and Functions
3. Demonstrate the Lattices and Algebraic Structures for the Modelling of Objects
4. Utilize the Counting Techniques to Solve Combinatorics Problems
5. Make use of the Binomial and multinomial Theorems to Solve Problems involving Recurrence Relations and Generating Functions
6. Demonstrate Graphs and Trees as Tools to Visualize and Simplify Situations

CO-PO Mapping

COs	PO1	PO2	PO3	PO12	PSO1
1	3	3	3	1	1
2	3	2	2	1	1
3	3	1	1	1	1
4	3	2	2	1	1
5	3	2	2	1	1
6	3	3	3	1	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Statement Logic and Predicate Logic****12 Hours**

Statements and Notations - Connectives - Well-formed Formulas - Truth Tables - Tautology - Equivalence Implication - Normal Forms - Rules of Inference for Statement Logic - Proof Techniques - Proof by Contradiction - Method of Induction.

Predicative Logic - Quantifiers - Universal Quantifiers - Free & Bound Variables - Rules of Inference for Predicate Logic

Program Correctness - Design of Logic Circuits

Unit II**Binary Relations, Functions and Algebraic Structures****12 Hours**

Binary Relations - Properties and Operations - Relational Graphs - Relation Matrices - Equivalence Relations - Compatibility Relations - Partial Ordering Relations - Hasse Diagram

Lattices - Properties and Types

Functions - Types of functions - Inverse Function - Composition of Functions

Algebraic Structures - Properties - Semi Groups - Monoids - Groups - Abelian Groups - Subgroups

Relations in Databases - Rings - Fields

Unit III**Combinatorics, Generating Functions and Recurrence Relations****12 Hours**

Basics of Counting - Cardinality - Sum and Product Rules - Permutations and Combinations with Repetitions - Binomial Coefficients - Binomial and Multinomial Theorems - The Principle of Inclusion and Exclusion - Pigeonhole Principle.

Generating Functions - Function of Sequences - Calculating Coefficient of Generating Functions - Recurrence Relations - Solving Recurrence Relation by Substitution.

Algorithm Analysis - Time and Space Complexity - Combinatorics for Bioinformatics

Unit IV**Basics of Graph Theory****12 Hours**

Representation of Graphs - Degree of a Graph - Handshaking Property - Complete Graphs - Regular Graphs - Bipartite Graphs - Walk - Path - Circuit - Cycle - Planar Graphs - Euler's Formula - Isomorphism - Euler Circuit and Hamilton Cycle - Chromatic Number - Trees and its Properties - Binary Trees and its Types.

Operations on Graphs, Four Color Problem, Applications of Graphs and Trees, Ternary Tree

Total: 48 Hours**Textbook (s)**

1. Kenneth H. Rosen, Discrete Mathematics and Applications, 7th Edition, Tata McGraw Hill, 2015.
2. J. L. Mott, A. Kandel & T. P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, Prentice Hall India, 2nd Edition, 2010.

Reference (s)

1. Tremblay J.P. and P. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 1997.
2. C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics, A Computer Oriented Approach, 3rd Edition, Tata McGraw Hill, 2008.
3. D. S. Chandrasekharaiyah, Mathematical Foundation to Computer Science, Prism Books Pvt. Ltd, Hyderabad, 4th Edition, 2012.
4. Ralph P. Grimaldi, B. V. Ramana, —Discrete and Combinatorial Mathematics - An Applied Introduction||, Pearson Education, India, 5th Edition, 2011.
5. Seymour Lipschutz and Marc Lipson, Discrete Mathematics, Revised 3rd Edition, Schaum's Outline Series, Tata McGrawHill, New Delhi, 2009.

Web References:

1. <http://www.web.stanford.edu/class/cs103x>
2. http://www.cs.odu.edu/~cs381/cs381content/web_course.html
3. <http://www.cse.iitd.ernet.in/~bagchi/courses/discrete-book>
4. <http://www.saylor.org/course/cs202/>
5. <http://www.nptel.ac.in/courses/106106094/>

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	30	30	--
Understand	40	40	--
Apply	30	30	60
Analyze	--	--	30
Evaluate	--	--	10
Create	--	--	--
Total (%)	100	100	100

Sample Question(s)**Remember**

1. Define converse, contra positive and inverse of an implication
2. List out the different Principal normal forms with example
3. State the property of first theory of digraph theory by taking a suitable example
4. Define monoid and Abelian group with a suitable example
5. Define Pigeonhole Principle and the generalization of the Pigeonhole Principle

Understand

1. Explain the Planarity of the Kuratowski's two planar graphs
2. Explain the General Principle of Inclusion-Exclusion for n-sets
3. Draw the Hasse diagram of the following relation R is a relation defined as the divisors of 60 and denoted by D_{60} .
4. Compare between Eulerian graph and Hamiltonian graph

Apply

1. Show that the identity. $C(n, r-1) + C(n, r) = C(n+1, r)$
2. Show that the complete graphs K_2, K_3, K_4 are planar
3. Let G be the set of all non-zero real numbers with a binary operation *, defined as $a*b = a^2b^2$. Show that $\langle G, * \rangle$ is an abelian group.
4. Find the coefficient of x^9y^3 in the expansion of $(2x^3y)^{12}$

Analyze

1. Differentiate between Permutation and Combination and find the relation between them.
2. Compare the Equivalence Relation, Compatible relation and Partial Order Relation.
3. Justify, whether the following argument is valid or not.

$$p \rightarrow q$$

$$r \rightarrow s$$

$$p \vee r$$

$$q \vee s$$

4. Identify the combinations in set of electives of 7 subjects that has no repetitions for a group of 10 members having 5 students in each group.

23IT304 Database Management Systems**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Explain the fundamental concepts of database and Various data models
2. Understand the Relational Algebra and integrity constraints for Query execution
3. Apply the relational database to formulate the SQL Commands
4. Make use of Normalization to improve database design and schema refinement
5. Analyze the concept of transaction management, recovery and serializability in databases
6. Classify the concurrency control protocols, different types of data and Indexing techniques

CO-PO Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₁₂	PSO ₂
1	3	3	2	2	1	1
2	3	3	3	2	2	2
3	3	3	2	2	2	2
4	3	3	3	2	1	1
5	3	3	3	3	2	2
6	3	3	2	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Introduction to DBMS and ER Model****11 Hours**

DBMS Vs. File System, instance and schema, Data abstraction, Data independence, database users and database administrator, Database system structure, Introduction to Data Models (E-R Model, Relational Model, Hierarchical Model, Network Model, Object Oriented Data Model), Database Design Process, Entities, Attributes, Entity Sets, Relationships, Relationship Sets, Additional features of ER Model.

Applications of DBMS, Object Relational Data Model

Unit II**Introduction to Relational Model and Basic SQL Queries****12 Hours**

Relational Algebra Operations: Selection, Projection, Rename, Set Operators, Joins, Division, Examples of Relational Algebra Queries, Relational Calculus: Tuple Relational Calculus. Integrity Constraints over Relations, Introduction to Views. SQL Queries: Basic Structure, Set Operations, Aggregate Functions, Null values, Sub Queries, Group By And Having Clauses, Outer Joins.

Domain Relational Calculus, Query Optimization

Unit III**Normalization and Transaction Management****13 Hours**

Introduction To Schema Refinement - Problems Caused By Redundancy - Decomposition - Problems Related To Decomposition - Functional Dependency - Closure of a Set of Fds - Attribute Closure - First - Second - Third Normal Forms - BCNF - Multi Valued Dependencies - Fourth Normal Form, Join Dependency, Fifth Normal Form, Transactions: Acid Properties of Transaction - Transaction States - Schedule: Serial Schedule - Concurrent Schedules - Anomalies Associated with Concurrent Schedules (RW - WR - and WW Conflicts) - Serializability - Conflict Serializability - and View Serializability.

EF Codd Rules, Domain Dependency

Unit IV**Locking, Recovery Systems, Indexing, Different Types of Data****12 Hours**

Introduction to Lock Management-Lock Based Concurrency Control: 2pl-Strict 2pl-Concurrency without Locking: Timestamp-Based Concurrency Control, Optimistic Concurrency Control.

Introduction to Aries - the Log - the Write-Ahead Log Protocol-Check Pointing Indexing: Types of Single-Level Ordered Indexes, Multilevel Indexes Different Types of Data: Structured, Semi-Structured and Unstructured Data

Heap File, Hash File Organizations

Total: 48 Hours

Textbook (s)

1. Elmasri & Navatha, Fundamentals of Database Systems, Pearson Education, 7th Edition, 2016
2. Silberschatz Korth, Database System Concepts, McGraw hill, 7th Edition, 2019

Reference (s)

1. Soraya Sedkaoui, Data Analytics and Big Data, Wiley, 1st Edition, 2018.
2. Peter Rob & Carlos Coronel, Database Systems design, Implementation and Management, 9th Edition, 2010.
3. Raghurama Krishnan & Johannes Gehrke, Database Management Systems, TATA McGraw-Hill, 3rd Edition, 2003
4. C.J.Date, An Introduction to Database Systems, Pearson Education, 8th Edition, 2006

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	25	20	--
Understand	30	30	--
Apply	30	20	50
Analyze	15	30	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)**Remember**

1. List any four application of DBMS
2. Define data model
3. List any four applications for triggers
4. Define functional dependency
5. List the 4 properties of Transaction

Understand

1. Explain E-R Model with suitable example
2. Explain the role of integrity constraints in database design
3. Illustrate the working principle of 'write a head log' protocol
4. Differentiate 3NF and 4NF
5. Explain Two Phase Locking Protocol

Apply

1. When multiple transactions are being executed by the operating system in a multiprogramming environment, there are possibilities that instructions of one transaction are interleaved with some other transaction. Apply the suitable concept to overcome the problem
2. Classify various normal forms according to their applicability
3. Give some real-world applications of Normalization
4. Illustrate the Commit and Rollback operations of Transaction Control
5. Give some real-world applications for Database indexing techniques

Analyze

1. Compare File processing system with DBMS
2. Analyze different locking protocol for concurrency control and serializability
3. Normalization will increase the complexity of the database design. Justify
4. Compare DDL and DML of SQL
5. Compare and Contrast Serializability and Recoverability

Evaluate

1. Is database redesign being necessary? explain
2. How can you evaluate the performance of two data models?
3. Evaluate the performance of query processor and list the corresponding metrics
4. How can you assess the throughput and delay for any DBMS?
5. How can you evaluate the impact of data models on the query processing?

Open Book Examination Questions

1. Anitha has a large CD collection. Her friends like to borrow her CD's, and she has to keep track of who has what. She maintains a list of friends, identified by unique FID's and a list of CD's, identified by CID's. With each friend are the name and telephone numbers which she can call to get the CD back. With each CD is actor name and title. Whenever a friend borrows a CD, She will enter that fact into her database along with the date borrowed. Whenever the CD gets returned, that fact, too, gets noted along with the date returned. Anitha wants to keep a complete history of her friends' borrowing habits so that she can ask favors of the heavy borrowers.
Draw an ER diagram to figure out the above situation and identify types of attributes and cardinality. Represent this database as a collection of 3NF relational tables.
2. The relational scheme $R(A,B,C,D,E,F)$ and set of functional dependencies $AB \rightarrow D$, $E \rightarrow C$, $AF \rightarrow B$. From this, find out all super keys for this relation, and which of these super keys form a key.

23IT305 Data Communication Systems**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Summarize fundamental concepts and analysis of signals in data communication system
2. Outline the design, operation and propagation methods of wired transmission media
3. Classify different technical concepts of digital modulation and multiplexing
4. Examine the principles of wireless communications technology in cellular telephone systems.
5. Solve the basic concepts of error detection and checking at various data link layer protocols
6. Analyze the working principle of various data communication equipment

CO-PO Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₇	PO ₁₂	PSO1
1	2	2	2	2	2	3	2
2	3	3	3	2	3	2	2
3	2	2	2	2	3	2	3
4	3	3	3	2	3	3	2
5	2	2	2	2	2	2	3
6	3	3	3	3	2	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Syllabus**Unit I****15 Hours****Introduction to Data Communications and Networking**

Standards Organizations for Data Communications, Open Systems Interconnection, Serial and parallel Data Transmission, Data Communication Circuits Arrangements.

Signals, Noise, Modulation and De-Modulation: Signal Analysis, Electrical Noise, Information Capacity, Bits, Bit Rate, Baud and M-ary Encoding, Analog and Digital Modulation systems.**Metallic Cable Transmission Media:** Metallic Transmission Lines, Metallic Transmission Line Types, Metallic Transmission Line Equivalent Circuit, Wave Propagation on Metallic Transmission Lines**Optical Fiber Transmission Media:** Optical Fiber Communications System Block Diagram, Optical Fiber Construction, Propagation of Light through an Optical Fiber Cable, Optical Fiber Modes and Classifications. *Data representation, Transmission modes, Advantages and Disadvantages of optical fiber***Unit II****10 Hours****Digital Transmission**

Digital Transmission: Pulse Modulation, Pulse code Modulation, Linear Versus Nonlinear PCM Codes, PCM line Speed, Delta Modulation PCM and Differential PCM.

Multiplexing and T carriers: Time-Division Multiplexing, T1 Digital Carrier System, T Carrier systems, Frequency-Division Multiplexing, Wavelength Division Multiplexing.

*Analog-to-Digital Conversion, Digital-to-Digital Conversion, Code-division multiplexing (CDM) and SDM***Unit III****13 Hours****Wireless Communication Systems and Cellular Telephone Concepts****Wireless Communications Systems:** Electromagnetic Polarization, Rays and Wavefronts, Electromagnetic Radiation, Spherical Wavefront and the Inverse Square Law, Terrestrial Propagation of Electromagnetic Waves, Microwave Communications Systems, Satellite Communications Systems.**Cellular Telephone Concepts:** Cellular Telephone, Frequency Reuse, Call Splitting, Sectoring, Segmentation and Dualization, Cellular System Topology, Roaming and Handoffs.**Cellular Telephone Systems:** Digital Cellular Telephone, Global system for Mobile Communications, Personal Communications Satellite System.*Electromagnetic Spectrum, cellular mobile communications, Wireless Sensor Networks.***Unit IV****10 Hours****Data Communications Codes, Error Control and Data Link Protocols**

Data Communications Character Codes, Error Control, Error Detection and Correction.

Data Communications Equipment: Digital Service Unit and Channel Service Unit, Voice-Band Modem BlockDiagram, Voice-Band Data Communication Modem.

Data-Link Protocols: Data-Link Protocol Functions, Character-Oriented and Bit-Oriented Protocols, Asynchronous Data-Link Protocols, Synchronous Data-Link Control (SDLC), High-Level Data-Link Control (HDLC).

LLC sublayer, MAC sublayer, Congestion control

Total: 48 Hours

Textbook(s)

- Wayne Tomasi, Introduction to Data Communications and Networking, 1st Edition, Pearson Education, 2005
- Behrouz A Forouzan, Data Communications and Networking, 5th Edition, TMH, 2012.

Reference(s)

- Gallow, Computer Communications and Networking Technologies, 2nd Edition Thomson Brookes Cole, 2005
- Fred Halsall, Lingana Gouda Kulkarni, Computer Networking and Internet, 6th Edition, Pearson Education, 2014.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	25	10	--
Understand	50	35	--
Apply	--	20	50
Analyze	25	35	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)

Remember

- List 2 different kinds of transmission lines
- Define modulation
- List 7 layers in OSI reference model
- State Inverse square law
- List 5 types of cellular telephone

Understand

- Identify the functions of layers in OSI reference model
- Explain the principles involved in the transmission of data through optical fiber
- Explain the basic telephone call procedure
- Explain hand off process in cellular networks
- Explain HDLC protocol

Apply

- If the frame is 1101011011 and generator is 10011, what would be the transmitted frame
- What is the remainder obtained by dividing $x^7 + x^5 + 1$ by the generator polynomial $x^3 + 1$?
- Consider a 32-bit block of data 11100111 1101110100111001 10101001 that must be transmitted. If Longitudinal Redundancy Check is used, what is the transmitted bit stream?
- What is the data transfer rate in bps of a signal that is encoded using phase modulation with eight different phase angles and a baud rate of 3000?

Analyze

- A block of 32 bits has to be transmitted. Discuss how the thirty-two bit block is transmitted to the receiver using Longitudinal Redundancy Check
- In the Hamming code for a data unit of m bits, how do you compute the number of redundant bits needed?
- Compare Analog cellular telephone with digital cellular telephone
- A bit string 011110111110111110 needs to be transmitted at the data link layer. What is the string actually transmitted after bit stuffing?

5. A bit stream 10011101 is transmitted using the standard CRC method. The generator polynomial is x^3+1 show the actual bit string transmitted. Suppose the third bit from left is inverted during transmission show that this error is detected at receivers end.

Open Book Exam Questions:

1. Construct an amplitude modulated signal in such a way that a 1 MHz sinusoidal carrier is amplitude modulated by a symmetrical square wave of period 100 μ sec with the presence of 1030KHz and 970 KHz frequencies in the resultant modulated signal.
2. Build the checksum and hamming code for the following message 1011110 for even parity check and then compare the efficiency of these error detection methods with the cyclic redundancy check error detection mechanism using the polynomial $g(x)=x^3+x+1$.

23IT306 Object Oriented Programming through Java**3 0 2 4****Course Outcomes**

At the end of the course, students will be able to

1. Understand the basic concepts and principles of object-oriented Paradigm
2. Demonstrate the concept of inheritance and packages to solve various problems
3. Make use of interfaces to achieve abstraction
4. Interpret various runtime exceptions that appear in the applications
5. Apply multi-threading for synchronization.
6. Design interactive applications using Hibernate and spring Framework by establishing database connectivity

CO-PO Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PO ₁₂	PSO ₁	PSO ₂
1	3	3	2	2	2	2	2	2
2	3	3	3	3	2	3	2	2
3	3	3	3	2	2	2	2	2
4	3	3	3	3	2	3	2	2
5	3	3	2	2	3	2	2	2
6	3	3	3	3	2	3	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Syllabus**Unit I****12+6 Hours****Introduction to Java**

Overview of Object-Oriented Programming principles, Importance of Java to the Internet, Byte code, Data types, arrays, control statements, Classes and Objects- constructors, methods, access control, this keyword, overloading methods and constructors, garbage collection

Features of object-oriented programming-Java History-Computer Programming Hierarchy-Role of Java Programmer in Industry

Practical Components

1. Read in a, b, c and use the quadratic formula. Write a Java program that prints all real solutions to the quadratic equation $ax^2 + bx + c = 0$. If the discriminate $b^2 - 4ac$ is negative, display a message stating that there are no real solutions?
2. The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 1, 1. Every subsequent value is the sum of the 2 values preceding it. Write a Java program that uses both recursive and non-recursive functions to print the nth value of the Fibonacci sequence.
3. Write a program to demonstrate String handling methods and tokenizing given string/text using String Tokenizer class with the following test cases

Test case-1: "This, is, a, StringTokenizer"

```
o/p:   This
      ,
      is
      ,
      a
      ,
      StringTokenizer
```

Test case-2: INPUT: Input string is: This is example for Java Tokenizer

OUTPUT: The number of tokens in the string is: 6

4. Write a program to implement matrix operations using multidimensional arrays.

INPUT: Matrix A:

```
1 2 3
4 5 6
7 8 9
```

Matrix B:

```
9 8 7
6 5 4
3 2 1
```

OUTPUT (ADDITION)

Matrix A + Matrix B:

```
10 10 10
10 10 10
```

10 10 10
 OUTPUT (MULTIPLICATION)
 Matrix A * Matrix B:
 30 24 18
 84 69 54
 138 114 90

Unit II

12+8 Hours

Inheritance, Packages & Interface

Inheritance: Hierarchical abstractions, Base class and subclass, Benefits of inheritance, super keyword, final Keyword with inheritance, polymorphism, abstract classes

Packages: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, Member access rules. Interface: Defining an interface, differences between classes and interfaces, implementing interface, variables in interface and extending interfaces

Nested-Inner Class & Anonymous Classes-Generic Class Types

Practical Components

1. Write a program for creating one base class for student personal details and inherit those details into the sub class of student educational details to display complete student information.
2. You are tasked with creating a program that calculates and displays the areas of different geometric shapes. The program should exemplify the concept of runtime polymorphism using inheritance and method overriding.

Test Case 1: Circle Area Calculation

Input:

Circle: Radius: 5.0

Output:

Area: 78.54

Test Case 2: Multiple Shapes

Input:

Circle:Radius: 10.0

Rectangle:Width: 5.0, Height: 7.0

Output:

Circle:Area: 314.16

Rectangle:Area: 35.00

3. Write a program to create a package which has classes and methods to read Student admission details.

Test Case 1: Valid Admission Details

Input:

Enter student name: Alice Johnson

Enter student age: 22

Enter course: Biology

Output:

Student Name: Alice Johnson

Age: 22

Course: Biology

Test Case 2: Different Course

Input:

Enter student name: Bob Smith

Enter student age: 19

Enter course: Physics

Output:

Student Name: Bob Smith

Age: 19

Course: Physics

4. Write a Java program to create a Animal interface with a method called bark() that takes no arguments and returns void. Create a Dog class that implements Animal and overrides speak() to print "Dog is barking".

Unit III

12+8 Hours

Exception Handling & Multithreading

Exception handling: Concepts and benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built-in and User Defined Exceptions.

Multithreading: Definition thread, thread life cycle, creating threads, synchronizing threads

Control Flow in Exceptions– JVM reaction to Exceptions– Inter Communication of Threads– Critical Factor in Thread–Deadlock

Practical Components

1. Create a Java program using multiple catch blocks to handle exceptions arising from array index out of bounds and division by zero, printing specific error messages for each exception.
2. Develop a program to define and handle User Defined Exceptions (make use of throw - throws).
Test Case 1: Age above 18
 Input: int age = 20;
 Output: Registration successful!
Test Case 2: Negative Age
 Input: int age = -5;
 Output: Exception: Age must be 18 or above for registration.
3. Design a Java program that showcases the concept of blocking a thread and illustrating how to control the execution flow and coordination between multiple threads in a controlled manner.
4. Introduction to Eclipse Environment.

Unit IV

12+10 Hours

Java JDBC, Hibernate & Spring Framework

Java JDBC: Introduction, JDBC Driver, JDBC Connectivity steps, Connectivity with MySQL/Oracle.

Hibernate Framework: Introduction, Object Relational Mapping tool, Java Persistence API, Hibernate Architecture

Spring Framework: Introduction, Spring Framework

Spring Application, Spring Boot.

Practical Components

1. Establish JDBC connection with Oracle
2. A) Develop a Java program that uses JDBC to establish a connection with a database, inserts data into a specified table, and verifies the successful insertion by displaying the inserted records from the table.
 B) Create a Java program utilizing JDBC to establish a database connection, perform updates and deletions on specified records within a table, and validate the changes by displaying the modified table data.
Test Case 1: Update Record
 Input: Record ID to update, new values for the record's fields
 Action: Perform the update operation using JDBC
 Output: Display the updated record from the table
Test Case 2: Delete Record
 Input: Record ID to delete
 Action: Perform the delete operation using JDBC
 Output: Display a message confirming the deletion, or display the modified table without the deleted record
3. Implement Hibernate Example without IDE
4. Develop a Hibernate example in Eclipse to save a "Student" entity to a MySQL database, utilizing Hibernate configuration, Java classes, and libraries, ensuring successful execution and record storage

Total: 48+32 Hours

Textbook (s)

1. H. Schildt, Java: The complete reference, 7th Ed., TMH, 2016
2. T. A. Budd, An Introduction to Object-Oriented Programming, 3rd Ed., Addison Wesley Longman, 2012

Reference(s)

1. Dietal & Dietal, Java: How to Program, 8th Ed., PHI, 2010
2. E. Balaguruswamy, Programming with Java A Primer, 4th Ed., Tata McGraw Hill Companies, 2009
3. C. S. Horstmann and G. Cornell, Core Java, Vol 1. Fundamentals, 7th Ed., Pearson Education, 2014
4. C. Horstmann, BIG JAVA Compatible with Java 5 & 6, 3 rd Ed., Wiley Publishers, 2008

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Examination (%)
Remember	25	35	--
Understand	45	35	--
Apply	30	30	40
Analyze	--	--	20
Evaluate	--	--	40
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)**Remember**

1. List out 6 different java buzz words
2. List the three OOP principles
3. Define Inheritance
4. List the 5 keywords used in exception handling

Understand

1. Summarize the OOP principles
2. Illustrate the procedure for creating a user defined package
3. Interpret the Thread Life cycle
4. Interpret the Applet Life cycle
5. Define Encapsulation

Apply

1. Implement a java program that read an integer between 0 and 1000 and adds all the digits in the integer
2. Implement an abstract base class shape with two members base and height, a member function for initialization and a function to compute area (). Derive two specific classes Triangle and Rectangle which override the function area (). Use these classes in a main function and display the area of a triangle and a rectangle.
3. Demonstrate an applet that receives two numerical values as input from the user and then displays the sum of these numbers on the screen.
4. Given are two one dimensional arrays A and B which are sorted in ascending order. Develop a program to merge them into a single sorted array C that contains every item from arrays A and B, in ascending order.
5. Implement a Java program for creating one base class for student personal details and inherit those details into the sub class of student Educational details to display complete student information

Analyse

1. Compare and Contrast between procedure oriented and object oriented programming.
2. Analyze the concurrent programming using threads.
3. Differentiate method overloading and method overriding.
4. Differentiate sleep and suspend.
5. Analyze platform independency of java with the help of JVM.

Evaluate

1. Judge whether Hibernate and spring frameworks are better for java database connectivity.
2. Asses the performance of threads
3. Determine the importance of run time polymorphism
4. Defend why pointer were removed in JAVA
5. Judge why do you java to develop a web based application

23IT307 Python Programming and Applications Laboratory**0 0 3 1.5****Course Outcomes**

At the end of the course, students will be able to

1. Implement python strings and functions using control flow statements.
2. Implement python data structures for representing compound data.
3. Implement Object Oriented Programming principles of python.
4. Apply exception handling techniques and generators concepts for handling data
5. Apply different python libraries for data processing using packages and modules
6. Apply an appropriate problem-solving method for developing a solution using web scraping

CO-PO Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PO ₉	PO ₁₂	PSO ₁	PSO ₂
1	3	3	3	2	2	2	2	2	2
2	3	3	3	3	2	3	2	3	3
3	3	3	2	2	2	2	2	2	2
4	3	3	3	2	3	3	3	2	3
5	3	2	2	2	3	2	3	2	2
6	2	2	2	2	3	3	2	2	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

List of Experiments

1. A) Using a for loop, write a program that prints out the decimal equivalents of $1/2$, $1/3$, $1/4$, ..., $1/10$.
B) Write a function ball collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding. **Hint:** Represent a ball on a plane as a tuple of (x, y, r), r being the radius. If (distance between two balls centers) $\leq$ (sum of their radii) then (they are colliding)
2. A) Write a Python program to concatenate two strings and find the length of the concatenated string.
Test Case 1: Strings with Spaces
string1 = "Python"
string2 = " Programming"
Test Case 2: Empty Strings
string1 = ""
string2 = "Python"
B) Write a program to compute distance between two points taking input from the user
3. A) Find the sum of all the primes below two million. Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89,....
B) By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms
4. A) Write a program to use split and join methods in the string with a dictionary data structure
B) Write a program to perform advanced tuple operations: tuple unpacking, using tuples as dictionary keys, and functions returning multiple values as tuples.
5. A) Implement encapsulation in a class by using private and public attributes and methods.
B) Write a Python class named Circle constructed by a radius and two methods which will compute the area and the perimeter of a circle
C) Implement method overriding in python
6. A) Write a Python program that utilizes the datetime module to display the current date and time.
B) Write a Python program that imports the math module and calculates the square root of a given

number.

7. A) Write a program to find the number of rows in a text file using Generator and yield.
B) Find Sum of Squares of 1 to n numbers using Generator Expressions
8. A) Write a program with a logical error (e.g., incorrect formula for calculation) and debug it to understand how logical errors differ from syntax errors.
B) Create a Python program that demonstrates exception handling for different scenarios such as division by zero (ZeroDivisionError) and invalid input (ValueError). Utilize try, except, and finally blocks to handle these exceptions gracefully and manage resources effectively.
9. A) Create modules within the "personal_info" package to store and retrieve personal information such as name, age, and address. Import these modules into a program to display and manipulate the personal information.
B) Create the directory name called "Cars" inside this directory create sub-directories "BMW", "Audi" and "Nissan" and inside these sub directories create the corresponding python files that maintain the corresponding Car models, prices, and Manufacturing years. Create "view.py" in "Cars" that takes a particular Car name and outputs the corresponding details.
10. A) Write a Python Program to demonstrate NumPy arrays creation using array () function.
B) Write a python program to demonstrate use of ndim, shape, size, dtype.
C) Python program to demonstrate basic slicing, integer and Boolean indexing.
D) Write a python program to find min, max, sum, cumulative sum of array
11. A) Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
 - a) Apply head () function to the pandas data frame
 - b) Perform various data selection operations on Data Frame
 B) Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib
12. A) Write a Python program to draw a line using given axis values with suitable label in the x axis, y axis and a title. (Matplotlib)
B) Write a Python program to plot several lines with different format styles in one command using arrays. (Matplotlib)
C) Write a Python program to draw a line using given axis values taken from a text file, with suitable label in the x axis, y axis and a title (Matplotlib)
13. A) Write a Python program to create a bar plot of scores by group and gender. Use multiple X values on the same chart for men and women.
Sample Data: Means (men) = (22, 30, 35, 35, 26)
Means (women) = (25, 32, 30, 35, 29)
B) Write a Python programming to create a pie chart with a title of the popularity of programming Languages.
Sample data: Programming languages: Java, Python, PHP, JavaScript, C#, C++
Popularity: 22.2, 17.6, 8.8, 8, 7.7, 6.7
14. A) Write a python program to create a text file "intro.txt" and ask the user to write multiple lines of text by user input.
B) Write a python program to read the contents of existing two files and merge the contents into "merge.txt".
15. Create a program that uses the pickle module to store a dictionary in a file, and then retrieve the dictionary from the file.
16. Develop a Python program that uses the requests library to fetch HTML content from a website and then uses BeautifulSoup to extract specific information, like the titles of articles or the links on the page.

List of Augmented Experiments

1. FLAMES game
2. 2048 Game
3. Taking Screenshots using pyscreenshot
4. Desktop Notifier
5. Get Live Weather Desktop Notifications
6. Rock Paper Scissor game
7. Automate Instagram Messages.
8. Automating Happy Birthday post on Facebook.
9. Automate Google Search
10. Automated Trading
11. Automate the Conversion from Python2 to Python3.
12. GUI Application using Python-Tkinter.
13. ToDo GUI Application using Tkinter.

Reading Material (s)

1. Python Programming and Applications Lab Manual, Department of IT, GMRIT, Rajam

23IT308 Database Management Systems Laboratory**0 0 3 1.5****Course Outcomes**

At the end of the course, students will be able to

1. Demonstrate ER Modelling concepts to design the Database
2. Apply integrity constraints on a database
3. Apply different DDL, DML, DCL, TCL commands in creation and manipulation of Database
4. Implement subqueries to make the complex queries more readable and apply joins to combine different relations to get required data from database
5. Implementation of SQL conversion, number and string functions
6. Experiment with triggers, cursors and functions to maintain referential integrity of data

CO-PO Mapping

CO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PO ₉	PSO2
1	3	3	2	1	1	1	2
2	3	3	3	2	2	2	1
3	3	3	2	2	2	1	2
4	3	3	3	1	1	2	2
5	3	3	3	2	2	2	1
6	3	3	2	2	2	2	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

List of Experiments**Experiment 1**

Application: 1 "Established in 1977, "Roadway Travels" has been actively operating for decades, providing connectivity across various destinations in India through a fleet of several buses. Headquartered in Hyderabad, the company now aims to modernize its operations in the following key areas:

1. Reservation System:

Managing reservations is the responsibility of the booking office. Customers can reserve their seats up to 60 days in advance, utilizing either cash or credit payment methods. In instances where tickets are unavailable, customers receive wait-listed tickets, which can be confirmed once cancellations occur.

2. Ticketing:

The booking office handles ticketing processes, including sales and issuance. Both cash and credit payments are accepted for this purpose.

3. Cancellation and Modification:

Cancellation services are also facilitated at the booking office. Applicable cancellation charges will be levied as per company policy. Furthermore, modifications to reservations can be processed within this domain. Notably, wait-listed tickets that remain unconfirmed are eligible for full refunds."

The Following are the entities:

Bus (Busno, Source, Destination, coachtype)

Reservation (PNRNo, Busno, NoofSeats, JourneyDt, ContactNo, Address)

Ticket (TicketNo, BusNo, JourneyDt, Source, Destination, Dept_Time, Age, Sex)

Passenger (TicketNo, PNRNo, Name, ContactNo, Age, Sex)

Cancellation (PNRNo, JourneyDt, SeatNo, ContactNo)

Application: 2 Online Learning Platform: An online learning platform requires an ER model to handle courses, students, instructors, and enrollments. Courses have titles, descriptions, and durations. Instructors have names, expertise, and contact details. Students have profiles with names, email addresses, and student IDs. Enrollments link students to courses, including enrollment dates.

Entities and Attributes:

Course (Course_ID (Primary Key), Title, Description, Duration (in weeks or hours) Level (Beginner, Intermediate, Advanced), Category (e.g., Programming, Mathematics, Language), Price, Language, Thumbnail Image URL,)

Instructor (Instructor_ID (Primary Key), Name, Bio, ContactInfo (Email, Phone), Expertise (Areas of specialization), ProfilePictureURL)

Student (Student_ID (Primary Key), FirstName, LastName, Email, DOB, Address, Contact)

Enrollment (Enrollment_ID (Primary Key), Course_ID (Foreign Key referencing Course), Student_ID (Foreign Key referencing Student), EnrollmentDate, Status (Enrolled, Completed, Dropped, etc.))

Lesson (Lesson_ID (Primary Key), Course_ID (Foreign Key referencing Course), Title

Order (Sequence within the course), Duration (in minutes or hours), Content (Text, Video URL, PDF URL, etc.))

Quiz (Quiz_ID (Primary Key), Course_ID (Foreign Key referencing Course), Title, Number of Questions, Passing Score)

Question (Question_ID (Primary Key), Quiz_ID (Foreign Key referencing Quiz), Question Text, Question Type (Multiple Choice, True/False, Short Answer, etc.))

Answer (Answer_ID (Primary Key), Question_ID (Foreign Key referencing Question), AnswerText, Correct_Answer_Indicator)

Application: 3 Music Streaming Service: A music streaming service needs an ER model to organize its content and user interactions. The system should handle songs, albums, artists, playlists, and users. Songs have titles, durations, and release years. Albums include album names, release dates, and cover art. Artists have names, genres, and biographies. Users have profiles with names, email addresses, and subscription details. Playlists contain songs and are created by users.

Application: 4 Company Database: The Company is organized into departments. Each department has a unique name, a unique number, and a particular employee who manages the department. We keep track of the start date when that employee began managing the department. A department may have several locations. A department controls several projects, each of which has a unique name, a unique number, and a single location. We store each employee's name, social security number, address, salary, sex, and birthdate. An employee is assigned to one department but may work on several projects, which are not necessarily controlled by the same department. We keep track of the number of hours per week that an employee works on each project. We also keep track of the direct supervisor of each employee. We want to keep track of the dependents of each employee for insurance purposes. We keep each dependent's name, sex, birthdate, and relationship to the employee.

Entities are:

Company Database:

EMPLOYEE (SSN, EName, Address, Sex, Bdate, Salary, SuperSSN, DNo)

DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate)

DLOCATION (DNo, DLoc)

PROJECT (PNo, PName, PLocation, DNo)

WORKS_ON (SSN, PNo, Hours)

DEPENDENT (Essn, Dependent_name, Sex, Bdate, Relationship)

Apply ER Model for the above applications and identify the relations present in each application represent them in ER diagram. & Convert ER model to Relational Model.

Note: Students need to form a group minimum of 3 students and maximum of 5, and should design at least two applications into ER model by using EdrawMax software and convert them into relational model

Experiment 2

Creating users, roles and grant privileges to users and relations.

Experiment 3

Create and alter tables for Company Database in SQL using Integrity Constraints.

Integrity Constraints are CHECK, NOT_NULL, DEFAULT, UNIQUE, PRIMARY KEY, FOREIGN KEY.

Use atleast one constraint in one relation to understand the usage of constraints on database.

Schema: CREATE TABLE employee (Fname varchar (15) NOT NULL, Minit varchar(1), Lname varchar(15) NOT NULL, SSN varchar(9) NOT NULL, Bdate date, Address varchar(30), Sex varchar(1), Salary float, Super_ssn varchar(9), Dno int NOT NULL, PRIMARY KEY (ssn), FOREIGN KEY (Super_ssn) REFERENCES employee(ssn));

CREATE TABLE department (Dname varchar(15) NOT NULL, Dnumber int NOT NULL, Mgr_ssn varchar(9) NOT NULL, Mgr_start_date date, PRIMARY KEY (Dnumber), UNIQUE(Dname), FOREIGN KEY (Mgr_ssn) REFERENCES employee(ssn));

CREATE TABLE dept_locations (Dnumber int NOT NULL, Dlocation varchar(15), PRIMARY KEY (Dnumber, Dlocation), FOREIGN KEY (Dnumber) REFERENCES department (Dnumber));

CREATE TABLE project (Pname varchar(15) NOT NULL, Pnumber int NOT NULL, Plocation varchar(15), Dnum int NOT NULL, PRIMARY KEY (Pnumber), UNIQUE (Pname), FOREIGN KEY (Dnum) REFERENCES department (Dnumber));

CREATE TABLE works_on (Essn varchar(9) NOT NULL, Pno int NOT NULL, Hours float NOT NULL, PRIMARY KEY (Essn, Pno), FOREIGN KEY (Essn) REFERENCES employee(ssn), FOREIGN KEY (Pno) REFERENCES project(Pnumber));

CREATE TABLE dependent (Essn varchar(9) NOT NULL, Dependent_name varchar(15) NOT NULL, Sex varchar(1), Bdate date, Relationship varchar(8), PRIMARY KEY (Essn, Dependent_name), FOREIGN KEY (Essn) REFERENCES employee(ssn));

Experiment 4: Execute basic SQL queries on Employee Database

To Create a database called Employee which consists of EMP, Dept, Salgrade, Project, Works_on and Dependent tables as relations in the database use Data Definition Language command (Create, Alter).

Run sql queries on database using DML commands like Insert, Update, Delete and for retrieval of data from database use Select statement.

Employee Database:

EMP (Empno, Ename, Job, Mgr, Hiredate, sal, comm, deptno)

DEPT (Deptno, Dname, Location)

SALGRADE (Grade, Losal, Hisal)

PROJECT (Pno, Pname, Plocation, Deptno)

WORKS_ON (Empno, Pno, Hours)

DEPENDENTS (EMPNO, DependentName, Sex, Bdate, Relation)

4.1 Insertion:

Insert rows into table by using datatypes like varchar, int, date, float etc.,

Syn: INSERT INTO employee (Fname, Minit, Lname, SSN, Bdate, Address, Sex, Salary, Super_ssn, Dno) values ('James', 'E', 'Borg', 888665555, '10-NOV-1937', '430 Stone, Houston, TX', 'M', 55000, NULL, 1);

4.2 Retrieval (Set operations)

Syn: Select Name from EMP Union Select Salary from EMP;

4.3 Updating

Update rows by changing the values in a row using update command syntax.

4.4 Deletion

Delete an entire row or multiple rows from the table using this command

Experiment 5

Implement the SQL operations on Employee Database created in Experiment 4.

Operations are: In, Any, All, Between, Like, Exists, Group by, Order by, having.

Employee Database:

EMP (Empno, Ename, Job, Mgr, Hiredate, sal, comm, deptno)

DEPT (Deptno, Dname, Location)

SALGRADE (Grade, Losal, Hisal)

PROJECT (Pno, Pname, Plocation, Deptno)

WORKS_ON (Empno, Pno, Hours)

DEPENDENTS (EMPNO, DependentName, Sex, Bdate, Relation)

Experiment 6

Implementing the concepts of Rollback – commit, checkpoints, and Views.

Rollback – commit, checkpoints:

Create Teacher table with the following fields(Name, DeptNo, Date of joining, DeptName, Location, Salary)

1. Insert five records
2. Give Increment of 25% salary for Mathematics Department
3. Perform Rollback command
4. Give Increment of 15% salary for Commerce Department
5. Perform commit command.

Views:

To create different views, use the Employee Database

1. Create a view to display Hire date of all employees.
2. Create a view to display no of working hours of all employees with Location.

Experiment 7

Apply different types of joins available in SQL on company database created in Experiment 4.

Types of Joins:

- Inner Join
- Outer Join
- Left Join
- Right Join

Experiment 8

Apply subqueries and nested queries on company database (refer to experiment 4).

Experiment 9

Implement built in functions in oracle (Numeric, Aggregate functions) on Dual table (provided by Oracle) and Employee database.

Numeric Functions: ABS, CEIL, FLOOR, SQRT etc.,

Aggregate Functions: MIN, MAX, SUM, COUNT, AVG

Experiment 10**Implement String handling and Conversion functions on Dual table (provided by Oracle) and Employee database.**

String Functions: Lowercase, Uppercase, Initcap, Rtrim, Ltrim, Lpad, Rpad etc.,

Conversion Functions: TO_CHAR(), TO_DATE(), TO_NUMBER().

Experiment 11**Sql Practice links from online platforms:**

Employee Bonus	https://leetcode.com/problems/employee-bonus/
Big Countries	https://leetcode.com/problems/big-countries/
Employees Earning more than their managers	https://leetcode.com/problems/employees-earning-more-than-their-managers/
Managers with at least 5 direct reports	https://leetcode.com/problems/managers-with-at-least-5-direct-reports/
Second Highest Salary	https://leetcode.com/problems/second-highest-salary/
Count Salary Categories	https://leetcode.com/problems/count-salary-categories/

Experiment 12

Triangle	https://www.hackerrank.com/challenges/what-type-of-triangle/problem?isFullScreen=true
Average	https://www.hackerrank.com/challenges/average-population-of-each-continent/problem?isFullScreen=true
Population of each country in a continent	
Top Earners	https://www.hackerrank.com/challenges/earnings-of-employees/problem?isFullScreen=true
Occupations	https://www.hackerrank.com/challenges/occupations/problem?isFullScreen=true
New Company	https://www.hackerrank.com/challenges/the-company/problem?isFullScreen=true
15Days of Learning SQL	https://www.hackerrank.com/challenges/15-days-of-learning-sql/problem?isFullScreen=true

Experiment 13

Implement PL/SQL operations on Employee Database to retrieve one row as output.

Experiment 14

Implementing functions, stored procedures on company database using PL/SQL

Experiment 15

Implement cursors on Employee database using PL/SQL to retrieve multiple rows as output.

Experiment 16

Creating triggers using PL/SQL

List of Augmented Experiments

1. Inventory control management System
2. College Management System
3. Hospital management System
4. Library management System
5. Payroll management System
6. Health care organization Management System
7. Restaurant Management System
8. Blood Donation Management System
9. Art Gallery Management System
10. Hotel Management System
11. School Management System
12. Salary Management System
13. Wholesale Management System
14. Timetable Management System
15. Website Management

Reading Material (s)

1. Database Management Systems Lab Manual, Department of IT, GMRIT, Rajam

E-RESOURCES AND OTHER DIGITAL MATERIAL

- [1] Prof Arnab Bhattacharya IIT Kanpur, SQL Introduction <https://nptel.ac.in/courses/106104135/10>
- [2] Prof Arnab Bhattacharya IIT Kanpur SQL: Updates, Joins, Views, and Triggers <https://nptel.ac.in/courses/106104135/11>

23ESX01 Employability Skills I

0 0 2 0

Course Outcomes

At the end of the Employability Skills students will be able to

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Develop life skills with behavioral etiquettes and personal grooming
3. Assess analytical and aptitude skills
4. Develop algorithms for engineering applications
5. Solve engineering problems using software
6. Utilize simulation tools for testing

Co-Po Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01										3		2
C02								1		2		2
C03	2	1						2				
C04	2				2							
C05	2				2							
C06	2				2							

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Syllabus**Communication Skills & Confidence****7 Hours**

How Communication Skills affect Confidence? How to communicate effectively. (with Examples)

Listening: Listening? Listening Vs Hearing, Possible reasons for why people do not Listen at times, Active Listening Vs Passive Listening, How Listening can affect our relationships? How Listening helps in Campus Placements also? (with Examples)

Goal Setting: SMART Technique to Goal Setting, Putting First things First, SWOT Analysis and Time Management

Attitude & Gratitude: Attitude Vs Skills Vs Knowledge, Attitude Vs Behavior, how to develop Positive Attitude? Developing the attitude of Gratitude.

Public Speaking: JAM, J2M, Presentations by Students on General Topics.

Quantitative Aptitude**8 Hours**

Number system, L.C.M and H.C.F, Problems on Ages, Averages, Time and work, Pipes and cisterns

Department Specific:**15 Hours****Fundamentals of Competitive programming-Part1****UNIT-I**No. of Hours: **08 Hours**

Arrays: Linear arrays: memory representation, Mapping 2D array to 1D array, Sparse matrix, reorder an array according to given indexes, Median and Order Statistics, Subarrays: Arithmetic Subarrays, Zerosum subarrays, Sub sequences, Array is subset of another array **Lists:** Mapping list to array, Skip List, real-life Applications of list over arrays

UNIT-IINo. of Hours: **07 Hours****Stack:** parsing expressions, processing function calls, backtracking, stack over Queue, parenthesis checking**Queue:** Queue over Stack, queue can be sorted into another queue using a stack, reversing a queue

UNIT-I:

Arrays: Linear arrays: memory representation, Mapping 2D array to 1D array, Sparse matrix, reorder an array according to given indexes, Median and Order Statistics, Subarrays: Arithmetic Subarrays, Zerosum subarrays, Sub sequences, Array is subset of another array **Lists:** Mapping list to array, Skip List, real-life Applications of list over arrays

Topic	Problem Statement	Practice Link
Arrays	Convert 1D array into 2D array	https://leetcode.com/problems/convert-1d-array-into-2d-array/
	Minimise Maximum Distance between gas stations	https://practice.geeksforgeeks.org/problems/minimize-max-distance-to-gas-station/1
	Zero sum Sub Array	https://practice.geeksforgeeks.org/problems/zero-sum-subarrays1825/1
	Subarray that has the largest product, return the product.	https://leetcode.com/problems/maximum-product-subarray/
	Consecutive subsequence	https://www.hackerrank.com/challenges/consecutive-subsequences/problem
	Sparse Arrays Problem	HackerRank Sparse Arrays problem solution (programmingoneonone.com)
Lists	Interleave two singly linked lists into one.	Interleave two singly linked l CareerCup
	Given the head of a singly linked list, sort the list using insertion sort, and return sorted list.	https://leetcode.com/problems/insertion-sort-list/
	Swap Nodes in Pairs	Swap Nodes in Pairs - LeetCode

UNIT-II :

Stack: parsing expressions, processing function calls, backtracking, stack over Queue, parenthesis checking
Queue: Queue over Stack, queue can be sorted into another queue using a stack, reversing a queue

Topic	Problem Statement	Practice Link
Stack	Calculating long expressions	design and implement a calculator CareerCup
	Get minimum element from stack	https://practice.geeksforgeeks.org/problems/get-minimum-element-from-stack/1
	Valid Parentheses	https://leetcode.com/problems/valid-parentheses/
	Given a stack of N integers. In one operation, you can either pop an element from the stack or push any popped element into the stack.	https://www.codechef.com/problems/OPRSTACK
	Implement Stack using two queues	https://www.geeksforgeeks.org/implement-stack-using-queue/
Queue	Reverse First K elements of Queue	https://practice.geeksforgeeks.org/problems/reverse-first-k-elements-of-queue/1
	Program to check if a queue of first n natural number can be sorted using a stack	https://www.geeksforgeeks.org/check-queue-can-sorted-another-queue-using-stack/?ref=lbp
	Implement Queue using Stacks	Implement Queue using Stacks - LeetCode
	Queue ADT and evaluate its functions	https://www.codechef.com/problems/QUEUE

Total 30 Hours

23MA405 Probability and Statistics**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Interpret probability axioms and Bayes theorem related to engineering problems
2. Develop the notion of random variables, probability distributions
3. Identify the suitable distribution among Binomial, Poisson, exponential, normal in engineering applications
4. Utilize the sampling distribution of the sample mean in general situations and decide about the hypothesis
5. Choose the method to fit the curves, correlate the variables and to construct the regression lines
6. Make use the methods to apply in Control charts like $\bar{x}$, R and p-charts

CO – PO Mappings

COs	PO ₁	PO ₂
1	3	2
2	3	2
3	3	2
4	3	2
5	3	2
6	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 Hours****Probability & Random Variables**

Probability, The axioms of probability, Some Elementary theorems, Conditional probability, Baye's theorem.

Random variables – Discrete and Continuous Distributions and properties, Expectations, MGFs.

*Real time problems of Baye's theorem***Unit II****12 Hours****Probability Distributions**

Binomial, Poisson, Exponential, Normal distributions and their MGFs – related properties

Fitting of theoretical distributions of Binomial, Poisson distributions.

*Limiting cases from Binomial distribution to Poisson and Normal distribution***Unit III****12 Hours****Sampling Distribution & Testing of Hypothesis**Populations and samples, Sampling distributions of means (σ - known and σ - unknown), Central limit theorem.

Testing of Hypothesis– Type I and Type II errors, One tail and two-tail tests. Z- test for large samples, Small sample tests by Student's t-test, F-test, Chi-square test for independence of attributes.

*Real time problems in construction of confidence intervals and Testing of Hypothesis***Unit IV****12 Hours****Correlation and Regression, Statistical Quality Control**

Curve fitting by the method of least squares- linear, polynomial and exponential curves.

Correlation-Pearson's correlation coefficient and Spearman's Rank correlation, linear Regression

Statistical Quality Control methods - Methods of preparing Control charts, $\bar{x}$, R and p-charts*Construction of np-chart***Total: 48 Hours****Textbook (s)**

1. B.V.Ramana, Engineering Mathematics, TMH-publications, 4th Edition, 2015
2. Miller and J. E. Freund, Probability & Statistics for Engineers, Prentice Hall of India, 8th Edition, 2019
3. T. K. V. Iyengar, B. Krishna Gandhi et. al, Probability & Statistics, S. Chand & Company, 2014

Reference (s)

1. Arnold O. Allen, Probability & Statistics, Academic Press, 2nd Edition, 2005
2. Shahnaz Bathul, A textbook of Probability & Statistics, V. G. S. Book Links, 2nd Edition, 2007
3. Gupta S.C and Kapoor V K, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, 2014

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	20	20	--
Apply	60	60	70
Analyze	-	-	30
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample question (s)**Remember**

1. Find the mean, variance and moment generating function for the following function

$$f(x) = \begin{cases} x, & 0 < x < 1 \\ 2-x, & 1 < x < 2 \\ 0, & \text{elsewhere} \end{cases} \quad \text{Also find cdf } F(x).$$

2. The lifetime of a certain brand of an electric bulb may be considered a random variable with mean 1200 h and standard deviation 250 h. Find the probability, using central limit theorem, that the average lifetime of 60 bulbs exceeds 1250h.

Understand

1. In a normal distribution 31 % of the items are under 45 and 8 % are over 64. Find the mean and variance of the distribution.
2. In a sample of 400 parts manufactured by a factory, the number of defective parts was found to be 30. The company, however, claimed that only 5% of their product is defective. Is the claim tenable?

Apply

1. If 2% of electric bulbs manufactured by a certain company are defective. Find the probability that in a sample of 200 bulbs
 - i) less than 2 bulbs
 - ii) more than 3 bulbs are defective. [$e^{-4} = 0.0183$]
2. The following figures give the number of defectives in 20 samples containing 2000 items 425, 430, 236, 341, 225, 322, 280, 306, 337, 305, 356, 402, 236, 264, 126, 409, 193, 280, 326, 389. Calculate the values for central line and the control limits for p – chart.

Analyze

1. Classify any two discrete probability distributions and compare the properties.
2. The mean lifetime of 100 fluorescent light bulbs produced by a company is computed to be 1570 hours with a standard deviation of 120 hours. If μ is the mean lifetime of all the bulbs produced by the company. Test the hypothesis $\mu = 1600$ hours against the alternative hypothesis $\mu \neq 1600$ hours using a 5% level of significance.
3. A businessman goes to hotels X, Y, Z. 20%, 50%, 30% of the time respectively. It is known that 5%, 4%, 8% of the rooms in X, Y, Z hotels have faulty plumbing. Determine the probability that businessman's room having faulty plumbing is assigned to hotel Z?
4. Explain the construction and uses of mean chart and range chart.

Open Book Exam Questions

1. GMR Institute of technology, one of the top technical institute in Andhra Pradesh, India and one of the top cleanest campus in India (AICTE National Level clean and smart campus). The institute conducts a technical fest every year in the month of January/February, named "STEPSTONE". This technical fest completely organized by the students. The participants are coming from throughout India. There are several programs in this fest such as technical and cultural. In cultural competition, there is a special event is Painting (Art Competition). Out of 50 participants from various institutes, three paintings are shortlisted for final competition. The shortlisted Art Competition entries are from three colleges (painters): College A, College B and College C.



College A put in 15 paintings, 4% of their works have won First Prize, College B put in 5 paintings, 6% of their works have won First Prize and College C put in 10 paintings, 3% of his works have won First Prize.

- (a) What is the chance that College A will win First Prize?
 - (b) What is the chance that College B will win First Prize?
 - (c) What is the chance that College C will win First Prize?
2. Two eggs are needed for a cake recipe, and they are selected from a box of twelve eggs. Unfortunately, the box contains two bad eggs that will affect the taste of the cake:
 - If no bad eggs are selected, then the cake will have an acceptable taste with probability 0.95;
 - If precisely one bad egg is selected, then the cake will have an acceptable taste with probability 0.60;
 - if two bad eggs are selected, then the cake will have an acceptable taste with probability 0.10.
 What is the probability that
 - I. the cake does not have an acceptable taste ? (Analyze/Conceptual)
 - II. given that the cake does not have an acceptable taste, what is the probability that precisely one bad egg was used ?
 Assume that all selections of two eggs from twelve are equally likely.

23CS403 Computer Organization and Architecture**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Interpret the functional architecture of computing systems. (Understand).
2. Summarize the types of instruction and its micro-operation with addressing modes (Understand)
3. Identify various arithmetic operations on fixed, floating-point numbers and its representation (Apply)
4. Illustrate the concepts of control unit design and I/O processor (Understand)
5. Understand the memory hierarchy concepts (Understand)
6. Describe concept of parallelism and types of hazard (Understand)

CO-PO Mapping

COs	PO1	PO2	PO12	PSO1
1	3	2	1	2
2	3	2	1	2
3	3	3	1	2
4	3	2	1	2
5	3	2	1	2
6	3	2	1	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Overview & Micro operation****12 Hours**

Components of a computer system – Performance measures - Classifying Instruction Set Architecture-Representing instructions -Micro operation – Logical operations – Shift operations - instruction codes - Computer Registers instruction –memory Reference instruction –Input-Output Reference instruction - Instruction cycle -Addressing and addressing modes.

*Trends in Technology-Arithmetic micro-operations***Unit II****Arithmetic Operations****12 Hours**

ALU - Addition and subtraction with Signed Magnitude Data - Hardware Implementation – Multiplication – Hardware Implementation for Signed Magnitude Data – Division - Hardware Implementation for Signed Magnitude Data – Divide Overflow - Floating Point operations – Parallelism and Computer Arithmetic: Sub word Parallelism.

*BCD Adder-BCD Subtraction***UNIT III****Control Unit and Memory Systems****12 Hours**

Basic MIPS implementation – Building data path – Control Implementation scheme – Memory hierarchy – Cache basics – Measuring and improving cache performance - Virtual memory- Input/output system-programmed I/O-DMA and Interrupts-I/O processors

*Stack organization-RISC Vs CISC Architecture***Unit IV****Parallelism****12 Hours**

Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Multicore processors- Pipelining – Arithmetic pipeline –Instruction pipeline -Pipelined data path and control – Handling Data hazards & Control hazards – Exceptions.

*Vector processing –single processor Vs parallel processor***Total: 48 Hours****Text Book(s):**

1. David A. Patterson and John L. Hennessey, "Computer organization and design: The hardware /software interface", Morgan Kaufman / Elsevier, Fifth edition, 2014.
2. M.Morris Mano," Computer System Architecture", 3rd edition, Pearson /PHI,1992.

Reference(s):

1. V. Carl Hamacher, Zvonko G. Varanescic and Safat G. Zaky, "Computer Organization ", 6th edition, Mc Graw-Hill Inc, 2012.
2. William Stallings "Computer Organization and Architecture, Seventh Edition, Pearson Education, 2007.
3. Andrew S Tanenbaum "Structured Computer Organization ", 5th edition, Pearson/PHI, 2007

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open book Test ¹ (%)
Remember	40	--	--
Understand	40	50	--
Apply	20	50	80
Analyze	--	--	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. What is micro operation?
2. Show the Register Reference Instruction format.
3. Define PC and MAR.
4. What are the two types of data representation?
5. Define Associative Memory

Understand

1. Identify the basic functional units of the system
2. Explain about logic micro operations and its applications with examples
3. Differentiate RISC and CISC architecture in terms of their instruction set and addressing modes.
4. Compare hardwired control unit is differing from micro programmed control unit designs
5. Demonstrate control memory

Apply

1. Starting from an initial value of R=11011101, determine the sequence of binary values in R after a logical shift-left, followed by a logical shift-right and a circular shift-right.
2. Analyze the contents of Register A that holds 8 bit binary 11011001 and Determine the B-operand and the logic micro operation to be performed in order to change the value in A to: (i) 01101101 (ii) 11111101 State the differences between register stack and memory stack.
3. Perform the arithmetic operations (+70) + (+80) and (-70) + (-80) with binary numbers in signed-2's complement representation. Use eight bits to accommodate each number together with its sign. Show that overflow occurs in both cases, that the last two carries are unequal, and that there is a sign reversal.
4. Show the hardware to be used for the addition and subtraction of two decimal numbers with negative numbers in signed-10's complement representation. Indicate how an overflow is detected. Derive the flowchart algorithm and try a few numbers to convince yourself that the algorithm produces correct results.
5. The procedure for aligning mantissas during addition or subtraction of floating-point numbers can be stated as follows: Subtract the smaller exponent from the larger and shift right the mantissa having the smaller exponent a number of places equal to the difference between the exponents. The exponent of the sum (or difference) is equal to the larger exponents. Without using a magnitude comparator, assuming biased exponents, and taking into account that only the AC can be shifted, derive an algorithm in flowchart form for aligning the mantissas and placing the larger exponent in the AC

Open book questions

Apply

1. Smith and Goodman found that for a given small size, a direct-mapped instruction cache consistently outperformed a fully associative instruction cache using LRU replacement.

- Explain how this would be possible (*Hint: You can't explain this with the three C's model because it "ignores" replacement policy*)
- Explain where replacement policy fits into the three C's model, and explain why this means that misses caused by a replacement policy are "ignored"- or, more precisely, cannot in general be definitively classified by the three C's model.
- Are there any replacement policies for the fully associative cache that would outperform the direct-mapped cache? Ignore the policy of "do what a direct-mapped cache would do".
- Use a cache simulator to see if Smith and Goodman's results hold for memory reference traces that you have access to. If they do not hold, why not?

2. John takes two numbers in sign magnitude representation (the two numbers are same with different signs), The 1's complement of one number is 6. The difference between 1's complement of these two numbers is 32. Find the numbers. And also find the product of these two numbers using the result of 2's complement value of these two numbers.

Analyze

1. A two-word instruction is stored in memory at an address designated by the symbol W . The address field of the instruction (stored at $W + 1$) is designated by the symbol Y . The operand used during the execution of the instruction is stored at an address symbolized by Z . An index register contains the value X . State how Z is calculated from the other addresses if the addressing mode of the instruction is a. direct b. indirect c. relative d. indexed.

2. An 8-bit computer has a 16-bit address bus. The first 15 lines of the address are used to select a bank of 32K bytes of memory. The high-order bit of the address is used to select a register which receives the contents of the data bus. Explain how this configuration can be used to extend the memory capacity of the system to eight banks of 32K bytes each, for a total of 256K bytes of memory.

23IT403 Operating Systems**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Understand the different services provided by operating system at different level.
2. Analyze various CPU Scheduling Algorithms and synchronization techniques.
3. Identify deadlock prevention and avoidance measures.
4. Compare and contrast main memory and virtual memory.
5. Illustrate the functionality of file systems.
6. Evaluation of various disk scheduling algorithms.

CO – PO Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₇	PO ₁₂
1	3	3	2	2	2	2
2	3	3	2	2	2	2
3	3	3	3	2	2	2
4	3	3	3	2	2	2
5	3	3	2	2	2	2
6	3	2	2	2	2	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit I****12Hours****Operating-Systems Overview and Process Management**

Operating-System Overview: Computer-System Organization and Architecture, Operating-System Structure, Operating-System Operations & Services, System Calls & its types. Threads: Multi Core Programming, Multithreading Models, Thread Scheduling algorithms. Process Management: Process Concepts, Process Scheduling Criteria, Scheduling Algorithms and evaluation.

*Thread issues, Multilevel Queue, Multilevel feedback Queue Scheduling***Unit II****12 Hours****Inter Process Communication Mechanism**

Process Synchronization: Cooperative process, the Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Synchronization problems, Monitors.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance & Detection, Recovery from Deadlock.

*Synchronization Examples-Synchronization in Solaris, Synchronization in Linux.***Unit III****12 Hours****Memory Management**

Main Memory: Contiguous Memory allocation, Swapping, Segmentation, Paging, Segmented paging, Multilevel paging.

Virtual Memory Management: Demand Paging, Page Replacement algorithms, Allocation of Frames.

*Structure of page table, Thrashing, Memory-Mapped Files***Unit IV****12 Hours****File System Interface & I/O Systems**

Mass-Storage Structure: Disk structure, Disk Scheduling, Disk management, Raid Structure.

File System: Access Methods, Directory Structures, Allocation Methods, Free-Space Management.

I/O Systems: I/O hardware Application of I/O Interface, Kernel I/O Sub-System.

*File Sharing, File System Recovery***Total: 48 Hours****Textbook (s)**

1. Operating System Concepts, Abraham Silberschatz, Greg Gagne, Peter B. Galvin, 9th Edition, Wiley, 2016.

- Operating Systems, Harvey M. Deitel, Paul J. Deitel, David R. Choffnes, 3rd Edition, Pearson Prentice Hall, 2004.

Reference (s)

- Operating Systems: Internals and Design Principles, William Stallings, 7th Edition, Pearson Prentice Hall, 2013.
- Operating systems: A Concept based Approach, D. M. Dhamdhare, 2nd Edition, TMH, 2006.
- Operating System: A Design Approach, Crowley, 1st Edition, TMH, 2001.
- Modern Operating Systems, Andrew S Tanenbaum, 3rd Edition, PHI, 2009.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	30	10	--
Apply	30	30	40
Analyze	10	20	30
Evaluate	10	20	30
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)

Remember

- List any four operating systems
- Define operating system
- List four operating system services

Understand

- Explain System calls
- Explain the role memory management in operating system
- Illustrate the working principle critical section problem

Apply

- When multiple transactions are being executed by the operating system in a multiprogramming environment, there are possibilities that instructions of one transaction are interleaved with some other transaction. Apply the suitable concept to overcome the problem
- Give an example of a scenario that might benefit from a file system supporting an append-only access write.

Analyze

- Context switching between two threads of execution within the operating system is usually performed by a small assembly language function. In general terms, what does this small function do internally?
- Compare CPU scheduling algorithms
- Analyze the general strategy behind deadlock prevention and give an example of a practical deadlock prevention method.

Evaluate

- Assuming the operating system detects the system, is deadlocked, what can the operating system do to recover from deadlock?
- Describe how to implement a lock using semaphores.

Open Book Exam Questions

- A file to be shared among different processes, each of which has a unique number. The file can be accessed simultaneously by several processes, subject to the following constraint: the sum of all unique numbers associated with all processes currently accessing the file must be less than n. Write a monitor to co-ordinate the access to the file. You may want to write start access and end access monitor procedures.
- Consider a paging system with the page table stored in memory:
 - If a memory reference takes 200 nanoseconds, how long does a paged memory reference take?
 - If we add associative registers, and 75% of all page-table references are found in the associative registers, what is the effective memory reference time?

23CS303 Design and Analysis of Algorithms**3 0 0 3****Course Outcomes**

At the end of the Course, students will be able to:

1. Analyse the performance of algorithms using space and time complexity, and asymptotic notations.
2. Implement algorithms using brute force and divide and conquer approaches.
3. Apply advanced data structures and graph algorithms to solve complex computational problems effectively.
4. Demonstrate the ability to solve problems efficiently using greedy approach.
5. Develop problem-solving skills by tackling complex computational problems using dynamic programming and backtracking.
6. Apply branch and bound techniques to solve complex problems, and understand the concepts of NP-completeness to identify NP-complete problems.

COs-POs Mapping

COs	PO1	PO2	PO3	PSO1
1	3	3	2	2
2	2	2	2	2
3	3	3	3	2
4	3	2	3	2
5	3	2	2	2
6	3	3	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

SYLLABUS:**Unit I****12 hours****Algorithm Analysis and Divide and Conquer**

Fundamentals of algorithmic problem solving - Analysis framework - Performance Analysis: Space and Time complexity - Growth of Functions: Asymptotic Notations - Mathematical Analysis of Non-recursive and Recursive algorithms - Master's theorem - Brute Force String Matching Algorithm- Divide and Conquer: Merge sort, Quick sort, Fibonacci search.

*Interpolation search and Radix sort***Unit II****12 hours****Advanced Data Structures and Graph Algorithms:**

Balanced Search Trees: AVL trees, B-trees - Heaps: Heapsort - Disjoint set: Find and Union Operations - Graphs: Introduction, Representation - Graph Traversals: BFS, DFS, Topological sort.

*Tries and Strongly Connected Components***Unit III****12 hours****Greedy and Dynamic Programming**

Greedy Method: General method, Job sequencing with deadlines, Optimal Merge Patterns - Minimum cost spanning trees: Prim's and Kruskal's Algorithms - Single source shortest path problem: Dijkstra's Algorithm - Dynamic Programming: General method, Matrix chain multiplication, 0/1 knapsack problem, All pairs shortest path problem: Floyd Warshall Algorithm.

*Graph coloring problem, Huffman Trees and Codes***Unit IV****12 hours****Backtracking and Branch and Bound**

Backtracking: General method, n-queen problem, sum of subsets problem, Hamiltonian Circuit problem. Branch and Bound: General method, Knapsack Problem, Traveling sales person problem, Assignment Problem. Complexity Classes : P, NP and NP-Complete Problems.

Exhaustive Search, Space and Time Trade-Offs

Textbook (s)

1. Introduction to The Design and Analysis of Algorithms, 3rd Edition, Anany Levitin, Pearson Education, 2017.
2. Introduction to Algorithms, second edition, T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, PHI Pvt. Ltd./ Pearson Education
3. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekaran, University press.

Reference (s)

1. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson Education.
2. Algorithms – Richard Johnsonbaugh and Marc A. Schaefer, Pearson Education.
3. www.geeksforgeeks.org
4. www.hackerearth.com
5. www.tutorialspoint.com

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Practical Test
Remember	20	20	--
Understand	40	40	--
Apply	20	20	50
Analyze	20	20	50
Evaluate	--	-	--
Create	--	-	--
Total (%)	100	100	100

Sample Question (S)**Remember:**

1. Define time complexity and space complexity in the context of algorithms.
2. What is the purpose of asymptotic notations like Big O, Big Omega, and Big Theta?
3. List the steps involved in the Merge Sort algorithm.
4. State the Master's theorem for divide-and-conquer recurrences.
5. What are the key differences between AVL trees and B-trees?

Understand:

1. Explain how the Brute Force String Matching Algorithm works and its time complexity.
2. Describe the basic idea of the Divide and Conquer approach with an example.
3. How does the Floyd-Warshall algorithm find the shortest paths between all pairs of vertices in a graph?
4. Explain the difference between a min-heap and a max-heap.
5. What is the significance of the depth-first search (DFS) in finding strongly connected components in a graph?

Apply:

1. Apply the Quick Sort algorithm to the following list of numbers: [34, 7, 23, 32, 5, 62].
2. Using Dijkstra's algorithm, find the shortest path from a given source vertex to all other vertices in a weighted graph.
3. Given a set of jobs with deadlines and profits, use the Greedy method to find the maximum profit sequence.
4. Implement the BFS algorithm on a graph represented by an adjacency list.
5. Use the dynamic programming approach to solve the 0/1 Knapsack problem with given weights and values.

Analyze:

1. Analyze the time complexity of the Radix Sort algorithm and compare it with other sorting algorithms like Quick Sort and Merge Sort.
2. Compare and contrast the space efficiency of AVL trees and B-trees.
3. Analyze the advantages and disadvantages of using the Backtracking approach for solving the n-queen problem.
4. Discuss the time complexity of the Floyd-Warshall algorithm and its feasibility for large graphs.
5. Examine the differences between P, NP, and NP-Complete problems, and provide examples of each.

23IT405 Web Technologies**3 0 2 4****Course Outcomes**

At the end of the course, students will be able to

1. Illustrate client-side scripting tools to create and modify web pages.
2. Apply CSS framework to design responsive and interactive web pages
3. Examine jQuery for efficient element manipulation and work with JSON objects for seamless data exchange
4. Demonstrate server-side scripting languages to develop business logic.
5. Make use of database connectivity to communicate database server from web server.
6. Test for client-server web application development in real time internet domains

CO-PO Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₅	PSO ₁	PSO ₂
1	3	3	3	2	3	3
2	3	3	3	2	3	3
3	2	2	2	3	3	3
4	2	2	2	3	2	3
5	3	3	3	3	3	3
6	2	2	2	2	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit- I****12+8 Hours****HTML Tags**

Introduction, Links, Lists, Tables, Forms, Canvas, Semantics, Plug-ins. **CSS:** Introduction, CSS Properties, Selectors, Combinators, Controlling Fonts, Forms, Pseudo classes, Transitions, Animations (data-aos), 2D and 3D Transforms, Navigation Bar, Layouts,

Java Script: Introduction, Functions, Events, Validations, Objects, Document Object Model (DOM), Division Replacement, Browser Object Model (BOM)

CSS Tooltips, Font Combinations.

Practical Components

1. Design the following static web pages required for Online Examination System web site.
 - a) Home Page
 - b) Login Page: a. Student Login Page b. Admin Login Page
 - c) Registration page
 - d) Test Page
 - e) Results Page.
2. For Specific pages of Online Examination System like Test page and Result page Apply different font styles, font families, font colors, animations and other formatting styles to the above static web pages.
3. Validate login page and registration page using Java Script.
4. Create an HTML page with any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.

Unit- II**12+8 Hours****Bootstrap**

Responsive Design, Layouts, Grids, Media Queries, **Components-** Forms, Drop Downs, Cards, Input Groups, Collapse, List Groups, Navbar, Popovers, Flex Box. **Utilities-** Borders, Positions, Scroll spy, Visibility, CSS Components, SVG, Java Script Components. **JSON:** Introduction, Parsing, Objects, JSON arrays, Dynamic HTML Data. **jQuery:** Selectors, Filters, Form Plug-ins, Auto Validations

Bootstrap icons, Jumbotron.

Practical Components

1. Design an interactive area using HTML and CSS. Use JavaScript to implement the color change effect during mouseover and reversion during mouse out.

2. **Inner Function with Constant Addition:** Design a function “createAdderWithConstant” that takes a constant as a parameter and returns an inner function. The inner function, when given a number, adds the constant to it and returns the result. Use the inner function to add the same constant to different numbers.
3. Make the static pages Responsive and attractive using Bootstrap components (**Mobile View)
4. Validate login page and registration page using JQuery.

Unit- III PHP

12+8 Hours

Introduction, Modal View Architecture (MVC), Creating PHP script, Running PHP script, Introduction to PHP, Arrays, Functions, sending parameters in URL, working with Forms, **working with Database:** Running SQL Queries, connecting with Databases, Uploading Files, PHP Sessions, Redirecting, Routing, Connecting PHP with JavaScript and jQuery, Authentication.

PHP Cookies, PHP Exception Handling, Introduction to PHP Laravel

Practical Components

1. Write a PHP to connect to the database, Insert the details of the student who registered through Online Examination System student login page including photograph.
2. Develop and demonstrate PHP Script for the following problems:
 - a. Write a PHP Script to find out the Sum of the Individual Digits.
 - b. Write a PHP Script to check whether the given number is Palindrome or not
3. Write a PHP program to insert the questions and respective answers into the database through admin page, sending mails to registered students through admin.
4. Write a PHP program, assuming four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Create a Cookie and add these four user ID"s and passwords to this Cookie. Read the user id and passwords entered in the Login form (week1) and authenticate with the values (user id and passwords) available in the cookies.
 - a. If he is a valid user (i.e., user-name and password match) you should welcome him by name (user-name) else you should display “You are not an authenticated user”

Unit- IV Flask

12+8 Hours

Introduction to Flask, Virtual Environment, features of flask, url building, routing, Templates and Jinja Code, Rendering Templates, Static files, Building Forms, Sending Form data to Templates, Template Inheritance (header, footer, etc), Session Tracking, connecting database (SQLite), Retrieving database values to templates, File uploading, Sending Mails, Deployment of website.

wsgi file, csrf token, http methods.

Practical Components

1. Write a Flask code to connect to the database, and authenticate Login pages with jQuery and start a Session for Student, Change password for Student
2. After user login, display Questions from the database into test page in shuffled manner using flask and store in database.
3. Write a Flask code to do the following
 - a) Evaluate the answers of the test which is given by the student in the Test page.
 - b) Calculate the total score of the student and store it into the database and display score in dashboard of student.
4. Using flask retrieve results in a responsive table format of all students with filtering. Deploy the application developed in real time environment

Total: 48+32 Hours

Textbook(s):

1. Programming the World Wide Web, 8th edition Robert W. Sebesta, pearson.
2. Bootstrap: Responsive Web Development, 1st Edition, jake spurlock foreword by dave winer, O'Reilly publications.

Reference Book(s):

1. Web programming with HTML, XHTML and CSS, 2e, Jon Duckett, Wiley India
2. Web programming Bai, Michael Ekedahl, CENAGE Learning, India edition.

3. An Introduction to Web Design + Programming, Paul S.Wang, India Edition
4. Flask Web Development 2e Miquel Grinberg O'Reilly publications.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Examination (%)
Remember	20	20	--
Understand	50	40	--
Apply	30	40	40
Analyze	--	--	20
Evaluate	--	--	40
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)**Understand**

1. What is the use of cascading style sheet? Explain different style sheets used in HTML.
2. Explain string object with suitable example.
3. Illustrate how work java script events.
4. Describe procedure for how to connect PHP to MYSQL.
5. Explain AJAX technologies

Apply

1. Write an HTML program to display your class timetable.
2. Write a java script to find reverse of a given number using functions.
3. Design a responsive registration page using bootstrap.
4. Insert an image into a web page. Write a script which displays a message when the mouse is over the image. The co-ordinates of the mouse should be displayed if click is attempted on the image.
5. A person X has created the table (emp) and inserted the data in the table. After the completion of insertion, he found that one of the inserted record is invalid. So, write a PHP program to update the table by deleting the invalid record. [Assume database table name is emp (empno, ename, dept, age)]

Analyse

1. Compare traditional web application development with AJAX and analyze what way AJAX useful for real time internet application.

23CS307 Design and Analysis of Algorithms Lab**Course Outcomes:**

After undergoing this course, the students will be able to:

1. Analyze the performance of algorithms by implementing and measuring their space and time complexity using asymptotic notations.
2. Implement algorithms using brute force and divide and conquer approaches, and assess their efficiency.
3. Implement advanced data structures and graph algorithms to solve complex computational problems, and evaluate their performance.
4. Solve optimization problems efficiently using a greedy approach, and analyze the results.
5. Develop dynamic programming solutions to tackle complex computational problems, and measure their effectiveness.
6. Apply backtracking and branch and bound techniques to solve complex problems.

CO-PO Mapping:

COs	PO2	PO3	PO4	PO12	PSO1
1	3	1	2	2	2
2	2	2	2	2	2
3	3	3	3	2	2
4	2	3	3	2	2
5	2	2	2	2	2
6	3	2	2	2	2

List of Experiments

1. Analysis of recursive algorithms
2. Analysis of Non-recursive algorithms
3. Solve the String matching problem using Brute Force approach
4. Solve sorting problem using divide and conquer approach
5. Implement heapsort algorithm using a max-heap.
6. Implement Simple Union and Find operation on disjoint-sets
7. Implement the graph traversal algorithm.
8. Implement topological sorting of a directed acyclic graph (DAG).
9. Find the minimum cost spanning tree for a given graph using greedy approach
10. Implement dijkstra's algorithm using greedy approach
11. Solve matrix chain multiplication problem using dynamic programming
12. Solve the 0/1 knapsack using dynamic programming
13. Implement Floyd algorithm using dynamic programming
14. Find the sum of subsets using backtracking technique
15. Solve N queen problem using the backtracking technique.
16. Find the solution for Assignment Problem using branch and bound method

Indicative list of Augmented Experiments:

1. Basic File System Simulation Using B-Trees
2. Implementation of Huffman Coding for Data Compression
3. Topological Sorting of Courses with Prerequisites
4. Implementation of Tries for Auto-Completion and Spell Checking
5. Route Optimization for a Delivery Service Using Traveling Salesman Problem (TSP) Algorithms
6. Implementation of a Priority Queue Using a Binary Heap for Task Scheduling
7. Graph Coloring Problem for Map Coloring
8. Dynamic Programming for Optimal Binary Search Tree Construction
9. Visualizing Strongly Connected Components in Social Network Analysis
10. Rod Cutting Problem

Reading Material (s)

1. Design and Analysis of Algorithms Lab manual, Department of CSE & IT, GMRIT, Rajam
2. <https://leetcode.com/>

23IT407 Operating Systems Laboratory**0031.5****Course Outcomes**

At the end of the course, students will be able to

1. Demonstrate the basic commands and Shell Scripting in UNIX and Linux Environment.
2. Make use of various CPU Scheduling algorithms and synchronization techniques
3. Analyze Dead Lock detection and avoidance mechanisms.
4. Illustrate the performance of various Page Replacement algorithms
5. Implement various memory allocation techniques
6. Implement various memory and file allocation techniques

CO-PO Mapping

COs	PO1	PO2	PO3	PO5	PO9
1	2	2	2	3	2
2	3	3	3	3	1
3	3	3	3	3	2
4	2	2	2	3	1
5	3	3	3	3	2
6	2	2	2	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments

1. Execute the following UNIX commands: cal, date, echo, bc, passwd, who, uname, pwd, cd, mkdir, rmdir, cat, cp, rm, mv, more.
2. Execute the following UNIX commands: cmp, comm, diff, tar, df, du, chmod and vi-editor commands.
3. a) Write a shell script to accept three numbers and display the largest.
b) Write a shell script which will accept different numbers and find their sum.
c) Write a shell script to find the number of files in a directory.
4. a) Write a shell script to display first ten positive numbers using until loop.
b) Write a shell script to print the first 10 odd numbers using the while loop.
5. Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time.
a) FCFS b) SJF
6. Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time.
a) Round Robin (pre-emptive) b) Priority
7. Write a C program to simulate producer-consumer problem using semaphores.
8. Write a C program to simulate the concept of Dining-Philosophers problem.
9. Simulate Bankers Algorithm for Dead Lock Avoidance.
10. Simulate Bankers Algorithm for Dead Lock Prevention.
11. Write a C program to simulate page replacement algorithms.
a) FIFO b) LRU
12. Write a C program to simulate page replacement algorithms.
a) LFU b) Optimal
13. Write a C program to implement Paging technique for memory management.
14. Write a C program to stimulate the following contiguous memory allocation techniques
a) Worst-fit b) Best fit.
15. Write a C program for implementation memory allocation methods for
a) Fixed Partition b) Variable Partition
16. Simulate all File Organization techniques
a) Single level directory b) Two level c) Hierarchical

List of Augmented Experiments

1. Simulate the UNIX help main menu
2. Simulate the File Management Commands Sub-menu

3. Simulate the Text Processing Commands Sub-menu
4. Simulate the System Status Commands Sub-menu
5. Code for Shell Script to make a menu driven calculator using case in Unix / Linux / Ubuntu
6. Code for Shell Script to create a Menu Driven program : Hard Link - Soft Link - Counting each of the links for a specific link and Display the soft-links in Unix / Linux / Ubuntu
7. Using the file input - do the following using sed - displaying the result on the screen
8. Create a chat server using Message Queue
9. Simulate alarm using Unix / Linux / Ubuntu alarm system call
10. Implement a game to create 1 master process and 10 racing processes where the master process is feeding a pipe with "Win" - and then broadcast the signal SIGUSR1 to its group of process. When a racing process gets the signal SIGUSR1 - it tries to read the pipe - the one getting the "Win" message is out for the rest of the game. At the end of the game - each process has a number which is the round number in which it caught the message "Win".
11. Simulate dice rolling.
12. Simulate Text editor in UNIX / Linux / Ubuntu

Reading Material(s)

1. Linux Programming Lab manual, Department of IT, GMRIT, Rajam.

23ESX01 Employability Skills I**0 0 2 2****Course Outcomes**

At the end of the Employability Skills students will be able to

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Develop life skills with behavioral etiquettes and personal grooming
3. Assess analytical and aptitude skills
4. Develop algorithms for engineering applications
5. Solve engineering problems using software
6. Utilize simulation tools for testing

COs-POs Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01										3		2
C02								1		2		2
C03	2	1						2				
C04	2				2							
C05	2				2							
C06	2				2							

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Syllabus**Building Confidence:****8 Hours**

Fear? Steps to Overcoming the Fear of Public Speaking?

Self Esteem: Definition? Types of Self Esteem, Causes of Low Self Esteem, Merits of Positive Self Esteem and Steps to build a positive Self Esteem.

Group Discussions (Practice): GD? GD Vs Debate, Overview of a GD , Skills assessed in a GD, Dos & Don'ts, & Conducting practice sessions (Simple Topics).

Motivational Talk: Team Work: Team Vs Group? Stages in Team Building, Mistakes to avoid and Lessons to Learn (Through Stories or Can be a Case Specific)

Quantitative Aptitude:**7 Hours**

Percentages, Profit and loss, Mixtures and Allegations, Simple Interest, Compound Interest

Department Specific:**15 Hours****Fundamentals of Competitive programming-part2****UNIT-I****No. of Hours: 8 Hours****Hash Table:** Introduction, hash table operations, double hashing**Trees: Symmetrical Binary Trees,** Path sum, Invert binary tree, Maximum depth, Directory Deletion, Balanced Binary Tree

Topic	Problem Statement	Practice Link
Hash Table	open-addressing-collision-handling-technique-in-hashing	https://www.geeksforgeeks.org/open-addressing-collision-handling-technique-in-hashing/
	open-addressing-collision-handling-technique-in-hashing	https://www.techiedelight.com/check-subarray-with-0-sum-exists-not/
	Check if two same sub-sequences exist in a string or not	https://www.geeksforgeeks.org/check-if-two-same-sub-sequences-exist-in-a-string-or-not/
	Problem on Double hashing	https://www.topcoder.com/thrive/articles/double-hashing
	Java Program to Implement Hash Tables with Double Hashing	https://www.geeksforgeeks.org/java-program-to-implement-hash-tables-with-double-hashing/

Trees	Java program to check is binary tree is symmetric or not	https://www.geeksforgeeks.org/symmetric-tree-tree-which-is-mirror-image-of-itself/
	Maximum Sum Path in Binary Tree	https://takeuforward.org/data-structure/maximum-sum-path-in-binary-tree/
	Convert a Binary Tree into its Mirror Tree (Invert Binary Tree)	https://www.geeksforgeeks.org/write-an-efficient-c-function-to-convert-a-tree-into-its-mirror-tree/
	Find the Maximum Depth or Height of given Binary Tree	https://www.geeksforgeeks.org/find-the-maximum-depth-or-height-of-a-tree/
	To find the Balanced binary tree.	https://www.geeksforgeeks.org/balanced-binary-tree/
	Insertion-in-an-avl-tree	https://www.geeksforgeeks.org/insertion-in-an-avl-tree/

UNIT-II**No. of Hours:** 7 Hours**Graphs:** Weighted and Directed Graphs, Minimum Spanning Trees, Disjoint set, Cycle Detection in Graphs, Kruskal's algorithm, Prim's Algorithm, Dijkstra's algorithm

Topic	Problem Statement	Practice Link
Graphs	Given a Directed Acyclic Graph of N vertices from 0 to N-1 and a 2D Integer array(or vector) edges[][] of length M, where there is a directed edge from edge[i][0] to edge[i][1] with a distance of edge[i][2] for all i.	https://www.geeksforgeeks.org/problems/shortest-path-in-undirected-graph/1?utm_source=geeksforgeeks&utm_medium=ml_article_practice_tab&utm_campaign=article_practice_tab
	Undirected, connected and weighted graph G(V, E), consisting of V number of vertices (numbered from 0 to V-1) and E number of edges.	https://www.codingninjas.com/studio/problems/minimum-spanning-tree-631769?utm_source=striver&utm_medium=website&utm_campaign=a_zcoursetuf
	You are given a stream of 'n' non-negative integers as the input, and you have to group the stream of integers in the form of disjoint intervals.	https://www.codingninjas.com/studio/problems/data-stream-as-disjoint-intervals-1382362?utm_source=striver&utm_medium=website&utm_campaign=a_zcoursetuf
	Find the shortest distance of all the vertex's from the source vertex S.	https://www.geeksforgeeks.org/problems/implementing-dijkstra-set-1-adjacency-matrix/0
	Minimum spanning tree with the minimum possible total edge weight.	https://www.codingninjas.com/studio/problems/kruskal%E2%80%99s-minimum-spanning-tree-algorithm-1082553?utm_source=striver&utm_medium=website&utm_campaign=a_zcoursetuf
	Given a weighted, undirected and connected graph of V vertices and E edges. The task is to find the sum of weights of the edges of the Minimum Spanning Tree.	https://www.geeksforgeeks.org/problems/minimum-spanning-tree/1?itm_source=geeksforgeeks&itm_medium=article&itm_campaign=bottom_sticky_on_article
	Given a Directed Acyclic Graph of N vertices from 0 to N-1 and a 2D Integer array(or vector) edges[][] of length M, where there is a directed edge from edge[i][0] to edge[i][1] with a distance of edge[i][2] for all i.	https://www.geeksforgeeks.org/problems/shortest-path-in-undirected-graph/1?utm_source=geeksforgeeks&utm_medium=ml_article_practice_tab&utm_campaign=article_practice_tab
	You are given an undirected, connected and weighted graph G(V, E), consisting of V number of vertices (numbered from 0 to V-1) and E number of edges.	https://www.codingninjas.com/studio/problems/minimum-spanning-tree-631769?utm_source=striver&utm_medium=website&utm_campaign=a_zcoursetuf

Total 30 Hours

23IT501 Computer Networking**3 0 2 4****Course Outcomes**

At the end of the course, students will be able to

1. Understand the basic concept of network infrastructure and their functionalities
2. Demonstrate the logical link control layer protocols along with error detection and correction mechanisms.
3. Classify the medium access control protocols and their applications
4. Identify various routing protocols and congestion control mechanism in data communication.
5. Importance of transport layer and its protocols
6. Make use of the internal functionalities of Application layer protocols.

CO – PO Mapping

COs	PO ₁	PO ₂	PO ₄	PO ₅	PO ₁₂	PSO1
1	3	2	3	3	2	2
2	3	3	2	2	1	2
3	2	3	3	3	2	2
4	2	3	2	2	2	3
5	2	3	3	3	1	2
6	2	3	3	3	1	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit I****11 +8 Hours****Physical Layer- Network Hardware-Network Software-and Transmission Media**

OSI-TCP/IP reference model-the ARPANET-Network Topologies-Physical Layer: Transmission media: wired transmission Media-Twisted pair -Coaxial Cable-Fiber optics- Wireless Transmission media: Electromagnetic Spectrum-Radio wave Transmission-and Microwave Transmission. **Switching-Techniques:** Circuit Switching-Packet Switching-Message Switching.

*Taxonomy of networking devices.***Practical Components**

1. Familiarization with Networking Components and devices: LAN Adapters - Hubs -Switches – Routers
2. Familiarization with Transmission media and Tools: Co-axial cable - UTP Cable - Crimping Tool - Connectors etc.
3. Preparing the UTP cable for cross and direct connections using crimping tool.

Unit II**13+8 Hours****Data link layer**

Data link layer Design Issues: Framing-error detection and correction-CRC-Elementary Data link Protocols: Stop and wait-Sliding Window protocols: Go-back-n-Selective Repeat-Medium Access sub layer: Channel allocation methods-Multiple Access protocols: ALOHA-CSMA-IEEE Standard 802.3 and Ethernet-IEEE Standard 802.4: Token bus.

*Data Link Control Protocols: HDLC-SLIP-PPP***Practical Components**

1. Implement the data link layer framing methods: Character stuffing method
2. Implement the data link layer framing methods Bit Stuffing method.
3. Implement on a data set of characters the two CRC polynomials: CRC 12 - CRC 16.
4. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.

Unit III**13+8 Hours****Network Layer**

Network Layer design issues-Virtual circuit and Datagram subnets, Routing algorithms: - Adaptive, Non-adaptive and Hybrid Routing Protocols, Internet layer protocols: IPv4 and IPv6, Congestion-Control: Congestion prevention policies, Token bucket and Leaky bucket

Internet control protocols

Practical Components

1. Implement Dijkstra's algorithm to compute the shortest path through a network.
2. Take an example subnet graph with weights indicating delay between nodes. Now Obtain Routing table at each.
3. Take a node using distance vector routing algorithm. Routing Mechanism.
4. Take an example subnet of hosts. Obtain broadcast tree for it.
5. Program on Leaky bucket and Token bucket

Unit IV**11+8 Hours****Transport Layer**

Transport Layer Services-Connection Management-Elements of Transport Protocols- UDP and TCP.

Application Layer-Domain name system-Electronic Mail-WWW, ATM Transport protocol-Proxy

Real time transport protocol-session control protocols.

Practical Components

1. Design TCP client and server application to transfer file.
2. Design UDP Client server to transfer a file.
3. Design TCP iterative Client and server application to reverse the given input sentence.
4. Design a TCP concurrent server to convert a given text into upper case using multiplexing system call "select".

Total: 48 + 32 Hours**Textbook (s)**

1. Andrew S Tanenbaum, Computer Networks, 5th Edition, Pearson Education /PHI, 2013
2. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, Tata McGraw Hill Higher Education, 2017

Reference (s)

1. William Stallings, Data and Computer Communications, 9th Edition, Pearson Prentice Hall, 2013
2. W.A. Shay, Thomson, Understanding Communications and Networks, 3rd Edition, Cengage Learning, 2005

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	25	30	--
Understand	35	40	--
Apply	20	20	50
Analyze	20	10	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)**Remember**

1. List the applications of Computer Networks
2. Write two differences between OSI and TCP/IP models.
3. State 5 key assumptions in Dynamic channel allocation?
4. State the purpose of DNS.
5. Define congestion.
6. State the 2-army problem.

Understand

1. Illustrate OSI Reference model.
2. Explain various design issues of data link layer.

3. What are the responsibilities of Data Link layer and explain Pure Aloha and Slotted Aloha protocols.
4. Describe Distance Vector routing algorithm with example and explain count to infinity problem
5. Represent the Manchester encoding for the bit stream: 0001110101.

Apply

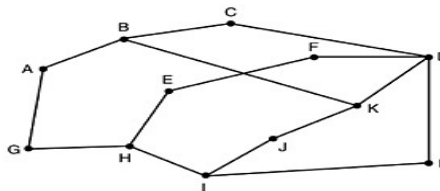
1. What is the check summed frame transmitted if the message is 1101011011 and the generator polynomial is $x^4 + x + 1$ using CRC
2. Can you think of any circumstances under which an open-loop protocol, (e.g., a Hamming code) might be preferable to the feedback-type protocols?
3. Assuming that all routers and hosts are working properly and that all software in both is free of all errors, is there any chance, however small, that a packet will be delivered to the wrong destination?

Analyze

1. The following data fragment occurs in the middle of a data stream for which the byte-stuffing algorithm described in the text is used: A B ESC C ESC FLAG FLAG D. What is the output after stuffing?
2. The following character encoding is used in a data link protocol: A: 01000111; B: 11100011; FLAG: 01111110; ESC: 11100000 Show the bit sequence transmitted (in binary) for the four-character frame: A B ESC FLAG when each of the following framing methods are used:
 - (a) Character count.
 - (b) Flag bytes with byte stuffing.
 - (c) Starting and ending flag bytes, with bit stuffing.
3. Analyze Data link protocols almost always put the CRC in a trailer rather than in a header.

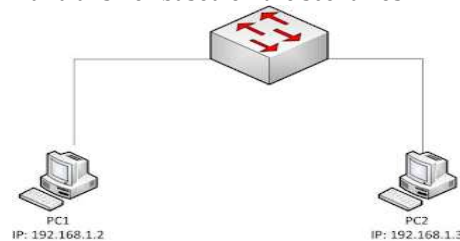
Evaluate

1. Consider the user of differentiated services with expedited forwarding. Is there a guarantee that expedited packets experience a shorter delay than regular packets? Justify.
2. Compute a multicast spanning tree for router C in the following subnet for a group with members at routers A, B, C, D, E, F, I, and K.



Open Book Exam Questions

1. Refer the below diagram and answer based on the scenarios.



Scenario: Two PC's are connected to a switch. The IP addresses of the PC's are as displayed in the diagram. PC (192.168.1.2) is connected to port 2 on the switch and PC (192.168.1.3) is connected to port 3 on the switch.

Questions

1. Does the switch need an IP address for PC1 to communicate with PC2?
2. What would be the MAC-address learned by the switch on port 2?
3. If the PC on port is disconnected, would the MAC-address table be flushed?

4. If PC1 requires to communicate with PC2, what is required from PC2?
 5. Is a router required for PC1 to communicate with PC2?
 6. In the above diagram, how many mac-addresses would be available in the mac-address table of the switch after PC1 communicates with PC2?
 7. What should be the value of default gateway on the TCP/IP adapter settings on the respective PC's for communication between them to be successful?
2. Refer the below diagram and answer based on the scenarios.



IP address of PC1 – 192.168.1.1/24

IP address of PC2 – 192.168.1.2/24

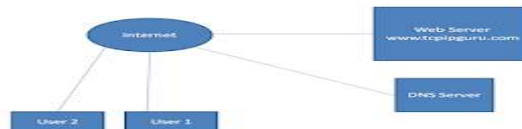
IP address of PC3 – 192.168.2.1/24

PC1, PC2 and PC3 are connected to port 2, port 3 and port 4 on the switch. Port 2, Port 3 and Port 4 are members of VLAN 2.

Questions –

1. If PC1 pings PC3, will a response be received?
2. If an ARP Packet intended for PC2 is initiated by PC1, will it reach PC3?
3. Can PC1 ping PC2 without a default gateway configured on its TCP IP adapter settings?
4. If Port 3 is made a member of VLAN 3 would PC1 be able to ping PC2?

3. Refer the below diagram and answer based on the scenarios.



User 1 and User 2 is connected to the internet. User 1 is located in India and User 2 is located in Kenya. The Web Server is located in US and the DNS Server in Singapore.

Questions

1. User 1 types www.tcpipguru.com on the browser window. What would be the destination port number when the DNS request is sent to the DNS Server by user 1?
2. User 2 pings www.tcpipguru.com. Is the DNS Server required for the ping to be successful?
3. What has to be established before HTTP data can be sent or received from user 1 to the Web Server?
4. User 1 and User 2 simultaneously types www.tcpipguru.com on the browser of the respective computers. How does the server differentiate between the connections?
5. Will the communication be disrupted between the Web Server and the users if the DNS Server goes down during the data transfer between the web server and the user?
6. User 1 opens two instances of the website www.tcpipguru.com on his computer. How does the Web Server differentiate between the communications?

23IT502 Artificial Intelligence**3 0 0 3****Course Outcomes:**

At the end of the course students are able to:

1. Explain fundamental concepts of AI, its foundation and principles
2. Understand the informed and Un-informed problem types and apply search strategy to solve them
3. Examine the useful knowledge representation techniques and inference methods to solve real life problems
4. Identify the appropriate AI database methods and their language representation to solve a given problem
5. Apply valid solutions for problems involving uncertain inputs or outcomes using decision making techniques
6. Demonstrate and examine the learning methods, reasoning systems and planning to develop models within the constraints of application area

CO – PO Mapping

COs	PO ₁	PO2	PO3	PO4	PSO ₁	PSO2
1	3	3	3	3	3	3
2	2	2	2	2	3	3
3	2	2	2	2	2	2
4	2	2	2	2	3	3
5	2	2	2	3	3	3
6	2	2	2	2	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit I****12 Hours****Introduction & Heuristic Search Techniques**

AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation. Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Heuristic search, Hill climbing & A* Algorithms, Problem reduction, Constraint satisfaction.

*Means-Ends Analysis and data abstraction-mapping***Unit II****13 Hours****Knowledge Representation**

Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rule-based deduction systems. Reasoning under uncertainty, Baye's probabilistic interferences. Inference in first order logic, propositional vs. first order inference, forward chaining, Backward chaining, Resolution,

*Filler structures-conceptual dependency-scripts***Unit III****12 Hours****Game Playing & Learning**

Game Playing- Adversarial search, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions. Natural language processing - syntactic processing, Semantic Analysis, vision, speech recognition **Learning:** Rote learning, learning by taking advice, learning in problem solving, learning from examples, learning from observation Inductive learning, Decision trees.

*Case grammars- Conceptual parsing***Unit IV****11 Hours**

Expert systems - Structure of expert systems, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert

systems, expert systems and the internet interacts web, scope of knowledge engineering, difficulties in knowledge acquisition methods, selecting an appropriate knowledge acquisition method, societal impacts reasoning in artificial intelligence

Expert systems, shell-explanation-knowledge acquisition

Total: 48 Hours

Textbook (s)

1. E. Rich K.Knight and B. Nair, Artificial Intelligence, 3rd Edition, TMH, 1 July 2017.
2. Russel Norvig, Artificial Intelligence A Modern Approach, 3rd Edition, Pearson Education, 2010

Reference (s)

1. Patrick Henry Winston, Artificial Intelligence, Third edition, Pearson Education Asia, 2005
2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, 2nd Edition, PHI, 2009

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	30	--
Understand	35	30	--
Apply	25	40	70
Analyze	--	--	20
Evaluate	--	--	10
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)

Remember

1. State the tasks which are associated with A.I.
2. Give an example of script-arithmetic problem.
3. Define Script
4. Recall Intelligence

Understand

1. Explain Turing Test.
2. Explain the characteristics of production system.
3. Write A* algorithm in detail and explain its functionality to solve 8-puzzle problem.
4. Explain the semantic analysis phase done through case grammars in Natural Language understanding

Apply

1. Distinguish between weak and strong slot filler structures
2. Discuss the tic-tac-toe problem in detail and explain how it can be solved using AI technique
3. Construct semantic net representation for the following:
 - (i) Pompeian (Marcus), Blacksmith (Marcus)
 - (ii) Mary gave the green flowered vase to her favorite cousin.

Analyze

1. Show that the tower of Hanoi problem can be classified under the area of AI. Give a state space representation of the problem.
2. Give an example of a problem for which breadth-first search would work better than depth-first search. Justify your answer.
3. Consider the following sentences:

John likes all kinds of food.
Apples are food. Chicken is food
Anything anyone eats and isn't killed by food.
Bill eats peanuts and is still alive. Sue eats everything Bill eats.

 - (a) Translate these sentences into formula in predicate logic.
 - (b) Convert the formulas of part A into clause form.

Prove that John likes peanuts using resolution.

Evaluate

1. Convert the following statements to conceptual dependencies.
 - (i) I gave a pen to my friend

- (ii) Rama ate ice cream
 - (iii) I borrowed a book from your friend
 - (iv) While going home, I saw frog
2. Assume the following facts:
 Steve only likes easy courses.
 Science courses are hard.
 All the courses in the basket weaving department are easy.
 BK 301 is a basket weaving course.
 Use resolution to answer the question.
 "What course would Steve like?"
3. Trace the constraint satisfaction procedure solving the crypt arithmetic problem.
- $$\begin{array}{r}
 \text{SEND} \\
 + \text{MORE} \\
 \hline
 \text{MONEY}
 \end{array}$$

Open Book Exam Questions

1. The function h' is an estimator of h of best-first search algorithm. Explain what is done in the algorithm if h' underestimates h and h' overestimate h .
2. Write A* algorithm in detail and explain its functionality to solve 8-puzzle problem.
3. Consider the problem of finding cloths to wear in the morning. To solve this problem, it's necessary to use knowledge such as:
 Wear jeans unless either they are dirty or you have a job interview today.
 Wear a sweater if it's cold ☐ It's usually cold in the winter.
 Wear sandals if it's warm
 It's usually warm in the summer.
 Build a JTMS-style database of the necessary facts to solve this problem.

23IT503 Cloud Computing**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Understand the Basic Concept of Distributed Systems and its Design Requirements
2. Illustrate the key dimensions and the challenge of Cloud Computing
3. Understand the Various Cloud Computing Architectures.
4. Classify the Levels of Virtualization and Mechanism of Tools.
5. Demonstrate different CPU, memory and I/O virtualization techniques
6. Analyze various Cloud service providers

CO – PO Mapping

COs	PO1	PO ₂	PO3	PO4	PO5	PO ₆	PO ₇	PO ₈	PSO2
1	3	3	3	3	2	2	3	1	2
2	3	3	3	3	2	1	2	3	2
3	2	2	2	2	2	3	1	2	2
4	2	2	2	2	3	3	3	1	2
5	2	2	2	2	2	3	1	2	3
6	2	2	2	2	3	3	3	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit I****12 Hours****Characterization of Distributed Systems:**

Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges. System Models: Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

Communication between Distributed Objects- Object Model, Distributed Object Model.

Unit II**13 Hours****Introduction to Cloud Computing**

Overview of Computing Paradigm: Recent Trends in Computing, Evolution of Cloud Computing. Introduction to Cloud Computing: Cloud Computing (NIST Model), Properties, Characteristics & Disadvantages, Role of Open Standards.

Cloud Computing Architecture: Cloud Computing Stack, Service Models (XaaS), Deployment Models.

Infrastructure as a Service (IaaS): Introduction to IaaS, Resource Virtualization.

Platform as a Service (PaaS): Introduction to PaaS, Cloud Platform and Management.

Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS.

Salesforce, EMC cloud

Unit III**12 Hours****Virtualization & Design**

Virtualization, Virtual machine, Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Data centre, Virtualization for Data-Centre Automation. Service Levels for Cloud Applications Ready for the cloud: Web Application Design, Machine Image Design, Privacy Design, Database Management.

VMware, KVM, oracle VM,

Unit IV**11 Hours****Cloud Service Providers**

Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue, service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM,

Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP

Knowledge as a Service, Rack space, VMware, Manjra soft, Aneka Platform

Total: 48 Hours

Textbook (s)

1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems- Concepts and Design", Fourth Edition, Pearson Publication
2. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
3. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
4. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
5. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

Reference (s)

1. Michael Miller, Cloud Computing-Web Based Applications that change the way you work and collaborate online, 1st Edition, Pearson Education, Publishing, 2011
2. Kai Hwang, Geoffrey C Fox and Jack J.Dongarra, Distributed & Cloud Computing from Parallel Processing to the Internet of Things , 1st Edition, MK Publishing, 2010
3. David S Linthicum, Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide, 1st Edition, Addison-Wesley, 2009
4. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp2011.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test ³ (%)
Remember	40	45	20
Understand	40	45	60
Apply	20	10	
Analyze	--	--	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. Define Cloud Computing.
2. List types of virtualization.
3. Define proactive scaling.
4. What is CIA Triad?

Understand

1. Explain different cloud Infrastructure models.
2. Explain different levels of virtualization.
3. Explain about cloud Network security in detail.
4. Explain about Recovery Point Objective.
5. With neat diagram explain the functioning of Xen Architecture.
6. List and explain various cloud service providers risks.

Analyze

1. Compare cloud center and service infrastructure.
2. Analyze different cloud services provided by Amazon

23IT504 Software Engineering Principles**3 0 2 4****Course Outcomes**

1. Understand the need of Software Life Cycle Models
2. Interpret the Requirements of the Software Systems process
3. Summarize the system models of software engineering
4. Select different software architecture styles for real-time software projects
5. Identify various testing techniques on software products
6. Analyze Risk management and Software quality of the software products

COs-POs Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO2
1	3	3	3	2	2	2
2	3	2	2	2	2	3
3	3	2	3	2	2	2
4	2	2	2	2	2	3
5	3	2	2	2	2	2
6	3	3	3	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Syllabus**Unit I****12+8 Hours**

Introduction to Software Engineering and Life Cycle Models -Software engineering definitions software development projects, the evolving role of software, Changing Nature of Software, Software myths.

Software Process models: Linear Sequential model, Prototyping model, Evolutionary models: Incremental model, Spiral model, Agile developmental process

Business Process Engineering Overview - Product Engineering Overview (Self study)

Practical Components

1. Practice UML tool with Rational Rose
2. Implement various UML diagrams
3. Suggest the suitable life cycle model for credit card validation system
4. Design a Hospital Management System
5. Design a Student Registration System
6. Perform Agile Testing

Unit II**12+8 Hours**

Software Requirements Engineering -Process and System Models, Functional & Non-functional requirements, Feasibility studies, elicitation and analysis, requirements validation, context models, behavioral model, data model

Software Prototyping – Prototyping in the Software Process

Practical Components

1. Prepare the requirement analysis and SRS document
2. Estimate the effort using COCOMO Model
3. Develop DFD and Context model for given problem

Unit III**12+8 Hours**

System Design Engineering -Design concepts, data design, software architecture, Architectural styles and patterns, User interface design - Golden rules, User interface analysis and design and steps, Verification and Validation.

Data Acquisition System - Monitoring and Control System

Practical Components

1. Suggest architecture style for internet banking system
2. Suggest User interface design for E-book management System
3. Case study on Student Feedback System (DFD, Use cases)

Unit IV**12+8 Hours**

Software Testing and Risk Management -Testing levels: Unit testing, integration testing, system testing – alpha and beta testing, black box and white box testing, debugging, Risk management - Risk types, strategies, estimation and Planning. Software Quality -Quality assurance and its techniques, Configuration Management.

Software Implementation Techniques - Testing as an Engineering Activity

Practical Components

1. Prepare Test suite
2. Perform code generation using automated tools
3. Case study to understand the importance of risk management and mitigation of risk
4. How to use tools to manage and mitigate risks [eg. Logicgate, AuditBoard etc]

Total: 48+32 Hours

Textbook (s)

1. Rajib Mal, Fundamentals of Software Engineering, 3rd Edition, Eastern Economy Edition, 2009
2. Roger S. Pressman, Software Engineering, A practitioner's Approach, 6th Edition, McGraw-Hill International Edition, 2005

Reference(s)

1. I. Sommerville, Software Engineering, 7th Edition, Pearson education, 2004
2. K K Aggarwal and Yogesh Singh, Software engineering, 3rd Edition, New age international publication, 2008

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Practical Test * (%)
Remember	25	15	--
Understand	35	15	20
Apply	20	25	30
Analyze	20	25	30
Evaluate	--	10	20
Create	--	10	--
Total (%)	100	100	100

Sample Question (S)

Remember

1. Define software engineering
2. List 3 software myths
3. Define Feasibility study
4. What is meant by debugging?
5. Define Risk

Understand

1. Explain various quality assurance techniques
2. Describe software architecture styles and patterns
3. Illustrate golden rules for user interface design
4. Explain various techniques for requirements elicitation and analysis
5. Describe the differences between white box testing and black box testing

Apply

1. Classify the techniques of requirement analysis

Analyze

1. Compare and Contrast software life cycle models
2. Analyze risk types in the risk management

Evaluate

1. How do you assess the quality of the software product?
2. How do you assess the performance of software models?

* Practical test should contain only questions related to Higher Order Thinking (HOT) Skills

23CSC11 Artificial Neural Networks**3 0 0 3****Course Outcomes**

1. Explain the structure and functioning of biological and artificial neural networks
2. Analyse the behaviour of basic neural network models in solving linearly and non-linearly separable problems.
3. Design feedforward neural networks using backpropagation and gradient descent techniques.
4. Describe associative memory networks and demonstrate pattern storage and retrieval using feedback models like Hopfield Networks.
5. Explain different unsupervised learning models and their learning mechanisms.
6. Apply neural network models to solve real-world problems such as character recognition, image classification, and signal processing.

CO-PO Mapping

COs	PO1	PO2	PO3	PO5	PO12
1	3	2	2	1	1
2	3	3	2	1	1
3	3	3	3	1	1
4	3	3	3	1	2
5	3	3	3	3	2
6	3	3	3	2	3

3-Strongly Linked | 2- Moderately linked | 1- Weakly linked

Unit I**12 Hours**

Basics of Neural Networks: Introduction to Biological Neural Networks, Biological Neural Networks vs Artificial Neural Networks.

Artificial Neural Networks: Introduction to Artificial Neural Networks, Neural Networks Terminologies, Activation Functions and its Types, Basic Models of Neural Networks (McCulloch-Pitts Neuron and Hebb Network), Types of Learning Laws.

Benefits of Neural Networks, Evolution of Neural Network Models

Unit II**Supervised Learning Networks****12 Hours**

Perceptron Networks: Perceptron, Perceptron Learning Algorithm, Linearly Separable Problem (AND, OR, XOR), Perceptron Convergence Theorem.

Multi-Layer Feedforward Networks: Introduction to Feed Forward Neural Networks, Multilayer Perceptron Architecture and Layers, Cross Validation, Gradient Descent Algorithm, variations of gradient descent. Back Propagation Algorithm.

Overfitting and Underfitting in Neural Networks, Vanishing and Exploding Gradient Problem

Unit III**Associative and Feedback Networks****12 Hours**

Associative Memory: Hetero-associative Memory Neural Network, Auto-associative Network, Bidirectional Associative Memory (BAM).

Feedback Networks: Hopfield Networks - Energy Function and Convergence - Pattern Storage and Retrieval

Limitations of Associative Memories and Hopfield Networks

Unit IV**12 Hours**

Supervised Learning Networks: Competitive Learning, Kohonen Self-Organizing Maps, Learning Vector Quantization (VLQ), Adaptive Resonance Theory (ART1).

Applications of Neural Network: Character Recognition, Signal Processing, Image Classification.

Comparison of SOM, and ART1, Applications of SOM

Total: 48 Hours

Textbook (s)

1. Laurene Fausett, "Fundamentals of Neural Networks", Pearson Education, 2004.
2. Simon Haykin, "Neural Networks - A comprehensive foundation", Pearson Education, 2003.
3. S. N. Sivanandam, S N Deepa, Principles of Soft Computing, 2nd Edition Wiley India, 2007.
4. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep Learning." An MIT Press book in preparation, 2015.

Reference (s)

1. Satish Kumar, "Neural Networks: A Classroom Approach" Tata McGraw Hill Education, 2004.
2. Simon Haykin, "Neural networks and Learning Machines", Prentice Hall, 2008
3. Josh Patterson and Adam Gibson "Deep Learning A Practitioner's Approach" O'Reilly Media, Inc. 2017

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	40	40	--
Apply	20	20	40
Analyze	20	20	40
Evaluate	--	--	20
Create	--	--	--
Total (%)	100	100	100

Sample Questions

Remember

1. Define the simple artificial neuron and the calculation of net input.
2. Define the bias and threshold
3. list out various activation functions

Understand

1. Explain the basic models of Artificial Neural Networks.
2. List the terminologies of artificial neural networks
3. Explain about the Neural Network with backpropagation algorithm and its architecture in detail.

Apply

1. Demonstrate the perceptron network architecture with training algorithm in detail
2. Demonstrate the Full Counter Propagation Network (CPN) algorithm with neat architecture.
3. Construct the convolution neural network with neat diagram.

Analyze

1. Justify the Back propagation network architecture and analyse its training algorithm
2. Analyse different layers of convolution neural network in detail.

Evaluate

1. Kohonen Self – Organizing net with two cluster units and five inputs. The weight vector for cluster units are given by $W = \begin{bmatrix} 1.0 & 0.9 & 0.7 & 0.5 & 0.3 \\ 0.3 & 0.5 & 0.7 & 0.9 & 1.0 \end{bmatrix}$
Use the square of the Euclidean distance to find the winning cluster unit for the input pattern $x = [0.0 \ 0.5 \ 1.0 \ 0.5 \ 0.0]$.
Using learning rate 0.25, find the new weights for the winning unit.
2. Consider the CPN net with using the input pair $x = [0110]$ and $y = [01]$ perform Phase 1 of training (one step only). Find the activation of the cluster layer units and update the weights using learning rates $\alpha = 0.2$ and $\beta = 0.3$. $V = \begin{bmatrix} 0.7 & 0.5 \\ 0.7 & 0.5 \\ 0.5 & 0.7 \\ 0.5 & 0.7 \end{bmatrix}$ $W = \begin{bmatrix} 0.2 & 0.2 \\ 0.2 & 0.2 \end{bmatrix}$

23CSC21 Backend Programming Languages**3 0 0 3****Course Outcomes:**

1. Demonstrate a comprehensive understanding of web fundamentals.
2. Apply RESTful API for modern web applications.
3. Develop and deploy basic web applications using Node.js and Express.js.
4. Demonstrate the ability to understand C# concepts and build web applications using ASP.NET MVC.
5. Create efficient and dynamic RESTful APIs with CRUD functionality.
6. Design and develop web applications using Python.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO5	PSO1	PSO2
1	3	2	1	1	2	1
2	3	3	3	2	3	3
3	3	3	3	3	3	3
4	3	3	3	3	3	3
5	3	3	3	3	3	3
6	3	3	3	3	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit-I**12 Hours**

Overview of the web: Basic concepts of web, Anatomy of HTTP transaction, Request and response structures, HTTP status codes, REST APIs, Browser storage - Local storage & Session storage

RESTful programming: Introduction to Restful API, REST Principles, Resource Identification, Representation of Resources: JSON, XML and Plain Text/HTML, HTTP Methods: GET, POST, PUT and DELETE, Stateless Communication, Versioning, Error Handling, Pagination.

Basic HTML Tags, Basic CSS concepts, Authentication and Authorization in RESTful

Unit-II**12 Hours****Programming with JavaScript**

Introduction to Node.js, Features of Node.js, npm, understanding package. json, Modules: fs, http, path and os, Express.js: Introduction to Express.js, Setting up an Express server, Handling GET and POST requests, Middleware in Express, Template Engine: Embedded JavaScript Templates, rendering dynamic HTML, building a REST API: Creating routes for CRUD operations, understanding authentication vs. authorization, Implementing basic JWT.

Basics of JavaScript and ES6 JavaScript, Node Packages, async, await

Unit-III**14Hours****Programming with C#**

Introduction to .NET: Introduction, .NET Framework vs .NET Core vs .NET, components of .NET, CLR, FCL, Managed code and Unmanaged code, C# Concepts: Introduction, Features, Datatypes, Functions, Arrays, Classes and Objects, Properties, Inheritance, Polymorphism, Interfaces, Namespaces, Collections, Delegates, Events, Exception Handling, Introduction to ASP.NET: MVC, Routing, Razor pages vs MVC, Create RESTful endpoints, Model Binding

C# variables, LINQ, async/await, Multithreading, ORM, ASP.NET life cycle, web forms, ADO.NET introduction

Unit-IV**10 Hours****Programming with Python**

Introduction to Python, Classes and objects, Constructors, Encapsulation, Inheritance, Polymorphism, Decorators and Closures, Abstract Base Classes, Generators and Iterators, Metaclasses, Functional Programming: map(), filter(), reduce(), Python's HTTP package, building a REST API: creating routes for CRUD operations.

Basic concepts of python, Python packages

Total: 48 Hours

Textbook (s)

1. Restful Web APIs, Leonard Richardson, Mike Amundsen, Sam Ruby, O'Reilly Media.
2. Web Development with Node and Express, Ethan Brown, O'Reilly Media.
3. C# Programming, Wikibooks Contributors, Platypus Global Media.
4. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

Reference (s)

1. Pro ASP.NET Core 6, Adam Freeman, 9th edition, A press.
2. Automate the Boring Stuff with Python, Al Sweigart, No Starch Press, 2nd Edition.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	30	--
Understand	40	40	--
Apply	30	30	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember:**

1. What are the advantages of Restful API?
2. What is the difference between Node.js and Express.js?
3. Define C# Function?
4. Write a short note about Abstract Base Classes.
5. Write a short note on Browser Storage.

Understand:

1. Explain about request and response structure.
2. What is Restful API? Explain about various Rest principles.
3. Describe the procedure to use middleware in Express.js.
4. Explain in detail about CLR.
5. Discuss about map(), filter(), reduce() in Python.

Apply:

1. Implement a basic Node.js program that reads and writes a file using the fs module.
2. Create a simple HTTP server using the http module that responds with "Welcome to Node.js!".
3. Write a simple C# program to handle an Exception.
4. Write a simple C# code that calculates and displays the sum of two numbers entered by the user.
5. Implement a simple HTTP server in Python that handles GET and POST requests.

Analyze:

1. How does the client-server architecture impact the way web applications handle user requests?
2. Compare the http module in Node.js with Express.js in terms of request handling and ease of use.
3. Compare how Razor pages are different from MVC.
4. Analyze the difference between .NET Framework and .NET Core?
5. Analyze the difference between synchronous and asynchronous HTTP requests in Python.

23ITC31 Fundamentals of Security**3 0 0 3****Course Outcomes**

1. Describe the fundamental concepts of information security
2. Illustrate the use of cryptography and its functions
3. Identify different types of Cryptography techniques
4. Classify different types of Security Threats and Vulnerability
5. Demonstrate the concepts of network security
6. Summarize transport and network layer security

CO-PO Mapping

CO	PO ₁	PO ₂	PO ₃	PO ₄	PSO1	PSO2
1	3	1	1	1	3	3
2	3	3	2	2	3	2
3	2	2	2	2	2	2
4	2	2	2	2	3	3
5	3	2	2	2	2	3
6	3	2	2	2	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Security concepts****12 Hours**

What is security, Data vs Information vs Cyber security, Goals of Information Security, Computer Security Concepts, threats, attacks and assets, security functional requirements, fundamental security design principles, computer security strategy

protocols suite, hacking, network sniffing, social engineering

Unit II**Cryptography****12 Hours**

Introduction to cryptography, Cryptographic functions (Authentication, Nonrepudiation, confidentiality, integrity), Cryptanalysis. Types of Cryptography (Symmetric key and Asymmetric Key), Cryptography, cryptographic Algorithms, Substitution Techniques, Transportation, Techniques Message Integrity, Encryption and Decryption Techniques, Digital Signatures, Email Standards: MIME and PGP

Applications of Cryptography, cipher types, steganography

Unit III**Security Threats and Vulnerabilities****12 Hours**

Malware Overview of Security Threats and Vulnerability: Types of attacks on Confidentiality, Integrity and Availability, Types of malware.

Security Counter-Measures: Passwords, Access Control (Authenticating users, Handling User Access), Antivirus Software, Firewalls, Intrusion Detection Systems & IPS

Types of firewalls, advanced persistent threat, Buffer Overflow

Unit IV**Network Security****12 Hours**

TCP/IP Suite, DNS, MITM, Attacks on TCP and DNS, VPN, Application layer security (PGP, S/MIME), Transport layer security (TLS), Network layer security (IPSec) Anonymous networks: Tor, I2P.

TCP Vulnerabilities, SSH vs SSL,

Total: 48 Hours

Textbook (s)

1. William Stallings, Lawrie Brown, Computer Security Principle sand Practice Third Edition, 2015
2. Nihad A. Hassan, Rami Hijazi, Digital Privacy and Security Using Windows: A Practical Guide, Apress, 2017

Reference (s)

1. Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.
2. Ross Anderson, Security Engineering: A Guide to Building Dependable Distributed, 3rd Edition, John Wiley & Sons Inc, 2023.
3. Kozierok, Charles M. The TCP/IP guide: a comprehensive, illustrated Internet protocols reference, 2005
4. Harris, Shon, "CISSP all-in-one exam guide." Sixth edition (2013).

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	40	--
Understand	30	40	--
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. What is security.
2. Define cyber security
3. List any four computer security concepts
4. Define threat
5. Define intrusion

Understand

1. Explain Cryptographic functions
2. Explain the role of Symmetric key cryptography
3. Illustrate hashing techniques
4. Outline the purpose of digital signatures

Apply

1. Digital signature
2. Buila a firewall mechanism to protect laptop
3. RSA algorithm with example

Analyze

1. Compare and contrast RSA and ECC.
2. Distinguish differences between Symmetric and Asymmetric key cryptography.
3. Examine the key sharing techniques in both Symmetric and Asymmetric key cryptography techniques

Evaluate

1. Justify the ECC is best public key cryptosystem than other public key approaches.
2. Explain the importance of IPSec protocol.
3. Explain the importance of I2P protocol

Open Book Exam Questions

Question 1:

In a public-key system using RSA, you intercept the ciphertext $C=10$ sent to a user whose public key is $e=5$, and $n=35$. What is the plaintext M ? and Perform encryption and decryption using the RSA algorithm for the following: 1. $P=3$; $q=11$, $e=7$; $M=5$. 2. $P=17$; $q=31$, $e=7$; $M=2$.

Question 2:

Suppose we have a set of blocks encoded with the RSA algorithm and we don't have the private key. Assume $n=pq$, e is the public key. Suppose also someone tells us they know one of the plaintext blocks has a common factor with n . Does this help us in any way?

23IT004 Computer Graphics and Multimedia**3 0 0 3****Course Outcomes**

1. Demonstrate the contemporary graphics hardware-the actual methodology and techniques to draw computer graphics-animations etc. for the real world presentation and how it is implemented in Computer graphics software and various applications of computer graphics.
2. Apply algorithms for rasterization and clipping of 2D graphic primitives and filling of closed regions and understand the basic 2D and 3D Transformations such as translation-rotation and scaling.
3. Identify the usage of various clipping algorithms
4. Analyze algorithms for visible surface detection and various projection types.
5. Demonstrate the ability to develop an animation movie.
6. Summarize the introductory concepts in multimedia processing.

COs-POs Mapping

COs	PO ₂	PO ₃	PO ₅
1	3	2	1
2	2	3	1
3	3	2	2
4	3	2	1
5	2	3	2
6	2	2	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 Hours****Introduction & Output primitives**

Application of Computer Graphics- overview of graphics systems-raster scan systems-random scan systems-raster scan display processors

Output primitives :Points and lines-line drawing algorithms (Bresenham's and DDA Line derivations and algorithms)-mid-point circle and ellipse algorithms. Filled area primitives: Inside and outside tests-Scan line polygon fill algorithm-boundary-fill and flood-fill algorithms.

Graphics monitors-work stations and input devices

Unit II**12 Hours****2-D Geometrical transforms & 2D-Viewing**

Translation-scaling-rotation-reflection and shear transformations-matrix representations and homogeneous coordinates-composite transforms-transformations between coordinate systems.

2-D viewing: The viewing pipeline-viewing coordinate reference frame-window to view-port coordinate transformation-viewing functions-Cohen-Sutherland and Cyrus beck line clipping algorithms-Sutherland – Hodgeman polygon clipping algorithm.

Transformation Functions and raster methods for transformations

Unit III**12 Hours****3-D object representation-Transformations & Visible Surface Detection Methods**

Polygon surfaces-quadric surfaces- spline representation -Hermite curve-Bezier curve and B-Spline curves-Bezier and B-Spline surfaces.3-D Geometric transformations: Translation-rotation-scaling-reflection and shear transformations-composite transformations. 3D Viewing pipeline-clipping-projections (Parallel and Perspective).

Visible surface detection methods: Classification-back-face detection-depth-buffer-scan-line-depth sorting -BSPtree methods-area sub-division and octree methods.

Basic illumination models-polygon rendering methods

Unit IV**12 Hours****Computer Animation & Fundamentals of Multimedia**

Design of animation sequence-general computer animation functions-raster animation-computer animation languages-key frame systems-motion specifications.

Fundamental concepts in Text and Image: Multimedia and hypermedia-world wide web-overview of multimedia software tools. Graphics and image data representation graphics/image data types-file formats.

Multimedia data compression: Lossless compression algorithm: Run-Length Coding-Variable Length Coding- Dictionary Based Coding-Arithmetic Coding-Lossless Image Compression -Lossy compression algorithm.

Digital voice and video-Image video and animation

Total: 48 Hours**Textbook (s)**

1. D. Hearn & M.P. Baker, Computer Graphics, 2/e, Pearson Education, New Delhi, 2005
2. Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, PHI/Pearson Education, 2004.

Reference (s)

1. Newman W.M. and Sproull R.F., Principles of Interactive Computer Graphics, 2nd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 1997.
2. S. Harrington, Computer Graphics, A Programming Approach, MGH Publication, New Delhi, 1994.
3. J.D. Foley et. Al, A Fundamental of Computer Graphics, Addition Wesley, London, 1993.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	35	--
Understand	35	35	--
Apply	35	20	40
Analyze	10	10	40
Evaluate	--	--	20
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)**Remember**

1. List the applications of computer graphics
2. Write 2D transformation matrix for translation, rotation and scaling
3. Define parallel projection
4. List the steps to design computer animation

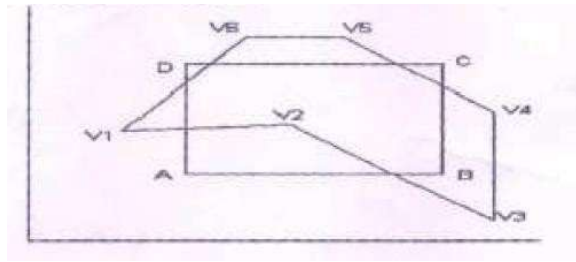
Understand

1. Explain Bresenham's Line drawing algorithm
2. Explain Sutherland-Hodgeman polygon clipping algorithm
3. Write about Depth sorting visible surface detection method
4. Explain about Lossless Image Compression.

Apply

1. Draw a circle with center (5,8) and radius 7 units using Midpoint circle generation algorithm
2. Obtain the reflection of a point A(10, 10) with respect to the line $y=x+2$.
3. Use Cohen Sutherland clipping algorithm to clip two lines p1p2 and p3p4 with p1(40,15) p2(75,45) p3(70,20) p4(100,10) against window a(50,10) b(80,10) c(80,40) d(50,40)
4. Clip the polygon v1-v6 against the window ABCD. Assume any convenient numerical

values for the vertices preserving the information containing the figure. Employ Sutherland-Hodgeman algorithm



Analyze

1. Compare raster scan and random scan systems
2. Write the functionalities of B-spline curves
3. Test the Bresenham's line drawing algorithm to draw a line between the points (20,10) and (30,18)
4. Compare and contrast parallel and perspective projections.

23IT005 Information Theory and Coding**3 0 0 3****Course Outcomes:**

At the end of the course students are able to:

1. Demonstrate the basic concepts of information theory-source coding-channel and channel capacity-channel coding and relation among them.
2. Interpret the real life applications based on the fundamental theory.
3. Determine the entropy-channel capacity-bit error rate-code rate-steady-state probability and so on.
4. Compute the encoder and decoder of one block code or convolution code using any program language.
5. Conclude the information content of a random variable from its probability distribution.
6. Predict the efficient code for data on imperfect communication channels.

CO – PO Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₆	PO ₈
1	1	2	1	2	1
2	2	3	2	1	2
3	2	1	3	2	2
4	3	3	3	1	2
5	1	1	1	2	1
6	1	1	1	1	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit I****12 Hours****Information Theory**

Information–Entropy–Information rate–classification of codes–Kraft McMillan inequality–Source coding theorem–Shannon–Fano coding–Huffman coding–Extended Huffman coding–Joint and conditional entropies–Mutual information–Discrete memory less channels–BSC.

*BEC Channel capacity–Shannon limit***Unit II****12 Hours****Source Coding- Text-Audio and Speech**

Text: Adaptive Huffman Coding–Arithmetic Coding–LZW algorithm–Audio: Perceptual coding–Masking techniques–Psychoacoustic model–MEG Audio layers I-II-III–Dolby AC3–Speech: Channel Vocoder.

*Linear Predictive Coding***Unit III****12 Hours****Source Coding: Image and Video**

Image and Video Formats–GIF–TIFF–SIF–CIF–QCIF–Image compression: READ–JPEG–Video Compression: Principles–I–B–P frames–Motion estimation–Motion compensation.

*H.261–MPEG standard***Unit IV****12 Hours****Error Control Coding Block & Convolutional Codes**

Definitions and Principles: Hamming weight–Hamming distance–Minimum distance decoding–Single parity codes–Hamming codes–Repetition codes–Linear block codes–Cyclic codes–Syndrome calculation–Encoder and decoder–CRC–Convolution codes–code tree–trellis–state diagram–Encoding.

*Decoding: Sequential search and Viterbi algorithm –Principle of Turbo coding***Total: 48 Hours**

Textbook (s)

1. R Bose, Information Theory-Coding and Crptography, 2nd Edition TMH, 2007
2. Fred Halsall, Multimedia Communications: Applications-Networks-Protocols and Standards, 1st Edition Pearson Education Asia, 2000

Reference (s)

1. K Sayood, Introduction to Data Compression, 3rd Ed., Elsevier, 2006
2. S Gravano, Introduction to Error Control Codes, 2nd Edition Oxford University Press, 2007
3. Amitabha Bhattacharya, Digital Communication, 2nd Edition ,TMH, 2006

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	20	--
Understand	40	30	--
Apply	20	30	50
Analyze	10	20	30
Evaluate	--	--	20
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)**Remember**

1. Write the conditional entropy $H(Y|X)$ in bits
2. State the entropy of the source, $H(X)$
3. List the advantage and disadvantage of cyclic code
4. Define rate of information.

Understand

1. Draw the mutual information $I(X; Y)$?
2. Represent binary cyclic code?
3. Indicate the different methods for controlling the errors?
4. Contrast fixed length codes inefficient for alphabets whose letters are not equiprobable? Discuss this in relation to Morse code

Apply

1. Find the alternative expression for $H(Y) - H(Y|X)$ in terms of the joint entropy & both marginal entropies
2. Demonstrate a plot of the function you would need to use in order to recover completely the continuous signal transmitted, using just such a finite list of discrete periodic samples of it
3. Select the important properties of codes while encoding a source?
4. Compute the coding rate R of your code? How do you know whether it is optimally efficient?

Analyze

1. Justify In terms of the probability distributions, what are the conditional entropies $H(X|Y)$ and $H(Y|X)$?
2. Compare is there any limit to the capacity of such a channel if you can increase its bandwidth W in Hertz without limit, but while not changing N_0 or P ? If so, what is that limit?
3. Conclude that mutual information is non-negative.
4. Identify code word corresponding to the information sequence 10011 using time domain and transform domain

Open Book Exam Questions

1. (Capacity of sneezing) A sick student is sneezing periodically every minute, with each sneeze happening i.i.d. with probability p . He decides to send k bits to a friend by modulating the sneezes. For that, every time he realizes he is about to sneeze he chooses to suppress a sneeze or not. A friend listens for n minutes and then tries to decode k bits.
 - i. Find capacity in bits per minute. (Hint: Think how to define the channel so that channel input at time t were not dependent on the arrival of the sneeze at time t . To rule out strategies that depend on arrivals of past sneezes)

- ii. Suppose sender can suppress at most E sneezes and listener can wait indefinitely ($n = \infty$). Show that sender can transmit $C_{puc}E + o(E)$ bits reliably as $E \rightarrow \infty$ and find C_{puc} . Curiously, $C_{puc} \geq 1.44$ bits/sneeze regardless of p .
2. (Finiteness of entropy) We have shown that any N -valued random variable X , with $E[X] < \infty$ has $H(X) \leq E[X]h(1/E[X]) < \infty$. Next let us improve this result.
- i. Show that $E[\log X] < \infty \Rightarrow H(X) < \infty$. Moreover, show that the condition of X being integer-valued is not superfluous by giving a counterexample.
 - ii. Show that if $k \rightarrow P_X(k)$ is a decreasing sequence, then $H(X) < \infty \Rightarrow E[\log X] < \infty$. Moreover, show that the monotonicity of pmf is not superfluous by giving a counterexample.

23IT006 Data Warehousing and Data Mining**3 0 0 3****Course Outcomes**

1. Understand the functionality of the various data mining and data warehousing component.
2. Apply the pre-processing techniques on different types of data for mining.
3. Implement the association rule mining concepts for generating association rules.
4. Design and deploy appropriate classification technique.
5. Analyse the clustering techniques on a given dataset.
6. Apply the data mining techniques to mine complex types of data.

COs-POs Mapping

COs	PO ₂	PO ₃	PO ₄	PO ₅	PSO1
1	3	1	1	1	1
2	3	3	2	3	3
3	3	3	3	2	2
4	3	3	3	2	2
5	3	3	3	2	2
6	3	2	3	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 Hours****Introduction to Data Mining and Warehousing**

Overview of Data warehouse-Data Warehouse Architecture, OLTP vs. OLAP -Introduction to Data Mining: Data Mining and KDD, Basic Data Mining Tasks, Types of Data , Data Pre-processing, Measures of Similarity and Dissimilarity

Data Warehouse Implementation , Data Warehousing to Data Mining

Unit II**12 Hours****Mining Association Rules in Large Databases**

Association Rule Mining, Mining Single-Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining multidimensional Association rules from relational databases and Data warehouses

Evaluation of Association Patterns-Effect of Skewed support distribution

Unit III**12Hours****Classification of Data**

Preliminaries-General Approach to Solving Classification Problem-Decision Tree Induction-Rule-based Classifier-Bayesian Classification.

Classification by Backpropagation-Genetic Algorithms

Unit IV**12 Hours****Cluster analysis**

Cluster analysis, types of clustering ,Types of clusters ,K-means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation ,Mining sequence patterns.

Grid-Base Clustering Methods-Model Based Clustering Methods

Total: 48 Hours**Textbook (s)**

1. Pang, Ning Tan, Michael Steinbach, Vipin Kumar Introduction to Data Mining, 2nd Edition, Pearson Addison Wesley, 2018
2. Jiawei Han & Micheline Kamber, Data Mining Concepts and Techniques, 3rd Edition, Morgan Kaufmann, 2016

Reference (s)

1. Margaret H Dunham, Data Mining Introductory and advanced topics, 2nd Edition, Pearson Education, 2004
2. Arun K Pujari, Data Mining Techniques, 2nd Edition, University Press, 1999.
3. Ian H. Witten, Eibe Frank, Mark A. Hall, Data Mining: Practical Machine Learning Tools and Techniques, 3rd Edition, Morgan Kaufmann Publishers, 2011

SAMPLE QUESTION (S)**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam
Remember	35	15	---
Understand	40	25	---
Apply	25	30	40
Analyze		20	30
Evaluate	--	10	30
Create	--	--	---
Total (%)	100	100	100

Remember

1. What are the steps in the data mining process?
2. What is Descriptive and predictive data mining?
3. Define data warehouse.
4. What is clustering?

Understand

1. Identify the different types of data repositories on which mining can be performed
2. Differentiate the types of data in cluster analysis.
3. Explain the various OLAP operations.

Apply

1. Generate frequent Itemsets from retail dataset.

Analyze

1. Compare the parametric methods and non-parametric methods of reduction
2. Criticize over the data quality is so important in a data warehouse environment

Evaluate

1. Judge the attributes requirement for high performance data mining
2. Determine the data visualization help in decision-making
3. Select the factors to be considered while selecting the sample in statistics

OBE Questions:**Apply**

1. An emergency room in a hospital measures 10 variables (blood pressure, age etc) of newly admitted patients. A decision has to be taken whether to put the patient in an intensive care unit. Due to high cost of ICU , high risk patients given high priority. Predict high risk patient and discriminate them from low risk patients.
 - a. prepare training and test set.
 - b. Build a model for high risk patients.

Analyze

1. A credit card company typically receives hundreds of thousands of applications for new cards. The application contains information regarding several different attributes, such as annual salary, any outstanding debits, age ect. The problem is categorize applications into those who have good credit, bad credit or fall into a grey area.

23IT507 Cloud Computing Laboratory**0 0 3 1.5****Course Outcomes**

At the end of the course, students will be able to

1. Demonstrate the different types of Distributed system Architectures
2. Illustrate the working of Virtual Machine using Virtual box
3. Create and launch the Google App Engine
4. Understand the configuration and working of Hadoop in real time scenario
5. Demonstrate cloud scenario using Cloud Sim and run a scheduling algorithm
6. Demonstrate the role of Map Reduce Component in Hadoop

Co-Po Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO9	PSO1
1	3	3	3	3	-	2	2
2	3	3	3	-	3	2	2
3	2	2	2	2	3	2	2
4	3	3	3	-	3	3	3
5	2	2	2	-	2	2	2
6	2	2	2	3	2	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments

1. The client and server programs can be located on different machines. This makes it possible to distribute the workload between the client and server machines. In order to understand the working of client and server design a RPC for remote computation where client submits an integer value to the server and server calculates factorial and returns the result to the client program.

Test cases for a client-server factorial program for Validation:

- Test Case 1: The client enters a valid integer value. The server calculates the factorial of the integer value and returns the correct result to the client.
 - Test Case 2: The client enters an invalid integer value. The client program displays an error message.
 - Test Case 3: The client enters a very large integer value. The server calculates the factorial of the integer value, but it takes a long time to do so. The client program displays a progress bar to let the user know how long the calculation is taking.
 - Test Case 4: The server is unavailable. The client program displays an error message.
 - Test Case 5: The network connection between the client and server is interrupted. The client program displays an error message.
2. MPI is used to send messages from one process (computer, workstation etc.) to another. These messages can contain data ranging from primitive types (integers, strings and so forth) to actual objects. In order to understand working of a distributed application using Message Passing Interface (MPI) for remote computation design a application where client submits a string to the server and server returns the reverse of it to the client.

Test cases for a client-server program for Validation:

- Test Case 1: The client enters a valid string value. The server returns correct result to the client.
 - Test Case 2: The client enters an invalid string value. The client program displays an error message.
 - Test Case 3: The server is unavailable. The client program displays an error message.
 - Test Case 4: The network connection between the client and server is interrupted. The client program displays an error message.
3. Remote Method Invocation (RMI) mechanism and the Common Object Request Broker Architecture (CORBA) are the two most important and widely used distributed object systems. Each system has its own features and shortcomings. Both are being used in the industry for various applications ranging from e-commerce to health care. Selecting which of these two distribution mechanisms to use for a project is a tough task. In order to understand working of a distributed application using Remote Method Invocation (RMI) design a distributed

application using RMI for remote computation where client submits two strings to the server and server returns the concatenation of the given strings.

Test cases for a client-server program for Validation:

- Test Case 1: The client enters a valid string value. The server returns correct result to the client.
 - Test Case 2: The client enters an invalid string value. The client program displays an error message.
 - Test Case 3: The server is unavailable. The client program displays an error message.
 - Test Case 4: The network connection between the client and server is interrupted. The client program displays an error message.
4. The Apache Hadoop software library is a framework that allows for the distributed processing of large data sets across clusters of computers using simple programming models. It is designed to scale up from single servers to thousands of machines, each offering local computation and storage. Rather than rely on hardware to deliver high availability, the library itself is designed to detect and handle failures at the application layer, so delivering a highly available service on top of a cluster of computers, each of which may be prone to failures. In order to understand the working of Hadoop framework install Hadoop single node cluster and run applications like wordcount.

Test case name	Step	Description
Word count	1	Put the local file /etc/redhat-release into native HDFS.
	2	Put the local file /etc/redhat-release into IBM Storage Scale HDFS Transparency cluster
	3	Run the MapReduce WordCount job with input from the native HDFS and generate output to IBM Storage Scale HDFS Transparency cluster.
	4	Run the MapReduce WordCount job . Scale HDFS Transparency cluster and generate output to the native HDFS.

5. One of the main components of Hadoop is Map Reduce. The first component of Hadoop that is, Hadoop Distributed File System (HDFS) is responsible for storing the file. The second component that is, Map Reduce is responsible for processing the file. MapReduce has mainly 2 tasks which are divided phase-wise. In first phase, Map is utilised and in next phase Reduce is utilised. In order to understand the working of map reduce design and develop a distributed application to find the coolest/hottest year from the available weather data. Use weather data from the Internet and process it using MapReduce.

Test cases: -

```

1 The Day is Cold Day :20200101 -21.8
2 The Day is Cold Day :20200102 -23.4
3 The Day is Cold Day :20200103 -25.4
4 The Day is Cold Day :20200104 -26.8
5 The Day is Cold Day :20200105 -28.8
6 The Day is Cold Day :20200106 -30.0
7 The Day is Cold Day :20200107 -31.4
8 The Day is Cold Day :20200108 -33.6
9 The Day is Cold Day :20200109 -26.6
10 The Day is Cold Day :20200110 -24.3

```

6. One of the components of Hadoop is Map Reduce. The first component of Hadoop that is, Hadoop Distributed File System (HDFS) is responsible for storing the file. The second component that is, Map Reduce is responsible for processing the file. MapReduce has mainly 2 tasks which are divided phase-wise. In first phase, Map is utilised and in next phase Reduce is utilised. In order to understand working of map reduce design a distributed application using MapReduce under Hadoop for Character counting in a given text file.

Test Cases: -

Input

GMR Cloud Lab

Output

```

M 1      u 1
G 1      d 1
R 1      a 1
C 1      b 1
L 2
o 1

```

7. One of the components of Hadoop is Map Reduce. The first component of Hadoop that is, Hadoop Distributed File System (HDFS) is responsible for storing the file. The second component that is, Map Reduce is responsible for processing the file. MapReduce has mainly 2 tasks which are divided phase-wise. In first phase, Map is utilised and in next phase Reduce is utilised. In order to understand working of map reduce design a distributed application using MapReduce under Hadoop for finding maximum number in first and second columns in every line of a given text file.

Test Cases: -

- Test Case 1: The input text file contains a single line with two numbers. The maximum number in the first and second columns should be the same number.
- Test Case 2: The input text file contains multiple lines with two numbers each. The maximum number in the first and second columns should be different for each line.
- Test Case 3: The input text file contains a line with only one number. The maximum number in the first and second columns should be the same number (the number that is in the line).
- Test Case 4: The input text file contains a line with two numbers that are not integers. The maximum number in the first and second columns should be the largest number in the line.
- Test Case 5: The input text file contains a line with a number that is out of range for an integer. The maximum number in the first and second columns should be the largest number in the line that is within the range of an integer.

8. A virtual machine (VM) is a software program that creates a virtual computer within a physical computer. The VM has its own operating system, applications, and files, and it can run independently of the host computer. To understand the working environment of virtual machine, install a C/ Python compiler in the virtual machine execute Programs.

Test Cases: -

- Test Case 1: The VM should be able to boot up and start the operating system.
- Test Case 2: The VM should be able to connect to the internet.
- Test Case 3: The VM should be able to install and run applications.
- Test Case 4: The VM should be able to share files with the host computer.
- Test Case 5: The VM should be able to be shut down and restarted.

9. Google App Engine is a fully managed platform as a service (PaaS) that allows you to develop and host web applications without having to worry about the underlying infrastructure. App Engine provides a variety of features that make it easy to deploy and scale your applications, In order to understand working of Google App Engine. Create hello world app and other simple web applications using python/java.

Test Cases: -

- Test Case 1: The application should be able to be deployed to App Engine without any errors.
- Test Case 2: The application should be able to be accessed by users from all over the world.
- Test Case 3: The application should be able to handle high traffic loads.
- Test Case 4: The application should be secure and protected from attacks.
- Test Case 5: The application should be cost-effective and not exceed your budget.

10. Cloud Sim is an open-source software tool that allows you to simulate cloud computing systems. It is used by researchers and practitioners to study the performance, scalability, and cost-effectiveness of cloud computing systems. To understand the working of Cloud Sim, simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim.

Test Cases: -

- Test Case 1: The simulation should be able to create a cloud with a specified number of servers, storage, and networks.
- Test Case 2: The simulation should be able to allocate VMs to users in a fair and efficient manner.
- Test Case 3: The simulation should be able to schedule jobs on VMs in a fair and efficient manner.

- Test Case 4: The simulation should be able to track the performance of the cloud, such as the CPU usage, memory usage, and network traffic.
- Test Case 5: The simulation should be able to generate reports on the performance of the cloud.

11. Cloud mesh is a Python library that provides a unified interface to multiple cloud computing platforms, including Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP). It is designed to make it easy to deploy, manage, and scale applications across multiple clouds. To understand the working of Cloud mesh develop a program using Cloud mesh to demonstrates the use of dotdict.

Test Cases

- Test Case 1: Cloudmesh should be able to provision a compute instance on AWS.
- Test Case 2: Cloudmesh should be able to provision a storage volume on Azure.
- Test Case 3: Cloudmesh should be able to provision a network on GCP.
- Test Case 4: Cloudmesh should be able to deploy an application to AWS.
- Test Case 5: Cloudmesh should be able to deploy an application to Azure.
- Test Case 6: Cloudmesh should be able to deploy an application to GCP.

12. Cloud mesh is a Python library that provides a unified interface to multiple cloud computing platforms, including Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP). It is designed to make it easy to deploy, manage, and scale applications across multiple clouds. To understand the working of Cloud mesh, develop a program using cloud mesh that demonstrates the use of FlatDict.

Test Cases

- Test Case 1: Cloudmesh should be able to provision a compute instance on AWS.
- Test Case 2: Cloudmesh should be able to provision a storage volume on Azure.
- Test Case 3: Cloudmesh should be able to provision a network on GCP.
- Test Case 4: Cloudmesh should be able to deploy an application to AWS.
- Test Case 5: Cloudmesh should be able to deploy an application to Azure.
- Test Case 6: Cloudmesh should be able to deploy an application to GCP.

13. Cloud mesh is a Python library that provides a unified interface to multiple cloud computing platforms, including Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP). It is designed to make it easy to deploy, manage, and scale applications across multiple clouds. To understand the working of Cloud mesh develop a program using cloudmesh that demonstrates the use of cloudmesh common StopWatch.

Test Cases

- Test Case 1: Cloudmesh should be able to provision a compute instance on AWS.
- Test Case 2: Cloudmesh should be able to provision a storage volume on Azure.
- Test Case 3: Cloudmesh should be able to provision a network on GCP.
- Test Case 4: Cloudmesh should be able to deploy an application to AWS.
- Test Case 5: Cloudmesh should be able to deploy an application to Azure.
- Test Case 6: Cloudmesh should be able to deploy an application to GCP.

14. Pi Cloud is a project that aims to create a personal cloud server using a Raspberry Pi. It is a relatively new project, but it has the potential to be a great way to create a low-cost and secure cloud server for your home or office. To understand the working of Pi cloud develop a program using Pi cloud to save passwords in the database as well and have a backup storage in the cloud system.

Test Cases:-

- Test Case 1: The program should be able to save a password in the database.
- Test Case 2: The program should be able to retrieve a password from the database.
- Test Case 3: The program should be able to encrypt the password before saving it to the database.
- Test Case 4: The program should be able to decrypt the password when it is retrieved from the database.
- Test Case 5: The program should be able to backup the database to the cloud system.
- Test Case 6: The program should be able to restore the database from the cloud system.
- Test Case 7: The program should be able to handle invalid passwords, such as passwords that are too short or contain common words.
- Test Case 8: The program should be able to handle errors, such as database errors and network errors.

15.A virtual machine (VM) is a software program that creates a simulated computer within a physical computer. This allows you to run multiple operating systems on the same physical computer, each in its own VM. To understand the architecture of VM design a Python script for adding a virtual machine.

Test Cases:-

- Test Case 1: The VM should be able to start and stop.
- Test Case 2: The VM should be able to boot into an operating system.
- Test Case 3: The VM should be able to install and run applications.
- Test Case 4: The VM should be able to connect to a network.
- Test Case 5: The VM should be able to share files with other VMs.
- Test Case 6: The VM should be able to be backed up and restored.
- Test Case 7: The VM should be able to handle different types of errors, such as hardware failures and software crashes.

16.GAE Launcher is a command-line tool that is used to deploy and manage Google App Engine (GAE) applications. To understand the working of GAE launcher to launch the web applications.

- Test Case 1: The GAE Launcher should be able to launch a web application that is in the correct directory.
- Test Case 2: The GAE Launcher should be able to launch a web application that has the correct configuration file.
- Test Case 3: The GAE Launcher should be able to launch a web application that has the correct dependencies.
- Test Case 4: The GAE Launcher should be able to launch a web application that is in the correct environment.

List of Augmented Experiments

Concept: using different features of cloud computing creating own cloud for institute, organization etc.

Objective: student must be able to create own cloud using different features which are learned in

Previous practices.

Scope: creating a cloud like social site for institute.

Technology: any open system used for cloud

Reading Material(s)

1 CC Lab manual–Department of IT-GMRIT Rajam

23TPX01 Term Paper**0 0 3 1.5****Course Outcomes**

At the end of the term paper the students will be able to

1. Interpret the literature to link the earlier research with the contemporary technologies.
2. Communicate effectively as an individual to present ideas clearly and coherently
3. Review the research findings and its correlation to the latest applications
4. Prepare documents and present the concepts clearly and coherently
5. Inculcate the spirit of enquiry for self-learning
6. Identify interdisciplinary oriented topics

Co-Po Mapping

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P01 0	P01 1	P01 2	PSO 1	PSO 2
C01				2										
C02										3		3		
C03	3													
C04										3				
C05												3		
C06	1													

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

23ESX02 Employability Skills II**0 0 2 0****Course Outcomes**

At the end of the Employability Skills students will be able to

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Develop life skills with behavioral etiquettes and personal grooming
3. Assess analytical and aptitude skills
4. Develop algorithms for engineering applications
5. Solve engineering problems using software
6. Utilize simulation tools for testing

Co-Po Mapping

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01										3		2
C02								1		2		2
C03	2	1						2				
C04	2				2							
C05	2				2							
C06	2				2							

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Syllabus**Soft Skills:**

Sl. No.	5 th Semester (Topic & Content)	No. of Periods
1.	Introduction to Campus Placements: Stages of Campus Placement, Skills assessed in Campus Placements & How to get ready?	01
2.	Motivational Talk on Positive Thinking: Beliefs, Thoughts, Actions, Habits & Results (Success)	01
3.	Resume Preparation: Resume? Templates? Mistakes to be avoided in a Resume, Steps to be followed in preparing it.(with examples)	02
4.	Group Discussions (Recap): GD? Stages of a GD, Skills assessed in a GD, Blunders to be avoided, How to excel in a GD? (through Practice Sessions)	02
5.	Psychometric Tests: Definition, Types of Psychometric Tests: Numerical Computation, Data Interpretation, Verbal Comprehension, Verbal Critical Reasoning and Personality Questionnaires	01
6.	Exercises related to Communication: Story Writing, TAT etc	01
Total Periods		08

Quantitative Aptitude:

Sl. No.	Semester-V (Topic)	No. of Periods
1.	Square & Cube roots	01
2.	Partnership	01
3.	Partnership	01
4.	Logarithms	01
5.	Progressions	01
6.	Mensuration	01
7.	Mensuration	01
8.	Data Sufficiency	01
Total Periods		08

Domain Specific: Competitive programming Skills**UNIT-I****No of Hours:** 06 Hours

Stack: real world applications **Queue:** importance of Circular queue **Priority Queue:** implementation of Priority Queue **Binary Search Tree:** applications of binary search tree, Time complexity in BST, Lowest Common Ancestor of a BST, Binary Search Tree Iterator.

UNIT-II**No of Hours:** 10 Hours

Recursion: Definition, examples and how recursion differs from iteration **Dynamic Programming:** Dynamic Programming Approaches, Maximum sum of non-adjacent elements, Count Subsets with Sum K, palindrome partitioning

UNIT-I**No of Hours:** 06 Hours

Stack: real world applications **Queue:** importance of Circular queue **Priority Queue:** implementation of Priority Queue **Binary Search Tree:** applications of binary search tree, Time complexity in BST, Lowest Common Ancestor of a BST, Binary Search Tree Iterator

Topic	Problem Statement	Practice Link
Stack	Game of Two Stacks	https://www.hackerrank.com/challenges/game-of-two-stacks/problem
Queue	Design Circular Queue	https://leetcode.com/problems/design-circular-queue/
Priority Queue	Implementation of Heap (Min Heap & Max Heap).	https://leetcode.com/discuss/general-discussion/1113631/important-concepts-problems-in-priority-queueheaps
Binary Search Tree	Balance a Binary Search Tree	https://leetcode.com/problems/balance-a-binary-search-tree/
	Binary Tree Level Order Traversal	https://leetcode.com/problems/binary-tree-level-order-traversal/
	Lowest Common Ancestor of a Binary Search Tree	https://leetcode.com/problems/lowest-common-ancestor-of-a-binary-search-tree/
	Binary Search Tree Iterator	https://leetcode.com/problems/binary-search-tree-iterator/description/

UNIT-II**No of Hours:** 10 Hours

Recursion: Definition, examples and how recursion differs from iteration **Dynamic Programming:** Dynamic Programming Approaches, Maximum sum of non-adjacent elements, Count Subsets with Sum K, palindrome partitioning

Topic	Problem Statement	Practice Link
Recursion	Lemonade Change	https://leetcode.com/problems/lemonade-change/
	N Meetings in one room	https://practice.geeksforgeeks.org/problems/n-meetings-in-one-room-1587115620/1
	Candy	https://leetcode.com/problems/candy/
	Sudoku Solver	https://leetcode.com/problems/sudoku-solver/
	Palindrome Partitioning	https://leetcode.com/problems/palindrome-partitioning/
	Bit Flip	https://leetcode.com/problems/minimum-bit-flips-to-convert-number/
	M Coloring Problem	https://practice.geeksforgeeks.org/problems/m-coloring-problem-1587115620/1#
Dynamic Programming	Subset Sum Problem	https://practice.geeksforgeeks.org/problems/subset-sum-problem-1611555638/1?utm_source=gfg&utm_medium=article&utm_campaign=bottom_sticky_on_article
	Aeroplanes Scheduling	https://www.hackerearth.com/practice/algorithms/dynamic-programming/state-space-reduction/practice-problems/algorithm/aeroplanes-scheduling-7df0c65c/

	Coutinho !	https://www.hackerearth.com/practice/algorithms/dynamic-programming/state-space-reduction/practice-problems/algorithm/coutinho/
	Grid Game	https://leetcode.com/problems/grid-game/
	Bytelandian-gold-coins	https://www.hackerearth.com/practice/algorithms/dynamic-programming/state-space-reduction/practice-problems/algorithm/bytelandian-gold-coins/
	Prefix XOR Sum	https://www.hackerearth.com/practice/algorithms/dynamic-programming/introduction-to-dynamic-programming-1/practice-problems/algorithm/prefix-xor-sum-0e16e052/
	Summer Vacation	https://www.hackerearth.com/practice/algorithms/dynamic-programming/bit-masking/practice-problems/algorithm/summer-vacation-b0a74639/
	Digit String	https://www.hackerearth.com/practice/algorithms/dynamic-programming/introduction-to-dynamic-programming-1/practice-problems/algorithm/digit-string-b0713246/
	Rat in Maze (Path in a Maze)	https://www.hackerrank.com/contests/noi-ph-practice-page/challenges/path-in-a-maze
	Samu and Shooting Game	https://www.hackerearth.com/practice/algorithms/dynamic-programming/2-dimensional/practice-problems/algorithm/samu-and-shooting-game/

Total 30 Hours

23SIX01 Summer Internship #1**0 0 0 1****Course Outcomes**

1. Demonstrate the application of knowledge and skill sets acquired from the course and workplace in the assigned job function/s
2. Solve real life challenges in the workplace by analyzing work environment and conditions, and selecting appropriate skill sets acquired from the course
3. Articulate career options by considering opportunities in company, sector, industry, professional and educational advancement
4. Communicate and collaborate effectively and appropriately with different professionals in the work environment through written and oral means
5. Demonstrate the ability to harness resources by examining challenges and considering opportunities
6. Demonstrate appreciation and respect for diverse groups of professionals by engaging harmoniously with different company stakeholders

COs –POs Mapping

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
C01	3													
C02	3													
C03												3		
C04										3				
C05		2												
C06								3						

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

23HSX10 Engineering Economics and Project Management**3 0 0 3****Course Outcome**

1. Illustrate the basic principles of engineering economics.
2. Demonstrate Cost-Volume-Profit (CVP) analysis in business decision making.
3. Implement the simple financial statements for measuring financial performance of a firm.
4. Evaluate investment proposals through various capital budgeting methods.
5. State key issues of organization, management and administration.
6. Determine the accurate project cost estimates and plan future activities.

COs – POs Mapping

CO _s	PO ₁	PO ₁₀	PO ₁₁
1	3	2	1
2	3	1	2
3	1	3	2
4	1	3	2
5	2	1	3
6	1	2	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit-I**12 Hours****Introduction to Engineering Economics - Demand Forecasting & Cost Analysis**

Concept of Engineering Economics – Types of efficiency – Managerial Economics Nature and Scope – Law of Demand – Types of Elasticity of demand.

Demand Forecasting & Cost Analysis: Demand Forecasting: Meaning, Factors Governing Demand Forecasting, Methods of Demand Forecasting (Survey and Statistical Methods) – Cost Analysis: Basic Cost Concepts, Break Even Analysis.

Factors affecting the elasticity of demand – Supply and law of Supply

Unit-II**12 Hours****Market Structures - Financial Statements & Ratio Analysis**

Different type of Markets Structures – Features – Price Out-put determination under Perfect Competition and Monopoly

Financial Statements & Ratio Analysis: Introduction to Financial Accounting – Double entry system – Journal – Ledger – Trail Balance – Final Accounts (with simple adjustments) – Financial Analysis through Ratios: Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio, Creditors Turnover Ratio, Capital Turnover Ratio), Solvency Ratios (Debt- Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).

Price output determination under Monopolistic markets, accounting concepts and conventions

Unit-III**12 Hours****Investment Decisions and Fundamentals of Management**

Time Value of Money – Capital Budgeting: Meaning, Need and Techniques of Capital Budgeting

Introduction to Management: Nature – Importance – Classical Theories of Management: F.W.Taylor's and Henri Fayol's Theory – Functions and Levels of Management – Decision Making Process – Inventory Control, Objectives, Functions – Analysis of Inventory – EOQ.

Maslow & Douglas McGregor theories of Management, ABC Analysis

Unit-IV**12 Hours****Project Management**

Introduction – Project Life Cycle and its Phases – Project Selection Methods and Criteria – Technical Feasibility – Project Control and Scheduling through Networks – Probabilistic Models of Networks – Time-Cost Relationship (Crashing) – Human Aspects in Project Management: Form of Project Organization – Role & Traits of Project Manager.

Sources of Long-term and Short-term Project Finance

Total: 48 Hours

Textbook (s)

1. Pravin Kumar, Fundamentals of Engineering Economics, Wiley India Pvt. Ltd. New Delhi, 2015
2. Rajeev M Gupta, Project Management, 2nd Ed., PHI Learning Pvt. Ltd. New Delhi, 2014
3. Panneer Selvam. R, Engineering economics, 2nd Ed., Prentice Hall of India, New Delhi, 2013

Reference (s)

1. R.B.Khanna, Project Management, PHI Learning Pvt. Ltd. New Delhi, 2011
2. R. Panneer Selvam & P.Senthil Kumar, Project Management, PHI Learning Pvt. Ltd. New Delhi, 2010
3. A. Aryasri, Management Science, 4th Ed., Tata McGraw Hill, 2014
4. A. Aryasri, Managerial Economics and Financial Analysis, 4th Ed., Tata McGraw Hill, 2014
5. Koontz & Weihrich, Essentials of Management, 6th Ed., TMH, 2010
6. Chuck Williams and Mukherjee, Principle of Management 7th Ed., Cengage Learning, 2013

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	25	25	--
Understand	35	35	--
Apply	40	40	50
Analyze	--	--	50
Evaluate	--	--	-
Create	--	--	--
Total (%)	100	100	100

Remember

1. Define Managerial Economics. Explain its nature and scope.
2. Define Production Function? List the various types of production functions.
3. Define the meaning of productivity? Explain how productivity can be enhanced in the Indian industries.
4. Define management and its functions.
5. List out short-term source of finance and explain briefly.
6. Why is it essential to define project life cycle and divide it into various phases?

Understand

1. Summarize engineering economics with suitable examples.
2. Explain different elements of costs used in cost analysis.
3. Illustrate the effect of price on demand and supply with the help of a diagram.
4. Explain the features of Perfect Competition.
5. Describe the Top level Upper Middle level of management and its functions.
6. Explain Price-Output determination under Perfect Competition under Market period.

Apply

1. Consider the following data of company for the year 2015
 Sales = Rs.2,40,000/-
 Fixed cost = Rs.50,000/-
 Variable cost = Rs.75,000/-
 Find out the followings
 a) Profit b) BEP c) Margin of safety
2. The following trial balance of Mr. Ramesh, prepare trading, profit & loss A/c for the year ended 31.12.2018 and balance sheet as on that date.

Particulars	Debit (Rs.)	Credit (Rs.)
Capital		1,00,000
Drawing	18,000	
Furniture	32,500	
Machinery	15,000	
Bills payable		15,000
Interest paid	900	
Sales		1,00,000
Purchases	75,000	
Opening stock	25,000	

Advertisement	15,000	
Wages	2,000	
Insurance	1,000	
Commission received		4,500
Sundry debtors	28,100	
Cash in hand	20,000	
Sundry creditors		10,000
Interest received		3,000
Total	2,32,500	2,32,500

Adjustments:

Closing Stock Rs.60,000 b) Outstanding wages Rs.500

3. From the following balances as on the date March 31st, 2014.

Particulars	Amount (Rs.)	Particulars	Amount (Rs.)
10% Debentures	3,00,000	Cash in hand	30,000
6% Long term Loans	50,000	Debtors	15,000
Share capital	2,50,000	Opening stock	50,000
Creditors	1,00,000	Closing stock	40,000
Bill payable	45,000	Gross Profit	20,000
Sales	100000	Building	700000

Calculate: Current Ratio, Debt-equity ratio, Quick ratio, Inventory turnover ratio, Debtors turnover ratio

4. A company requires 40,000 kg of raw materials. The company incurs a handling cost of Rs.360/- plus freight of Rs.390 per order. The incremental carrying cost of inventory of raw material is Rs. 15 per kg. Calculate:
 a) EOQ b) Number of orders per annum c) How frequently should orders be placed
5. The following table gives the activities in a construction project and other related information:

Activity	Immediate Predecessors	t ₀	t _m	t _p
A	-	1	9	11
B	-	5	6	7
C	A	5	7	9
D	A,B	4	7	10
E	C,D	1	4	7
F	C,D	7	9	11

- a) Draw PERT diagram
 b) Calculate total project duration
 c) Mark the critical path
 d) Find out the S.D and Variance of each activity
6. ABC Ltd., a US based organization, is engaged in manufacturing television screens. It is planning to establish a subsidiary organization in India to manufacture picture tubes. Cost studies produced the following estimates for the Indian subsidiary based on the estimated annual sales of picture tube (Rs.400000/-):

Particulars	Total Annual Cost (Rs.)	Percent of total annual cost that is variable
Materials	1936000	100%
Labour	900000	70%
Overhead	800000	64%
Administration	300000	30%

The Indian production would be sold by manufacturer's representatives who would receive a commission of 8% of the sales. No portion of the parent organizations' expenses is to be allocated to the Indian subsidiary.

Questions:

1. Compute the sale price per picture tube to enable management to realize an estimated 10% profit on sale proceeds in India.
2. Is it feasible for ABC Ltd., to invest in the Indian market by studying the preceding calculation? **(For Open Book Examination and not for semester end examination)**

Analyze:

1. From the following cases analysis the situation of price elasticity of product.

Case 1:

<u>Price of product (Rs.)</u>	<u>Quantity of Demand (Units)</u>
100	1000
90	1500

Case 2:

<u>Price of product (Rs.)</u>	<u>Quantity of Demand (Units)</u>
100	1000
70	1100

2. Analyze the attributes to be consider for selection project.
3. Differentiate between Perfect Competition & Monopoly Competition.
4. Compare significances and limitation of liquidity and solvency ratios.
5. You are given the following information about two companies in the year 2020.

Particular	Company - A	Company - B
Sales	Rs. 50,00,000	Rs. 50,00,000
Fixed Expenses	Rs. 12,00,000	Rs. 17,00,000
Variable Expenses	Rs. 35,00,000	Rs. 30,00,000

A friend seeks your advices as to which company's shares be should purchase. Assuming the capital invested is equal for the two companies, state the advice that you will give.

6. A private school is considering the purchase a school bus to transport students to school. The initial cost of the bus is Rs.600,000. The life of bus is estimated to be five years, after the life time the vehicles would have to be scrapped with no salvage value. The school's management team has derived the following estimates for annual revenues and cost for the next five years.

year	Annual Revenue	Diver Cost	Repairs & maintenance	Other costs	Annual depreciation
1	330000	33,000	8,000	130000	120000
2	330000	35,000	13,000	135000	120000
3	350000	36,000	15,000	140000	120000
4	380000	38,000	16,000	136000	120000
5	400000	40,000	18,000	142000	120000

The buses would be purchased at the beginning of the project (i.e., in Year 0) and all revenues and expenditures shown in the table above would be incurred at the end of each relevant year. A business consultant has advised management that they should use a cost of capital of 10% to evaluate this project.

Questions:

1. Attributes to be involved to estimate the net cash flow for each year in this project.
2. Justify the steps involved in the calculation process of net present cash flows above the project investment. **(For Open Book Examination and not for semester end examination)**

23IT602 Automata and Compiler Design**3 0 0 3****Course Outcomes:**

At the end of the course students are able to:

1. Analyze and design finite automata, pushdown automata for the formal languages and grammars.
2. Demonstrate compiler structure that includes all the phases of Compiler Design.
3. Apply working skills in theory and design a Non-Recursive Predictive Parser (LL (1)) in compiler design.
4. Apply the working skills in theory about the Model of an LR () parser and construct all three types of LR Parsers.
5. Understand various code forms of intermediate Code generation phase of the Compiler.
6. Demonstrate the machine dependent and independent codes for Optimization.

CO – PO Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₁₂
1	1	3	2	2	2
2	2	3	3	3	3
3	3	2	2	2	2
4	2	1	3	3	3
5	2	1	3	3	2
6	2	1	3	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Syllabus**Unit I****13 Hours****Finite Automata & Lexical Analysis**

DFA - NFA - Recognition of a language by an Automaton - Equivalence of DFA and NFA - Finite Automata with Null-Closure - Minimization of FA - Equivalence of FAs, Regular Sets and Languages - Equivalence of FA & regular expression Overview of Language Processing-Compiler-Assembler-Interpreters-Linkers & Loaders-Structure of Compiler-Phases of a Compiler-Lexical Analysis-Role of Lexical Analysis-Token-Patterns and Lexemes-Lexical Errors-

*Finite Automata with output: Mealy and Moore Machines***Unit II****12 Hours****Push-Down Automata & Syntax Analysis**

Non-regular Languages - CFLs - Closure Properties of CFLs - CFGs - derivation trees - Simplification - Ambiguity Push-Down Automata - Normal Forms - Chomsky Hierarchy ,Top-down Parsing-First and Follow-LL(1) Grammar-Non-Recursive Predictive Parsing

*Handling Ambiguous grammars-Error recovery in LR parsing***Unit III****12 Hours****Bottom-up parsing-Shift Reduce Parsing**

Model of an LR Parsers-Construction of SLR Tables-Construction of CLR (1)- LALR Parsing tables-Dangling ELSE ambiguity. Semantic Analysis-SDT-Intermediate Code -Three Address Code-Quadruples-Triples-Indirect Triples-Abstract Syntax Trees-DAG for Expressions.

*Data structures used in symbol table***Unit IV****11 Hours****Optimization**

Machine Independent Code Optimization-Common Sub-expression Elimination-Constant Folding-Copy Propagation-Dead Code Elimination-Strength Reduction-Loop Optimization-Basic Blocks-Flow Graph-DAG for basic Blocks-Machine Dependent Code Optimization: Peephole Optimization-Register Allocation-Instruction Scheduling

*Code generation algorithm-optimization among basic blocks***Total: 48 Hours****Textbook (s)**

1. J. E. Hopcroft and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson/Addison Wesley, 2007

2. Mishra & Chandra Sekharan, Theory of Computer Science& Automata Language and Computation, 3rd Edition, Prentice Hall of India, 2007.
3. Alfred V Aho, Monical S Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers, Principles Techniques and Tools, 2nd Edition, Pearson, 2007.
4. V. Raghavan, Principles of Compiler Design, 2nd Edition, TMH, 2011.

Reference (s)

1. P. Linz, Introduction to Formal Language and Computation, 2nd Edition, Narosa, 2006.
2. H. R. Lewis & C. H. Papadimitriou, Elements of the Theory of Computation, Prentice Hall of India, 2nd Edition -2006.
3. Nandini Prasad, Principles of Compiler Design, 2nd Edition, Elsevier, 2012
4. Kenneth C Loudon, Compiler Construction, Principles and Practice, 1st Edition, Cengage, 1997.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	50	40	--
Apply	30	40	70
Analyze	--	--	20
Evaluate	--	--	10
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)

Remember

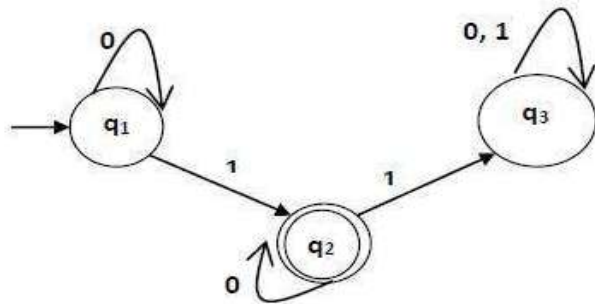
1. List out the different tuples of Deterministic Finite Automata
2. List out the closure properties of regular sets
3. State some software tools that manipulate source program.
4. List out the cousins of compiler.

Understand

1. Explain the procedure of simplification of CFG
2. Describe the types of Turing machines
3. Illustrate the pumping lemma with an example
4. Represent the Error-recovery actions in a lexical analyzer.
5. Formulate the roles and tasks of a lexical analyzer.
6. Illustrate Why lexical and syntax analyzers are separated out.
7. Identify the problems with top down parsing

Apply

1. Apply the Arden's theorem to convert the following Finite automata to Regular expression



2. Apply Pumping lemma to prove the language $L = \{ a^p / p \text{ is a prime number} \}$ is not regular
3. Eliminate UNIT productions from the CFG:
 $S \rightarrow A$
 $A \rightarrow B$
 $B \rightarrow a/b/c$
4. Demonstrate top down parsing and bottom up parsing methods.
5. Show the contents of activation record.
6. Choose the properties of optimizing compiler.

Analyze

1. Compare and Contrast Mealy machine and Moore machine
2. Analyze the solution to the PCP with the two lists $M = (abb, aa, aaa)$ and $N = (bba, aaa, aa)$
3. Analyze whether the language $L = \{anbncn/n \geq 1\}$ is Context free language or not
4. Identify the difficulties with top down parsing.
5. Breakdown the grammar for flow-of-control statements.
6. Differentiate declarations are done in a procedure using syntax directed translations

Evaluate

1. Assess the performance of Pushdown automata over Finite automata
2. "Regular sets are closed under union" is true or false? Justify your answer
3. "We can design PDA for $L = \{anbncn/n \geq 1\}$ " is true or false? Justify your answer
4. Determine the addressing mode and associated costs in the target machine.
5. Defend the step to partition a sequence of 3 address statements into basic blocks.
6. Choose the important classes of local transformations on basic blocks.
7. Criticize code optimization and optimizing compiler.

Open Book Exam Questions

Give regular expressions for the following sets of strings. You may only use basic regular expressions formed from characters and epsilon (ϵ), character classes denoting a single character ($[...]$ and $[\wedge ...]$), concatenation (xy), alternation ($x|y$), repetition (x^* and x^+), and optional ($x?$). You may also give names to subexpressions ($name=re$) and use parentheses for grouping.

- (a) Identifiers formed as follows: an identifier consists of one or more letters (a-z and A-Z), digits (0-9) and underscores (_). An identifier must begin with a letter and may not end with an underscore.
 - (b) Remote file identifiers of the form `user@hostname:filename`, constructed as follows. The parts of the identifier are made up of words, which are sequences of one or more letters and digits. The user part contains a single word. A hostname consists of one or more words separated by periods, like `www.google.com` or `attu`. A filename consists of one or more words separated by slash (/) characters with an optional leading and/or trailing slash (standard Unix conventions). The `user@` part is optional and may be omitted. The entire `user@hostname:` part may be omitted, including the trailing colon. The `user@` part may not appear unless the `hostname:` part is also included.
1. Draw a DFA that accepts the same set of strings generated by the regular expression $p(p|q)^*p$
 2. Convert the following into three address statements.


```
main()
{ int i, a[5], b[5];
  for (i=0; i<5; i++)
    a[b[i]] = b[a[i]];
}
```
 3. For this C program segment, construct the tree and generate the assembler code you are allowed to use pseudo assembler code.


```
for (i=0; i<10; i++)
  a[i] = random() % 2;
```

23IT603 Machine Learning**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Understand the fundamental concepts, issues and challenges of machine learning
2. Demonstrate the basic terminology used in Machine learning
3. Apply supervised learning algorithms for classification and regression models
4. Apply unsupervised learning algorithms for clustering and ensemble learning
5. Understand the basics of evolutionary learning
6. Compare and contrast between artificial neural networks and deep neural networks

CO – PO Mapping

COs	PO1	PO2	PO3	PO4	PSO1	PSO2
1	2	2	2	2	3	3
2	2	2	2	2	3	3
3	1	1	1	1	1	1
4	2	2	2	2	2	2
5	2	2	2	3	3	3
6	1	1	1	1	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit I****12 Hours****Introduction to Machine Learning**

Learning, Types of Machine Learning-Supervised Learning, Unsupervised Learning; Phases of Machine Learning: Dataset Collection, Data Preparation, Hypothesis Formulation and Model Selection, Training, Testing and Validation; Terminology: Regularization, Overfitting, Underfitting, Averages, Variance and Covariance, Probability Distributions, The Bias-Variance Trade-off, Confusion Matrix, Cross Validation.

Machine Learning Tools: Weka, R, Python, MATLAB, Tensor Flow

Unit II**12 Hours****Supervised Learning**

Regression: Linear Regression, Linear Regression with Multiple Variables, Logistic Regression; Learning with Trees: Constructing Decision Trees, ID3, CART; Bayesian Learning: Bayes Theorem, Graphical Models: Making Bayesian Networks, Naïve Bayes Classifier. Instance based Learning: K-Nearest Neighbors Classifier.

Conditional Probability, Support Vector Machine, Distance Metrics in Data Mining.

Unit III**12 Hours****Un-Supervised Learning**

Clustering: Introduction, Similarity and Distance Measures, K-Means, K-Medoids, Hierarchical Clustering, Clustering with Categorical Attributes; Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis. Ensemble Learning: Boosting, Bagging, Random Forest.

Density Based Clustering, DBSCAN, Attribute subset selection.

Unit IV**12 Hours****Evolutionary Learning and Neural Network**

Evolutionary Learning: Genetic Algorithms, Genetic Operators. Genetic Programming; Models of Evolution and Learning- Lamarckian Evolution, Baldwin Effect; Artificial Neural Network (ANN): Representation-Problems-Multilayer Networks and Back Propagation Algorithms; Deep Learning- Convolution Neural Network (CNN), Recurrent Neural Network (RNN), Optimization techniques- Ant colony optimization, particle swarm optimization

Linear Separability, The Perceptron, Activation Function and its properties.

Total: 48 Hours**Textbook (s)**

1. Stephen Marsland, "Machine Learning - An Algorithmic Perspective ", CRC Press, 2014.
2. Sunila Gollapudi, "Practical Machine Learning" First Edition 2016, PACKT Publishing Ltd.

Reference (s)

1. Tom M. Mitchell, "Machine Learning ",Tata McGraw Hill, 2017.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	30	--
Understand	40	40	--
Apply	20	30	80
Analyze	--	--	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)**Remember**

1. Define Machine Learning.
2. List the types of Machine Learning.
3. State Bayes Theorem.
4. What is Regularization?

Understand

1. Demonstrate Linear Regression.
2. Explain Back Propagation Algorithm.
3. Illustrate Decision Tree Induction process in detail.
4. Demonstrate Genetic Operators in detail.

Apply

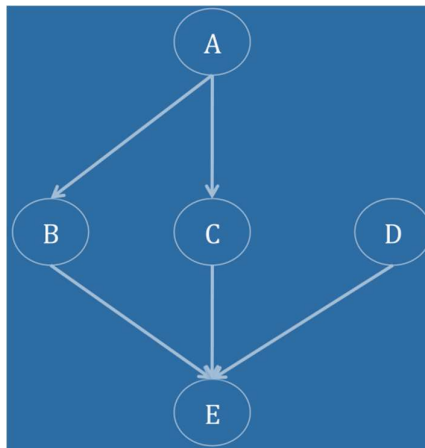
1. Apply the concept of Regularization to solve overfitting problem.
2. Build a Linear Regression for a given dataset.
3. Apply k-Means algorithm on a given dataset to identify clusters.

Analyze

1. Distinguish between Logistic Regression and SVM.
2. Analyze Dimensionality Reduction using PCA
3. Analyze various Neural Network Architectures in Machine Learning.

Open Book Exam Questions

1. An admissions committee for a college is trying to determine the probability that an admitted candidate is really qualified; the relevant probabilities are given in the Bayesian Network shown here.



A = Applicant is qualified

B = Applicant has a high grade point average

C = Applicant has excellent recommendations

D = Applicant has a parent who is an alumni of the college

E = Applicant is admitted.

Represent $p(A|D,E)$ in-terms of the conditional probabilities given in the Bayesian Network above. Make sure even the “constant” can be represented using the Bayesian Network.

2. We have some data about when people go hiking. The data take into effect, whether hike is on a weekend or not, if the weather is rainy or sunny, and if the person will have company during the hike. Find the optimum decision tree for hiking habits, using the training data below.

Weekend?	Company?	Weather	Go Hiking?
Y	N	R	N
Y	Y	R	N
Y	Y	R	Y
Y	Y	S	Y
Y	N	S	Y
Y	N	S	N
Y	Y	R	N
Y	Y	S	Y
N	Y	S	N
N	Y	R	N
N	N	S	N

23CSC12 Deep Learning**3 0 2 4****Course Outcomes**

1. Explain the fundamentals of deep learning and Deep Neural networks
2. Give Differences between MLP and Deep Neural Networks.
3. Make use of different CNN models.
4. Compare different character encoding techniques.
5. Exemplify different Deep unsupervised models.
6. Examine different deep learning applications.

COs-POs Mapping

COs	PO1	PO2	PO3	PO4	PO5	PSO1
1	3	2	2	1	3	2
2	3	3	2	1	2	2
3	3	3	3	2	3	2
4	3	2	3	2	3	2
5	3	2	2	2	2	2
6	3	3	3	3	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12+8 Hours**

Introduction Deep Learning: Introduction, need of Deep learning, Applications of Deep Learning, Relu function, types of Relu function, Model Parameters vs Hyper parameters.

Deep neural networks (DNNs): Difficulty of training DNNs, Greedy layer wise training, Optimization for training DNNs, Optimization methods for neural networks (AdaGrad, RMSProp, Adam), Second order methods for training, Regularization methods (dropout, drop connect, batch normalization).

Types of learning laws, limitation of Deep Learning.

Practical Components

1. Design Structure and Parameter's Initialization in a Neural Network Model
2. Determine the forward Computation and cost function in MLP
3. Implement Backpropagation algorithm for MLP
4. Implement Deep Neural Network Model and predict the Output

Unit II**12+10 Hours**

Convolutional networks: Building blocks of CNNs, Filters and Feature Maps, Pooling layers, Convolutions over volumes, Softmax regression, hyper-parameter tuning.

CNN models: Lenet, Alex Net, VGG -16, Residual Networks, YOLO.

Transfer Learning: introduction, types of transfer learning, transfer learning with CNN models.

Linear Least Square Filters, Least Mean Square Algorithm, XOR Problem

Practical Components

1. Implement Digit recognizer using CNN of MNIST Data set
2. Implement Character recognizer using CNN
3. Implement Transfer Learning with VGG -16
4. Transfer Learning with YOLO

Unit III**11+8 Hours**

Recurrent Networks: One-hot encoding of words and characters, using word embeddings, Recurrent Neural Network Model, vanishing gradients with RNNs, Gated Recurrent Unit (GRU) LSTM (long short-term memory).

Keras ,tensorflow, data augmentation, Batch Normalization, Dropout

Practical Components

1. One-Hot Encoding and Word Embeddings
2. Pretrained Word Embeddings

3. RNN model for text classification
4. Understand and Implement LSTM

Unit IV**12 + 6 Hours****Sequence Models:** Encoder Decoder sequence to sequence architectures**Deep Unsupervised Learning:** Auto encoders, Variational Auto encoders, Generative Adversarial Network, Deep Boltzmann Machines.**Case study:** Image segmentation, object detection*n-grams, bag-of-words, Bi directional RNN, Exploding gradient***Practical Components**

1. Understand and Implement Auto encoders
2. Understand and Implement Variational Auto encoders
3. Understand and Implement Generative Adversarial Network
4. Understand and Implement Deep Boltzmann Machines

Total: 48+32 Hours**Textbook (s)**

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep Learning." An MIT Press book in preparation. (2015).
2. Fundamentals of Deep Learning: Designing Next-generation Machine Intelligence Algorithms by Nicholas Locascio and Nikhil Buduma O'Reilly Media; 1 edition (June 29, 2017)
3. Simon S. Haykin, Neural Networks, Prentice Hall, 2nd edition
4. B. Yegnanarayana, "Artificial Neural Networks", PHI.

Reference (s)

1. Francois Chollet, Deep Learning with Python
2. Deep Learning: A Practitioner's Approach by Adam Gibson and Josh Patterson Shroff/O'Reilly; First edition (2017)
3. Python Deep Learning by Daniel Slater and Gianmario Spacagna, Packt Publishing; 2/e (January 16, 2020)
4. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006
5. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)
Remember	20	20
Understand	50	50
Apply	30	30
Analyze	--	--
Evaluate	--	--
Create	--	--
Total (%)	100	100

SAMPLE QUESTION (S)**Remember**

1. What is neuron?
2. List any two learning rules.
3. Define Convolution neural network
4. Define one-hot encoding technique
5. Define LSTM

Understand

1. Explain Multilayer perceptron
2. Explain data representation through tensors
3. Outline different character encoding techniques
4. Illustrate usage of auto encoders
5. Construct Gated Recurrent Unit (GRU)

Apply

1. Apply 2D tensors to represent image data
2. Develop CNN model to classify digits.
3. Build a CNN model to recognize images
4. Apply LSTM to extract text from a video
5. Build an appropriate DL model for image segmentation

Analyze

1. Examine differences between ANN and CNN.
2. Compare ML with DL
3. Compare and contrast different activation functions.

Evaluate

1. Evaluate performance of DL and ML for an image classification problem.

23CSC22 Web Application Frameworks**3 2 0 4****Course Outcomes:**

1. Describe the fundamentals of web framework.
2. Design and implement Angular-based applications.
3. Design and implement React-based applications.
4. Build robust and secure web applications using Spring Boot.
5. Create efficient and dynamic REST APIs with CRUD functionality
6. Design and develop dynamic web applications using MVT architecture

CO-PO Mapping:

COs	PO1	PO2	PO3	PO5	PS01	PS02
1	3	3	1	1	2	1
2	3	3	3	3	2	3
3	3	3	3	3	2	3
4	3	3	3	3	3	2
5	2	3	2	3	2	3
6	3	3	3	2	2	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit-I**13+10 Hours****Fundamentals of Web Framework**

Introduction to frameworks-Framework applications, General-purpose website frameworks-Server-side, Client-side features, Types of framework architecture.

Angular.js

Introduction – Angular MVC, Ajax, Data binding, Angular concepts - Directives, Components & Modules, Templates & Data Binding, Routing & Navigation, Modules, Expressions, HTTP and API integration.

JavaScript ES6 concepts, MVC, Three-tier organisation, Ajax, Scopes, Controllers

Practical Components

1. Implementation of angular directives
2. Implementation of angular components
3. Implementation of custom/user-defined directive
4. Create a TODO Application using Angular JS (Single page application)
5. Implement routing and navigation in Angular JS

Unit-II**13+12 Hours****React.js**

Introduction to React: What is Full-Stack Web Development?, Introduction to React, React App Overview, Core Components: Introduction to JSX, React Components, State and Props, Lifecycle Methods: class and function components, use of fetch and axios, Hooks, React Router and Single Page Applications: Presentational and Container Components, React Virtual DOM, React Router: Parameters, React Forms, Flow Architecture and Introduction to Redux: Controlled Forms, Uncontrolled Components, The Flux Architecture, Introduction to Redux, React Redux Forms

JavaScript ES6 concepts, React Events, State Management, Introduction to React Native

Practical Components

1. React Components
2. React Router and Single page applications
3. Controlled Form Validation, Uncontrolled Forms
4. Create a TODO Application using React JS
5. Creating a movie list Application in React JS
6. Creating a Progressive web application with Reusable React Components

Unit-III**10+4 Hours****Spring Boot**

Introduction to Spring Boot, Application Structure, Framework Theory, Annotations, Bean Management, Dependency Injection, Spring Data: JDBC, ORM, JPA, Building Rest APIs, Starter Dependencies, database Integration, Creating Model Class.

Spring MVC, Error Handling, Spring Boot Security, Asynchronous Programming

Practical Components

1. Configuration in Spring Boot and Create a Simple Spring Boot Application
2. Apply Validation to given input data with REST endpoint and test with valid or invalid data using any API tester.

Unit-IV**Django****12+6 Hours**

Introduction, virtual environment, install Django, Create Django App, App Life Cycle, Project Structure, URL mapping, Django MVT - model and CRUD operations on model, Django view and Django template and configuration, Static File Handling, Django Admin- create user, Response and Redirect, Django Forms
Basic concepts of python, Python packages, Django Cookies and sessions handling

Practical Components

1. Creating models for database queries
2. Writing Django template for rendering data
3. Implementation of REST API using Django

Total: 48+32 Hours**Textbook (s)**

1. Angular: Up and Running, ShyamSeshadri, 1st Edition, O'Reilly, 2018
2. Struts the Complete Reference, James Holmes, 2nd Edition, Mc. Graw Hill Professional, 2006.
3. Professional Java Development with the Spring Framework, Alef Arendsen, Thomas Risberg, Rod Johnson, Wiley publications, 2007.
4. Programming with Django, Wiley Publishing

Reference (s)

1. Angular 6 for Enterprise-Ready Web Applications, DoguhanUluca, 1st edition, 2018
2. The Definitive Guide to Django, Adrian Holovaty, Jacob Kaplan-Moss, Apress, 2009.
3. Struts 2 In Action, Donald Brown, Chad Michael Davis, Scott Stanlick, Dreamtech press, 2008.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)
Remember	50	40
Understand	30	40
Apply	20	20
Analyze	--	--
Evaluate	--	--
Create	--	--
Total (%)	100	100

SAMPLE QUESTION (S)**Remember:**

1. What is a web framework?
2. Define Full-Stack Web Development.
3. What is Spring Boot?
4. What is Django?
5. What command is used to create a Django project?

Understand:

1. Explain the concept of Model-View-Controller (MVC) in a framework.
2. Explain the difference between state and props in React.
3. Describe the role of JSX in React.
4. Explain the purpose of Spring Boot Annotations with examples.
5. What is the difference between Django MVT and traditional MVC architecture?

Apply:

1. Create a simple HTTP request using a client-side framework.
2. Write a simple React component using JSX.
3. Write a simple Spring Boot application that prints "Hello, World!".
4. Implement a simple CRUD application using Spring Data JPA.
5. Develop a Django model for a product catalog and apply CRUD operations.

Analyze:

1. Compare and contrast server-side and client-side frameworks.
2. Compare useEffect and lifecycle methods in class components.
3. How does Spring Boot handle Bean Management and Dependency Injection?
4. How does Django's URL dispatcher work?
5. Compare Django ORM vs. raw SQL queries.

23ITC32 Cybernet Security**3 0 2 4****Course Outcomes**

1. Describe the fundamental concepts of Cyber security
2. Demonstrate the web security and different attacks
3. Make use of different network scanning and security measures
4. Analyze different types of Intrusion detection techniques
5. Develop different types of Intrusion prevention systems
6. Identify different cybercrimes, IT laws and acts.

CO-PO Mapping

CO	PO ₁	PO ₃	PO ₄	PO ₁₂	PSO ₁	PSO ₂
1	3	3	1	2	2	2
2	3	3	1	3	2	1
3	1	2	3	3	2	2
4	3	1	1	3	2	2
5	1	3	3	3	3	3
6	1	3	2	1	1	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12+8 Hours****Introduction to Cyber Security**

What is Cyber Security, its need, cyber-threats, Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage), Career Growth, Statistics, Inferences, Need for a Comprehensive Cyber Security Policy, Classification of Cyber Crimes, kinds of cybercrimes, Reasons for Cyber Crimes, Cyber Security Tools : Nmap, Metasploit, wireshark, tcpdump, snort.

Cyber security awareness, social engineering, cyber stalking

Practical Components

1. Lab Activity: Study the use of network reconnaissance tools like WHOIS, dig, ping, hping, traceroute, nslookup to gather information about networks and domain registrars.
2. Lab Activity: Study of packet sniffer tools like tcpdump , wireshark etc.
3. Lab Activity: Perform Network Scanning using NMAP in windows.
4. Lab Activity: Perform Network Scanning using and ZENMAP in kali Linux.

Unit II**12+8 Hours****Web security**

Same origin Policy, Cross Origin Resource Sharing, DDOS, SQL Injection, XSS, Homograph, Generating and storing session tokens.

Networking Scanning & Security Measures:

Packet Sniffing and spoofing, Network scanning types, port scanning & its tools, and Network Architecture

Security Measures: IPtables(firewalls) , Webservers (Nmap & Metasploit for securing webservers),

Cyber Threats and Attacks (Malware, DOS, MITM, Social engineering attacks, Spoofing, Phishing)

Cross-Site Request Forgery (XSRF/CSRF), spear phishing.

Practical Components

1. Lab Activity: Perform port scanning using Nmap
2. Lab Activity: Penetration Testing and Exploiting with Metasploit, Armitage and msfconsole
3. Lab Activity: Simulate DOS and DDOS attacks using various tools.
4. Lab Activity: Study of SQLMap to explore SQL Injection attacks

Unit III**12+8 Hours****Intrusion Detection System**

Intruders, Intrusion Detection, Analysis Approaches, Network-Based IDS, Host-Based IDS, signature based IDS, anomaly based IDS, advantages and disadvantages of NIDS and HIDS

Intrusion Detection Tools, snort architecture, snort rules, case studies of intrusion detection systems, Intrusion detection exchange format.

Honeypots, different types of honeypots, benefits and dangers of honeypots

firewall vs IDS, Physical IDS, honeynet

Practical Components

1. Lab Activity: Use iptables in linux to create firewalls..
2. Lab Activity: Study of Intrusion detection tool SNORT. Use Snort as packet sniffer and write your own IDS rules
3. Lab Activity: Setup honeypot
4. Lab Activity: Demonstrate Intrusion Detection System (IDS) using any tool (SNORT or any other software)

Unit IV

12 + 8 Hours

Cyber Laws and Digital Forensics

Digital Forensics: Introduction to Digital Forensics, historical background of digital forensics, Forensic Software, and Hardware, need for computer forensics science, special tools and techniques digital forensic life cycle, challenges in digital forensic.

Law Perspective: Introduction to the Legal Perspectives of Cybercrimes and Cybersecurity, Cybercrime and the Legal Landscape around the World, Why Do We Need Cyber laws, The Indian IT Act, Cybercrime Scenario in India, Digital Signatures and the Indian IT Act.

Cybercrime and Punishment

Practical Components

1. Lab Activity: Write a security policy for password protection
2. Lab Activity: Install Rootkits to study variety of options
3. Lab Activity: Implement Digital Signature Scheme.
4. Lab Activity: Case Study on Indian IT ACT 2000

Total: 48+32 Hours

Textbook (s)

1. Wenliang Du, Computer & Internet Security: A Hands-on Approach, (2019)
2. William Stallings, Lawrie Brown, Computer Security Principle sand Practice Third Edition, 2015
3. Sunit Belapure and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives, Wiley India Pvt. Ltd, 2011.
4. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi

Reference (s)

1. Pande, Jeetendra. "Introduction to Cyber Security.", (2017)
2. Pavan Duggal, Cyber frauds, cybercrimes & law in India.
3. Ali A. Ghorbani, Network intrusion detection and prevention concepts and techniques, Springer, 2010
4. Roberto Di Pietro, Luigi V. Mancini (2008), Intrusion Detection System, Springer
5. Dafydd Stuttard and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Wiley Publication

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)
Remember	50	40
Understand	30	40
Apply	20	20
Analyze	--	--

Evaluate	--	--
Create	--	--
Total (%)	100	100

Sample Question (S)

Remember

1. What is cyber security.
2. Define security policy.
3. List classification in cyber security.
4. Define network scanning.
5. What is digital forensics.

Understand

1. Explain security policy for password protection.
2. Explain reasons for cyber crime.
3. Outline SQL injection attack.
4. Classify different approaches for packet filtering using firewall.
5. Explain IP Spoofing.

Apply

1. Apply IPS methods to prevent intruder.
2. Apply snort rules to detect intrusion
3. Identify open ports in a network using nmap.
4. Plan to filter unauthorized packets using iptables
5. Build host based IPS.

Analyze

1. Compare and contrast iptables and snort.
2. Compare and contrast different tools to address DOS.
3. Examine different post scanning methods.
4. Distinguish nmap and metasploit.
5. Compare different tools related to digital forensics

Open Book Exam Questions

Question 1:

	Source Address	Source Port	Dest Address	Dest Port	Action
1	Any	Any	192.168.1.0	> 1023	Allow
2	192.168.1.1	Any	Any	Any	Deny
3	Any	Any	192.168.1.1	Any	Deny
4	192.168.1.0	Any	Any	Any	Allow
5	Any	Any	192.168.1.2	SMTP	Allow
6	Any	Any	192.168.1.3	HTTP	Allow
7	Any	Any	Any	Any	Deny

The above table shows a sample of a packet filter firewall ruleset for an imaginary network of IP address that range from 192.168.1.0 to 192.168.1.254. Describe the effect of each rule.

Question 2:

Perform following activities using nmap tool:

- a. Write an nmap command to check/find list of open ports for "gmrit.org" website.
- b. Nmap to reveal open services and ports by IP address as well as by domain name(Note: IP number is of your choice).
- c. Nmap command to scan multiple hosts at once.
- d. Nmap command to find OS information of a host(host IP address is of your choice).
- e. Nmap command to check firewall settings of a host(host IP address is of your choice).

23IT007 The Internet of Things**3 0 2 4****Course Outcomes**

At the end of the course, students will be able to

1. Understand IoT framework, architecture and design principles of WSN for IoT
2. Identify various devices and technologies for IoT deployment
3. Understand the design principles of Web and Internet Connectivity and its protocols
4. Understand MAC and IP addressing in IoT, 6LowPAN and LoRaWAN protocols
5. Understand the importance of Cloud computing in IoT along with vulnerabilities
6. Demonstrate an application using IoT technology

Co-Po Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₅	PO ₁₀
1	3	3	3	3	3
2	3	3	3	3	3
3	3	3	3	3	3
4	3	3	3	3	3
5	3	3	3	3	3
6	3	3	3	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I**The Overview of IoT****12+8 Hours**

Wireless Sensor Networks: History and Context, the node, connecting nodes, Networking Nodes, Sensors, Actuators – Examples and working principle

Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, IoT Conceptual Framework, IoT Reference Architecture, Technology Behind IoT, M2M Communication

Types of sensors, Examples of M2M and IoT.

Practical Components:

1. Study of IoT development boards
2. Study of Sensors that are attached with development boards
3. Study of the fundamentals of Arduino and Raspberry Pi

UNIT II**IoT Physical Devices and Endpoints****12+8 Hours**

IoT Development Boards: Arduino IDE and Board Types, RaspberryPi Development Kit, RFID Technology – Principles, Architecture and Applications;

Web of Things - Web of Things vs Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.

NFC, Bluetooth low Energy (BLE), Wi-Fi, ZigBee,

Practical Components:

1. Interfacing of Ubimote, BLE Mote and Wi-Fi mote with the development boards
2. Reading sensor values from the different sensors available
3. Demonstration of traffic light simulation using development boards

UNIT III**12+8 Hours**

Design Principles for Web Connectivity: IoT/M2M system Layers and Designs Standardizations, Communication Technologies; Application-level Protocols: Constrained Applications Protocol (CoAP),

Lightweight Machine-to-Machine Communication; Message Communication Protocols: Message Queue Telemetry Transport (MQTT);

Internet Connectivity Principles: Introduction, Internet Connectivity, Internet-Based Communication, IP Addressing in the IoT, Media Access Control

Introduction to 6LOWPAN, LORAWAN

Practical Components:

1. Embedded Programming

- 1.1 Toggling LEDs
- 1.2 Transmitting a string through UART
- 1.3 Controlling LEDs blinking pattern through UART
- 1.4 Echo each character typed on serial terminal.
- 1.5 Digital IO configuration.
- 1.6 Timer based LED Toggle.

Unit IV

12+8 Hours

Data Collection, Storage and Computing: Introduction, Cloud computing Paradigm for Data Collection, Storage and Computing, Everything as a Service and Cloud Service Models for IoT

IoT Privacy, Security and Vulnerabilities Solutions: Security and Privacy Requirements, Threat Analysis, IoT Layered Attacker Model, Access Control and Secure Message Communication, Security Models

Applications of IoT: Home Automation, Smart Cities, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection

Types of Computing, Tomography

Practical Components:

1. Experiments on interfacing with UbiSense

- 1.1 Switch on and switch of a DC motor based on the position of a switch
- 1.2 Create an application that has three LEDs (Red, Green and white). The LEDs should follow the cycle (All Off, Red On, Green On, White On) for each clap (use sound sensor)..
- 1.3 Create a web application for the above applications wherever possible with suitable modifications to get input and to send output..
- 1.4 Transmitting the measured physical value from the UbiSense over the Air.

Total: 48 + 32 Hours

Textbook(s):

1. Raj Kamal, "Internet of Things: Architecture and Design Principles". McGrawHill Publication, 2017
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015

Reference Book(s):

1. Designingthe Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
2. Getting Started with the Internet of Things CunoPfister , Oreilly.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	30	10	--
Apply	30	30	40
Analyze	10	20	30
Evaluate	10	20	30
Create	--	--	--
Total (%)	100	100	100

Sample Questions:

Remember

1. Define Wireless Sensor Network
2. What is Internet of Things
3. List any two applications of internet of things
4. What is smart object
5. What is M2M Communication

Understand

1. Explain the responsibilities of various layers in five layered architectures of IoT environment with neat sketch.
2. Explain the concept of CoAP in IoT
3. Explain Web of Things concept with a proper architecture
4. Illustrate any two real-time applications by using IoT technology
5. Discuss IoT Layered attacker model

Apply

1. Identify the importance of IoT in wireless networks
2. Identify various technologies behind IoT Technology
3. How can you justify lightweight communication is useful for IoT environment
4. How RFID is useful for IoT environment for data processing

Analyze

1. Differentiate the major significances of nesC, keil C and Dynamic
2. Comparative analysis on IoT programming approaches
3. Compare the communication efficiencies for the following protocols such as CoAP, MQTT, and XMPP in terms of Transport Layer Protocols.
4. Comparative analysis on real-time analytics in Cloud-IoT and fog computing.

Open Book Exam Questions

1. What type of real time applications are deployed based on IoT structure and give proper explanation for any best two applications with proper architecture.
2. How Can you justify how IoT network is considered as a light weight environment and what type of technologies are working behind for the IoT network deployment. Explain each technology in which how it communicates with developer.

23CS008 Cryptography and Network Security**3 0 2 4****Course Outcomes**

At the end of the course, students will be able to

1. Explain the fundamentals of Cryptography, encryption and decryption algorithms
2. Make use of the symmetric and public key cryptographic algorithms
3. Choose the various authentication applications for security
4. Interpret the functionalities of IP and web security.
5. Demonstrates the functionalities of firewalls
6. Explain various non-cryptographic protocol vulnerabilities

CO-PO Mapping

CO	PO3	PO6	PO8
1	2	2	3
2	2	2	3
3	2	1	3
4	2	1	2
5	2	2	3
6	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12+10 Hours**

Introduction: Security Attacks, Security Goals, Computer criminals, Methods of Defence, Security Services, Security Mechanisms. **Basics of Cryptography:** Symmetric Cipher Model, Substitution Techniques, Transportation, Techniques, Other Cipher Properties- Confusion, Diffusion, Block and Stream Ciphers. Block Cipher Design Principles and Modes of Operations, **Symmetric Key Cryptosystems:** Principles of Private Key System, Data Encryption Standard (DES), Strength of DES, Triple DES, International Data Encryption algorithm (IDEA), Advanced Encryption Standard (AES) *Blowfish, CAST-128.*

Practical Components:

1. Write a program that contains a string (char pointer) with a value "Hello world". The program should XOR each character in this string with 0 and displays the result.
2. Write a program that contains a string (char pointer) with a value "Hello world". The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a program to perform encryption and decryption using the following algorithms
 - a. Caesar cipher
 - b. Substitution cipher
4. Write a program to perform encryption and decryption using the following algorithms
 - a. Mono-alphabetic cipher
 - b. Hill Cipher
5. Write a program to perform encryption using the following algorithms
 - a. Railfence Technique
 - b. Transposition Technique

Unit II**12+8 Hours**

Public Key Cryptography: Principles of Public Key Cryptosystems, RSA Algorithm, Diffie-Hellman Key Exchange. Cryptographic Hash Functions: Principles of Cryptographic Hash functions, Applications of Cryptographic Hash Functions, Secure Hash Algorithm (SHA), Message Authentication Codes – Message Authentication Requirements and Functions, HMAC, Digital Signatures, Elgamal Digital Signature Schemes *Digital Signature Standards*

Practical Components:

1. Write a program to implement the Play-fair Cipher algorithm.
2. Write a program to implement the DES algorithm logic.
3. Write a program to implement the Blowfish algorithm logic.

Unit III

12+8 Hours

Authentication Applications: Kerberos, Key Management and Distribution, X.509 Directory Authentication service, Public Key Infrastructure, Electronic Mail Security: Pretty Good Privacy, S/MIME.

IP Security: Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining security Associations, Internet Key Exchange,

Web Security: Web Security Considerations, Secure Sockets Layer and Transport Layer Security.

HTTPS, Electronic Payment

Practical Components:

1. Write a Java program to implement RSA algorithm.
2. Calculate the message digest of a text using the SHA-1 algorithm.
3. Write a program to implement the Triple-DES algorithm logic.
4. Write a program to implement the AES algorithm logic.

Unit IV

Locking, Recovery Systems, Indexing, Different Types of Data

12 + 6 Hours

IDS and Firewalls: Intruders, Intrusion Detection, Password Management, Firewalls-Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration, Trusted Systems. Non-cryptographic protocol Vulnerabilities: DoS, DDoS, Session Hijacking and Spoofing, Software Vulnerabilities- Phishing, Buffer Overflow.

Format String Attacks, SQL Injection Cybercrime and Computer Crime, Intellectual Property.

Practical Components:

1. Implement the Diffie-Hellman Key Exchange mechanism.
2. Write a program that can encrypt and decrypt using a general substitution block cipher.
3. Write a program that can encrypt and decrypt in 4-bit in cipher clock chaining mode using DES.

Total: 48+32Hours

Textbook (s)

1. William Stallings, "Cryptography And Network Security – Principles and Practices", 7th edition, Pearson Education Limited 2017.
2. AtulKahate, "Cryptography and Network Security", 2nd edition Tata McGraw-Hill, 2003.
3. Behourz A Forouzan, Cryptography and Network Security, 2nd edition, Tata McGraw-Hill 2011

Reference (s)

1. Matt Bishop, "Computer Security art and science ", Second Edition, Pearson Education, 2002
2. Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education, 2007
3. Jonathan Katz, and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press, 2007
4. Douglas R. Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC, 2006
5. Wenbo Mao, "Modern Cryptography – Theory and Practice", Pearson Education, First Edition, 2006.
6. OWASP top ten security vulnerabilities: <http://xml.coverpages.org/OWASPTopTen.pdf>

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)
Remember	30	30
Understand	40	40
Apply	30	30
Analyze	--	--
Evaluate	--	--
Create	--	--
Total (%)	100	100

SAMPLE QUESTION (S)**Remember**

1. Mention any two security attacks
2. List any two goals of security
3. Define Hash function

Understand

1. Differentiate between asymmetric and symmetric key cryptography
2. How do we achieve authentication?
3. Differentiate between the two applications of hash function.

Apply

1. How do we apply PGP to the Email Security?
2. Implement firewall using iptables command.
3. Can message encryption itself provide measure of authentication?

Open Book Exam Questions**Question 1:**

A man named Jones wanted to chat with his girlfriend Goldie. But he can see that all his family is around him and even his girlfriend is also with her parents. So, he thought to send a secret message to his girlfriend. They usually love to meet in the "Central Park". Now Jones wants to send a message to Goldie as "Hi Goldie. How are you. Because you are with your parents, and I am with my parents we cannot speak with each other. But I want to meet you at our favourite place central park tomorrow after your class". Help Jones to convert the message to unreadable format using the key of their favourite place. Also suggest him how would Jones tell Goldie that the letter is originated from Jones only.

Question 2:

You have decided to start a startup after graduation. But you alone cannot be doing this, so you have to ask help from your friends. Suggest what techniques you require and which sort of people you would select so that your company will be a huge success. Explain the techniques clearly to your friends and tell them what they have to do in detail.

23IT009 User Interface / User Experience**3 0 2 4****Course Outcomes**

At the end of the course, students will be able to

1. Describe the structure of user Interface and design process.
2. Describe the web user interface.
3. Design the standards and structures for Human computer interaction
4. Understand the system menus and navigation schemes.
5. Demonstrate the Guidance of multimedia systems and its accessibility
6. Summarize the concepts of windows layout and visualization

CO – PO Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₅	PO ₁₀
1	3	3	3	3	3
2	3	3	3	3	3
3	3	3	3	3	3
4	3	3	3	3	3
5	3	3	3	3	3
6	3	3	3	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit I****12+8 Hours****The User Interface**

The User Interface-Introduction, Overview, The importance of user interface – Defining the user interface, the importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design, web user interface-popularity, characteristic & principles.

Practical Components:

1. Design Job application web page and apply font colors, menu items. Icons and different user interfaces concepts using bootstrap frame work.
2. Make the above page is Responsive and attractive using Bootstrap components in Mobile view.
3. Design a Responsive Product Landing Page with Bootstrap
4. Build a Responsive E-Commerce Website with Bootstrap

Unit II**12+8 Hours****The User Interface Design process**

The User Interface Design process- Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business functions-Business definition and requirement analysis, Basic business functions, Design standards, Human consideration in screen design.

Practical Components:

1. Apply different font styles, font families, font colors, animations and other formatting styles to the following static web pages using PHP.
 - i) Job application
 - ii) Registration form
2. Insert a image or Icons to the text fields, menu items and apply coloring to the above web pages
3. Design a Registration Form UI with Figma
4. Create a Responsive Website Header with Figma

Unit III**12+8 Hours****System menus and navigation schemes**

System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, selecting menu choices, Navigating menus,

Multimedia Text for Web Pages – Effective Feedback– Guidance & Assistance– Internationalization– Accessibility– Icons– Image, Kinds of graphical menus, Multimedia – Coloring.

Practical Components:

1. Create a HTTP Server that supports the following operations
 - i) Create
 - ii) Read
 - iii) Delete
 - iv) Update
2. Implementation of custom/user-defined directive
3. Develop a Task Tracker Application in which, Many individuals struggle to manage their daily tasks and prioritize their work effectively. There is a need for a user-friendly task tracker application that helps users organize their tasks, set priorities, and track their progress easily.
4. Develop a web application that displays a list of popular books with descriptions. Users can click on a book to view more details.

Unit IV

12+8 Hours

Windows

Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management, Organizing window functions, Window operations, Web systems,

Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Characteristics of device based controls, Windows Tests-prototypes, kinds of tests.

Practical Components

1. Writing Django templates for rendering data
2. Implementation of REST API using Django
3. Develop a Responsive Blog Website with Django
4. Design a responsive portfolio website from scratch using HTML, CSS, and JavaScript, that showcases their skills, projects, and achievements while ensuring it looks and functions well on various devices and screen sizes.

Total: 48+32 Hours

Textbook (s)

1. Wilbent. O. Galitz, "The Essential Guide To User Interface Design", John Wiley & Sons, 2002.
2. Designing the User Interface: Strategies for Effective Human-Computer Interaction, 5th Edition, Ben Shneiderman, Catherine Plaisant, 2010.

Reference (s)

1. Alan Cooper, "The Essential Of User Interface Design", Wiley – Dream Tech Ltd., 2002.
2. Ben Sheiderman, "Design The User Interface", Pearson Education, 1998.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)
Remember	20	20
Understand	30	10
Apply	30	30
Analyze	10	20
Evaluate	10	20
Create	--	--
Total (%)	100	100

Sample Question (S)**Remember**

1. Define user interface.
2. List any three functions of menus.
3. List the components of windows.

Understand

1. Explain the principles of user interface design.
2. Explain the various contents of menu.
3. Explain the various windows operations.

Apply

1. Write suitable illustration explain how Response time and Time delays are handled in user interface design.
2. Give an example of a user navigating menus.

Analyze

1. Compare menus with dialog boxes.
2. Compare the characteristics of GUI versus and Web design.

Evaluate

1. Describe at least four guidelines to be followed in phrasing of menus during the development of system menus

23IT606 Machine Learning Lab using Python**0 0 3 1.5****Course Outcomes**

At the end of the course, students will be able to

1. Demonstrate the basics of importing and exporting the datasets using various libraries in python.
2. Apply various visualization techniques on datasets using various libraries in python
3. Implement different supervised learning algorithms
4. Implement different Un supervised learning algorithms
5. Make use of neural network techniques for image classification.
6. Apply machine learning techniques on various case studies

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO9	PS01	PS02
1	2	2	2	2	3	2	3	3
2	2	2	2	2	3	1	3	3
3	1	1	1	1	3	2	1	1
4	2	2	2	2	3	1	2	2
5	2	2	2	3	3	2	3	3
6	1	1	1	1	3	2	3	3

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

List of Experiments

1. Implement a python script for importing and exporting data using python pandas.
2. Write a program to demonstrate various visualization techniques.
3. Plot the graphs for employee database using matplotlib.
4. Implement simple linear regression.
5. Implement logistic regression.
6. Write a program to demonstrate the working of the decision tree based ID3 algorithm.
Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
7. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
8. Implement KNN algorithm for classification.
9. Design non-linear model using support vector machines.
10. Implement k-means clustering algorithm.
11. Implement random forest ensemble method.
12. Build an Artificial Neural Network (ANN) by implementing the back propagation algorithm and test the same using appropriate dataset.
13. Implement an algorithm to demonstrate the significance of genetic algorithm
14. Implement the finite words classification system using Back-propagation algorithm
15. Sentiment analysis on tweets – a case study.
16. Object detection in an image – a case study

List of Augmented Experiments

1. Identifying Tweets on Twitter Using Natural Language Processing
2. Fraud Detection While Handling Imbalanced Data
3. Stock Price Prediction
4. Recommendation Systems.
5. Sales Forecasting.

6. Cancer Disease Detection in Health Care
7. Face Detection System.
8. Visual Tracking System.
9. Chatbot using IBM Watson's API
10. Image Caption Generator.

Reading Material(s)

1. Machine learning using python lab manual, Department of IT, GMRIT, Rajam.

23MPX01 Mini Project**0 0 3 1.5****Course Outcomes**

At the end of the project work the students will be able to

1. Identify a contemporary engineering application to serve the society at large
2. Apply complex engineering concepts and use computational tools to get the desired solution
3. Analyze the assembled/fabricated/developed products intended.
4. Prepare documents and present the project report articulating the applications of the concepts and ideas coherently
5. Demonstrate ethical and professional attributes during the project implementation.
6. Evaluate & execute the project in a collaborative environment.

Co-Po Mapping

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	3	2				3	2						3	3
C02	3	3			3								3	3
C03	3	3	3	2							2		3	3
C04										3		2	3	3
C05								3					3	3
C06									3				3	3

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

23ESX02 Employability Skills II**0 0 2 2****Course Outcomes**

At the end of the Employability Skills students will be able to

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Develop life skills with behavioral etiquettes and personal grooming
3. Assess analytical and aptitude skills
4. Develop algorithms for engineering applications
5. Solve engineering problems using software
6. Utilize simulation tools for testing

Co-Po Mapping

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01										3		2
C02								1		2		2
C03	2	1						2				
C04	2				2							
C05	2				2							
C06	2				2							

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Syllabus**Soft Skills:**

Sl No.	6 th Semester (Topic & Content)	No. of Periods
1.	Resume (Recap): Resume? Templates? Mistakes to be avoided in a Resume and Steps to be followed in preparing it.	01
2.	Group Discussions (Recap) & Practice: GD? Stages of a GD, Skills assessed in a GD, Blunders to be avoided, How to excel in a GD? Practice sessions and sharing Feedback. (Screening sample Videos)	01
3.	Interview Skills: Interview? Types of Interview, Dos & Don'ts, Skills assessed in an Interview, Mistakes to be avoided, How to equip oneself to excel? How to handle the Typical Interview Questions? (with Examples)	03
4.	Mock Interviews: Practice sessions with Feedback.	02
5.	Exercises related to Communication: Email Writing, Voice Versant., etc.	01
Total Periods		08

Quantitative Aptitude:

Sl No.	Semester-VI (Topic)	No. of Periods
1.	Time and Distance	01
2.	Time and Distance	01
3.	Problems on Trains	01
4.	Problems on Trains	01
5.	Blood relations	01
6.	Ratio and Proportions	01
7.	Calendars	01
8.	Clocks	01
Total Periods		08

Domain Specific:**15 Hours****Competitive programming Skills****UNIT-I****No. of Hours: 8 Hours**

Suffix Tree: Introduction, **Suffix Array:** Longest Duplicate Substring **Algorithms on Strings:** KMP string matching algorithm, Rabin - karp algorithm **Tries:** Introduction to Tries, types of tries, insertion in a trie

UNIT-II**No of Hours: 7 Hours**

NP Completeness: NP hard problems, travelling salesman problem **Multidimensional Pattern Matching**

UNIT-I**No. of Hours: 8 Hours**

Suffix Tree: Introduction, **Suffix Array:** Longest Duplicate Substring **Algorithms on Strings:** KMP string matching algorithm, Rabin - Karp algorithm **Tries:** Introduction to Tries, types of tries, insertion in a trie

Topic	Problem Statement	Practice Link
Suffix Tree	Same Tree	https://leetcode.com/problems/same-tree/description/
	Minimum Suffix Flips	https://leetcode.com/problems/minimum-suffix-flips/description/
	Execution Of All Suffix Instructions Staying in a Grid	https://leetcode.com/problems/execution-of-all-suffix-instructions-staying-in-a-grid/description/
Suffix Array	Longest-Duplicate-Substring	https://leetcode.com/problems/longest-duplicate-substring/description/
	Number-Of-Ways-To-Separate-Numbers	https://leetcode.com/problems/number-of-ways-to-separate-numbers/description/
	Sum-Of-Scores-Of-Built-Strings	https://leetcode.com/problems/sum-of-scores-of-built-strings/description/
Algorithms on Strings	Contains-Duplicate	https://leetcode.com/problems/contains-duplicate/description/
	Check-If-String-Is-Transformable-With-Substring-Sort-Operations	https://leetcode.com/problems/check-if-string-is-transformable-with-substring-sort-operations/description/
	Execution-Of-All-Suffix-Instructions-Staying-In-a Grid	https://leetcode.com/problems/execution-of-all-suffix-instructions-staying-in-a-grid/description/
	Evaluate-Reverse-Polish-Notation	https://leetcode.com/problems/evaluate-reverse-polish-notation/description/?envType=daily-question&envId=2024-01-30
	Rabbits-In-Forest	https://leetcode.com/problems/rabbits-in-forest/description/
Introduction. to Tries	Implement Trie-Prefix-Tree	https://leetcode.com/problems/implement-trie-prefix-tree
	Implement Trie-Prefix-Tree	https://www.codingninjas.com/studio/problems/implement-trie_1387095
	Longest Common Prefix	https://leetcode.com/problems/longest-common-prefix
Types of Tries	Search Suggestion Systems	https://leetcode.com/problems/search-suggestions-system
	Word Break	https://leetcode.com/problems/word-break
	Maximum XOR of two numbers in an array	https://leetcode.com/problems/maximum-xor-of-two-numbers-in-an-array/
Insertion in a Trie	Power Set	https://www.codingninjas.com/studio/problems/1062667?topList=striver-sde-sheet-problems

UNIT-II**No of Hours:** 7 Hours**NP Completeness:** NP hard problems, travelling salesman problem **Multidimensional Pattern Matching**

Topic	Problem Statement	Practice Link
NP Completeness	Walking The Approximate Longest Path	https://www.hackerrank.com/challenges/walking-the-approximate-longest-path
	Sam's Puzzle	https://www.hackerrank.com/challenges/sams-puzzle
	Spies Revised	https://www.hackerrank.com/challenges/spies-revised
	Voting	https://www.codechef.com/problems/VOTING
	This is NP Problem?	https://leetcode.com/problems/magnetic-force-between-two-balls/solutions/818827/this-is-np-problem
Travelling Sales Problem	TSP-Grid	https://www.hackerrank.com/challenges/tsp-grid
	XOR Travelling Salesman	https://www.hackerrank.com/contests/dakshcoderun/challenges/xor-traveling-salesman
	Find the shortest Superstring	https://leetcode.com/problems/find-the-shortest-superstring
	Travelling Salesman	https://www.geeksforgeeks.org/problems/travelling-salesman-problem2732/1
Multi-Dimensional Pattern Matching	Longest Increasing Path in a matrix	https://leetcode.com/problems/longest-increasing-path-in-a-matrix
	Matching Specific String	https://www.hackerrank.com/challenges/matching-specific-string
	Pattern Matching	https://www.hackerrank.com/contests/ai-python/challenges/pattern-matching-1-2
	Camelcase Matching	https://leetcode.com/problems/camelcase-matching/

Total 30 Hours

Audit Course

Course Outcomes

At the end of the Audit Course the students will be able to

1. Interpret the meaning of values and select their goals by self- Investigation based on personal values.
2. Interpret the major events and issues related to a period in Indian history.
3. Assess the benefits and limitations of science and its application in technological developments towards human welfare
4. Check the awareness regarding basic human rights and to uphold the dignity of every individual.
5. Assess the individual and group behaviour, and understand the implications of organizational behaviour on the process of management.
6. Determine the appropriateness of various leadership styles and conflict management strategies used in organizations.

Co-Po Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C01												3		
C02												3		
C03												3		
C04												2		
C05												3		
C06												2		

23PWX01 Project Work**0 0 16 8**

At the end of the project work the students will be able to

1. Identify a contemporary engineering application to serve the society at large
2. Use engineering concepts and computational tools to get the desired solution
3. Justify the assembled/fabricated/developed products intended.
4. Organize documents and present the project report articulating the applications of the concepts and ideas coherently
5. Demonstrate ethical and professional attributes during the project implementation.
6. Execute the project in a collaborative environment.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	3	2				3	2						3	3
C02	3	3			3								3	3
C03	3	3	3	2							2		3	3
C04										3		2	3	3
C05								3					3	3
C06									3				3	3

23SIX02 Summer Internship #II**0 0 0 1****Course Outcomes**

1. Demonstrate communication skills to meet the requirement of industry
2. Develop logical thinking and analytical skills to thrive in competitive examinations
3. Use mathematical concepts to solve technical quizzes
4. Develop technical skills to work out real time problems
5. Develop algorithms for different applications
6. Solve industry defined problems using appropriate programming skills

COs –POs Mapping

COs	PO1	PO2	PO5	PO6	PO10	PO12
1					3	
2	3	1				
3	3					
4	3	1	3			2
5	3	1	3	3		1
6	3	1	3			1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

23CSC13 Natural Language Processing**3 0 0 3****Course Outcomes**

1. Describe the fundamentals & building blocks of Natural Language Processing
2. Demonstrate different text representations & labelling methods
3. Apply different Natural Language models and named entities
4. Apply Recurrent neural network for NLP
5. Make use of GRUs and LSTM models for translation
6. Discuss different applications of NLP

CO-PO Mapping:

CO	PO2	PO3	PO4	PO12	PSO1
1	3	2	1	2	1
2	3	3	2	2	1
3	3	2	2	2	2
4	2	3	1	2	1
5	3	3	2	2	2
6	3	2	2	2	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 Hours**

Introduction to NLP: Definition, History, NLP in the real world, Building blocks of language, Approaches to NLP, NLP Pipeline, NLP Challenges, Deep learning in NLP, Morphology fundamentals;
Objectives of NLP, The applications of NLP.

Unit II**12 Hours**

Text Representation and Sequence Labelling: Basic Vectorization approaches- One-Hot Encoding, Bag of Words, Bag of N-Gram, TF-IDF; Distributed universal text and handcrafted feature Representations, Neural language models, N-gram language model.
 Sequence labeling for POS and Named Entities: POS tagging, Named Entities tagging, hidden markov models, conditional Random Fields Visualizing Embeddings, Viterbi algorithm.
Evaluation of Named Entity Recognition, Markov chains.

Unit III**12 Hours****Deep learning architectures for NLP:**

RNN for language model, GRUs and LSTMs for machine translation, - Sequence to sequence modelling - Encoder decoder -Attention mechanism, Transformer Networks – BERT, GPT, Graph NLP, Hidden Markov Model, Conditional Random Field, Topic modelling .
Transformers as Autoregressive Language Models, Potential Harms from Language Models.

Unit IV**12 Hours****Applications of NLP:**

Sentiment analysis, machine translation, automated speech recognition systems, question-answering based systems, topic modelling, Text Generation and Summarization, Evaluation metrics for NLP models and Visualization.
Semantic Role Labeling Lexicons for Sentiment, Affect, and Connotat.

Total: 48 Hours**Textbook (s)**

1. Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft)

2. Daniel Jurafsky, James H Martin, Speech & language processing, preparation [cited 2020 June 1] Available
3. from: <https://web.stanford.edu/~jurafsky/slp3> (2018).
4. Vajjala, Sowmya, Bodhisattwa Majumder, Anuj Gupta, and Harshit Surana. Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems. O'Reilly Media, 2020.

Reference (s)

1. Rajesh Arumugam, Rajalingappa Shanmugamani : Hands-On Natural Language Processing with Python
2. Manning C., Schütze H, Foundations of Statistical Natural Language Processing--(MIT Press)
3. Jacob Eisenstein. Natural Language Processing.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	40	--
Understand	30	40	--
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. What is Natural language processing.
2. Define purpose of different building blocks of NLP
3. List any two challenges in NLP.

Understand

1. Explain different Basic Vectorization approaches
2. Explain the role of various Named Entities
3. Explain purpose of Viterbi algorithm

Apply

1. Apply various Deep learning models for NLP
2. Make use of RNN for text translation

Analyze

1. Compare and contrast GRUs and LSTMs for machine translation.
2. Distinguish various methods to Convolutional neural networks for sentence classification.

Evaluate

1. Evaluate the statistics of a sentiment analysis
2. Design an automated speech recognition systems

Open book Question:

1. Design a model to analyse a given sentence is negative, positive or neutral for a given dataset.
2. Design and develop a model to translate a text to speech for a given set of statements.

23CSC23 Web Application Databases**3 0 0 3****Course Outcomes:**

1. Describe the architecture and programming concepts of web databases.
2. Implement state management and database connectivity mechanisms
3. Apply structured database management techniques.
4. Apply the principles of unstructured databases and NoSQL technologies.
5. Develop proficiency in database connections and communication protocols.
6. Analyze the security mechanisms for web services

CO-PO Mapping:

COs	PO1	PO3	PO5	PS01
1	3	1	2	3
2	2	3	3	3
3	3	3	1	3
4	3	2	2	2
5	2	3	3	3
6	2	2	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit-I**11 Hours****Overview of Web databases**

Web application Overview: Basic concepts of web, Web database architectures, Web database gateways, Web-database programming: Client-side and server-side web database programming, State management: Session management, cookies, request and response header.

Database gateways, CGI, Browser extensions

Unit-II**Structured Database – PostgreSQL****13 Hours**

Structured Databases: Structured data, Data models, Relational database management systems, Overview of PostgreSQL – Introduction, Environment Setup, PostgreSQL Database: Create, Select and Drop, CRUD operations, Advanced PostgreSQL: Constraints, Views, Transactions, Auto Increment, Privileges, Functions, Python interface, Concept of migrate database, Challenges of structured data- MySQL, SQLite
PostgreSQL Interfaces, Triggers, MySQL Connection, SQLite Connection

Unit-III**13 Hours****Unstructured Database – MongoDB**

Unstructured Databases: Unstructured data and its usages, NoSQL databases, Overview of MongoDB – Introduction, No SQL Database, Advantage over RDBMS, MongoDB Data Types, Install MongoDB, Data Modeling, MongoDB Operators, Database Commands, MongoDB Architecture - Create Database, Drop Database, Collection - Create Collection, Drop Collection, CRUD: Documents, MongoDB Shell, MongoDB Cloud, Challenges of unstructured data- Cassandra, GraphQL

Architecture of Cassandra, Cassandra Data model, GraphQL Architecture and Application Components

Unit-IV**Database connections, Security & Communication in web services****11 Hours**

Connecting to database: Native database APIs, Database-independent APIs, Template-driven database access packages, Third-party class libraries.

Web requests: Structure of web requests, JavaScript Object Notation (JSON), Request methods – GET, POST, PUT, DELETE, response status codes

Security: User authentication, User authorisation, Proxy servers, Digital signatures, Digital certificates, SSL and HTTPS.

JDBC, ODBC, template parsing, JSON, User authentication and authorisation

Total: 48 Hours

Textbook (s)

1. Web Database Applications with PHP and MySQL, Hugh E. Williams, David Lane, 2nd Edition, O'Reilly, 2004.
2. Mastering PostgreSQL 13, Hans-Jürgen Schönig, 4th Edition, Kindle Edition.
3. NoSQL Distilled, PramodSadhalage, Martin Fowler, 1st Edition, 2012

Reference (s)

1. Getting Started with NoSQL, GauravVaish, Paperback, Packt, 2013.
2. Fundamentals of Database Systems, ElmasriNavathe Pearson Education.
3. An Introduction to Database systems, C.J. Date, A.Kannan, S.SwamiNadhan, Pearson, 8th Edition.
4. Web Application Security, Andrew Hoffman, O'Reilly, 2020.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	40	40	--
Apply	20	20	40
Analyze	20	20	40
Evaluate	--	--	20
Create	--	--	--
Total (%)	100	100	100

Sample Questions

Remember:

1. What are the basic components of a web application?
2. What is a web database architecture?
3. What is a relational database management system (RDBMS)?
4. List different types of NoSQL databases.
5. Define database-independent APIs.

Understand:

1. Explain the process of session management in a web application.
2. Explain how PostgreSQL handles transactions.
3. Explain the architecture of MongoDB and how it differs from RDBMS.
4. How does JSON differ from XML in web communication?
5. Explain the difference between DELETE and TRUNCATE in PostgreSQL.

Apply:

1. Create a client-side script that validates form inputs.
2. Perform a database migration using PostgreSQL.
3. Implement CRUD operations in MongoDB using Python or Node.js.
4. Implement JWT-based authentication in a web application.
5. Write a query to filter data using comparison operators.

Analyze:

1. Compare two-tier and three-tier web database architectures.
2. Compare PostgreSQL, MySQL, and SQLite in terms of performance and scalability.
3. How does MongoDB handle ACID properties compared to traditional databases?
4. Compare session-based authentication vs. token-based authentication.
5. Analyze the impact of response status codes on API performance

23ITC33 Cloud Security (Elective V)**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Describe core concepts of the cloud computing paradigm
2. Illustrate characteristics, advantages and challenges brought by the various models and services in cloud computing.
3. Classify the known threats, risks, vulnerabilities and privacy issues associated with Cloud based services.
4. Categorize security challenges, threats and risks involved in the cloud application
5. Analyze the Security Requirements for the Architecture in cloud services
6. Examine the Data Security measures and best practices for ensuring the security of the cloud.

CO-PO Mapping

CO	PO1	PO2	PO4	PO8	PO12	PSO2
1	3	2	1	2	2	2
2	2	2	2	2	2	2
3	3	2	2	2	3	2
4	3	2	2	2	2	2
5	3	3	3	3	2	3
6	3	2	2	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit 1: Introduction to Cloud Computing,**12 Hours**

Cloud Computing Fundamentals - Definition and evolution of Cloud Computing, Essential Characteristics, Benefits, Cloud Reference Architecture, Cloud Service Models: SaaS, Paas, IaaS, Cloud Deployment Models: Public, Private, Hybrid, Community.

Unit 2: Cloud Security Risks, Threats, Vulnerabilities, and Privacy Issues**12 Hours**

Cloud Computing Software Security Fundamentals- Cloud Information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Security Concerns, Risk Tolerance, Legal and Regulatory Issues.

Unit 3: Security Challenges, Threats, and Risks in Cloud Applications**12 Hours**

Cloud Computing Risk Issues and Security Challenges: The CIA Triad, Privacy and Compliance Risks, Threats to Infrastructure, Data, and Access Control, Cloud Service Provider Risks Security Challenges- Security Policy Implementation, Virtualization, Virtual Machine, Virtualization of CPU, Memory and I/O devices, Virtualization Security Management, VM Security Recommendations, VM-Specific Security Techniques.

Unit 4: Security Architecture, Data Security in the Cloud and Best Practices**12 Hours**

Securing the cloud: Architecture and Data Security Requirements for the Architecture, Security Patterns and Architectural Elements, Cloud Security Architecture, Planning Key Strategies for Secure Operation. Overview of Data Security in Cloud Computing, Data Encryption: Applications and Limits, Cloud Data Security: Sensitive Data Categorization, Cloud Data Storage, Cloud Lock-in, Key strategies to secure the cloud, best practices for cloud computing, Security monitoring

Total: 48 Hours**Textbook (s)**

1. Russell Dean Vines and Ronald L. Krutz ,Cloud Security: A Comprehensive Guide To Secure Cloud Computing, Wiley India Pvt Ltd, 2010

2. Securing The Cloud: Cloud Computing Security Techniques and Tactics by Vic (J.R.) Winkler (Syngress/Elsevier), 2011

Reference (s)

1. Cloud Computing Design Patterns by Thomas Erl (Prentice Hall)
2. Barrie Sosinsky, Cloud Computing Bible, Wiley India, 2011
3. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	OBE
Remember	50	40	-
Understand	30	40	-
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	-
Create	--	--	-
Total (%)	100	100	100

Sample Questions

Remember

1. Define Cloud Computing.
2. List Cloud Service Models
3. List Cloud Information Security Objectives
4. What is cloud foundry?

Understand

1. Identify Cloud Computing Risk Issues and Security Challenges
2. Explain the Data Security
3. Explain all session management techniques
4. Explain different cloud service models

Apply

1. Demonstrate the process for war file deployment in the cloud.
2. How does Sensitive Data Categorization happens in Cloud?

Analyze

1. Justify your answer which technique is used for Session management.
2. Deploy Security Challenges

23EC602 Digital Signal Processing (Elective V)**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Classify discrete time signals and systems
2. Implement Digital systems by using realization techniques
3. Implement discrete Fourier transform and Fast Fourier transform on time domain signals
4. Differentiate FIR and IIR digital filters
5. Demonstrate the concept Multirate signal processing
6. Interpret the architecture of Digital signal processors

CO - PO Mapping

COs	PO ₁	PO ₂	PSO ₂
1	2	-	2
2	3	2	3
3	3	2	3
4	3	2	3
5	3	2	3
6	2	-	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Syllabus**Unit I****12 Hours****Introduction to Discrete-Time signals and systems**

Classification of Discrete time signals, linear Time Invariant systems, stability, and causality, Linear convolution in time domain and graphical approach, Frequency Domain Representation of Discrete-Time Signals and systems. Concept of Z-transforms, Region of Convergence, properties, Inverse Z transform, Realization of Digital filter structures: Direct form-I, Direct form-II, Transposed form, Cascaded form, Parallel form.

*Lattice structure, Lattice-Ladder structure***Unit II****12 Hours****Discrete-Time signals in Transform domain**

Discrete Fourier Series(DFS), Discrete Time Fourier transforms(DTFT), Discrete Fourier transform(DFT), Properties of DFT, linear convolution using DFT, Circular convolution, Fast Fourier transforms (FFT) - Radix-2 decimation in time, decimation in frequency FFT Algorithms, Decimation in frequency FFT Algorithms, Inverse FFT, Overlap-save method, Overlap-add method

*Relation between DTFT, DFS, DFT, Radix-4FFT***Unit III****12 Hours****IIR & FIR Digital Filters**

Analog filter approximations-Butter worth and Chebyshev, Impulse Invariant transformation, Bilinear transformation, Design of IIR Digital filters from analog filters, FIR Digital Filters: Characteristics of FIR Digital Filters, frequency response, Design of FIR Digital Filters using Window Techniques, Frequency Sampling Technique.

Comparison of IIR & FIR filters. Frequency Transformation in digital domain

Unit IV**12 Hours****Multirate Signal Processing & TMS Processors**

Multirate Processing: Decimation, interpolation, sampling rate conversion, Implementation of sampling rate conversion. Introduction to DSP processors: Overview of Digital signal processors, Von Neumann Architecture, Harvard Architecture, Multiplier Accumulator (MAC), Pipelining, Architecture of TMS320C50, Bus structure, CPU, on chip memory, on-chip peripherals.

Cascading sampling rate converters, Addressing modes

Total: 48 Hours**Textbook (s)**

1. Digital Signal Processing by Sanjit K. Mitra 2nd Edition, TATA McGraw Hill
2. John G. Proakis, Dimitris, G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications: Pearson Education / PHI, 4th Edition, 2013.
3. Digital Signal Processors – Architecture, Programming and Applications, B. Venkataramani, M. Bhaskar, TATA McGraw Hill, 2002

Reference (s)

1. Sanjit K. Mitra, Digital Signal Processing, Tata McGraw Hill publishers, 3rd Edition, 2009.
2. Alan V. Oppenheim, Ronald W. Schaffer Digital Signal Processing, PHI, 4th Edition, 2007
3. Andreas Antoniou, Digital Signal Processing, TATA McGraw Hill, 2006
4. MH Hayes, Digital Signal Processing, Schaum's Outlines, Tata McGraw Hill, 2007

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	25	--	--
Understand	35	25	--
Apply	20	45	60
Analyze	20	30	40
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)**Remember**

1. Define Signal and System.
2. State the advantages and limitations of DSP?
3. Define about Gibbs's phenomena
4. state the need of Multi rate signal processing
5. List the difference between FIR and IIR filters

Understand

1. Identify the following systems for time invariant
 - (i) $y(n) = x(n) - x(n-1)$
 - (ii) $y(n) = nx(n)$
 - (iii) $y(n) = e^{x(n)}$
2. Identify the stability of the given systems
 - (i) $y(n) = \cos(x(n))$
 - (ii) $y(n) = x(-n-2)$
 - (iii) $y(n) = ax^2(n)$
3. Illustrate whether the signal $x(n) = \sin 15\pi n + \sin \sqrt{2}n$ is periodic or not.
4. Illustrate windowing techniques to design FIR filters.
5. Represent $y(n) = x(n) + 2x(n-1) + 3x(n-2) + 2y(n-1) + 3y(n-2)$ in direct form-I structure.

Apply

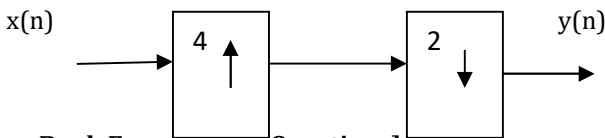
1. Realize the system given by the difference equation $y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7x(n) - 0.252x(n-2)$ in parallel form.
2. Find the DFT of a sequence $x[n] = \{1, 2, 3, 4, 4, 3, 2, 1\}$ using DIT algorithm
3. Compute the IDFT of the sequence $X[k] = \{12, 0, 0, 0, 4, 0, 0, 0\}$ using DIF Algorithm

[Open Book Examination Questions]

4. A DSP system is characterized by linear difference equation $y(n) = 2x(n) + 4x(n-1) + 6x(n-2) + 8x(n-3)$ with digital input $x(n) = \{1, 0, 1, 1\}$. Find the output response of the system. Find the transfer function of FIR system

[Open Book Examination Questions]

5. Show the expression for the output in terms of $x(n)$ for the multi rate system given as follows



[Open Book Examination Questions]

Analyse

1. Resolve analog filter with transfer function $(s+0.1)/(s+0.1)^2+9$, into a digital IIR filter using bilinear transformation. The digital filter should have a resonant frequency of $\omega_r = \pi/4$
2. The specification of the desired LPF is
Design a Butterworth IIR digital filter using Impulse invariant transformation technique

$$0.8 \leq |H(\omega)| \leq 0.1 \quad 0 \leq \omega \leq 0.2\pi$$

$$|H(\omega)| \leq 0.2 \quad 0.32\pi \leq \omega \leq \pi$$

3. Compare the frequency response of Linear phase FIR filter
Case(1) impulse response $h_{(n)}$ is symmetrical N is odd
Case(2) impulse response $h_{(n)}$ is anti symmetrical N is even
Case(3) impulse response $h_{(n)}$ is symmetrical N is even
Case(4) impulse response $h_{(n)}$ is anti-symmetrical N is odd
4. Outline the structural realization of linear phase FIR filter for given N

[Open Book Examination Questions]

- Case(1) $h(n) = \{3 \ 2 \ 1 \ 2 \ 3\}$ for $N=5$
 Case(2) $h(n) = \{-3 \ -2 \ 0 \ 2 \ 3\}$ for $N=5$
 Case(3) $h(n) = \{3 \ 2 \ 1 \ 1 \ 2 \ 3\}$ for $N=6$
 Case(4) $h(n) = \{-3 \ -2 \ -1 \ 1 \ 2 \ 3\}$ for $N=6$

[Open Book Examination Questions]

5. Compare different windowing techniques

[Open Book Examination Questions]

23IT010 Information Retrieval Systems (Elective V)**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Learn Classical and advanced techniques employed by Web Search engines
2. Know different ways of representation and retrieval of documents.
3. Apply techniques of preprocessing needed for IRS
4. Apply the techniques of clustering on unstructured data
5. Apply indexing methods for fast retrieval from Document data.
6. Develop an IRS by using different user search techniques and text search algorithms

CO – PO Mapping

COs	PO ₃	PO ₆	PO ₈
1	3	2	2
2	3	2	2
3	2	3	1
4	2	3	1
5	2	3	1
6	3	3	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit I****Introduction & Capabilities:****12 Hours****Introduction:**

Definition, Objectives, Precision, Recall, Comparison to DBMS, Digital libraries and Data Warehouses, Functional Overview. **Information Retrieval System Capabilities:** Search, Browse Capabilities.

Miscellaneous capabilities.

Unit II**12 Hours****Cataloging and Automatic Indexing & Data Structures**

Cataloging and Automatic Indexing: Objectives, Indexing Process, Information Extraction. Statistical indexing: Probabilistic Weighting, Vector Weighting, Concept indexing **Data Structures:** Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT datastructure. Signature file structure, Hypertext data structure.

Classes of automatic indexing, Natural language

Unit III**12 Hours****Document and Term Clustering & Text Search Algorithms**

Document and Term Clustering: Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters. **Text Search Algorithms:** Software text search algorithms: Brute force, Knuth Pratt Morris, Boyer Moore.

Hardware text search systems

Unit IV**12 Hours****User Search Techniques & Information Retrieval System Evaluation**

User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, weighted searches of Boolean systems, Searching the Internet and hypertext.

Information Retrieval System Evaluation : Introduction, Measures used in System Evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results.

Selective dissemination of information search, Measurement Example-TREC Results.

Total: 48 Hours**Textbook (s)**

1. M. T. M. Gerald J Kowalski, Information Storage and Retrieval Systems: Springer International Edition, 2018
2. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.
3. W. B. Frakes, Ricardo Baeza-Yates, Information Retrieval Data Structures and Algorithms: Prentice Hall PTR, 2016.

Reference (s)

1. R. Baeza-Yates, Modern Information Retrieval: Pearson Education, 2000.
2. R. Korfage, Information Storage & Retrieval: John Wiley & Sons, 2006
3. Frakes, W.B. and Ricardo Baeza Yates, Information Retrieval Data Structures and Algorithms, 1st Edition Prentice Hall, 1992.
4. Robert Korfage, Information Storage & Retrieval, 1st Edition, John Wiley & Sons, 2005

Sample Question (S)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	30	--
Understand	40	40	--
Apply	10	20	80
Analyze	20	10	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)

Remember

1. Define measures for IRS
2. Define PAT
3. State Browse capabilities
4. List automatic indexing
5. Recall term clustering algorithms

Understand

1. Explain Functional Overview
2. Explain Stemming algorithms
3. Summarize Brute force algorithms
4. Illustrate S/w text search Algorithms
5. Interpret standard test collection
6. Classify S/w & H/w text search systems

Apply

1. Demonstrate Precision
2. Design a hybrid Indexing Data Structure
3. Use stemming Algorithms for IRS

Analyze

1. Analyze s/w and h/w indexing methods
2. Analyze search and Browse capabilities
3. Compare Pat and Stemming algorithms
4. Analyze Term clustering Algorithms

Evaluate

1. Determine Which of the indexing algorithm is efficient
2. Check all automatic indexing methods for its efficiency
3. Compare S/w text search and H/w text search algorithms

Open Book Exam Questions

1. Suppose I have a query Q which is specified as "Intelligent Software" Assuming that query vector is computed just in terms of TF weights (no IDF weights), and similarity is measured by the cosine metric, what is the similarity between Q and D?

23CS005 Mobile Computing (Elective V)**3 0 0 3****Course Outcomes**

1. Explain the basic concepts and fundamentals of mobile computing and telecommunication systems along with various standards.
2. Illustrate the techniques, protocols related to GSM and GPRS architecture to perform requirements analysis.
3. Explain major components of Mobile IP to improve the service qualities of a network
4. Compare various ad hoc routing protocols to examine the performance of network
5. Explain the architecture of Wireless Sensor Network and WLAN design issues and limitations.
6. Outline the basic knowledge in developing smart phone applications using various platforms, toolkits, APIs and third party libraries

CO – PO Mapping

COs	PO1	PO3	PO8
1	2	3	2
2	2	2	2
3	2	1	2
4	2	2	2
5	2	2	2
6	2	2	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit I****Introduction to Mobile Communications****12 Hours**

Overview: Mobile Communication and Mobile Computing – Architecture; Generations of Telecommunications – 1G, 2G, 3G, 4G and 5G; Wireless Technologies – WPAN, WLAN, WMAN; Wireless Medium Access Control (MAC) – Overview, SDMA, TDMA, FDMA, CDMA;

2G Technologies: GSM – Services, Architecture, Radio Interface, Protocol Stack, Localization, Call Handling, Handover, Security; 2.5G – GPRS and 3G – EDGE.

Networking: Communication Modes, Basic Network Designs, Cellular Infrastructures

Unit II**Mobile Network Layer and Transport Layer****12 Hours**

Mobile Network Layer: Mobile IP Overview, IP Packet delivery, Agent discovery and advertisement, Registration, Tunneling and Encapsulation, Optimizations, Security, and Dynamic Host Configuration Protocol (DHCP).

Mobile Transport Layer – Motivation, Traditional TCP, Classical TCP Approaches: Indirect TCP, Snooping TCP, Mobile TCP, Transaction-oriented TCP; Optimizations, TCP for 2.5G/3G.

Multi Task gadget: wide area mobile data - air link standards for data - wireless application environment

Unit III**Mobile Ad-hoc Network (MANET)****12 Hours**

Introduction to Mobile ad-hoc networks, Characteristics and features, Applications, Limitations; Routing protocols – Design Issues, Routing algorithms: Proactive (DSDV & OLSR) and Reactive (DSR & AODV), Security in ad hoc networks; Wireless LAN – IEEE 802.11 – System Architecture, Protocol Layers.

Wireless Sensor Network (WSN): Introduction, Architecture, Applications, Properties and Security.

Satellite systems: history - applications - basics - broadcast systems

Unit IV**Mobile Platforms and Applications****12 Hours**

Mobile OS: Overview on Mobile Device Operation Systems (Android, iOS, Black Berry) – Architecture, App development Kit; Introduction to Network Simulators: Characteristics, Applications, Limitations, Types of Simulators: Wireless Application Protocol (WAP): Introduction, Architecture, Applications.

Application layer Protocols – FTP, SMTP, HTTP, DNS; Windows 10.

Total: 48 Hours**Textbook (s)**

1. Raj Kamal, Mobile Computing, Oxford press, Third Edition, 2018
2. Jochen Schiller, Mobile Communications, Pearson Education, Second Edition, 2019

Reference (s)

1. Asoke K Talukder, Hasan Ahmad and Roopa Yavagal, Mobile Computing, Second Edition, McGraw Hill, 2010
2. Prasant Kumar Pattnail and Rajib Mall, Fundamentals of Mobile Computing, Second Edition, PHI Learning Pvt. Ltd., 2015
3. Frank Adelstein, et al., Fundamentals of Mobile and Pervasive Computing, McGraw Hill, 2005
4. http://www.isi.edu/nsnam/ns/doc/ns_doc.pdf (NS2 manual)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	25	10
Understand	25	15	20
Apply	25	20	30
Analyze	20	20	30
Evaluate	--	10	10
Create	--	10	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. Define Mobile Computing
2. List the applications of mobile computing
3. List the limitations of mobile computing
4. Define Mobile Adhoc Network
5. List the MANET routing issues

Understand

1. Explain mobile computing with architecture
2. Explain TDMA and FDMA with neat diagrams
3. Illustrate the different services provided by the GSM, Explain with system architecture
4. Explain IP Packet delivery with diagram
5. Describe DSSS (Direct Sequence Spread Spectrum)

Apply

1. Illustrate Registration process achieved in mobile network layer
2. Discuss the feature of tunneling and encapsulation
3. Illustrate the function of Dynamic Host Configuration Protocol (DHCP)
4. Discuss about security in Ad-hoc network
5. Illustrate the properties of MANETS

Analyze

1. Compare Snooping TCP and Indirect TCP
2. Analyze the performance of Dynamic Source Routing protocol
3. Compare about iOS and Blackberry Operating Systems
4. Compare NS2 and NS3 simulators
5. Explain about Android Operating System with architecture

Evaluate

1. Evaluate the performance of Wireless Datagram protocol
2. Evaluate the performance of DSDV
3. Evaluate the performance of DSR
4. How Traditional TCP is different from I-TCP
5. How localization and Call handling is performed

Open Book Exam Questions

Q1. Describe the functions of the MS and SIM. Why does GSM separate the MS and SIM? How and where is user-related data represented/stored in the GSM system? How is user data protected from unauthorized access, especially over the air interface? How could the position of an MS (not only the current BTS) be localized? Think of the MS reports regarding signal quality.

Q2. Describe the Concept of GPRS. Using the best delay class in GPRS and a data rate of 115.2 kbit/s – how many bytes are in transit before a first acknowledgement from the receiver could reach the sender (neglect further delays in the fixed network and receiver system)? Now think of typical web transfer with 10 Kbyte average transmission size – how would a standard TCP behave on top of GPRS (see chapters 9 and 10)? Think of congestion avoidance and its relation to the round-trip time. What changes are needed?

23IT017 Social Network Analysis (Elective VI)**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Acquire Knowledge to analyze Social Networks
2. Model, Aggregate and Represent Knowledge for Semantic Web
3. Use Extraction and Mining tools for Social Networks
4. Apply Reality Mining to Predict Human Behaviors for Social Communities
5. Apply various Algorithms for Evolution and Opinion Mining in Social Networks
6. Write algorithms and systems for expert location in social networks

CO - PO Mapping

COs	PO2	PO4	PO5	PO12
1	2	2	3	2
2	2	2	3	2
3	1	1	3	3
4	1	1	2	2
5	2	2	3	2
6	2	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Syllabus**Unit I****12 Hours****Introduction**

Introduction to Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Statistical Properties of Social Networks, Network analysis, Development of Social Network Analysis-Key concepts and measures in network analysis, Discussion networks-Blogs and online communities-Web-based networks
Case Studies of Social Network sites like Facebook-Twitter-Linkedin etc.

Unit II**12 Hours****Evolution**

Evolution in Social Networks- Framework, Tracing Smoothly Evolving Communities, Models and Algorithms for Social Influence Analysis, Influence Related Statistics, Social Similarity and Influence, Influence Maximization in Viral Marketing, Link Prediction in Social Networks, Feature based Link Prediction

Neurons & Social Actor-Advanced techniques in Link Prediction

Unit III**12 Hours****Mining Communities and Opinion Mining**

Applications of Community Mining Algorithms, Node Classification in Social Networks
 Opinion Extraction-Sentiment Classification and Clustering, Temporal Sentiment Analysis-Irony Detection in Opinion Mining-Wish Analysis-Product Review Mining-Review Classification
Tracking Sentiments towards Topics over Time

Unit IV**12 Hours****Modelling and Visualization**

Visualizing Online Social Networks, A Taxonomy of Visualizations, Graph Representation-Centrality-Clustering-Node-Edge Diagrams-Visualizing Social Networks with Matrix-Based Representations-Node-Link Diagrams,

Hybrid Representations, Modelling and Aggregating Social Network Data, Random Walks and their Applications, Ontological representation of Social Individuals and Relationships.

Use of Hadoop and MapReduce-Gephi

Total: 48 Hours

Textbook (s)

1. Charu C. Aggarwal, Social Network Data Analytics, Springer, 2011
2. Peter Mika, Social Networks and the Semantic Web, Springer, 1st Edition, 2007.

Reference (s)

1. Borko Furht, Handbook of Social Network Technologies and Applications, Springer, 1st Edition, 2010.
2. Guandong Xu, Yanchun Zhang and Lin Li, Web Mining and Social Networking, Techniques and applications, Springer, 1st Edition, 2011.
3. Giles, Mark Smith, John Yen, Advances in Social Network Mining and Analysis, Springer, 2010.
4. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, Computational Social Network Analysis: Trends, Tools and Research Advances, Springer, 2009.

SAMPLE QUESTION (S)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Comprehensive Test1 (%)
Remember	35	20	-
Understand	35	30	-
Apply	20	40	70
Analyze	10	10	20
Evaluate	--	-	10
Create	--	-	-
Total (%)	100	100	100

Sample Question (S)

Remember

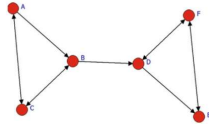
1. What are the limitations of current web?
2. List the statistical properties of social networks
3. Define social similarity.
4. What are the two different measures in influence related statistics

Understand

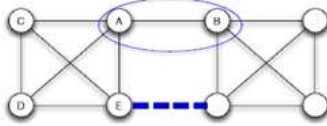
1. Explain about development of semantic web in research.
2. Demonstrate web based networks.
3. Illustrate the ways of visualizing social networks with matrix based representation and node – link diagram.
4. Explain core methods of community detection and mining.
5. Explain algorithms and systems for expert location in social networks.
6. Outline the models and algorithms for social influence analysis.

Apply

1. Make use of the following graph to solve Degree Centrality, Between-ness Centrality and Cliques.

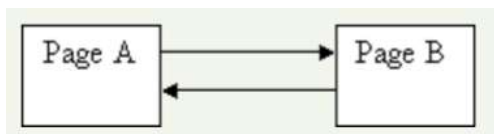


2. Solve Path, Length and Distance between nodes (i.e., Density measures) using SNA Data Processing Tools.
3. Make use of the above graph to solve network density and cut points.
4. Develop random graphs using Erdos Reini Model
5. Solve Weak Ties, Traidic closure for the following graph.

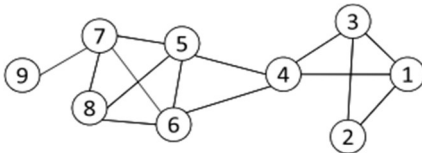


Analyse

1. Compute PageRank for the following figure.



2. Discover Spectral Clustering steps for the following graph.



3. Examine the ways to visualize community's hubs and node centrality measures using sna package.
4. Analyze positive, moderate and negative feeds using sentiment analysis on twitter data.

Open Book Exam Questions

1. [Visualization of team data in Gephi-What should be my considerations?](#)
2. [How do we calculate data processing time using cloud analyst?](#)

23IT011 Real Time Operating Systems (Elective VI)**3 0 0 3****Course Outcomes**

At the end of the course, students will be able to

1. Understand various real time application systems to learn the important aspects of safety and reliability
2. Explain the scheduling processes of real-time systems to learn resource handling, sharing and dependencies among real-time tasks
3. Use periodic scheduling to adopt the design objectives of real time platform
4. Analyze real-time tasks scheduling in multiprocessor and distributed systems
5. Explain features of real time operating system to study the importance of multitasking techniques
6. Use real time database and communication to review the basic concepts of real-time database

CO – PO Mapping

COs	PO ₂	PO ₃	PO12
1	3	3	2
2	3	2	2
3	3	2	2
4	3	3	2
5	2	2	2
6	2	2	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit I****12 Hours****Real-Time Systems**

Introduction: Real time definition - Applications of Real-Time systems - A basic model of Real-time system - Characteristics of Real-time system - Safety and Reliability - Types of Real-time tasks - timing constraints - Modeling timing constraints Some important concepts - Types of Real-time tasks and their characteristics - Task scheduling - Clock-Driven scheduling - Hybrid schedulers - Event-Driven scheduling - Earliest Deadline First (EDF) scheduling.

Identify some RTOS for review - Embedded Programming in C

Unit II**12 Hours****Scheduling Periodic Tasks**

Rate monotonic algorithm (RMA). Some issues associated with RMA. Issues in using RMA practical situations. Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks. Priority inversion. Priority Inheritance Protocol (PIP) - Highest Locker Protocol (HLP) - Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP. Important features of PCP - Some issues in using a resource sharing protocol. Handling task dependencies

Memory Management - and Porting μ Cos

Unit III**12 Hours****Scheduling Real-Time Tasks in Multiprocessor and Distributed Systems**

Multiprocessor task allocation - Dynamic allocation of tasks - Fault tolerant scheduling of tasks - Clock in distributed Real-time systems - Centralized clock synchronization Commercial Real-time operating systems: Time services - Features of a Real-time operating system - Unix as a Real-time operating system - Unix-based Real-time operating systems - Windows as a Real-time operating system - POSIX-RT - A survey of contemporary Real-time operating systems. Benchmarking real-time systems.

*RTOS for fault Tolerant Applications***Unit IV****12 Hours****Real Time Databases and Communication**

Real-time Databases: Example applications of Real-time databases. Review of basic database concepts - Real-time databases - Characteristics of temporal data. Concurrency control in real-time databases - Commercial real-time databases - Real-time Communication: Basic concepts - Examples of applications - Real-time communication in a LAN and Real-time communication over packet switched networks.

Comparison and study of various RTOS like QNX - VX Works

Total: 48 Hours**Textbook (s)**

1. Rajib Mall, Real-time Systems Theory and Practice, 1st edition, Pearson Publication, 2008.

Reference (s)

1. Jane W. S. Liu, Real-Time Systems, Pearson Education, 2000.
2. C.M. Krishna and K.G. Shin, Real-Time Systems, TMH, 2009

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	25	15	10
Understand	35	25	20
Apply	20	35	30
Analyze	20	25	20
Evaluate	--	--	10
Create	--	--	10
Total (%)	100	100	100

Sample Question (S)**Remember**

1. Define real-time system.
2. List few applications of real-time systems.
3. What is meant by fail safe state?
4. Name any two important sensor devices and two actuators used in real time systems.

Understand

1. Explain the basic model of real-time system.
2. Explain characteristics of real-time systems.
3. Explain the key differences between the characteristics of a soft-real time task such as web browsing and a non-real time task such as e-mail delivery.

Apply

1. In a real time system what is the difference between a performance constraint and a behavioral constraint? Give practical examples of each type of constraint.
2. Draw a schematic model showing the important components of a typical hard real system. Explain the working of output interface using a suitable schematic diagram. Explain using a suitable circuit diagram how analog to digital conversion is achieved in an output interface.
3. Draw a schematic model showing the important components of a typical hard real system. Explain the working of input interface using a suitable schematic diagram. Explain using a suitable circuit diagram how digital to analog conversion is achieved in an input interface.

Analyze

1. Is it possible to have an extremely safe but unreliable system? If your answer is affirmative, then give example of such a system. If your answer is no, then explain why such a system is not possible to exist.
2. Identify the constraints that a set of periodic real-time tasks need to satisfy for RMA to be optimal scheduler for the set of tasks?

3. Compare the performance of IEEE 802.4 protocol with IEEE 802.5 protocol for real-time applications at high, medium and low bandwidths.

Evaluate

1. Can one have concurrent execution of threads/processes without having parallelism? If yes, describe how. If not, explain why not.

Open Book Exam Questions

1. A host of a party has invited $N > 2$ guests to his house. Due to fear of Covid-19 exposure, the host does not wish to open the door of his house multiple times to let guests in. Instead, he wishes that all N guests, even though they may arrive at different times to his door, wait for each other and enter the house all at once. The host and guests are represented by threads in a multithreaded program. Given below is the pseudocode for the host thread, where the host waits for all guests to arrive, then calls `opendoor()`, and signals a condition variable once. You must write the corresponding code for the guest threads. The guests must wait for all N of them to arrive and for the host to open the door, and must call `enterHouse()` only after that. You must ensure that all N waiting guests enter the house after the door is opened. You must use only locks and condition variables for synchronization. The following variables are used in this solution: lock `m`, condition variables `cv_host` and `cv_guest`, and integer `guest_count` (initialized to 0). You must not use any other variables in the guest for synchronization.

```
// host
lock(m)
while(guest_count < N)
wait(cv_host, m)
openDoor()
signal(cv_guest)
unlock(m)
```

23IT012 Digital Image Processing (Elective VI)**3 0 0 3****Course Outcomes**

1. Interpret fundamental concepts of digital image processing
2. Infer image transforms
3. Exemplify image enhancement and color image processing
4. Assess image restoration techniques
5. Summarize line, point, threshold and region-based segmentation for digital images
6. Attribute various compression models and compression techniques for digital images

COs – POs Mapping

COs	PO ₃	PO ₅	PO ₆
1	-	2	2
2	-	2	2
3	-	2	2
4	2	2	3
5	-	2	2
6	2	2	3

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Unit I**12 Hours****Digital Image Fundamentals**

Fundamental steps in Digital image processing, Components of an Image processing system, Elements of visual perception, Image sampling and quantization, basic relationships between pixels, An introduction to mathematical tools in digital image processing.

Image transforms: 2D DFT and its properties, Discrete cosine transform, Discrete Wavelet Transform.

Walsh Transform, Hadamard Transform

Unit II**12 Hours****Image Enhancement and Color Image Processing**

Enhancement in spatial domain: Intensity transformations, Histogram Processing, smoothing and sharpening,

Image Enhancement in Frequency Domain: Smoothing and Sharpening Filters

Color fundamentals, Color models, Pseudo color Image Processing, Full Color Image Processing, color transformations.

Color Image Enhancement in spatial and frequency domain

Unit III**12 Hours****Image Restoration**

Image Degradation/Restoration model, Noise models, Restoration using spatial filtering, Periodic noise reduction by frequency domain filtering, Linear Position-Invariant Degradations, Inverse filtering, Minimum Mean Square Error Filtering, Constrained Least squares filtering.

Estimating the degradation function, Geometric Mean filter

Unit IV**12 Hours****Image Segmentation and Compression**

Image segmentation: Fundamentals, point, Line and Edge detection, Thresholding, Region based

Segmentation, Image Compression: Fundamentals, Image Compression Models, Lossless Compression, Lossy Compression, Transform coding and JPEG compression standard.

Watershed algorithm

Total: 48 Hours**Textbook (s)**

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Pearson Education, 3rd Edition 2011

2. S.Sridhar, Digital Image Processing, Oxford publishers, 2nd Edition, 2016

Reference (s)

1. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson Education, 1st Edition, 2015
2. S.Jayaraman, S.Esakirajan, T.Veerakaumar, Digital Image Processing, McGraw Hill publishers, 2011
3. M.Sonka, V. Hlavac, R. Boyle, Image Processing, Analysis and Machine Vision, Vikas Publishing House, 2001

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test ¹ (%)
Remember	25	20	--
Understand	30	25	--
Apply	25	30	40
Analyse	20	25	60
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. List the 6 components of digital image processing system
2. Define image enhancement
3. Define image segmentation
4. State the lossy compression
5. List out the 3 color models

Understand

1. Interpret the process of image sampling and quantization
2. Summarize the fundamental steps in digital image processing
3. Represent RGB color model
4. Explain the properties of 2D Discrete Fourier Transform
5. Illustrate contrast stretching transformation function to increase the dynamic range of the gray levels in the image

Apply

1. Consider the image segment shown below. Compute N4, N8 distances

3	1	2	1 (q)
2	2	0	2
1	2	1	1
(p) 1	0	1	2

2. Compute histogram equalization for a given 8x8 image
3. Compute the efficiency of Huffman Coding for the given symbols

Symbol	a1	a2	a3	a4	a5	a6
Probability	0.1	0.4	0.06	0.1	0.04	0.3

4. Implement segmentation on given image using bimodal thresholding
5. Show that a linear, spatially-invariant degradation system with additive noise can be modeled in the spatial domain as the convolution of the degradation function with an image followed by addition of noise

Analyse

1. Differentiate between image enhancement and restoration in terms of processing and applications
2. Compare lossy and lossless compression methods in terms of entropy, applications and transforms used
3. Is image enhancement a subjective approach? Justify your answer
4. Is lossless compression preferred to lossy compression? Justify your answer

5. Differentiate region based segmentation and thresholding based segmentation in terms of approach and applications.

Open Book Exam Questions

1. Consider the sub-image given below to perform histogram equalization, then compress the equalized image using Huffman coding to calculate average code length and compression ratio.

4	4	4	4	4
3	4	5	4	3
3	5	5	5	3
3	4	5	4	3
4	4	4	4	4

2. There are a number of image distortions or degradations from which we may wish to recover or restore the original image. In particular, four particularly common degradation / restoration problems are:

Degradation	Recovery
Adding Noise	Denoising
Removing Image Pieces	Inpainting
Blurring	Deblurring
Downsampling	Upsampling / Super-resolution

For each of these four problems:

- Describe a context, real-life or otherwise, in which this degradation appears.
- Offer a mathematical formulation of the degradation.
- Briefly describe one or two methods / strategies which are used to solve the recovery

23IT014 Distributed Systems (Elective VI)

3 0 0 3

Course Outcomes

At the end of the course, students will be able to

1. Understand architecture and communication systems in Distributed Systems
2. Understand synchronization and various Distributed File Systems in Distributed Systems
3. Analyze Distributed Mutual Exclusion and Domain Name System
4. Recognize Inter Process Communication and Distributed Objects in Distributed Systems
5. Understand various types of Distributed Systems
6. Use and apply important methods in distributed systems to support scalability and fault tolerance

CO - PO Mapping

COs	PO ₂	PO ₇	PO ₁₂
1	3	2	2
2	3	2	2
3	3	2	2
4	3	2	2
5	3	1	2
6	1	1	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Syllabus

Unit I

12 Hours

Characterization of Distributed Systems:

Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges. System Models: Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

Beyond the Syllabus: Communication between Distributed Objects- Object Model, Distributed Object Model

Unit II

12 Hours

Time and Global States:

Introduction, Clocks Events and Process States, Synchronizing Physical Clocks, Logical Time and Logical Clocks. Coordination and Agreement: Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication. Distributed File Systems: Introduction, File Service Architecture, Case Study 1: Sun Network File System, Case Study 2: The Andrew File System. Name Services: Introduction, Name Services and the Domain Name System, Directory Services, Case Study of the Global Name Services

Beyond the Syllabus: Distributed Debugging, Consensus and Related Problems, , Global States.

Unit III

12 Hours

Inter Process Communication:

Introduction, The API for the Internet Protocols, External Data Representation and Marshalling, Client-Server Communication, , Case Study: IPC in UNIX.

Distributed Objects and Remote Invocation: Introduction, Communication between Distributed Objects, Remote Procedure Call, Case Study: JAVA RMI.

Beyond the Syllabus: Group Communication, Events and Notifications

Unit IV

12 Hours

Transactions and Concurrency Control:

Introduction, Transactions, Nested Transactions, Locks, Optimistic Concurrency Control, Comparison of Methods for Concurrency Control. Distributed Transactions: Introduction, Flat and Nested Distributed Transactions, Atomic Commit Protocols, Concurrency Control in Distributed Transactions, Distributed Deadlocks.
Beyond the Syllabus: Timestamp Ordering, Transaction Recovery.

Total: 48 Hours

Textbook (s)

1. Distributed Systems, Concepts and Design, George Coulouris, J Dollimore and Tim Kindberg, Pearson Education, Edition. 2009.

Reference (s)

1. Distributed Systems, Principles and Paradigms, Andrew S. Tanenbaum, Maarten Van Steen, 2nd Edition, PHI.
2. Distributed Systems, An Algorithm Approach, Sukumar Ghosh, Chapman&Hall/CRC, Taylor & Francis Group, 2007.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	30	10	--
Apply	30	30	40
Analyze	10	20	30
Evaluate	10	20	30
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)

Remember

1. Define distributed systems?
2. Define System model
3. Define Name spaces

Understand

1. Explain the Communication between distributed objects
2. Explain the Differences between intranet and internet
3. Explain the various challenges of distributed systems
4. Explain in detail about the various system models

Apply

1. Discuss about the distributed file system
2. Describe about the client server communication.

Analyze

1. Detail about Remote Procedure call with a case study
2. Detail about Events and Notifications

Open Book Exam Questions

1. How does a server know that one of his remote objects provided by him is no longer used by clients and can be collected? How does Java RMI handle this problem and what alternatives are there?
2. Activation is a technology used to load remote objects into a server on demand (i.e. when a client invokes a method on this object. Explain why this is much better than pre-loading remote objects?
3. De-activation is a technology used to preserve server resources where a server which provides remote objects to clients can de-activate those remote objects, e.g. if they haven't been used for a while. Clients should not know about this. What must the server do to avoid surprises for the clients?

Course Outcomes

1. Understand the various challenging issues of wireless Ad hoc networks
2. Apply the MAC protocols using reservation and scheduling mechanism
3. Apply the routing protocols and transport layer protocol using various TCS mechanism in wireless Ad hoc networks
4. Understand the issues of MAC and network layer solution to provide quality of service
5. Understand the significances of various battery management schemes for wireless Ad hoc networks
6. Analyze the security requirements and secure routing in wireless Ad hoc networks

CO – PO Mapping

COs	PO1	PO2	PO3	PO6	PO7	PO10
1	3	2	1	2	1	2
2	3	3	2	1	2	1
3	3	3	3	2	3	1
4	3	3	2	2	1	2
5	3	3	2	1	1	2
6	3	2	3	3	3	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**UNIT I****12 Hours**

Wireless Ad Hoc Networks: Introduction, Properties, applications, limitations, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet. **MAC Protocols:** Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms.

Contention – Based MAC Protocols with Scheduling Mechanisms

UNIT II**12 Hours**

Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Proactive/ Table-Driven Routing Protocols, Reactive/ On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols, Power – Aware Routing Protocols. **Transport Layer:** Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks.

Other Transport Layer Protocol for Ad Hoc Wireless Networks.

UNIT III**12 Hours**

Quality of Service: Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks. **Energy Management:** Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Ad Hoc Wireless Networks, Battery Management Schemes, Transmission Power Management Schemes.

System Power Management Schemes.

UNIT IV**12 Hours**

Security Protocols: Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

Wireless Sensor Networks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, Location Discovery.
Quality of a Sensor Network, Evolving Standards, Other Issues

Total: 48 Hours

Textbook (s)

1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI.
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control - Jagannathan Sarangapani, CRC Press

Reference (s)

1. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer.
2. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,First ed. Pearson Education

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	50	
Understand	35	30	
Apply	25	20	20
Analyze	--	--	20
Evaluate	--	-	60
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)

Remember

1. Find out the major significance of cellular wireless networks and Ad hoc wireless networks.
2. List few latest application systems of Ad hoc wireless networks.
3. Identify the challenging issues in Ad hoc network configuration and maintenance.
4. Show the proactive steps to solve the hidden terminal problem.
5. List the transmission impediments of wireless channel.
6. List the issues that affect the design deployment and performance of ad hoc wireless system.
7. List the benefits when deployment of a commercial ad hoc wireless networks compared to wired network

Understand

1. Summarize the issues that affect the deployment and performance of ad hoc wireless system.
2. Outline the benefits when deployment of a commercial ad hoc wireless networks compared to wired network.
3. Compare Ad-hoc Networks and Wireless LAN.
4. Compare the efficiency of the packet queuing mechanism adopted in MACA and MACAW.
5. Relate contention based protocols with reservation mechanism and contention based protocols with scheduling mechanism by means of packet delivery, reception and acknowledgement ratio.

Apply

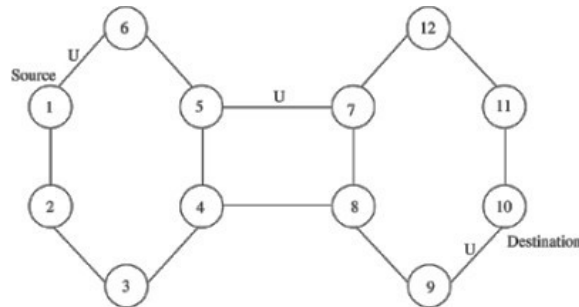
1. Calculate the maximum achievable data rate over a 9 KHz channel whose signal to noise ratio is 20dB.
2. Think of four scenarios where wireless networks can replace wired networks in order to improve the efficiency of people at their workplace. Briefly describe how in each case a wireless network will fit the role better than a wired network.
3. Determine the transfer time of a 22 KB file with a mobile data network (a) with a transmission rate of 10 Kbps and (b) repeat the same for 802.11 WLAN operating at 2 Mbps. (c) What is the length of the file that WLAN can carry in the time that mobile data service carried a 20 KB file? (d) What do you infer from the answers to the above questions?

Analyze

1. Discuss the deployment scenarios for various HIPERLAN standards in the ETSI BRAN system.
2. Compare the EY-NPMA and the CSMA/CA mechanisms.
3. In the serial communications, the baud rate of transmission is specified. Legacy applications on Bluetooth devices specify the baud rate. In the case of the old serial communications, the data rate is the specified baud rate, but in the case of Bluetooth serial communications, it is not so. Why?

Open Book Exam Questions

1. Consider the topology given in below to simulate DSR, SSA, and ABR protocols for path establishment from node 1 to node 10, find the paths found and the ratio of the number of *Route Request* packets sent in the network. (Links labeled "U" refer to unstable ones.)



2. Justify whether the LCC algorithm (when run consistently with node degrees or node IDs) give a deterministic result? If so, prove the above fact. Otherwise, give a counter-example.
3. Critique on how content-based multicasting (CBM) could be advantageous or disadvantageous as far as the bandwidth utilization of the network is concerned.
4. Discuss how network security requirements vary in the following application scenarios of ad hoc wireless networks:
 - A. Home Network
 - B. Classroom Network
 - C. Military Network
 - D. Emergency Search and Rescue Network
5. Discuss how security provisioning in ad hoc wireless networks differs from that in infrastructure-based networks?

23CS015 Software Project Management (Elective VI)

3 0 0 3

Course Outcomes

At the end of the course, students will be able to

1. Explain the concepts and issues of Software Project Management
2. Illustrate various Software Architectures
3. Classify Software Risks and Risk Management Strategies
4. Design effective software development model to meet organizational needs
5. Experiment with appropriate methodologies to develop a project schedule
6. Experiment with appropriate techniques to assess ongoing project performance

CO-PO Mapping

COs	PO1	PO2	PO3	PO11	PO12	PS02
1	3	2	2	2	2	2
2	3	2	2	2	2	3
3	3	2	2	2	2	3
4	3	2	3	2	2	3
5	3	2	3	3	2	3
6	3	2	3	3	2	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

12 Hours

Conventional Software Management: The Waterfall Model, Conventional Software Management Performance. **Transition:** The principles of conventional software Engineering, Principles of Modern software management, transitioning to an iterative process.

Evolution of Software Economics: Software Economics, Software Cost Estimation. **Improving Software Economics:** Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation, Achieving Required Quality, Peer Inspections. *Software Development Phases, Procedural vs Object Oriented Paradigm.*

Unit II

12 Hours

Life Cycle Phases: Engineering and Production Stages, Inception, Elaboration, Construction, Transition Phases.

Artifacts of Software Process: The Artifact Sets, Types of Artifacts.

Software Architectures: A Management Perspective and Technical Perspective,

Workflows of the process: Software Process Workflows, Iteration Workflows.

Off-the-Shelf Components, Requirement Specification Document, Methods of Specification.

Unit III

12 Hours

Checkpoints of the Process: Major Milestones, Minor Milestones, Periodic Status Assessments.

Iterative Process Planning: Work breakdown Structures, Planning Guidelines, Cost and Schedule Estimating process, Iteration Planning Process.

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, Evolution of Organizations.

Process Automation: Automation Building Blocks, The Project Environment.

CASE Tools for Requirements Specification, Planning and Estimation, Pragmatic Planning.

Unit IV

12 Hours

Project control and Process Instrumentation: The Seven Core Metrics, Management Indicators, Quality Indicators, Life Cycle Expectations, Pragmatic Software Metrics, Metrics Automation, Tailoring the Process.

Future Software Project Management: Modern Project Profiles, Next Generation Software Economics, The Cost Estimation Models: Function Point Analysis, SLOC, Basic COCOMO.

Textbook (s)

1. Walker Royce, "Software Project Management – A UnifiedFramework", 1stEdition, Pearson Education, 2005.
2. PankajJalote, "Software Project Management in Practice", 1stEdition, Pearson Education, 2002.

Reference (s)

1. Bob Hughes, "Mike Cotterell, Rajib Mall, Software ProjectManagement", 5thEdition, McGraw-Hill Higher Education, 2011.
2. Joel Henry, "Software Project Management", 1st Edition, Pearson Education, 2004.
3. Norman E. Fenton, Shari Lawrence Pfleeger, "Software Metrics: A Rigorous and Practical Approach ", 1st Edition, PWS Publishing Company, 1997.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	30	--
Understand	40	40	--
Apply	20	30	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. Define Software Process
2. List the phases of Software Development.
3. What is an Artifact?
4. What is Process Automation?

Understand

1. Explain various formal methods of specification.
2. Explain COCOMO II Model.
3. Explain Critical Path Methods to schedule a software project.

Apply

1. Identify the amount of Information need to present in a page.
2. Organize the different Software tool specification methods.
3. Assume that the size of an organic type software product has been estimated to be 32,000 lines of source code. Assume that the average salary of software engineers be Rest. 15,000/- per month. Determine the effort required to develop the software product and the nominal development time.

Open Book Questions

1. Calculate the effort and development time for the model related to your mini-project which was developed in previous semester using COCOMO basic cost estimation model. (Take your mini-project size in KLOC) [APPLY]
2. Analyze your mini-project with respect to changes using Type 0, Type 1, Type 2, Type 3 & Type 4 categories. [APPLY]

23CS014 Green Computing (Elective VIII)

0 0 0 3

Course Outcomes

At the end of the course, students will be able to

1. Understand green IT with its different dimensions and strategies.
2. Analyze green devices and hardware along with its green software methodologies.
3. Examine the green IT standards for enhancing environmental sustainability.
4. Analyze the various green enterprise activities, functions and their role with IT.
5. Identify the various laws, standards and protocols for regulating green IT.
6. Identify the various key sustainability and green IT trends.

CO – PO Mapping

COs	PO2	PO3	PO6	PO7
1	2	2	3	3
2	3	3	3	3
3	3	3	3	3
4	3	3	3	3
5	2	2	3	3
6	2	2	3	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus

Unit I

12

Hours

Fundamentals

Introduction, Environmental Concerns and Sustainable Development, Environmental Impacts of IT, Green IT, Holistic Approach to Greening IT, Greening IT, Applying IT for enhancing Environmental Sustainability, Green IT Standards and Eco-Labeling of IT.

Enterprise Green IT strategy, Green IT: Burden or Opportunity?

Unit II

12

Hours

Green Devices and Hardware with Green Software

Green Devices and Hardware: Introduction, Life Cycle of a device or hardware, Reuse, Recycle and Dispose. Green Software: Introduction, Energy-saving software techniques, Evaluating and measuring software Impact to platform power.

Research the sustainability of paper use in an organization.

Unit III

12

Hours

Green Enterprises and the Role of IT

Introduction, Organization and Enterprise Greening, Information systems in Greening Enterprises, Greening Enterprise: IT Usage and Hardware, Inter-Organizational Enterprise activities and Green Issues, Enablers and making the case for IT and Green Enterprise.

Analyze an organization's IT sustainability.

Unit IV

12

Hours

Managing and Regulating Green IT

Introduction, Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication and Social media.

Laws, Standards and Protocols: Introduction, The regulatory environment and IT manufacturers, Non regulatory government initiatives, Industry associations and standards bodies.

Green building standards, Green data centers, Social movements and Greenpeace.

Textbook (s)

1. Harnessing Green IT Principles and Practices , San Murugesan, G.R. Gangadharan, Wiley Publication, ISBN:9788126539680,2012.

Reference (s)

1. Foundation of Green IT, Marty Poniatowski, Prentice Hall Publication, ISBN:9780137043750,2009.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	30	30	--
Apply	30	30	50
Analyze			50
Evaluate			--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)**Remember**

1. Define Green IT
2. Define Green Software

Understand

1. Explain the Life Cycle of a Green device or hardware.
2. Illustrate the concept of process re-engineering in a simple way from a green perspective.

Apply

1. Identify the several key standards for process and product of Green IT.
2. Apply ERP system with modules and relationships in any recent trend.

Analyze

1. Analyze and give recommendations on how green strategies can be implemented in Homes to make a greener world. Explain about the same in your perspective.
2. Classify the major categories of information systems within an organization? Provide examples of greening enterprise activities at each level.

Evaluate

1. Recommend with a case study to depict the ways in which a green enterprise transformation (GET) can be applied for a service organization. For the selected service organization, briefly explain the following:
 - i) the practical aspects of a preliminary green IT audit.
 - ii) the green business objectives.
 - iii) a high-level SWOT analysis from a GET perspective.
2. Choose the UML diagrams to present the following models of green information systems:
 - i) use case diagram for "emissions benchmark maintenance".
 - ii) state machine diagram for "class-emission report".

Open Book Exam Questions

1. What is the meaning of Green Computing, gather statistics, or develop a list of ways to practice green computing; now expand the discussion to determine if Green Computing is possible, if it can make a difference, or if it is a marketing term used by large organizations in today's environmentally friendly society.
2. "Green computing or green IT is the study and practice of environmentally sustainable computing or IT"
 - i. In your own words, explain the term Green IT.
 - ii. Summarise the challenges in making Green IT a reality. Consider environmental factors such as political, economic, social, technological, legal and ecological in your answer.
 - iii. Cite 2 examples of success stories on Green IT. Evaluate if the same effort is achievable in your origin country.

Course Outcome:

At the end of the course students are able to:

1. Understand the catalogue of design patterns
2. Exemplify the appropriate pattern to solve object oriented design problems using design patterns
3. Identify design solution using creational patterns
4. Apply structural patterns to solve design problems.
5. Design solutions by using behavioural patterns.
6. Use various design patterns for the Pattern Community

COs-POs Mapping:

COs	PO ₂	PO ₃	PO ₅
1	3	3	1
2	2	2	1
3	3	3	2
4	2	2	1
5	3	2	2
6	3	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12 Hours**

Introduction: What Is a Design Pattern? Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

Unit II**12 Hours**

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns. Structural Pattern Part-I: Adapter, Bridge, Composite.

Unit III**12 Hours**

Structural Pattern Part-II: Decorator, Façade, Flyweight, Proxy. Behavioral Patterns Part-I: Chain of Responsibility, Command, Interpreter, Iterator

Unit IV**12Hours**

Behavioral Patterns Part-II: Mediator, Memento, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns: A Brief History, the Pattern Community an Invitation, A Parting Thought.

Total: 48 Hours**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Test (%)
Remember	20	20	--
Understand	35	35	--
Apply	25	25	50
Analyze	20	20	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Text Book:

1. Erich Gamma, Design Patterns, Pearson Education, 2015

Reference Books:

1. Mark Grand, Pattern's in JAVA Vol-I, Wiley Dream Tech, 1998
2. Mark Grand, JAVA Enterprise Design Patterns Vol-III, Wiley Dream Tech.2001
3. Eric Freeman, Head First Design Patterns, Oreilly-SPD, 2004
4. Alan Shalloway, Design Patterns Explained, Pearson Education, 2004

Remember

1. Define Prototype
2. Define Decorator pattern

Understand

1. List the Related patterns of Observer
2. Define Intent of State Pattern
3. Explain about motivation, Structure, Participants and consequences of Observer pattern
4. Explain about motivation, Structure, Participants and consequences of Mediator pattern

Apply

1. Identify all the Participants for Proxy Pattern.
2. Develop the Motivation, Structure, Collaborations and Implementation of Prototype and Singleton Pattern
3. Develop the Intent, Applicability, Sample code, and Known uses of the Factory Method

Analyze

1. Formulate the benefits of design Patterns to the Young Designers
2. Formulate Pattern community features
3. Analyze the Flyweight pattern in detail

23IT016 Professional Ethics (Elective VIII)

0003

Course Outcomes

At the end of the course, students will be able to

1. Understand the importance of ethics in person and IT environment
2. Infer selective strategies for managing security vulnerabilities and action plan on security incident.
3. Explain the laws and regulations that pertain to data protection
4. Examine specific aspects of Intellectual Property and Rights.
5. Interpret and analyse the concepts of intellectual property and ethical issues of software manufacturers
6. Analyze the ethical implications of social networking and impact of IT on living.

CO – PO Mapping

COs	PO1	PO6	PO8	PO12
1	2	3	3	3
2	2	2	2	3
3	2	3	3	3
4	3	2	3	2
5	2	3	3	3
6	3	2	3	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus

Unit I

12 Hours

An Overview of Ethics and Ethics for IT Professional and IT Users

ETHICS: Definition of Ethics, The Importance of Integrity, The Difference Between Morals, Ethics, and Laws ,Ethics in the Business World ,Why Fostering Good Business Ethics Is Important, Improving Corporate Ethics Creating an Ethical Work Environment ,Including Ethical Considerations in Decision Making .

Ethics for IT Workers and IT Users

IT Professionals, The Changing Professional Services Industry, Professional Relationships That Must Be managed, Professional Codes of Ethics, Professional Organizations, Certification, Government Licensing, IT Professional Malpractice, IT Users, Common Ethical Issues for IT Users .

Ethics in Information Technology, Supporting the Ethical Practices of IT Users

Unit II

12 Hours

Computer, Internet Crime and Privacy

IT Security Incidents: A Major Concern, Why Computer Incidents Are So Prevalent, Types of Exploits, Types of Perpetrators , Implementing Trustworthy Computing ,Risk Assessment ,Establishing a Security Policy ,Educating Employees, Contractors, and Part-Time Workers , prevention ,Detection , Response.

Privacy: Privacy Protection and the Law, Information Privacy, Privacy Laws, Applications, and Court Rulings, Key Privacy and Anonymity Issues, Identity Theft, Consumer Profiling, Treating Consumer Data Responsibly Workplace Monitoring.

Federal Laws for Prosecuting Computer Attacks, Advanced Surveillance Technology

Unit III

12 Hours

Intellectual Property:

Intellectual Property definition, Copyrights ,Copyright Term ,Eligible Works Fair Use Doctrine ,Software Copyright Protection ,The Prioritizing Resources and Organization for Intellectual Property (PRO-IP) Act of 2008 ,General Agreement on Tariffs and Trade (GATT) ,The WTO and the WTO TRIPS Agreement (1994) ,The World Intellectual Property Organization (WIPO) Copyright Treaty (1996) ,The Digital Millennium Copyright Act (1998) , Patents ,Software Patents ,Software Cross-Licensing Agreements , Defensive Publishing and Patent Trolls , Submarine Patents and Patent Farming .

Key Intellectual Property Issues: Plagiarism, Reverse Engineering, Open Source Code, Competitive Intelligence.

Software Development: Strategies for Engineering Quality Software, the Importance of Software Quality, Software Product Liability, Key Issues in Software Development, Development of Safety-Critical Systems, Quality Management Standards.

ACM code of ethics and professional conduct

Unit IV

12 Hours

Social Networking

What Is a Social Networking Web Site? ,Business Applications of Online Social Networking ,Social Network Advertising ,The Use of Social Networks in the Hiring Process ,Social Shopping Web Sites ,Social Networking Ethical Issues ,Cyberbullying, Cyber stalking, Encounters with Sexual Predators, Uploading of Inappropriate Material.

The Impact of Information Technology on Productivity and Quality of Life

The Impact of IT on the Standard of Living and Worker Productivity ,IT Investment and Productivity ,The Digital Divide ,The Impact of IT on Healthcare Costs ,Electronic Health Records, Use of Mobile and Wireless Technology in the Healthcare Industry ,Telemedicine ,Medical Information Web Sites for Laypeople.

Online Virtual Worlds, Crime in Virtual Worlds, Educational and Business Uses of Virtual Worlds

Total: 48 Hours

Textbook (s)

1. George W Reynolds, "Ethics in Information Technology," 5th Edition, Cengage Learning US, 2015,

Reference (s)

1. Deborah G. Johnson, "Computer Ethics," 3rd Edition, Prentice Hall, 2001,
2. Sara Base, A Gift of Fire: Social, Legal and Ethical Issues, for Computing and the Internet," 4th Edition, Pearson Edition 2012

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	50	40	30
Apply	10	10	30
Analyze	--	10	20
Evaluate	--	--	20
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)

Remember

1. Name the qualities of a self-confident people.
2. Define risk benefit analysis.
3. State the importance of whistle blowing.
4. Write the important aspects of technology transfer.
5. List the condition involved in valid informed consent.
6. Mention various types of vulnerabilities.

Understand

1. Generalize the term 'self-confidence'.
2. Illustrate empathy.
3. Discuss caring and sharing in brief.
4. List out the civic virtues.
5. Describe the importance of ethics in engineering field.
6. Identify the importance of service learning.
7. Discuss the criteria required for a profession.

Apply

1. Explain the scope of engineering ethics.

2. Explain the skill needed to handle the problems about the moral issues in engineering ethics.
3. Discuss the different models of professional roles.
4. Discuss the importance of duties ethics and virtues in engineering profession.
5. Give the code of ethics played by the Institute of Electrical and Electronics Engineers. Discuss in detail
6. Give the criteria that help to ensure a safety design.
7. Illustrate the ethical theories for right-action, self-interest and duty ethics.

Analyze

1. Identify the categories of Risk.
2. Find out three conditions referred as safe exit.
3. Are the engineers possible to educate the public for safe operation of the equipment? If so, discuss with suitable instance.
4. Compare and contrast the engineering equipment with standard experiments.
5. Take apart the effect of information on risk assessment.
6. Investigate on safety measures. Explain the safety measures considered in Net Banking Systems.

23FIX01 Full Semester Internship

0009

At the end of the Full Semester Internship the students are able to

1. Use the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. Select appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
4. Use ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
5. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
6. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	3												3	3
C02		3											3	3
C03					3								3	3
C04								3						
C05									3					
C06										3				