

**Curriculum  
2019**

**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 JNTU Kakinada, AP)  
NBA Accredited and NAAC Accredited




# Academic Regulations

AR 19

## Undergraduate Programs

Version 5.0



**GMR Institute of Technology**  
Rajam 532 127, Andhra Pradesh  
Accredited by NAAC & NBA  
[www.gmrit.org](http://www.gmrit.org)

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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 2019 – 2020 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 vide G.O No.52

- 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
  - ❖ Under Category A: 70% of the seats are filled through EAMCET counseling
  - ❖ Under Category B: 30% seats are filled based on 10+2 merits in compliance with guidelines of APSCHE
- b. Admission eligibility-Under Lateral Entry Scheme

Students with diploma qualification have an option of direct admission into 2<sup>nd</sup> 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 ECET. 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 minimum of 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 schedules 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:

- a. Pursues a course of study in not less than four and not more than eight academic years
- b. 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
- c. Registers for 164 credits and must secure all the 164 credits
- d. A student shall be eligible for the award of B.Tech degree with Honours or Minors degree if he/she earns 20 credits in addition to the 164 credits
- e. A student shall be permitted to register for Honours or Minors and not for both

#### 4. Branches of Study

##### B. Tech. Programmes

- I Chemical Engineering (CHE)
- II Civil Engineering (CE)
- III Computer Science and Engineering (CSE)
- IV Electrical and Electronics Engineering (EEE)
- V Electronics and Communication Engineering (ECE)
- VI Information Technology (IT)
- VII Mechanical Engineering (ME)

#### 5. Program Structure & Curriculum Framework

The curriculum of B. Tech. program has different categories of courses. For a total of 164 credits the indicative credit distribution among these categories is listed in table below for all the programs

S. No.	Categories of Courses	Credits
1	Basic Science & Humanities	25.5
2	Engineering Science	19.5
3	Professional Core	61
4	Professional Core Electives	16
5	Open Electives	12
6	Integrated and Skill	7
7	Internships and Seminar	15
8	Project	8

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 bases on their interest/career path spanned across 5<sup>th</sup> to 8<sup>th</sup> 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. 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 to make the students to learns the concepts in theory classes and given an opportunity to implement them in the laboratory apart from also learning new things by doing
- b. **Mini project:** The curriculum offers Mini Projects for the students during 6<sup>th</sup> 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 the 5<sup>th</sup> semester. Every student will take up this either individually or as a batch of maximum 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:** The final year project work shall be carried out either in 7<sup>th</sup> or 8<sup>th</sup> semester based on the choice of the students. 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 project and FSI 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 and the students shall register for one Audit courses in the beginning of 3<sup>rd</sup> semester. The list of the courses will be notified at the beginning of the third semester for all students and the student has to choose one audit course under self-study mode.

All the students (regular and lateral entry students) shall complete the audit course similar to other regular courses and the results will be indicated with “Satisfactory” (40% of the total marks) or “Not Satisfactory” performance

- f. MOOCs and Self-Study Courses:** 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 the attendance is not mandatory. The courses shall be opted from MOOCs platform viz. NPTEL, SWAYAM or any other platforms as approved by the respective Board of Studies (BoS).

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, the evaluation and assessment of MOOCs for B. Tech. (Honours) shall be in line with the assessment platforms offering these courses. Further, if the grade is not specified by the particular platform, the office of CoE shall follow the institutional SOP for the award of the grade

- 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 4<sup>th</sup> semester. This summer internship programme shall be availed to a maximum duration of 6 weeks and the assessment shall be carried out in the very beginning month of the 5<sup>th</sup> semester with both internal and external experts and will be accounted for the calculation of CGPA. Students can also choose Community Engagement to take field related projects.

- 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 which are very much needed for skill up gradation. Assessment shall be carried out in the very beginning month of the 7th semester with both internal and external experts and will be accounted for the calculation of CGPA.
- h. Employability Skills:** It is mandatory for all students to take a course on Employability Skills from 3<sup>rd</sup> Semester to 6<sup>th</sup> 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 **4<sup>th</sup> and 6<sup>th</sup> 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.
- i. 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 and will not be taken into account for CGPA calculation. However, the student can compensate four 1-credit courses to a 4-credit course which is over and above for those students who have registered for B. Tech. (Honours). If a student does not successfully complete the registered course under this category in a semester at its first attempt, the registration of the course will be cancelled automatically. Further it will not be treated as an arrear and no supplementary examination will be conducted for the course. Alternatively, if he/she wishes, he/she can register for the same course/some other course in the subsequent semesters and successfully complete it as and when offered by the programme
- j. Full Semester Internship (FSI):** Students shall undergo **mandatory FSI programme** at industries during 7<sup>th</sup> or 8<sup>th</sup> semester to get practical insight relevant to their core branch of engineering or in allied branch of study under the guidance of internal and external expert members in the institute and at industries respectively.  
The Institute shall allow approximately 50% of the students to pursue FSI during the 7<sup>th</sup> semester and the rest during 8<sup>th</sup> semester. The student shall register their choice of interest either in 7<sup>th</sup> or 8<sup>th</sup> semester for FSI in the beginning of 5<sup>th</sup> semester with Career Development Cell. The students opting for FSI in 7<sup>th</sup> semester should take up the courses offered in 8<sup>th</sup> semester on self-study mode during the internship period (7<sup>th</sup> semester) and those who undergo FSI in 8<sup>th</sup> semester should take the courses offered in that particular semester on self study mode during the internship period (8<sup>th</sup> semester)
- k. Semester Away Programme (SAP):** In lieu of **FSI**, interested students can have the option of undergoing Semester Away Programme during 7<sup>th</sup> semester with Higher Learning Institutions at Foreign Countries or Institutions of National Repute or Research Organizations in India, by earning necessary equivalent credits subject to the terms and conditions as prescribed by the respective host organization. The student shall acquire 9 credits (three 3-credit courses) at the host institution to compensate the credit requirement for FSI and take up the two electives in self-study mode. The students who are interested to opt for SAP shall register at the beginning of 3<sup>rd</sup> semester and initiate the process with the host institute



**l. 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 5<sup>th</sup> semester onwards. The students can choose any one of these career paths during the V semester and shall continue in the same career path by selecting specific electives in the VI and VII semesters in a sequence and finally leading to a Capstone project aligning with the career path in the VII/VIII 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 5<sup>th</sup> semester and if any student fails to take up the specific electives 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 7<sup>th</sup> semester shall take the respective elective course on self-study mode and further, complete the Capstone project in the 8<sup>th</sup> semester on campus
- In case of the students who are going for FSI in 8<sup>th</sup> semester shall take the respective elective course on self-study mode and further, complete the Capstone project in the 7<sup>th</sup> semester itself
- In case of the students going for FSI as a preplacement offer during 8<sup>th</sup> 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

**m. Language Electives:**

To enable the students to take up foreign languages as a language elective during the 2nd semester, students are provided with an option of selecting any of the foreign languages Viz. French, Spanish, Japanese and German apart from the national language Hindi. All these courses are offered as a language elective during the 2nd semester to prepare them for higher education and compete in the global market. All these courses are offered in Synchronous Online mode of delivery and the assessment will be done in line with the regular theory courses.

**n. Comprehensive Quiz:**

To enable and train the students to appear for the competitive examinations like GATE, Comprehensive quiz will be conducted twice i.e at the end of 4<sup>th</sup> and 6<sup>th</sup> semesters and the assessment will be done for 2 credits each and grade point will be accounted for CGPA calculation.

The Comprehensive Quiz I conducted at the end of 4<sup>th</sup> semester covers all the courses related to the 3<sup>rd</sup> and 4<sup>th</sup> semesters and the Comprehensive Quiz II conducted at the end of 6<sup>th</sup> semester covers all the courses related to 5<sup>th</sup> and 6<sup>th</sup> semesters. Both the Quiz examinations will have MCQ type questions, and an SOP will be issued by CoE for the paper setting and conduct of the quiz.

### 5.1. Basis for Credit Allotment for Courses Offered

S.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	1.0
9	Co- and Extra-curricular Activities (CC&EC)	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 (For every 15hrs of Duration)	-	-	-	1
14	Summer Internship (6 Weeks: Offline/Online)	-	-	-	1.5
15	Full Semester Internship (16 Weeks)	-	-	-	9
16	Comprehensive Quiz	-	-	-	2

### 5.2. Semester-wise curriculum structure

#### Course Structure 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
I	4 Theory	3	16.5
II	4 (3 Theory + 1 Language Elective)	3	16.5
III	7 (4 Theory + 2 Integrated + 1 Audit)	2 + Employability Skills + CCEC	23
IV	5 (4 Theory + 1 Integrated)	2 + Employability Skills + CCEC + Comprehensive Quiz	25
V	6 (2 Theory + 2 Integrated + 1 Professional Elective +1 Open Elective)	1 + Term Paper + Employability Skills + CCEC + Summer Internship #1	24.5
VI	5 (3 Theory + 1 Professional Integrated Elective +1 Open Elective + Audit Course)	1 + Mini Project + Employability Skills + CCEC + Summer Internship #2 + Comprehensive Quiz	26.5
VII	3 (2 MOOCs + 1 Open Elective (MOOCs))	Project	17
VIII	2 (1 MOOCs + 1 Open Elective (MOOCs))	FSI	15
<b>Total Credits</b>			<b>164</b>

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. 131.

### 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 Year		Total credits	Three years		Total credits
		Credits	Courses		Credits	Courses	
1	Theory courses	3	21	63	3	13	39
2	Integrated course	4	5	20	4	5	20
3	Laboratory course	1.5	12	18	1.5	6	9
4	Professional elective	3/4 (7)	4/1 (5)	16	3/4 (7)	4/1 (5)	16
5	Open Elective	3	4	12	3	4	12
6	Employability Skills	3	2	6	3	2	6
F7	CC & EC activities	1	2	2	1	2	2
8	Internship (Summer Internship/FSI)	1.5/9 (10.5)	2/1 (3)	12	1.5/9 (10.5)	2/1 (3)	12
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
12	Comprehensive Quiz	2	2	4	2	2	4
<b>Total</b>		-	<b>59</b>	<b>164</b>	-	<b>45</b>	<b>131</b>

### 5.4 Division of Marks for Continuous and Semester End Assessment

Course	Marks for Continuous Assessment	Marks for Semester end Assessment
Theory	40	60
Integrated Course	40	(60T+30L)
Drawing Courses	25	50
Laboratory	25	50
Term Paper	50	--
Audit Courses	50	--
Mini Project	25	50
Industry Driven Courses (IDC)	25	--
CC & EC	Participation In Activities	50
Employability Skills (AS+SS+DSS)	30+30+30	20+20+20
Full semester Internship	100	100
Project Work	100	100

## 6. Evaluation Methodology

- The assessment will be based on the performance in the continuous assessment & semester-end examinations carrying marks as specified
- At the end of each semester, final examinations will be conducted as per the academic calendar announced from time to time. Supplementary examinations shall also be conducted as per the schedule announced
- Continuous Assessment Marks will be awarded on the basis of Continuous Evaluation made during the semester as per the scheme
- The letter grade and the grade points are awarded based on the hybrid grading system having earned grades and awarded grades as shown below. Earned grades (A+, A & F) are awarded based on the percentage of marks secured and the remaining grades are awarded based on the relative performance and course average marks.

Range of Percentage of Marks	Letter Grade	Qualitative Meaning	Grade Point	Remarks
90-100	A+	Outstanding	10	Earned grade
85-89	A	Excellent	9	
Due to hybrid grading system the ranges of marks may vary for each course based on the courses average and normal distribution of marks	B+	Very Good	8	Awarded grade
	B	Good	7	
	C+	Average	6	
	C	Satisfactory	5	
	D	Pass	4	
< 40 for Theory and < 50 for Lab	F	Fail	0	Earned grade

- 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:

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

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

- In view that Hybrid grading system is adopted for the award of the grade points in each of courses, for the benefit of the students and other stack holders who wish to have an equivalence for the CGPA secured for the graduation, the following empirical relation is provided.

$$\text{Equivalent Percentage: } (CGPA)0.95 \times 10$$

### 6.1 Continuous Assessment Pattern for all courses

#### a. Theory Course:

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

Internal Test 1 & Test 2 will be conducted for 30 Marks (80 % of marks secured in 1<sup>st</sup> best internal tests and 20% marks secured in 2<sup>nd</sup> best internal test)

- 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 25% weight 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, the questions predominantly focusing on Higher Order Thinking Skills. In case, if the course has limited scope of HOTS, assessment shall be carried out with LOTs. This assessment is done strictly following the **process manual** that clearly explains the objectives and guidelines to be followed by both the faculty members and the students. (*Annexure*)

**b. Integrated Course:**

40 marks allotted for continuous assessment as given below:

**Theory Course:**

20 marks will be awarded based on two tests conducted similar to theory (Each Test will be conducted for 40 marks and scale down to 20 marks) as given below:

Internal Test 1 & Test 2: 20 Marks (80 % of marks secured in 1<sup>st</sup> best internal test and 20% marks secured in 2<sup>nd</sup> best internal test)

**Laboratory**

20 marks are awarded for continuous assessment and following is the pattern for the award of 20 marks

Preparation, Observation & Result: 10 Marks

Record : 05 Marks

Internal Test : 05 Marks

External Exam (Lab) : 30 Marks

External Exam (Theory) : 60 Marks

**c. Laboratory Course:**

25 marks are awarded for continuous assessment and following is the pattern for the award of 25 marks

Preparation, Observation & Result: 05 Marks

Record : 05 Marks

Internal Test : 05 Marks

Viva – Voce : 05 Marks

Augmented Experiment : 05 Marks (Laboratory Mini Project)

**Engineering drawing course** is evaluated in line with lab courses and the Pattern of awarding 25 marks for continuous evaluation is as follows

Day-to-day work : 15 marks

Internal test : 10 marks

There shall be two internal tests for 10 marks each during the semester and the average shall be considered

**d. Term Paper:**

Continuous Assessment : 50 Marks

**Distribution**

Literature Survey : 10 Marks

Review 1 : 10 Marks

Review 2 : 10 Marks

Publication/Presentation of Paper : 10 Marks

Final Presentation : 10 Marks (Assessment will be carried out at the end of sixth semester)

**e. Audit Courses:**

Online Objective Test : 50 Marks

**f. Mini Project:**

Continuous Assessment : 25 Marks

**Distribution**

Review 1 : 05 Marks

Review 2 : 05 Marks

Literature Survey : 05 Marks

Final Presentation : 10 Marks

**g. Project:**

Continuous Assessment : 100 Marks

**Distribution**

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:**

Continuous Assessment : 100 Marks

**Distribution**

Internship Progress Report : 10 Marks

On Site Assessment : 15 Marks

Assessment by Industry : 50 Marks  
(Intern Assessment Tool)

Final Assessment on Campus : 25 Marks

Total : 100 Marks

**Distribution**

Project Report : 60 Marks

Final Presentation : 40 Marks

**i. Co-Curricular and Extra Curricular (CCEC) Activities:**

Students shall acquire 1 credit each in 2<sup>nd</sup> and 3<sup>rd</sup> years with the following scheme:

Scheme of evaluation for the CCEC activities:

- No. of slots in each Semester @ 1 slots every week 16
- No. of Streams (1 CC + 1 EC + 1 Community Engagement): 3
- No. of minimum activities allotted for each stream 4

Requirement for the award of Credit

- Students shall choose at least two streams in each semester that are being offered
- Students shall secure an overall attendance of 75% in all events put together and perform in one activity from each of the chosen streams (Total of two events per semester)

The credits earned through these courses will be indicated in the grade memo and will be taken into account for CGPA calculation. For the award of grade point, students need to appear for the final summative assessment in which student will perform in any one of the activities offered by the department and grade point will be awarded through a rubric.

In case, if any student fails to meet the compliance in CCEC activities as stated above, he/she will not be eligible for the final summative assessment and need to attend the make-up classes conducted by the respective department in the following semester and a common schedule for the make-up classes will be notified with a prior notice.

The number of make-up classes/activities to be conducted for each of the semesters will be atleast 35% of the regular activities and students need to perform in at least two activities (one in each stream) per semester and secure 90% of attendance. The student has no flexibility to change the stream after initial registration.

**j. Employability Skills (ES):**

Students shall take this course during from 3<sup>rd</sup> – 6<sup>th</sup> 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 component AS & DSS the students are assessed based on the marks secured in continuous assessment. For SS, the students are assessed based on the attendance for the various activities scheduled. Min. of 16 periods shall be allotted for each stream per semester.

**Assessment for Aptitude Skills**

Continuous Assessment : 30 Marks

End Semester Assessment : 20 Marks

For continuous assessment, tests will be conducted along with midterm examinations. 30 marks will be evaluated by taking into account 80% of marks secured in 1<sup>st</sup> best assessment test and 20% marks secured in 2<sup>nd</sup> best assessment test along with 20 marks for End Semester Assessment in each semester to get qualified.

**Assessment of Soft Skills**

Min of six activities are conducted for SS training in a semester. Assessment for Soft Skill 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.

Continuous Assessment : 30 Marks

End Semester Assessment : 20 Marks

Under continuous assessment, the students will be assessed for the four activities based on this performance for 30M. At the end of the semester every student will be assessed in one of the activities offered by the department for 20M.

**Assessment of Domain Specific Skills**

The Domain specific skill training will be preferably a training program on branch specific Application Software tool. Students need to maintain 75% attendance in the training classes conducted to be eligible for assessment. For continuous assessment, two assessment tests will be conducted along with midterm examinations. 30 marks will be evaluated by taking into account 80% of marks secured in 1<sup>st</sup> best assessment test and 20% marks secured in 2<sup>nd</sup> best assessment test along with 20 marks for End Semester Assessment in each semester to get qualified.

Continuous Assessment : 30 Marks

End Semester Assessment: 20 Marks

After the semester end final assessment in all the three components (AS; SS & DSS) and upon securing the qualifying marks the student will secure 3-credits each at the end of 4<sup>th</sup> and 6<sup>th</sup> semesters. The total cumulative score secured by the student in all the three components in Employability Skills shall be scaled down separately to 100 marks for the calculation of the overall grade point.

In case, a student fails in any of the three skill components (AS/SS/DSS), students need to take the make-up classes wherever needed and take the final assessment as per the schedule announced. The schedule for the make-up classes for SS and AS & DSS End Semester Assessment will be notified. The student registered for make-up classes for SS shall maintain 90% of attendance. The number of make-up classes to be conducted for SS will be at least 35% of regular class work allotted per semester and the students need to attend 2 activities to get qualified in SS.

**k. Industry Driven One Credit Courses:**

Online Objective Test : 25 Marks

**Grading:**

Marks  $\geq$  20 : Very Good (A grade)

Marks  $<$  20 and  $\geq$  15 : Good (B grade)

Marks  $<$  15 and  $\geq$  10 : Satisfactory (C grade)

Marks  $<$  10 : Course registration gets cancelled



**I. Summer Internship #1:**

<b>Total Assessment</b>	: 100 Marks
Distribution	
Assessment by Industry Experts	: 30 Marks (Once in 3 weeks, Mode of assessment- Rubrics)
Report Writing	: 30 Marks
Presentation & Viva Voce	: 40 Marks
Distribution	
Technical Knowledge	: 10 Marks
Communication & Articulation	: 10 Marks
Presentation Skills	: 10 Marks
Viva Voce	: 10 Marks

**Summer Internship #2:**

Students shall appear for three continuous assessments which are spanned across 6 weeks of internship duration, preferably once in two weeks. The continuous assessment will be either with Subject Matter Experts (SMEs) or with Internal Experts depending on the feasibility at the time of assessment. Each online assessment will be having a combination of Multiple Choice Questions (MCQs), Snippets, Debugging and Computer Coding for a maximum of 100 Marks. At the end of the final continuous assessment, the average of the three continuous assessments will be taken as the final score for the calculation of CGPA as per the norms of autonomous regulation for the award of the grade

**m. Comprehensive Quiz:**

The test will be conducted for 100 marks and scaled down to 50 marks and the online examination will consist of 100 multiple choice questions for which 100 marks will be awarded and further it will be scaled down to 50 marks. The student needs to secure 40% of marks to clear the examination

**6.2 Performance Audit Committee**

The Performance Audit Committee is constituted by Internal Quality Assurance Cell comprising of the course coordinators/course faculty members and programme coordinator. This committee shall review the attainment of Course Outcomes and Program Outcomes, progress and status of the students of the semester concerned at the beginning and end of the semesters. The committee may invite faculty mentors and students as invitees and suggest appropriate solutions to ensure continuous improvement in the learning outcomes across all semesters.

**7. Attendance Requirements**

- 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. Condonation fee as fixed by the college for those who put on attendance between  $\geq 65\%$  and  $<75\%$  shall be charged before the 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) In case of the student having less than 65% of attendance in any of the courses during that particular semester, he/she will not be permitted to appear for that particular course in that particular semester end examinations. In such cases, the students need to register makeup classes which will be notified by the CoE office after the completion of that particular semester or at appropriate time whichever is applicable. The students need to secure 90% of the attendance in the make-up classes to appear for the supplementary examinations thereafter and this 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 that particular course
- e) His / her academic progress and conduct have been satisfactory

### 8. Promotion Policies

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

### 9. Graduation Requirements

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

- ❖ Student shall secure 164 credits for regular B. Tech. Programme and 131 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 164 credits within eight consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0 shall forfeit his/her degree and his/her admission stands cancelled
- ❖ A student of a lateral entry Programme who fails to earn 131 credits within six consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0 shall forfeit his/her Degree and his/her admission stands cancelled

#### b) Award of degree:

Classification of degree will be as follows:

- i. CGPA  $\geq$  8.0 + No history of arrears +20 addl. Credits : Degree with Honours  
(20 credits shall be earned through core domain courses)
- ii. CGPA  $\geq$  8.0 + No history of arrears +20 addl. Credits : Degree with Minor  
(20 credits shall be earned through inter-disciplinary courses)
- iii. CGPA  $\geq$  7.5 : Degree with Distinction
- iv. CGPA  $\geq$  6.5 and  $<$  7.5 : Degree with First Class
- v. CGPA  $\geq$  5.0 and  $<$  6.5 : Degree with Second Class
- vi. CGPA  $\geq$  4.0 and  $<$  5.0 : Degree with Pass Class

- ❖ **First Class with Distinction:** A candidate who qualifies for the award of the Degree (vide clause 8 (a)) having passed all the courses of study of all the eight semesters (six semesters for lateral entry candidates) at the first opportunity, 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**. For this purpose, the withdrawal from examination (vide clause 9) will not be construed as an opportunity for appearance in the examination
  - ❖ **First Class:** A candidate who qualifies for the award of the Degree (vide clause 8 (a)) having passed all the courses of study of all the eight semesters (six semesters for lateral entry candidates) within maximum period of ten consecutive semesters (eight consecutive semesters for lateral entry candidates) after the commencement of his/her study and securing a CGPA of 6.5 and above shall be declared to have passed in **First Class**
  - ❖ **Second Class:** A candidate who qualifies for the award of the Degree (vide clause 8 (a)) having passed all the courses of study of all the eight semesters (six semesters for lateral entry candidates) within maximum period of ten consecutive semesters (eight consecutive semesters for lateral entry candidates) after the commencement of his/her study and securing a CGPA of 5.0 and above shall be declared to have passed in **Second Class**
  - ❖ **Degree with Pass Mark:** All other candidates who qualify for the award of the degree shall be declared to have passed in Degree with Pass Mark
  - ❖ **Degree with Honours:** The students can register for Honours Degree or Degree with Minors by earning additional 20 credits over and above the credit requirement of B. Tech. (Regular) Degree Programme and also maintain minimum of 8 CGPA at the time of graduation clearing the courses in single attempt
- c) **Grafting:** In order to extend the benefit to the students with one/ two backlogs after either 6<sup>th</sup> semester or 8<sup>th</sup> semester, GRAFTING option is provided to the students enabling their placements and fulfilling graduation requirements. Following are the guidelines for the Grafting:
- ❖ Grafting will be done among the courses within the semester. A maximum of 7 marks shall be drawn from any one of the cleared courses in the semester and will be grafted to the failed course in the same semester
  - ❖ Students shall be given a choice of grafting only once in the 4 years Programme, either after 6<sup>th</sup> semester (Option#1) or after 8<sup>th</sup> semester (Option#2)
  - ❖ Option#1: Applicable to students who have maximum of TWO theory courses in 5<sup>th</sup> and/or 6<sup>th</sup> semesters
  - ❖ Option#2: Applicable to students who have maximum of TWO theory courses in 7<sup>th</sup> and/or 8<sup>th</sup> semesters
  - ❖ Eligibility for grafting:
    - i. Prior to the conduct of the supplementary examination after the declaration of the 6<sup>th</sup> or 8<sup>th</sup> semester results
    - ii. 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
    - iii. The marks obtained by her/him in latest attempt shall be taken into account for grafting of marks in the failed course(s)

- d) Betterment Chance:** Student who clears all the subjects up to 6<sup>th</sup> semester and wish to improve their CGPA can register and appear for one betterment chance for maximum of any five theory courses up to 6<sup>th</sup> semester. Betterment chance can be availed along with 7<sup>th</sup> and 8<sup>th</sup> semester examinations
- e) Quick Supplementary Examination:** Student shall appear for Quick Supplementary Examination (immediately after the completion of 8<sup>th</sup> semester) to clear the failed courses of 8<sup>th</sup> semester
- f)** All the candidates who register for the semester end examination will be issued 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

#### **10. Flexibility to Add or Drop Courses Self Study Courses (SSC)**

- a.** It is mandatory that all the students need to earn the minimum number of credits (as per clause 8) for the award of B. Tech. degree in their respective disciplines. However, a student can earn more number of credits if he/she opt, by registering one additional course, from the list of courses available in the curriculum of all disciplines, over and above to the existing courses from 4<sup>th</sup> semester to 6<sup>th</sup> semester
- b.** The student shall be permitted to drop any SSC at any point of time and registration for such courses will gets cancelled and it will not be reflected Cumulative Grade Memo (CGM)
- c.** All the courses registered and cleared by a student in this mode will be mentioned in the CGM as additional acquired. However, the CGPA is calculated for the 164/131 credits only (as mentioned in the clause 8)

#### **11. Withdrawal from the Examination**

- a.** A candidate may, for valid reasons, be granted permission by the Principal 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. Also, only ONE application for withdrawal is permitted for that semester examination in which withdrawal is sought.
- b.** In case of students who are attending NCC activities and the dates get overlapped with the examination schedule, the student shall be given a special examination/test and shall be treated as first attempt
- c.** Withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination and if it is made prior to the commencement of the examination in that course or courses and also recommended by the Head of the Department
- d.** Such withdrawal from the examination shall be treated as absent for the 1<sup>st</sup> attempt to the respective examination and will lose the eligibility for First Class with Distinction
- e.** If any student is intended to drop FSI subsequent to his/her registration followed by allotment, he/she needs to re-register the course
- f.** In case, if any student has not registered for FSI course either in 7<sup>th</sup> or 8<sup>th</sup> semester and he/she has a mandate requirement of internship as a part of pre-placement offer (PPO), he can take up the courses in the respective semester on self study mode
- g.** If any student withdraws from FSI course after the stipulated period mentioned in the clause 10d, he/she will be considered as detained from the semester. He/she needs to register for the semester in the next academic year

**12. 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 3<sup>rd</sup> 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 3<sup>rd</sup> semester shall be treated at par with the lateral entry students and shall complete all the courses works in the 1<sup>st</sup> & 2<sup>nd</sup> semester before joining as per the JNTUK regulations. The credits acquired per course during 1<sup>st</sup> & 2<sup>nd</sup> semester will be calculated as per the GMRIT regulations. In case of any credit mismatch for the 1<sup>st</sup> & 2<sup>nd</sup> semester when compared with JNTUK regulations, the student shall take the additional courses approved by the concern Board of Studies and Academic council during 3<sup>rd</sup> semester at GMRIT
  - Students getting admission into 5<sup>th</sup> or 7<sup>th</sup> semesters, the students shall clear all the earlier courses under JNTUK regulations and curriculum before joining and acquire the required credits. The credits acquired per course at JNTUK regulation will 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 taking necessary approvals from the concern 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 3<sup>rd</sup> 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 3<sup>rd</sup> semester shall be treated at par with the lateral entry students and shall complete all the courses works in the 1<sup>st</sup> & 2<sup>nd</sup> 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 1<sup>st</sup> & 2<sup>nd</sup> 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 3<sup>rd</sup> semester at GMRIT
- Students getting admission into 5<sup>th</sup> or 7<sup>th</sup> 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 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 taking necessary approvals from the concern 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 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 Degree. However,
- In case the students getting readmitted into a subsequent new regulation, and if the readmission is into any of the semesters from 1<sup>st</sup> to 4<sup>th</sup> 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 5<sup>th</sup> to 8<sup>th</sup> 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 taking necessary approvals from the concern Board of Studies & Academic council the details of the transferred students will be forwarded to the University.

### 13. Eligibility for Degree with Honours or Degree with Minors

- a. 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 164 credits for the award of B. Tech. (Regular) degree. He/She shall register Honours/Minors by paying registration fee during the 4<sup>th</sup> semester provided he/she secures  $\geq 8$  CGPA clearing all the courses in single attempt till 3<sup>rd</sup> semester. In case of students admitted through lateral entry, the CGPA compliance will be considered from 3<sup>rd</sup> semester onwards.
- b. The students shall have scope to earn these additional 20 credits from 4<sup>th</sup> 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 164 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.
- c. All the students who maintain  $\geq 8$  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.
- d. 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
- e. To acquire 20 additional credits, the students are suggested to register for four 4-credit courses under the list of the courses offered by the respective departments and two 2-credit MOOCs of 30 hours or 6 weeks duration each.
- f. For the award of **B. Tech. degree with Honours** the additional 20 credits shall be earned by taking the courses offered by the **respective department of study in one domain. A set of four courses are offered** under each of the **four** different domains preferably from the new emerging areas as recommended by the BoS

- g.** For the award of **B. Tech degree with Minors** the 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.
- h.** 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 164 credits will be awarded the B.Tech degree Honours or Minors.
- i.** 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 full fill these conditions will automatically get deregistered for B. Tech. (Honours)/B.Tech (Minors) without any notification.

**14. Gap Year:** The curriculum provides flexibility for the students having  $\geq 9$  CGPA shall 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 for the maximum time of graduation. A committee approved by the Academic Council shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing the Gap Year.

#### **15. Curriculum of all the UG Programmes**

The curriculum of the UG programmes mentioned below is provided by the respective BoS

- I. Chemical Engineering (CH)
- II. Civil Engineering (CE)
- III. Computer Science and Engineering (CSE)
- IV. Electrical and Electronics Engineering (EEE)
- V. Electronics and Communication Engineering (ECE)
- VI. Information Technology (IT)
- VII. Mechanical Engineering (ME)

#### **General**

- a. He/she represents "he" and "she" both
- b. Where the words 'he', 'him', 'his', occur, they imply 'she', 'her', 'hers' also
- c. The academic regulations should be read as a whole for the purpose of any interpretation
- d. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman, Academic Council will be final

The college may change or amend the academic regulations or syllabi from time to time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the institute.

## **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 dual commitment to academics and research, serving students in an atmosphere of innovation and critical thinking.

## **Department Mission**

- ❖ To provide adoptable education for the graduates in preparing them for a rewarding career to develop academic and research in a collaborative environment in the field of Information Technology.
- ❖ To prepare the students as thinking professionals and good citizens who will be able to apply their knowledge critically and innovatively in solving professional and social problems

## **Program Educational Objectives**

PEO1: Be a competent software engineer or developer either as an individual or as a team player in IT industry and allied branches providing viable solutions

PEO2: Initiate life-long learning to acquire new technologies and adapt to the changing needs of IT industry through self-study, graduate work, and professional development



PEO3: Exhibit professional excellence, ethics, soft skills, leadership qualities as a responsible citizen with societal interest

### **Program Outcomes**

Engineering graduate will be able to

- PO 1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. (Engineering knowledge)
- PO 2: 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)
- PO 3: 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)
- PO 4: 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)
- PO 5: 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)
- PO 6: 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)
- PO 7: 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)
- PO 8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. (Ethics)
- PO 9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. (Individual and team work)
- PO 10: 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)
- PO 11: 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)

PO 12: 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)

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: 164 (for Regular Students)  
131 (for Lateral Entry Students)

First Semester							
No	Course Code	Course	POs	Contact Hours			
				L	T*	P	C
1	19HSX01	Communicative English	10,12	3	1	-	3
2	19MAX01	Engineering Mathematics I	1,12	3	1	-	3
3	19PYX01 19CYX01	Engineering Physics / Engineering Chemistry	1,12/ 1,12	3	1	-	3
4	19BEX01 19BEX02	Basics of Engineering / Problem Solving and Programming Skills	1,12/ 1,12	3	1	-	3
5	19BEX03 19HSX02	Problem Solving and Programming Skills Laboratory/ Communicative English Laboratory	4/ 10,12	-	-	3	1.5
6	19BEX04 19BEX05	Engineering Drawing / Engineering Workshop	1,5,10/ 1,9,10	-	-	3	1.5
7	19PYX02 19CYX02	Engineering Physics Laboratory / Engineering Chemistry Laboratory	4/ 4	-	-	3	1.5
<b>Total</b>				<b>12</b>	<b>4</b>	<b>9</b>	<b>16.5</b>
Second Semester							
1		Language Elective	10,12	3	1	-	3
2	19MAX02	Engineering Mathematics II	1,12	3	1	-	3
3	19PYX01 19CYX01	Engineering Physics / Engineering Chemistry	1,12/ 1,12	3	1	-	3
4	19BEX01 19BEX02	Basics of Engineering / Problem Solving and Programming Skills	1,12/ 1,12	3	1	-	3
5	19BEX03 19HSX02	Problem Solving and Programming Skills Laboratory/ Communicative English Laboratory	4/ 10,12	-	-	3	1.5
6	19BEX04 19BEX05	Engineering Drawing / Engineering Workshop	1,5,10/ 1,9,10	-	-	3	1.5
7	19PYX02 19CYX02	Engineering Physics Laboratory / Engineering Chemistry Laboratory	4/ 4	-	-	3	1.5
<b>Total</b>				<b>12</b>	<b>4</b>	<b>9</b>	<b>16.5</b>
Third Semester							
1	19CS303	Data Structures	1,2,12	3	1	-	3
2	19CS304	Digital Logic Design	1,4	3	-	2	4
3	19CS305	Discrete Mathematical Structures	1,12	3	1	-	3
4	19IT304	Database Management Systems	1, 2, 3, 12, PSO2	3	1	-	3
5	19IT305	Data Communication Systems	1,2	3	1	-	3
6	19IT306	Object Oriented Programming through Java	1,3,7	3	-	2	4
7	19CS307	Data Structures Laboratory	1,3,4,5	-	-	3	1.5
8	19IT308	Database Management Systems Laboratory	1, 2, 3, 4, 5	-	-	3	1.5
9	19BEA01	Environmental Studies	1, 6, 7, 12	-	-	-	-
10	19IT409	Employability Skills I	1, 2, 5, 8, 10,12	1	1	1	-
11	19HSX11	CC & EC Activities I	6, 7, 9, 10	-	-	1	-
<b>Total</b>				<b>19</b>	<b>5</b>	<b>12</b>	<b>23</b>
Fourth Semester							
1	19MA405	Probability and Statistics	1,2	3	1	-	3
2	19CS403	Computer Organization and Architecture	1,12	3	1	-	3
3	19IT403	Operating Systems	1,2,7,12	3	1	-	3
4	19IT404	Computer Networking	1,2,12	3	1	-	3
5	19IT405	Web Technologies	1,2,12	3	-	2	4
6	19IT406	Python Programming Laboratory	1, 4	-	-	3	1.5
7	19IT407	Operating Systems Laboratory	1,12	-	-	3	1.5
8	19IT408	Comprehensive Quiz I (Sem. 3 & 4)	-	-	-	-	2

\* Hours suggested for tutorials

9	19IT409	Employability Skills I	1, 2, 5, 8, 10, 12	1	1	1	3
10	19HSX11	CC & EC Activities I	6, 7, 9, 10	-	-	1	1
<b>Total</b>				<b>16</b>	<b>5</b>	<b>10</b>	<b>25</b>
<b>Fifth Semester</b>							
1	19CS404	Design and Analysis of Algorithms	1,2,3,12, PSO1	3	-	2	4
2	19IT502	Artificial Intelligence	1, 12, PSO1	3	1	-	3
3	19IT503	Cloud Computing	2, 4, 6, 7, 8, PSO2	3	1	-	3
4	19IT504	Software Engineering Principles	1,2,7,12	3	-	2	4
5		Elective I (Professional Elective)		3	1	-	3
6		Elective II (Open Elective I)		3	1	-	3
7	19IT507	Cloud Computing Lab	1,12	-	-	3	1.5
8	19IT508	Term Paper	11, 12	-	-	3	1.5
9	19IT609	Employability Skills II	1, 2, 5, 8, 10, 12	1	1	1	-
10	19HSX12	CC & EC Activities II	6, 7, 9, 10	-	-	1	-
11	19IT511	Summer Internship #I	1, 2, 3				1.5
<b>Total</b>				<b>19</b>	<b>5</b>	<b>12</b>	<b>24.5</b>
<b>Sixth Semester</b>							
1	19HSX10	Engineering Economics and Project Management	2,5	3	1	-	3
2	19IT602	Automata and Compiler Design	1,2,3	3	1	-	3
3	19IT603	Machine Learning	2, 5	3	1	-	3
4		Elective III (Professional Elective )		3	-	2	4
5		Elective IV (Open Elective II)		3	1	-	3
6	19IT606	Machine Learning Lab using Python	3, 5, 9	-	-	3	1.5
7	19IT607	Mini Project	All	-	-	3	1.5
8	19IT608	Comprehensive Quiz II (Sem. 5 & 6)		-	-	-	2
9	19IT609	Employability Skills II	1, 2, 5, 8, 10, 12	1	1	1	3
10	19HSX12	CC & EC Activities II	6, 7, 9, 10	-	-	1	1
11		Audit Course	PO12	-	-	-	-
<b>Total</b>				<b>16</b>	<b>5</b>	<b>8</b>	<b>25</b>
<b>Seventh Semester</b>							
1		Elective V (Professional Elective )		3	1	-	3
2		Elective VI (Professional Elective )		3	1	-	3
3		Elective VII (Open Elective III)		3	1	-	3
4	19IT701	Project	All	-	-	16	8
5	19IT702	Summer Internship #II	1, 2, 5, 6, 7	-	-	-	1.5
<b>Total</b>				<b>9</b>	<b>3</b>	<b>16</b>	<b>18.5</b>
<b>Eighth Semester</b>							
1		Elective VIII (Professional Elective )		-	-	-	3
2		Elective IX (Open Elective IV)		-	-	-	3
3	19IT801	Full Semester Internship (FSI)	All	-	-	-	9
<b>Total</b>				<b>-</b>	<b>-</b>	<b>-</b>	<b>15</b>

**List of Electives****Language Electives**

No.	Course Code	Course	POs	Contact Hours			
				L	T	P	C
1	19HSX03	Advanced Communicative English	10,12	3	1	-	3
2	19HSX04	Communicative German		3	1	-	3
3	19HSX05	Communicative French		3	1	-	3
4	19HSX06	Communicative Japanese		3	1	-	3
5	19HSX07	Communicative Spanish		3	1	-	3
6	19HSX08	Communicative Korean		3	1	-	3
7	19HSX09	Communicative Hindi		3	1	-	3

**Elective I****Career Path I, II, III and Other Core Electives**

1	19CSC11	Exploratory Data Analytics (AI&ML)	1, 4, 12,PSO1	3	1	-	3
2	19CSC21	Web Programming Languages (Full Stack Development)	1, 2, 7, 12,PSO1,PSO2	3	1	-	3
3	19ITC31	Fundamentals of Security (Cyber Security)	1, 2, PSO1,PSO2	3	1	-	3
4	19IT004	Computer Graphics and Multimedia	2, 3, 5	3	1	-	3
5	19IT005	Information Theory and Coding	1,2,3,6,8	3	1	-	3
6	19IT006	Data Warehousing and Data Mining	2, 3, 4, 5, PSO1	3	1	-	3
7		MOOCs		-	-	-	3
<b>Elective II:Open Elective I</b>							
1	19CE001	Disaster Management	2, 7	3	1	-	3
2	19EE001	Electrical Installation, Safety and Auditing	2, 3, 6, 8,	3	1	-	3
3	19ME001	Fundamentals of Optimization Techniques	1, 2	3	1	-	3
4	19EC001	Sensors for Engineering Applications	1,	3	1	-	3
5	19CS001	Fundamentals of Artificial Intelligence	1, 2, 3	3	1	-	3
6	19CH001	Energy Conversion and Storage Devices	1, 3, 6, 7	3	1	-	3
7	19IT001	Fundamentals of Multimedia	1, 5, 7	3	1	-	3
8	19BS001	Nano Materials and Technology	1, 12	3	1	-	3
<b>Elective III Career Path I, II, III and Other Core Electives</b>							
1	19CSC12	Deep Learning (AI&ML)	1,2,4, PSO1	3	-	2	4
2	19CSC22	Web Application Developments Framework (Full Stack Development)	1, 3, 4,PSO1,PSO2	3	-	2	4
3	19ITC32	Cyber Security (Cyber Security)	1, 3,4,5,PSO1,PSO2	3	-	2	4
4	19IT007	The Internet of Things	1, 2, 3, 5, 10	3	-	2	4
5	19IT008	Cryptogaphy and Network Security	5, 6, 8	3	-	2	4
6	19IT009	User Interface/ User Experience	1, 2, 3, 5, 10	3	-	2	4
<b>Elective IV : Open Elective II</b>							
1	19CE002	Air Pollution and Environmental Impact Assessment	6, 7, 12	3	1	-	3
2	19EE002	Renewable Energy Souces	2, 7	3	1	-	3
3	19ME002	Principles of Entrepreneurship	1, 11	3	1	-	3
4	19EC002	Electronics for Agriculture	1, 2	3	1	-	3
5	19CS002	Fundamentals of Machine Learning	2, 5	3	1	-	3
6	19CH002	Industrial Safety and Hazard Management	1, 2, 3, 6, 8	3	1	-	3
7	19IT002	Fundamentals of Cloud Computing	1,7	3	1	-	3
8	19BS002	Advancd Numerical Techniques	1, 2	3	1	-	3
9	19BS003	Functional Materials and Applications	1,7	3	1	-	3
<b>Elective V Career Path I, II, III and Other Core Electives</b>							
1	19CSC13	Natural Language Processing (AI & ML)	1,4,12	3	1	-	3
2	19CSC23	Web Application Databases (Full Stack Development)	1,2,7,12	3	1	-	3
3	19ITC33	Cloud Security (Cyber Security)	1,2,4	3	1	-	3
4	19EC602	Digital Signal Processing	1,2, PSO2	3	1	-	3
5	19IT010	Information Retrieval Systems	3,6,8	3	1	-	3
6	19CS005	Mobile Computing	3, 5,8	3	1	-	3
7		MOOCs		-	-	-	3
<b>Elective VI</b>							
1	19IT017	Social Network Analysis	2,4,5,12	3	1	-	3
2	19IT011	Real Time Operating Systems	2,3,12	3	1	-	3
3	19IT012	Digital Image Processing	3,5,6	3	1	-	3
4	19IT014	Distributed Systems	2, 7, 12	3	1	-	3
5	19CS012	Wireless Ad hoc Networks	3, 5, 6, 12	3	1	-	3
6	19CS015	Software Project Management	3, 5, 6, 12, PSO2	3	1	-	3
7		MOOCs		-	-	-	3
<b>Elective VII: Open Elective III</b>							
1	19CE003	Solid Waste Management	3, 7, 12	3	1	-	3

2	19EE003	Fundamentals of Electrical Vehicle Technology	2, 3, 12	3	1	-	3
3	19ME003	Industrial Engineering and Management	1, 11	3	1	-	3
4	19EC003	Interfacing and Programming with Arduino	1,2	3	1	-	3
5	19CS003	Data Science for Engineering Applications	2, 3, 4	3	1	-	3
6	19CH003	Industrial Ecology for Sustainable Development	2, 6, 7	3	1	-	3
7	19IT003	Fundamentals of Mobile Computing	1,7	3	1	-	3
8	19BS004	Advanced Materials of Renewable Energy	1,7	3	1	-	3
9	19BS005	Applied Linear Algebra for Engineers	1,12	3	1	-	3
<b>Elective VIII: Professional Elective</b>							
1	19CS014	Green Computing	3, 6, 8	-	-	-	3
1	19IT013	Design Patterns	2,3,5	-	-	-	3
3	19IT016	Professional Ethics	5,6,8	-	-	-	3
4		MOOCs		-	-	-	3
<b>Elective IX: Open Elective IV</b>							
1	19CE019	Green Buildings	1, 7, 12	-	-	-	3
2	19EE017	Sustainable Energy	1, 2,12, PSO2	-	-	-	3
3	19ME019	Total Quality Management	1,11	-	-	-	3
4	19EC011	Communication Technologies	1,2	-	-	-	3
5	19CS020	Applications of Artificial Intelligence	2,3,6,7	-	-	-	3
6	19CH016	Green Technologies	1,6,7	-	-	-	3
7	19IT015	Human Computer Interaction	1,7	-	-	-	3
8	19BS006	Handling of Industrial Waste and Waste Water	1,7	-	-	-	3
<b>Audit Course</b>							
1	19AT001	Communication Etiquette in Workplaces					
2	19AT002	Contemporary India: Economy, Policy and Society					
3	19AT003	Design The Thinking					
4	19AT004	Ethics and Integrity					
5	19AT005	Indian Heritage and Culture					
6	19AT006	Human Values and Professional Ethics					
7	19AT007	Intellectual Property Rights					
8	19AT008	Introduction to Journalism					
9	19AT009	Mass Media Communication					
10	19AT010	Science, Technology and Development					
11	19AT011	Social Responsibility					
12	19AT012	The Art of Photography and Film Making					
13	19AT013	Gender Equality for Sustainability					
14	19AT014	Women in Leadership					
15	19AT015	Introduction to Research Methodology					
16	19AT016	Climatic Change and Circular Economy					
<b>B. Tech. (Honors)</b>							
<b>Domain - I: Modern Computing</b>							
01	19ITH11	Advanced Computer Architecture	2, 3	4	-	-	4
02	19ITH12	Micro Processors and Micro Controllers	2, 3	4	-	-	4
03	19ITH13	Embedded Systems	1, 2, 7,12	4	-	-	4
04	19ITH14	High Performance Computing	2, 3	4	-	-	4
<b>Domain - II: Data Engineering</b>							
01	19CSH11	Advanced Data Structures	2, 3, 4	4	-	-	4
02	19CSH12	Advanced Databases	2, 3, 4	4	-	-	4
03	19CSH13	Programming, Data Structures and Algorithms Using Python	2, 3, 4, 5	4	-	-	4
04	19CSH14	Bio-Informatics	1, 2, 5	4	-	-	4
<b>Domain - III: Modern Software Engineering</b>							
01	19CSH21	DevOps	1, 3, 5, 8, 10	4	-	-	4
02	19CSH22	Design Patterns	2, 3, 5	4	-	-	4
03	19CSH23	Advanced Software Engineering	1, 2, 3, 4, PSO1	4	-	-	4
04	19CSH24	Robotic Process Automation	3, 5, 8, PSO2	4	-	-	4
<b>Domain - IV: Security</b>							
01	19CSH31	Fundamentals of Systems Security	1, 2	4	-	-	4
02	19CSH32	Python Programming for Security	1, 3, 4	4	-	-	4

03	19CSH33	Management of Information Security	3, 6, 7	4	-	-	4
04	19CSH34	Computer Forensics	2, 3, 5	4	-	-	4
<b>B. Tech. (Minors)</b>							
<b>Energy Science &amp; Technology</b>							
1	19CHM11	Foundation of Energy Science and Technology	1, 2, 3, 5, 7, 12	4	-	-	4
2	19CHM12	Energy Generation from Waste	1, 2, 3, 4, 5	4	-	-	4
3	19CHM13	Energy Storage Systems	1, 2, 3, 6, 7	4	-	-	4
4	19CHM14	Hydrogen Energy and Fuel Cells	1, 2, 3, 7	4	-	-	4
<b>Nano Science &amp; Technology</b>							
5	19CHM21	Introduction and Characterization of Nano Materials	1, 2, 3, 7	4	-	-	4
6	19CHM22	Carbon Nanostructures and Applications	1, 3, 4, 5	4	-	-	4
7	19CHM23	Energy, Environment & Biomedical Nanotechnology	1, 2, 3, 7	4	-	-	4
8	19CHM24	Industrial Applications of Nano Technology	2, 3, 5, 7	4	-	-	4
<b>Environmental Engineering</b>							
9	19CEM11	Watershed Management	6,7	4	-	-	4
10	19CEM12	Industrial Pollution Control and Engineering	3,6,7	4	-	-	4
11	19CEM13	Solid and Hazardous Waste Management	1,3,6,7	4	-	-	4
12	19CEM14	Ecology and Environmental Assessment	1,3,6,7	4	-	-	4
<b>Artificial Intelligence &amp; Machine Learning</b>							
13	19CSM11	Fundamentals of AI & Machine Learning	1,12	4	-	-	4
14	19CSM12	Feature Engineering for Machine Learning	1,2,3	4	-	-	4
15	19CSM13	Exploratory Data Analytics	1,4	4	-	-	4
16	19CSM14	Deep Learning	1,2, 4	4	-	-	4
<b>Cyber Security</b>							
17	19CSM21	Fundamentals of Security	1,2	4	-	-	4
18	19CSM22	Management of Information Security	3,6,7	4	-	-	4
19	19CSM23	Cyber Security	1,3,4	4	-	-	4
20	19CSM24	Cloud Security	2,3	4	-	-	4
<b>Data Science &amp; Analytics</b>							
21	19CSM31	Data Cleaning	2,3,4	4	-	-	4
22	19CSM32	Data Engineering	1,2,3,4	4	-	-	4
23	19CSM33	Text Analytics	1,2,4	4	-	-	4
24	19CSM34	Social Network and Semantic Analysis	2, 4	4	-	-	4
<b>Computer Systems Programming</b>							
25	19CSM41	Programming Fundamentals	1,2,3	4	-	-	4
26	19CSM42	Data Structures & Algorithms	1,2,3,4	4	-	-	4
27	19CSM43	Fundamentals of Databases	1,4	4	-	-	4
28	19CSM44	Fundamentals of Computer Networks & Operating Systems	1,2,3	4	-	-	4
<b>Digital IC Design</b>							
29	19ECM11	Fundamentals of VLSI Design	1, 2, 3	4	-	-	4
30	19ECM12	Digital Design using HDL	1, 2, 3	4	-	-	4
31	19ECM13	FPGA Technology	1, 2	4	-	-	4
32	19ECM14	Analog and Mixed Signal Design	1, 2	4	-	-	4
<b>Industrial Automation</b>							
33	19ECM21	Microcontrollers and Interfacing	1, 2, 3	4	-	-	4
34	19ECM22	Sensors and Data Acquisition System	1, 2	4	-	-	4
35	19ECM23	Fundamentals of Labview	1, 2	4	-	-	4
36	19ECM24	Medical Robotics	1, 2, 3	4	-	-	4
<b>Communications and Networking</b>							
37	19ECM31	Principles of Communications	1, 2	4	-	-	4
38	19ECM32	Coding Theory and Practice	1, 2	4	-	-	4
39	19ECM33	Ad-hoc and Wireless Sensor Networks	1, 2, 3	4	-	-	4

40	19ECM34	Fundamentals of Multimedia Networking	1, 2, 3	4	-	-	4
<b>Avionics</b>							
41	19ECM41	Principles of Aerodynamics	1, 2	4	-	-	4
42	19ECM42	Aircraft Electrical Systems	1, 2	4	-	-	4
43	19ECM43	Aircraft Instrument Systems	1, 2	4	-	-	4
44	19ECM44	Aircraft Communication and Navigational Systems	1, 2	4	-	-	4
<b>Geographic Information System</b>							
45	19ECM51	Sensors and Sensing Technology	1, 2	4	-	-	4
46	19ECM52	Geographic Information Systems	1, 2	4	-	-	4
47	19ECM53	Digital Image Processing	1, 2	4	-	-	4
48	19ECM54	Lidar Systems	1, 2	4	-	-	4
<b>Electric Vehicles Technology</b>							
49	19EEM11	Introduction to Electric Vehicles Technologies	2, 3	4	-	-	4
50	19EEM12	Electrical Drives and Controllers for Electric Vehicles	2, 3	4	-	-	4
51	19EEM13	Charging Technology in Electric Vehicles	2, 3	4	-	-	4
52	19EEM14	Computer Vision in Electric Vehicles	2, 3	4	-	-	4
<b>Smart City Management</b>							
53	19EEM21	Fundamentals of Smart City	2, 3	4	-	-	4
54	19EEM22	Smart City Infrastructure	2, 3, 5, 6, 7, 11	4	-	-	4
55	19EEM23	Computational Methods for Smart City Management	3, 5	4	-	-	4
56	19EEM24	Communication Technologies and Mobility for Smart City	2, 3	4	-	-	4
<b>Industrial Applications and Control</b>							
57	19EEM31	Modelling and Simulations of Industrial Applications	2, 3	4	-	-	4
58	19EEM32	Industrial Sensors and Actuators	2, 3	4	-	-	4
59	19EEM33	Programmable Logic Controllers	2, 3	4	-	-	4
60	19EEM34	Control Design for Industrial Applications	2, 3	4	-	-	4
<b>Robotics and Automation</b>							
61	19MEM11	Introduction to Robotics	1,2,3	4	-	-	4
62	19MEM12	Drives and Sensors	1,2,3,4	4	-	-	4
63	19MEM13	Control Systems for Robotics	1,2,3,4	4	-	-	4
64	19MEM14	Machine Learning for Robotics	2,5	4	-	-	4
<b>Industrial Systems Engineering</b>							
65	19MEM21	Industrial Management	1,10,11,12	4	-	-	4
66	19MEM22	Fundamentals of Operations Research	1,2,3,5	4	-	-	4
67	19MEM23	Enterprise Resource Planning	1,2,3,5,11,12	4	-	-	4
68	19MEM24	Production Planning and Control	1,2,3,5,11,12	4	-	-	4



**19CS303 Data Structures****3 1 0 3****Course Outcomes**

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

1. Describe the operations and implementation of List ADT
2. Comprehend the operations and implementation of Stack and Queue
3. Illustrate the applications of linear data structures
4. Describe the operations and implementation of hash table
5. Comprehend the operations and implementation of tree data structure
6. Illustrate the variations of tree data structure

**CO-PO Mapping**

COs	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>12</sub>
1	3	2	2
2	3	2	2
3	2	3	3
4	2	3	3
5	3	2	2
6	2	3	3

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

**Unit I****Linear Data Structures – List****10 + 3 Hours**

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists- Circularly linked lists- Doubly-linked lists – Applications of lists – Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal) - Searching - Linear Search – Binary Search

*Doubly linked Circular list***Unit II****Linear Data Structures – Stack and Queue****12 + 4 Hours**

Stack ADT – Array implementation – Linked list implementation – Applications of Stack – infix to postfix conversion, evaluation of postfix expression – Queue ADT – Array implementation – Linked list implementation – Application of Queue – Ticket counter

*Circular Queue***Unit III****Sorting, Hashing Techniques and Trees****11 + 4 Hours**

Sorting – Bubble Sort – Selection Sort – Insertion Sort – Shell Sort – Radix Sort – Quick Sort – Merge Sort - Hashing - Hash Functions – Separate Chaining – Open Addressing – Rehashing  
Trees: Introduction, Terminology, Binary Trees, Representation of Binary Trees using arrays and linked lists, Binary tree traversals

*Extendible Hashing***Unit IV****Variations on Trees and Graphs****12 + 4 Hours**

Binary Search Trees: definition, basic operations of BST (Searching, Insertion and deletion) - Introduction to AVL trees: Balancing AVL tree by rotations after insertions and deletions of a data node Multi-way search trees: Introduction to m-way search trees, B-trees, B+ Trees;  
Heaps: Binary heaps, definition of a Max-heap, Min-heap, Creating Max-Heap, Applications: Heap sort  
Graphs: Terminology, Representation, Traversals: Depth First Search and Breadth First Search

*Priority queue operations: insertions and extract-max***Total: 45+15 Hours**

**Textbook (s)**

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, 2002
2. Michael Main, Walter Savitch, Data Structures and other objects using C++, 4<sup>th</sup> Edition, Addison Wesley, 2018

**Reference (s)**

1. S. Tanenbaum, Y. Langsam and M.J. Augenstein,, Data Structures using C and C++, 2<sup>nd</sup> Edition, Pearson Education, 2015
2. R. F. Gilberg, B. A. Forouzan, Data Structures A Pseudocode Approach with C, 2nd Edition, CENGAGE Learning, 2005

**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination <sup>1</sup> (%)
Remember	20	20	--
Understand	60	60	--
Apply	20	20	80
Analyze	--	--	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

**SAMPLE QUESTION (S)****Remember**

1. What are abstract data types?
2. List any 2 disadvantages of array
3. Define linked list
4. Define data structure
5. List any 2 applications of queue

**Understand**

1. Compare linked list with array
2. Explain Bubble Sort Process with an example
3. Demonstrate with neat diagram and algorithm to insert a node before the given key
4. Explain Deletion process using an example binary search tree
5. Explain why the selection sort is more efficient than the bubble sort
6. Explain with suitable example of LL rotation after inserting a new node into an AVL tree
7. Demonstrate the application of singly linked lists for the addition of the polynomials P1 and P2

**Apply**

1. Develop an algorithm to concatenate two single linked lists
2. Construct a priority queue and implement all basic operations to demonstrate priority queue
3. Build a recursive procedure to count the number of nodes in a binary tree

**Sample Questions for Open Book Examination****Apply**

1. Select appropriate data structure to simulate the operations of a Music Player – Songs in music player are linked to previous and next song. you can play songs either from starting or ending of the list.

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

2. A bracket is considered to be any one of the following characters: (, ), {, }, [, or ]. Two brackets are considered to be a matched pair if the an opening bracket (i.e., (, [, or {) occurs to the left of a closing bracket (i.e., ), ], or }) of the exact same type. There are three types of matched pairs of brackets: [], {},and (). A matching pair of brackets is not balanced if the set of brackets it encloses are not matched. For example, {[()]} is not balanced because the contents in between { and } are not balanced. The pair of square brackets encloses a single, unbalanced opening bracket, (, and the pair of parentheses encloses a single, unbalanced closing square bracket, ]. By this logic, we say a sequence of brackets is balanced if the following conditions are met: It contains no unmatched brackets. The subset of brackets enclosed within the confines of a matched pair of brackets is also a matched pair of brackets. Given n strings of brackets, determine whether each sequence of brackets is balanced. If a string is balanced, return YES. Otherwise, return NO.
3. You are given a stack of **N** integers such that the first element represents the top of the stack and the last element represents the bottom of the stack. You need to pop at least one element from the stack. At any one moment, you can convert stack into a queue. The bottom of the stack represents the front of the queue. You cannot convert the queue back into a stack. Your task is to remove exactly **K** elements such that the sum of the **K** removed elements is maximized.
4. Vikas is given a bag which consists of numbers (integers) blocks, Vikas has to organize the numbers again in the same order as he has inserted it into the bag, i.e. the first number inserted into the bag by Vikas should be picked up first followed by other numbers in series. Help Vikas to complete this work in  $O(n)$  time complexity with the condition to use one extra bag to complete the work (assume that the bags are compact and is in the form of a stack structure and has the same width as that of the number blocks and is large enough to fill the bag to the top and the number taken from bag is in reverse order).

**19CS304 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**

COs	PO <sub>1</sub>	PO <sub>4</sub>
1	3	2
2	3	2
3	3	3
4	3	2
5	3	3
6	2	3

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

**UNIT- I****10+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

**UNIT- II****12+8 Hours****Boolean Function Minimization**

Minimization of Switching Functions using K-Map up to 4-variables, Prime implicants, don't care 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 and Full Adder
2. Implementation and verification of Decoder and Encoder
3. Implementation and verification of MUX and 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

**Unit IV****11+10 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 functioning of Basic Shift Register
2. Implementation of Synchronous Counter
3. Implementation of Asynchronous Counter

**Total: 45+30 Hours****Textbook (s)**

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

**Reference (s)**

1. ZviKohavi, 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**

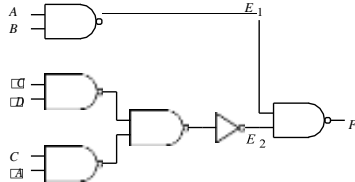
1. Explain working functionality of Programmable Logic Devices (PLD).
2. Represent the following Boolean expression to SOP and POS form:  $A+BC'+ABD'+ABCD$
3. Represent the Boolean function  $T=F(w, x, y, z) = \sum m(0,1,2,4,5,7,8,9,12,13)$  by using 8 to 1mux.
4. Illustrate a half adder using NAND –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

**19CS305 Discrete Mathematical Structures****3 1 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**

CO	PO <sub>1</sub>	PO <sub>12</sub>
1	3	2
2	3	2
3	2	3
4	2	3
5	2	3
6	3	3

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

**Unit I****Statement Logic and Predicate Logic****11+3 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****11+4 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+4 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****11+4 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: 45 + 15 Hours****Textbook (s)**

1. Kenneth H. Rosen, Discrete Mathematics and Applications, 7<sup>th</sup> 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, 3<sup>rd</sup> Edition, Tata McGraw Hill, 2008.
3. D. S. Chandrasekharaiah, Mathematical Foundation to Computer Science, Prism Books Pvt. Ltd, Hyderabad, 4<sup>th</sup> 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 3<sup>rd</sup> 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](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.

**19IT304 Database Management Systems****3 1 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 <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>12</sub>	PSO <sub>2</sub>
1	3	3	2	1	1
2	3	3	3	2	2
3	3	3	2	2	2
4	2	3	3	1	1
5	3	3	3	2	2
6	3	3	2	2	2

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

**Unit I****Introduction to DBMS and ER Model****11+4 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****11+4 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****11+4 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 + 3 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: 45+15 Hours**

**Textbook (s)**

1. Elmasri & Navatha, Fundamentals of Database Systems, Pearson Education, 7<sup>th</sup> Edition, 2016
2. Silberschatz Korth, Database System Concepts, McGraw hill, 7<sup>th</sup> 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, 9<sup>th</sup> 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, 8<sup>th</sup> Edition, 2006

**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	30	40	--
Apply	30	20	50
Analyze	--	--	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.

**19IT305 Data Communication Systems****3 1 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. Understand the technical concepts of digital modulation and multiplexing
4. Understand the principles of wireless communications technology in cellular telephone systems.
5. Demonstrate the basic concepts of error detection and checking at various data link layer protocols
6. Illustrate the working principle of various data communication equipment

**CO-PO Mapping**

COs	PO <sub>1</sub>	PO <sub>2</sub>
1	2	3
2	2	3
3	3	3
4	3	3
5	2	2
6	2	2

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

**Syllabus****Unit I****12+4 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.

*Transverse Electromagnetic Waves, Advantages and disadvantages of optical fiber cables, Telesonic Networks.***Unit II****11+4 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.

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.

*Electromagnetic Spectrum, Cognitive Radio, IoT(Internet of Things).***Unit III****12+3 Hours****Telephone Instruments and Cellular Telephone Concepts**

The Subscriber Loop, Standard Telephone Set, Basic Telephone Call Procedures, Cordless Telephones, Paging 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.

*Public Switching telephone networks, cellular mobile communications, Wireless Sensor Networks.*

#### Unit IV

**10+4 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 Block Diagram, Voice-Band Data Communication Modem.

Data -Link Protocols: Data -Link Protocol Functions, Character -and Bit-Oriented Protocols, Asynchronous Data- Link Protocols, Synchronous Data-Link Protocols, High-Level Data-Link Control

*Synchronization, Connectivity devices, Congestion control*

**Total: 45+15 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**

1. 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
2. In the Hamming code for a data unit of  $m$  bits how do you compute the number of redundant bits needed.
3. Compare Analog cellular telephone with digital cellular telephone
4. 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  $\mu$ 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  $g(x)=x^3+x+1$ .

**19IT306 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. Understand the role of interfaces to achieve abstraction
4. Interpret various runtime exceptions that appear in the applications
5. Demonstrate parallel processing applications using multi-threading.
6. Design interactive applications using Hibernate and spring Framework by establishing database connectivity

**CO-PO Mapping**

COs	PO <sub>1</sub>	PO <sub>3</sub>	PO <sub>7</sub>
1	1	2	3
2	1	3	3
3	1	3	2
4	1	3	3
5	1	3	2
6	1	3	3

**Syllabus****UNIT- I****10+9 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. Write a program that prints all real solutions to the quadratic equation  $ax^2 + bx + c = 0$ .
2. Write a program that uses both recursive and non-recursive functions to print the nth value in the Fibonacci sequence.
3. Write a program to demonstrate String handling methods and tokenizing given string/text using String Tokenizer class
4. Write a program to implement matrix operations using multidimensional arrays.

**UNIT- II****12+6 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. Write a program that illustrates runtime polymorphism.
3. Write a program to create a package which has classes and methods to read Student admission details.

**UNIT- III****11+6 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. Write a program to define and handle User Defined Exceptions (make use of throw - throws).
2. Introduction to Eclipse Environment

**UNIT- IV**

**12+9 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.*

**Total: 45+30=75 Hours**

**Practical Components**

1. Implement Hibernate Example without IDE
2. Implement Hibernate Example with Eclipse

**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, 3rd Ed., Wiley Publishers, 2008

**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Examination (%)
<b>Remember</b>	25	35	--
<b>Understand</b>	45	35	--
<b>Apply</b>	30	30	40
<b>Analyze</b>	--	--	20
<b>Evaluate</b>	--	--	40
<b>Create</b>	--	--	--
<b>Total (%)</b>	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

**19CS307 Data Structures Laboratory****00315****Course Outcomes**

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

1. Implement stack and queue data structures using array and linked list
2. Demonstrate the applications of stack and queue data structures
3. Implement sorting and searching algorithms and to compare their efficiency
4. Implement binary tree, binary search tree and tree traversals
5. Solve graph problems using appropriate data structure
6. Implement hashing techniques for real world applications (telephone directory, dictionary)

**CO-PO Mapping**

CO	PO <sub>1</sub>	PO <sub>3</sub>	PO <sub>4</sub>	PO <sub>5</sub>
1	3	3	3	3
2	3	3	3	2
3	2	2	2	3
4	2	2	2	2
5	3	3	3	3
6	2	2	2	2

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

**List of Experiments**

1. Implementation of list using array
2. Implementation of singly linked list
3. Implementation of doubly linked list
4. Implementation of Stack using array and linked list
5. Stack applications: Infix to postfix conversion
6. Implementation of sorting and searching algorithms: Bubble sort, Insertion sort & Selection sort, linear and binary
7. Implementation of BST
8. Implementation of tree traversal algorithms
9. Implementation of Shortest path algorithms
10. Implementation of Graph Traversals using stack and queue
11. Implement open hashing
12. Implementation of closed hashing

**Indicative list of applications based experiments**

1. Given an expression **exp** of length **n** consisting of some brackets. The task is to print the bracket numbers when the expression is being parsed.

**Input:**

The first line contains an integer **T**, the number of test cases. For each test case, there is a string **exp** containing the expression.

**Output:**

For each test case, the output is the bracket numbers of the expression.

2. Given an unsorted array **arr[]** of size **N**, rotate it by **D** elements (clockwise).

**Input:**

The first line of the input contains **T** denoting the number of test cases. First line of each test case contains two space separated elements, **N** denoting the size of the array and an integer **D** denoting the number size of the rotation. Subsequent line will be the **N** space separated array elements.

**Output:**

For each test case, in a new line, output the rotated array

**Example:****Input:**

```
2
5 2
1 2 3 4 5
10 3
2 4 6 8 10 12 14 16 18 20
```

**Output:**

3 4 5 1 2

8 10 12 14 16 18 20 2 4 6

3. Given a singly linked list. The task is to find the length of linked list, where length is defined as number of nodes in the linked list.

**Input:**

First line of input contains number of test cases T. For each test case, first line of input contains number of nodes N, to be inserted into the linked list and next line contains data of N nodes.

**Output:**

There will be a single line of output for each test case, which contains length of the linked list.

4. Given a doubly linked list, rotate the linked list counter-clockwise by P nodes. Here P is a given positive integer and is smaller than the count of nodes (N) in a linked list.

**Input:**

The first line of input contains an integer T denoting the no of test cases. For each test case, the first line of input contains two integers N and P denoting the number of nodes in Linked List and the number of nodes to be rotated respectively.

**Output:**

For each test case, output the final linked list after the P rotations in it.

5. Given a stack with **push()**, **pop()**, **empty()** operations, delete **middle** of it without using any additional data structure.

**Middle:**  $\text{ceil}(\text{size\_of\_stack}/2.0)$

**Input Format:**

The first line contains an integer T, the number of test cases. For each test case, the first line contains an integer **sizeOfStack** denoting the stack size. Next line contains space separated integers that will be pushed into the stack.

**Output Format:**

For each test case, in a new line, print the stack elements. **If stack size is 1 then just print**

6. Given a Queue Q containing N elements. The task is to reverse the Queue. Your task is to complete the function **rev()**, that reverses the N elements of the queue.

**Input Format:**

The first line of input contains an integer T denoting the Test cases. Then T test cases follow. The first line contains N which is the number of elements which will be reversed. Second line contains N space separated elements.

**Output Format:**

For each test case, in a new line, print the reversed queue.

7. Given a Binary Search Tree, find the sum of all leaf nodes. BST has the following property (duplicate nodes are possible): The **left subtree** of a node contains only nodes with **keys less** than the node's key; The **right subtree** of a node contains only nodes with **keys greater than or equal** to the node's key.

**Input:**

The first line of input contains a single integer T denoting the number of test cases. Then T test cases follow. Each test case consists of two lines. The first line of each test case consists of integer N, denoting the number of elements in the BST. The second line of each test case consists of N space-separated integers denoting the elements in the BST.

**Output:**

For each test case, in a new line, print the sum of leaf nodes.

**List of Augmented Experiments**

1. Develop an application to graphically demonstrate the operations of linked list
2. Develop an application to graphically demonstrate selected sorting algorithms
3. Develop an application to graphically demonstrate searching algorithms
4. Develop an application to graphically demonstrate Stack and Queue operations
5. Develop an application to generate and demonstrate the operations of expression tree
6. Develop an application to generate and demonstrate the operations on polynomials
7. Develop an application to generate and demonstrate operations on Binary tree
8. Develop an application to perform all operations on Binary Search Tree
9. Develop an application to perform all operations on AVL Tree
10. Develop an application to demonstrate all graph algorithms

**Reading Material (s)**

1. Data Structures Lab manual, Department of IT, GMRIT, Rajam.

**19IT308 Database Management Systems Laboratory****0031.5****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 <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>	PO <sub>5</sub>
1	2	1	2	1	1
2	2	1	3	2	2
3	2	1	2	2	2
4	2	1	3	1	1
5	3	3	2	2	2
6	3	3	2	2	2

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

**List of Experiments**

1. Design ER Model for a given application & Convert ER model to Relational Model.
2. Creating users - roles and Granting privileges.
3. Creating and altering tables for various relations in SQL using Integrity Constraints.
4. Implementing queries in SQL using
  - 4.1 Insertion
  - 4.2 Retrieval (operations like union - intersect - minus - in - exists - group by and having etc.)
  - 4.3 Updation
  - 4.4 Deletion
5. Implementing the concepts of Rollback – commit, checkpoints and Views
6. Implementing joins - sub queries - nested and co related nested queries.
7. Experiment with built in functions in oracle (Numeric, String, Date, Aggregate functions etc.)
8. Implementing operations on relations using PL/SQL.
9. Implementing functions, stored procedures using PL/SQL
10. Implementing cursors using PL/SQL
11. Implement Exception Handling using PL/SQL
12. 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

**19BEA01 Environmental Studies****Course Outcomes:**

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

1. Translate the learner's attitude to think globally and act locally
2. Motivate environmental organizations to create a concern about our present state of Environment.
3. Find solutions for conservation of natural resources
4. Identify the benefits of ecosystem conservation, biodiversity protection, implement pollution prevention and control measures
5. Illustrate social issues of environmental protection and adopt sustainable developmental practices
6. Perceives the basic structure of environmental policy and law pertaining to specific environmental issues (water quality, air quality, biodiversity protection, Forest, etc.)

**CO - PO Mapping**

COs	PO <sub>1</sub>	PO <sub>6</sub>	PO <sub>7</sub>	PO <sub>12</sub>
1	1	2	3	1
2	2	-	3	2
3	3	3	-	2
4	-	2	3	2
5	-	-	3	1
6	-	3	2	1

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

**Syllabus****Unit I****Multidisciplinary nature of Environmental Studies & Natural Resources**

Definition, Scope and Importance, Multidisciplinary nature of Environmental Studies, Value of Nature - Productive, Aesthetic/Recreation, Option, Need for Public Awareness, Institutions (BNHS, BVIEER, ZSI, BSI) and People in Environment (Medha Patkar, Sundarlal Bahuguna, Indira Gandhi, Rachael Carson).

Natural Resources: Renewable and Non-renewable resources - Importance, uses, overexploitation/threats, and conservation of (i) forest (ii) water (iii) mineral (iv) food and (v) energy resources. (The topics include benefits and problems associated with dams, mining and case studies), role of an individual in conservation of natural resources.

**Unit II****Ecosystem & Biodiversity**

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Biogeological cycles (Energy flow, Carbon and Nitrogen Cycles), Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structures and functions of the following ecosystems:

a. Forest Ecosystem b. Aquatic Ecosystem

Biodiversity and its Conservation: Definition and levels of biodiversity, Bio-geographical classification of India, hot spots of biodiversity - India as a mega diversity nation, Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation.

**Unit III****Environmental Pollution & Social Issues**

Environmental Pollution: Definition, Cause, effects, control measures and case studies of: Air pollution b. Water pollution c. Soil pollution

Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Disaster management (floods and cyclones)

Social Issues and the Environment: Sustainability, Urban problems related to energy, Water conservation and watershed management, Resettlement and rehabilitation of people; Environmental ethics: Issues and possible solutions, global warming, ozone layer depletion, Consumerism and waste products

#### **Unit IV**

##### **Human Population and the Environmental Acts**

Human Population and the Environment: Population growth, Affluence, Technology and Environmental Impact (Master Equation), Population explosion and Family Welfare Programme, Value Education, HIV/AIDS, Women and Child Welfare, Role of information Technology in Environment and human health. Environment Protection Acts: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act and Forest Conservation Act. Issues involved in enforcement of environmental legislation.

##### **Textbook(s) and Reading Material (s)**

1. E. Bharucha, Textbook of Environmental Studies, 1<sup>st</sup> Ed., University Press (India) Pvt. Ltd., 2005.
2. W. P. Cunningham, M.A. Cunningham, Principles of Environmental Science, 6<sup>th</sup> Ed., Tata McGraw Hill, 2008.
3. A. Kaushik, C. P. Kaushik, Perspectives in Environmental Studies, 4<sup>th</sup> Ed., New Age International Publishers, 2008.
4. H. S. Peavy, D. R. Rowe, G. Tchobanoglous, Environmental Engineering, 1<sup>st</sup> Ed., McGraw Hill Int. ed., 1984.
5. T. E. Graedel, B. R. Allenby, Industrial Ecology and Sustainable Engineering, 1<sup>st</sup> Ed., Pearson Publications, 2009.
6. <http://172.30.1.222/wbc/it/schedule.aspx>.
7. <http://172.30.1.8/wbc/it/coursepage.aspx>.
8. <https://www.edx.org/course/environmental-protection-and-sustainability>.

**19IT409 Employability Skills I****1 1 1 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
CO1										3		2
CO2								1		2		2
CO3	2	1						2				
CO4	2				2							
CO5	2				2							
CO6	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****Introduction to Android Studio, Basics of Android**

- Familiarizing with User Interface of Android Studio
- Android Emulator and Android Versions
- Lifecycle of Android

**Building first Android App, Views and ViewGroups**

- Running Android App in Emulator, Enabling Debug Mode in Mobile
- Understanding the Log Window, Running Processes
- Familiarizing Module level and Project level Gradle
- XML Introduction
- TextView, ImageView and Button
- Constraint Layout, Linear and Relative Layout

**Introduction to Kotlin Programming Language**

- Why Kotlin when we have Java?
- Kotlin Fundamentals



- Using Kotlin IDE and writing first Kotlin Program
- Control Statements and Loops, when Statement

**Integrating XML and Kotlin (Frontend and Backend)**

- Create a simple Birthday app (ImageView and TextView)
- Toast Message,View Binding, Data Binding
- onClickListener and other Listeners Implementation

**Total 30 Hours**

**19HSX11 CC & EC Activities I****0010****Course Outcomes**

At the end of the CC&amp;EC activities students will be able to

1. Interpret and present the abstractive technical information through an activity
2. Think critically in providing solutions to the generic and common problems
3. Demonstrate the creative thinking in dealing with liberal arts
4. Instill team sprit through active engagement with the peer
5. Develop programs of common interest having social impact
6. Empower the under privileged through motivational activities

**Co-Po Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C01										3
C02						3	2			
C03						3				
C04									3	
C05						3				
C06						3				

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

**19MA405 Probability and Statistics****3 1 0 3****Course Outcomes**

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

1. Interpret probability axioms and Baye's 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 <sub>1</sub>	PO <sub>2</sub>
1	2	1
2	2	1
3	2	1
4	2	1
5	3	2
6	3	2

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

**Unit I****11+4 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****11+4 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****11+4 Hours****Sampling Distribution & Testing of Hypothesis**Populations and samples, Sampling distributions of means ( $\sigma$  - known and  $\sigma$  - 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+3 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: 45+15 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

$$f(x) = \begin{cases} 2 - x, & 0 \leq x < 2 \\ 0, & \text{elsewhere} \end{cases}$$

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, 216, 341, 225, 322, 280, 306, 337, 305, 356, 402, 216, 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  $\mu$  is the mean lifetime of all the bulbs produced by the company. Test the hypothesis  $\mu = 1600$  hours against the alternative hypothesis  $\mu < 1600$  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.

**19CS403 Computer Organization and Architecture****3 1 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	PO <sub>1</sub>	PO <sub>12</sub>
1	3	2
2	3	2
3	2	1
4	2	2
5	2	1
6	2	3

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

**Unit I****Overview & Micro operation****12+4 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****10+4 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****11+3 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+4 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: 45+15 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", 3<sup>rd</sup> edition, Pearson /PHI,1992.

**Reference(s):**

1. V. Carl Hamacher, Zvonko G. Varanescic and Safat G. Zaky, "Computer Organization ", 6<sup>th</sup> 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 ", 5<sup>th</sup> edition, Pearson/PHI, 2007

**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open book Test <sup>1</sup> (%)
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.



**19IT403 Operating Systems****3 1 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. Apply Segmentation and Paging Techniques
4. Compare and contrast various memory management schemes
5. Understand the functionality of file systems
6. Evaluation of various disk scheduling algorithms

**CO - PO Mapping**

COs	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>7</sub>	PO <sub>12</sub>
1	3	3	2	2
2	3	3	2	2
3	3	3	2	2
4	3	3	2	2
5	3	3	1	2
6	3	1	1	1

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

**Syllabus****Unit I****12+4 Hours****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****11+4 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****11+4 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****11+3 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: 45+15 Hours**

**Textbook (s)**

1. Operating System Concepts, Abraham Silberschatz, Greg Gagne, Peter B. Galvin, 9th Edition, Wiley, 2016.
2. Operating Systems, Harvey M. Deitel, Paul J. Deitel, David R. Choffnes, 3rd Edition, Pearson Prentice Hall, 2004.

**Reference (s)**

1. Operating Systems: Internals and Design Principles, William Stallings, 7th Edition, Pearson Prentice Hall, 2013.
2. Operating systems: A Concept based Approach, D. M. Dhamdhare, 2nd Edition, TMH, 2006.
3. Operating System: A Design Approach, Crowley, 1st Edition, TMH, 2001.
4. 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**

1. List any four operating systems
2. Define operating system
3. List four operating system services

**Understand**

1. Explain System calls
2. Explain the role memory management in operating system
3. Illustrate the working principle critical section problem

**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. Give an example of a scenario that might benefit from a file system supporting an append-only access write.

**Analyze**

1. 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?
2. Compare CPU scheduling algorithms
3. Analyze the general strategy behind deadlock prevention and give an example of a practical deadlock prevention method.

**Evaluate**

1. Assuming the operating system detects the system, is deadlocked, what can the operating system do to recover from deadlock?
2. Describe how to implement a lock using semaphores.

**Open Book Exam Questions**

1. 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.

2. Consider a paging system with the page table stored in memory:
  - a. If a memory reference takes 200 nanoseconds, how long does a paged memory reference take?
  - b. 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?

**19IT404 Computer Networking****3 1 0 3****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. Illustrate the concepts of transport layer and its protocols
6. Understand the internal functionalities of Application layer protocols.

**CO - PO Mapping**

COs	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>12</sub>
1	3	2	2
2	3	3	1
3	2	3	2
4	2	3	2
5	1	3	1
6	1	3	1

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

**Syllabus****Unit I****11+4 Hours****Physical Layer- Network Hardware-Network Software-and Transmission Media**

OSI-TCP/IP-the ARPANET-Network Topologies-Physical Layer: Transmission media: Magnetic Media-Twisted pair-Base band Coaxial Cable-Fiber optics-Wireless Transmission: Electromagnetic Spectrum-Radio Transmission-and Microwave Transmission. Switching-Techniques: Circuit Switching-Packet Switching-Message Switching.

*Taxonomy of networking devices.***Unit II****12+4 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***Unit III****10+3 Hours****Network Layer**

Network Layer design issues-Virtual circuit and Datagram subnets-Routing algorithms: Shortest path routing-Flooding-Hierarchical routing-Distance vector routing-Broad cast and Multi cast routing, Congestion-Control: Congestion prevention policies.

*Internet control protocols***Unit IV****12+4 Hours****Transport Layer**

Transport Layer Services-Connection Management-Elements of Transport Protocols-Internet Transport Protocols: UDP and TCP. IPv4 & IPv6

Application Layer-Domain name system-Electronic Mail-WWW, ATM Transport protocol-Proxy

*Real time transport protocol-session control protocols.***Total: 45+15 Hours**

**Textbook (s)**

1. Andrew S Tanenbaum, Computer Networks, 5<sup>th</sup> Edition, Pearson Education /PHI, 2013
2. Behrouz A. Forouzan, Data Communications and Networking, 5<sup>th</sup> Edition, Tata McGraw Hill Higher Education, 2017

**Reference (s)**

1. William Stallings, Data and Computer Communications, 9<sup>th</sup> Edition, Pearson Prentice Hall, 2013
2. W.A. Shay, Thomson, Understanding Communications and Networks, 3<sup>rd</sup> 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?

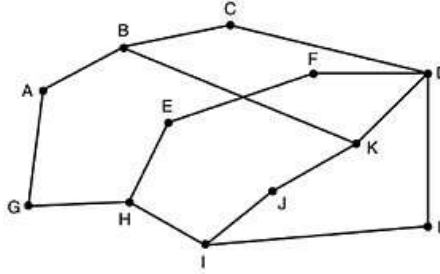
**Analyze**

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**

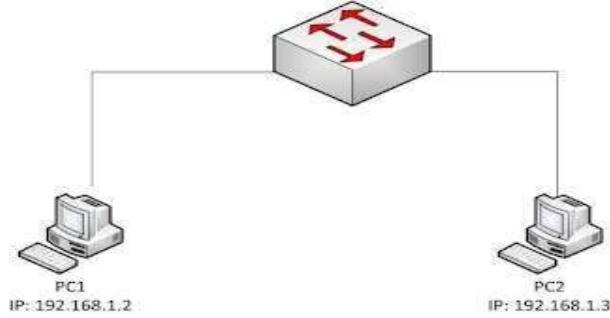
1. Consider the user of differentiated services with expedited forwarding. Is there a guarantee that expedited packets experience a shorter delay than regular packets? Justify.

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**

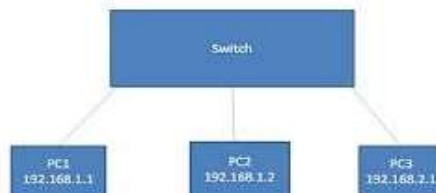
1. Refer the below diagram and answer based on the scenarios.



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

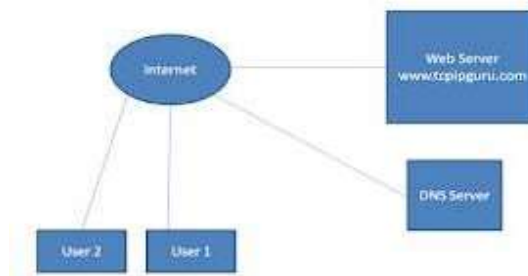
IP address of PC3 – 192.168.2.1/24

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?

**19IT405 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 <sub>1</sub>	PO <sub>2</sub>	PSO <sub>12</sub>
1	3	2	3
2	3	2	3
3	2	3	3
4	2	3	2
5	3	3	3
6	2	2	2

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

**Syllabus****Unit- I****10+9 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.
  - 1) Home Page
  - 2) Login Page: a. Student Login Page b. Admin Login Page
  - 3) Registration page
  - 4) Test Page
  - 5) Results Page.
2. 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.

**Unit- II****12+6 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, Transitions, Scroll spy, Visibility, CSS Components, SVG, Bootstrap Validator, Java Script Components. **JSON:** Introduction, Parsing, Objects, JSON Formatter and Validator, Dynamic HTML Data. **jQuery:** Selectors, Filters, Form Plug-ins, Auto Validations

*Bootstrap icons, Jumbotron.*

**Practical Components**

1. Apply different font styles, font families, font colors, animations and other formatting styles to the above static web pages.
2. Validate login page and registration page using Java Script.
3. Make the static pages Responsive and attractive using Bootstrap components (\*\*Mobile View)



**Unit- III****11+6 Hours****PHP**

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 register with the web site including photograph.
2. Write a PHP program to insert the questions and respective answers into the database through admin page, sending mails to registered students through admin.
3. 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

**Unit- IV****12+9 Hours****Flask**

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. After user login, display Questions from the database into test page in shuffled manner using flask and store in database.
2. Write a Flask code to do the following
  1. Evaluate the answers of the test which is given by the student in the Test page.
  2. Calculate the total score of the student and store it into the database and display score in dashboard of student.
3. Using flask retrieve results in a responsive table format of all students with filtering.
4. Deploy the application developed in real time environment

**Textbook(s):**

1. Programming the World Wide Web, 8<sup>th</sup> 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 (%)
<b>Remember</b>	20	20	--
<b>Understand</b>	50	40	--
<b>Apply</b>	30	40	40
<b>Analyze</b>	--	--	20
<b>Evaluate</b>	--	--	40
<b>Create</b>	--	--	--
<b>Total (%)</b>	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.

**19IT406 Python Programming Laboratory****00315****Course Outcomes**

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

1. Understand various programming platforms available for problem solving.
2. Understand mathematical and logical methods which improves critical thinking.
3. Understand available searching and sorting process to handle trees and graphs.
4. Apply an appropriate problem-solving method for developing a solution.
5. Design and develop simple web and database applications using frameworks.
6. Develop an ability to communicate among peers for solving complex problems and projects.

**CO-PO Mapping**

COs	PO <sub>1</sub>	PO <sub>4</sub>
1	3	3
2	3	3
3	3	3
4	2	2
5	3	2
6	2	3

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

**List of Experiments**

1.
  - a) Running instructions in Interactive interpreter and a Python Script.
  - b) Write a program to purposefully raise Indentation Error and Correct it.
2.
  - a) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem)
  - b) Write a program add.py that takes 2 numbers as command line arguments and prints its sum.
3.
  - a) Write a Program for checking whether the given number is a even number or not.
  - b) Using a for loop, write a program that prints out the decimal equivalents of  $1/2$ ,  $1/3$ ,  $1/4$ , ...,  $1/10$ .
  - c) Write a program using a for loop that loops over a sequence. What is sequence?
  - d) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.
4.
  - 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.
5.
  - a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure.
  - b) Write a program to use split and join methods in the string with a dictionary data structure.

6.
  - a) Write a program `combine_lists` that combines these lists into a dictionary.
  - b) Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?
7.
  - a) Write a program to print each line of a file in reverse order.
  - b) Write a program to compute the number of characters, words and lines in a file.
8.
  - a) 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)
  - b) Find mean, median, mode for the given set of numbers in a list.
9.
  - a) Write a function `nearly_equal` to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.
  - b) Write a function `dups` to find all duplicates in the list.
  - c) Write a function `unique` to find all the unique elements of a list.
10.
  - a) Write a function `cumulative_product` to compute cumulative product of a list of numbers.
  - b) Write a function `reverse` to reverse a list. Without using the reverse function.
  - c) Write function to compute gcd, lcm of two numbers. Each function shouldn't exceed one line.
11.
  - a) Write a program that defines a matrix and prints.
  - b) Write a program to perform addition of two square matrices.
  - c) Write a program to perform multiplication of two square matrices.
12.
  - a) Install packages `requests`, `flask` and explore them. using (pip)
  - b) Write a script that imports `requests` and fetch content from the page. Eg. (Wiki)
  - c) Write a simple script that serves a simple `HTTPResponse` and a simple `HTML Page`.

### 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. Advanced Problem Solving Skills Lab manual–Department of IT-GMRIT Rajam,

**19IT407 Operating Systems Laboratory****0 0 3 1.5****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	PO <sub>1</sub>	PO <sub>12</sub>
1	3	1
2	3	1
3	3	1
4	2	1
5	3	1
6	2	1

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. Simulate Bankers Algorithm for Dead Lock Avoidance.
8. Simulate Bankers Algorithm for Dead Lock Prevention.
9. Write a C program to simulate page replacement algorithms. a) FIFO b) LRU
10. Write a C program to simulate page replacement algorithms. a) LRU b) Optimal
11. Write a C program to simulate producer-consumer problem using semaphores.
12. Write a C program to simulate the concept of Dining-Philosophers problem.

**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.

**19IT409 Employability Skills II****1 1 1 3****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****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****Basic Components in Android**

- Fragments Implementation
- Navigation Drawer
- Different types of Navigation
- Activity and Fragment Lifecycle
- RecyclerView Implementation

**Firestore Introduction and Integration with Android Studio**

- Cloud Service Introduction
- Adding External Dependency and SHA keys
- Basic Services Introduction like Authentication, Cloud Firestore

**Introduction to Hybrid Apps and Implementation**

- Flutter
- React Native

Publishing app to Play Store and other App Stores

**Total 30 Hours**

**19HSX11 CC & EC Activities I****0011****Course Outcomes**

At the end of the CC&amp;EC activities students will be able to

1. Interpret and present the abstractive technical information through an activity
2. Think critically in providing solutions to the generic and common problems
3. Demonstrate the creative thinking in dealing with liberal arts
4. Instill team sprit through active engagement with the peer
5. Develop programs of common interest having social impact
6. Empower the under privileged through motivational activities

**Co-Po Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C01										3
C02						3	2			
C03						3				
C04									3	
C05						3				
C06						3				

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



**19CS404 Design and Analysis of Algorithms****3 0 2 4****Course Outcomes**

1. Understand the fundamentals for analysing time and space complexity of algorithms
2. Describe the basic principles of various algorithm design techniques
3. Choose and apply appropriate algorithm design technique to solve real time application
4. Analyze the performance of algorithm designed for real time application
5. Understand P and NP problems
6. Analyze the performance of algorithm designed for real time application

**CO-PO Mapping**

CO	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>12</sub>	PSO <sub>1</sub>
1	2	3	3	2	2
2	2	3	2	2	1
3	2	3	3	2	2
4	2	2	2	2	1
5	2	3	3	2	2
6	2	2	2	2	2

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

**Unit I****10 + 6 Hours****Introduction to Algorithms**

Fundamentals of algorithmic problem solving – Analysis framework - Performance Analysis: - Space complexity, Time complexity - Growth of Functions: Asymptotic Notation- Big oh notation, Omega notation, Theta notation, little oh, little omega. Mathematical Analysis of Non-recursive algorithms – Mathematical Analysis of Recursive algorithms - Brute Force: Bubble sort – Sequential search - String matching

*Time complexities of basic operations on array, stack, queue***Practical Components**

1. Problems on string matching using Brute Force approach
2. Analysis of recursive algorithms

**Unit II****12 + 8 Hours****Algorithm Design Techniques - I**

Decrease and Conquer: General method, Insertion sort, Topological sorting – Divide and Conquer: General method, Merge sort, Quick sort, Fibonacci search – Transform and conquer: General method, Heapsort – Disjoint sets: Operations, Simple Union and simple find, Weighted Union, Collapse Find.

*Graph representation, graph applications***Practical Components**

1. Problems on divide and conquer – median of 2 sorted arrays, inversion count
2. Problems on decrease and conquer

**Unit III****14 + 10 Hours****Algorithm Design Techniques - II**

Greedy method: General method, applications:-Job sequencing with deadlines, Minimum cost spanning trees (Prim's and Kruskal's Algorithms), Single source shortest path problem (Dijkstra's Algorithm), Optimal Merge Patterns (two way merge pattern) - Dynamic Programming: General method, applications:-Matrix chain multiplication, 0/1 knapsack problem, all pairs shortest path problem.

*Optimal BST, Huffman trees and codes***Practical Components**

1. Problems on Greedy technique
2. Problems on Dynamic Programming

**Unit IV****9 + 6 Hours****Limitations of algorithm power methods to cope up**

P, NP and NP-Complete Problems: - P and NP problems, NP-Complete problems. Backtracking: General method, applications: -n-queen problem, sum of subsets problem, Hamiltonian Circuit problem. Branch and Bound: General method, Applications: - Traveling sales person problem, Assignment Problem

*0/1 knapsack problem, graph coloring problem*

**Total: 45+30 hours****Practical Components**

1. Problems on backtracking technique
2. Problems on branch and bound technique

**Textbook (s)**

1. Introduction to The Design and Analysis of Algorithms, 3<sup>rd</sup> 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 Johnson Baugh and Marcus Schaefer, Pearson Education.
3. [www.geeksforgoeks.org](http://www.geeksforgoeks.org)
4. [www.hackerearth.com](http://www.hackerearth.com)
5. [www.tutorialspoint.com](http://www.tutorialspoint.com)

**SAMPLE QUESTION (S)****Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Practical Test
Remember	15	10	--
Understand	35	20	--
Apply	30	40	70
Analyze	20	30	20
Evaluate	--	-	10
Create	--	-	--
Total (%)	100	100	100

**Remember**

1. Define performance analysis of an algorithm.
2. Define recurrence relation
3. Define disjoint sets.
4. Define optimality principle

**Understand**

1. Explain back tracking algorithm
2. Explain Asymptotic notations
3. Explain the LC search algorithm
4. Explain the divide and conquer strategy. Write the applications of divide and conquer strategy and write the control abstraction for divide and conquer strategy
5. Explain the 4 cases of master theorem

6. What are implicit and explicit constraints in back tracking ?

### Apply

1. Solve the fractional knapsack problem with capacity  $m=20$ ,  $W=(18,15,10)$ ,  $P=(25,24,15)$  for the optimum solution.
2. Create two arrays that store all even no's in one array and all odd no's in another array for a given set of elements
3. Find the space and time complexity of an algorithm to find the maximum element from an array.
4. Solve the recurrence relation  $T(n)=2T(n/2)+n\log n$  using master theorem.
5. Demonstrate the process of Fibonacci search with an example
6. Find the shortest tour for the TSP for the given graph using FIFOB.

$$\begin{bmatrix} \infty & 20 & 30 & 10 & 11 \\ 15 & \infty & 16 & 4 & 2 \\ 3 & 5 & \infty & 2 & 4 \\ 19 & 6 & 18 & \infty & 3 \\ 16 & 4 & 7 & 16 & \infty \end{bmatrix}$$

### Analyze

1. Analyze the time complexity of quicksort .
2. Differentiate greedy method with dynamic approach
3. Discuss the worst case time complexity of travelling sales person problem
4. How polynomial multiplication is best with FFT
5. Compute the time complexity of fun()?

```
int fun(int n)
{ int count = 0;
  for (int i = n; i > 0; i /= 2)
    for (int j = 0; j < i; j++)
      count += 1;
  return count;
}
```

**19IT502 Artificial Intelligence****3 1 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 <sub>1</sub>	PO <sub>12</sub>	PSO <sub>1</sub>
1	2	3	3
2	2	2	3
3	3	3	2
4	2	3	3
5	2	2	3
6	3	3	3

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

**Syllabus****Unit I****12+4 Hours****Introduction & Heuristic Search Techniques**

AI problems, AI techniques, Classification of AI, Application of AI, Defining problem as a state space search, Production systems, Production system characteristics, Problem Characteristics, Heuristic Search Techniques- Generate-and-Test, Hill Climbing, Best-First-Search, Problem Reduction, Constraint Satisfaction

*Means-Ends Analysis and data abstraction-mapping***Unit II****11+3 Hours****Knowledge Representation**

Representations and Mapping, Framework for Knowledge representation, Approaches to Knowledge Representation, Issues in knowledge Representation, Use of Predicate Logic- Propositional Logic, Predicate Logic , Resolution. Representing knowledge using rules- Procedural Verses Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning, Weak Slot and Filler Structure- Semantic Nets, Frames. Strong-Slot

*Filler structures-conceptual dependency-scripts***Unit III****11+4 Hours****Game Playing**

Mini-max search, alpha-beta cutoffs, planning system, Goal stack planning, Hierarchical planning, understanding as constraint satisfaction, waltz algorithm, Natural language processing - syntactic processing, Semantic Analysis

*Case grammars- Conceptual parsing***Unit IV****11+4 Hours**

**Learning**

Rote learning, learning by taking advice, learning in problem solving, learning from examples, Winston’s learning program, decision trees, perception, vision, speech recognition, navigation, manipulation, robot architecture

*Expert systems, shell-explanation-knowledge acquisition*

**Total: 45+15 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  $\square$  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.

**19IT503 Cloud Computing****3 1 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. The fundamental ideas of different CPU, Memory and I/O virtualization techniques that serve in offering software computation, and storage services on the cloud
6. Analyze Cloud infrastructure including Google Cloud and Amazon Cloud.

**CO - PO Mapping**

COs	PO <sub>2</sub>	PO <sub>4</sub>	PO <sub>6</sub>	PO <sub>7</sub>	PO <sub>8</sub>	PSO2
1	3	1	2	3	1	2
2	3	3	1	2	3	2
3	2	2	3	1	2	2
4	2	1	3	3	1	1
5	2	2	3	1	2	2
6	2	3	3	3	3	2

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

**Syllabus****Unit I****12+4 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****13+4 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.

*Beyond the Syllabus: Companies in the Cloud Today, Amazon Web Services, Google services, IBM Cloud,*

*Windows Azure, Tata Cloud, Salesforce.com*

**Unit III****10+4 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.

*Beyond the Syllabus: various hypervisors like VMware, KVM, oracle VM,*

**Unit IV****10+3 Hours****Cloud Service Providers**

EMC, EMC IT, Captiva Cloud Toolkit, 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, Sales force, Sales Cloud.

*Service Cloud: Knowledge as a Service, Rack space, VMware, Manjra soft, Aneka Platform*

**Total: 45+15 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, 1<sup>st</sup> 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 , 1<sup>st</sup> Edition, MK Publishing, 2010
3. David S Linthicum, Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide, 1<sup>st</sup> 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 <sup>3</sup> (%)
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



**19IT504 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 <sub>1</sub>	PO <sub>2</sub>	PO <sub>7</sub>	PO <sub>12</sub>
1	3	3	2	2
2	3	3	2	2
3	3	2	2	2
4	2	2	2	2
5	2	3	2	2
6	2	3	2	2

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

**Syllabus****Unit I****12+6 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. Suggest the suitable life cycle model for credit card validation system
2. Perform Agile Testing

**Unit II****11+12 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****11+3 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

**Unit IV**

**11+9 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

**Total: 75 Hours**

**Textbook (s)**

1. Rajib Mal, Fundamentals of Software Engineering, 3rdEdition, Eastern Economy Edition, 2009
2. Roger S. Pressman, Software Engineering, A practitioner’s Approach, 6thEdition, McGraw-Hill International Edition, 2005

**Reference(s)**

1. I. Sommerville, Software Engineering, 7thEdition, 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 * (%)
<b>Remember</b>	25	15	--
<b>Understand</b>	35	15	20
<b>Apply</b>	20	25	30
<b>Analyze</b>	20	25	30
<b>Evaluate</b>	--	10	20
<b>Create</b>	--	10	--
<b>Total (%)</b>	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

**19CSC11 Exploratory Data Analytics****3 1 0 3****Course Outcomes**

1. Explain the Data Analysis Fundamentals
2. Illustrate various data Visual aids
3. Categorise different data transformation and descriptive statistics
4. Identify different Correlation and Inferences from statistical tests
5. Make use of the concept Hypothesis Testing
6. Classify different Multivariate Analysis techniques

**CO-PO Mapping**

COs	PO <sub>1</sub>	PO <sub>4</sub>	PO <sub>12</sub>	PSO <sub>1</sub>
1	3	2	1	3
2	3	3	2	3
3	3	2	2	2
4	2	3	1	3
5	3	3	2	3
6	3	2	2	2

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

**Unit I****11+4 Hours****Exploratory Data Analysis Fundamentals**

Understanding data science, significance of EDA, steps in EDA. types of analysis (univariate, bivariate, multivariate). Making sense of data: Numerical data-Discrete&continuous data,categorical data, Measurement scales-Nominal, Ordinal,Interval, Ratio. Comparing EDA with classical and Bayesian analysis, getting started with EDA: Numpy, Pandas,Scipy, and Matplotlib.

Grouping data: groupby mechanics, rearranging, reshaping data structures, data aggregation methods, and cross-tabulation methods.

*Objectives of Exploratory data Analysis, The applications of EDA.*

**Unit II****11+4 Hours****Visual aids for EDA**

Line chart, Bar charts,Box plot,residual plot, Scatter plot-bubble chart, scatterplot using seaborn, Area plot, stacked plot, and stem-and-leaf plot, pie chart, table chart, polar chart, histogram, lollipop chart, choosing the best chart.

Data transformation and descriptive statistics

Transformation techniques- performing data deduplication,replacing values, handling missing data, renaming axis indexes, outlier detection and filtering. Permutation and random sampling, computing indicators/dummy variables, string manipulations.

Descriptive statistics: Understanding statistics, distribution function (uniform, normal, exponential, binomial), cumulative distribution function, measure of central tendency, measure of dispersion (standard deviation, variance, skewness, kurtosis, percentiles, quartiles)

*Violin Plots, Inter Quartile Range, Discretizaion & binning, heatmaps*

**Unit III****11+4 Hours****Correlation and Inferences from statistical tests :**

Introducing correlation, covariance, Pearson's Correlation, Spearman's Rank Correlation.

Hypothesis Testing: Testing a difference in mean, testing a correlation, chi-squared tests, errors, power.

Model development and evaluation with regression techniques.

*Correlation vs causation, ANOVA,*

**Unit IV**

**12 + 3 Hours**

Multivariate Analysis: overview, Factor Analysis, Cluster Analysis, Discriminant analysis, EDA Case Study

*Multidimensional Scaling, MANOVA vs ANOVA*

**Total: 45+15 Hours**

**Textbook (s)**

1. Daniel J. Denis: Univariate, Bivariate, and Multivariate Statistics Using R: Quantitative Tools for Data Analysis and Data Science, Wiley,2020
2. Mukhiya Suresh Kumar Mukhiya, Ahmed Usman Ahmed: Hands-On Exploratory Data Analysis with Python: Perform EDA techniques to understand, summarize, and investigate your data, Packt, 2020
3. Downey, Allen. Think stats: exploratory data analysis. " O'Reilly Media, Inc.", 2014.
4. Neil H. Spencer: Essentials of Multivariate Data Analysis, CRC Press,2014

**Reference (s)**

1. Wes McKinney : Python for Data Analysis 2nd Edition,Wiley,2013
2. Glenn J. Myatt, Wayne P. Johnson: Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, 2nd Edition,Wiley,2014
3. Wendy L. MartinezAngel R. MartinezJeffrey L. Solka: Exploratory Data Analysis with MATLAB, 2nd Edition,CRC Press,2011
4. Radhika Datar, Harish Garg : Hands-On Exploratory Data Analysis with R , Packt,2019
5. Joseph F Hair, Barry J. Babin, Rolph E. Anderson, William C. Black: Multivariate Data Analysis Cengage, 2018

**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
<b>Remember</b>	50	40	--
<b>Understand</b>	30	40	--
<b>Apply</b>	20	20	50
<b>Analyze</b>	--	--	50
<b>Evaluate</b>	--	--	--
<b>Create</b>	--	--	--
Total (%)	100	100	100

**SAMPLE QUESTION (S)**

**Remember**

1. What is data science.
2. Define purpose of different data visualtion aids
3. List any two steps involved in EDA.

**Understand**

1. Explain different data representation
2. Explain the role of various data grouping methods
3. Explain purpose of hypothesis testing in detail

**Apply**

1. Apply various visual aids to identify behavior of data
2. Make use of Multivariate Analysis methods for data nanlysis
3. Examine data with various distribution function

**Analyze**

1. Comapre and contrast varius data grouping methods.
2. Distinguish various methods to address problems with dummy variables
3. Examine various string handling methods

### **Evaluate**

1. Evaluate the statistics of a given dataset
2. Justify the importance of data skewness
3. Measure data dispersion methods on a dataset

### **Open Book Exam Questions**

#### **Question 1:**

Perform below analysis on a house price prediction dataset.

- a. Univariate Analysis
  - i. Analysis of a numerical feature
  - ii. Analysis of a categorical feature
- b. Bivariate Analysis
  - i. Relationship of a numerical feature with another numerical feature
  - ii. Relationship of a numerical feature with a categorical feature

#### **Question 2:**

Perform below analysis on weather prediction dataset.

- a. Correlation Analysis
  - a. Correlation Heat Map
  - b. Zoomed Heat Map
- b. Investigation of missing values
  - a. What's missing? to what extent?
  - b. Visualizing missing values in a data frame

**19CSC21 Web Programming Languages****3 1 0 3****Course Outcomes**

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

1. Understand what web applications are.
2. Analyze the templates and common scenarios of web development.
3. Examine various web programming languages and their usages.
4. Analyze the flow of data through various layers of web.
5. Identify the use of data management and compatibility of web browsers.
6. Identify the need of security and performance for a web application.

**CO – PO Mapping**

COs	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>7</sub>	PO <sub>12</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
1	3	3	2	2	2	2
2	3	3	2	2	3	3
3	3	3	2	2	3	3
4	3	3	2	2	3	3
5	3	3	1	2	2	3
6	3	1	1	1	3	2

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

**Syllabus****Unit I****12+4 Hours****Overview of the web**

Web application Overview: Basic concepts of web, The importance of web technology, Web programming languages

Web server: Introduction, Anatomy of HTTP transaction, Request and response structures, REST APIs.

Data management: Browser storage - Local storage & Session storage, Database storage.

*HTML, CSS, HTTP, Status codes*

**Unit II****11+4 Hours****Web programming in JavaScript**

Introduction: Overview of fundamentals of JavaScript, ES6 JavaScript standard.

Node JS: Introduction, Node packages, HTTP web server – Creating a HTTP server that supports Create, Read, Update and Delete operations via various HTTP methods, Adding common request parser

Express: Creating a web server with express and body parser packages

*NodeJS, ES6, Node packages.*

**Unit III****11+4 Hours****Restful Programming**

Introduction: Evolution of RESTful services, REST API Architectural Constraints, Designing REST API, REST API Error Handling Patterns, REST API Handling Change- Versioning Patterns, REST API Cache Control Patterns, REST API Response Data Handling Patterns, REST API Security.

**Spring Boot**

Introduction, Framework Theory, Beans Implementation, Dao Implementation, Running Project, Creating Model Class,

*REST API Security, Creating XML Files*

**Unit IV****11+3 Hours****Web programming in Python**

Introduction: Basic concepts –, classes and interfaces, Python's HTTP package

HTTP server: Introduction, creating a server that supports Create, Read, Update and Delete operations

HTTP server, Python packages

**Total: 45+15 Hours**

**Textbook (s)**

1. Learn Web Development with Python, Fabrizio Romano, Gaston C. Hillar, Arun Ravindran, 1st Edition, 2018 Packt Publishing Pvt Ltd.
2. Learn Java for Web Development, Vishal Layka, 1st Edition, 2014. Apress Media LLC.
3. Node.js, John Bach, Alexander Aronowitz, 3rd Edition, 2021. mEm Inc.

**Reference (s)**

1. HTML 5 in simple steps, Kogent Learning Solutions Inc, Dreamtech Press.
2. Beginning HTML, XHTML, CSS, and JavaScript, John Duckett, Wiley India.
3. Beginning CSS: Cascading Style Sheets for Web Design, Ian Pouncey, Richard York, Wiley India.
4. Web Designing & Architecture-Educational Technology Centre, University of Buffalo.

**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. List any four HTML tags and CSS properties
2. Define web server
3. List four browser storage methods

**Understand**

1. What HTTP method should be used for updating data in a server?
2. Explain the of CSS in web development
3. Illustrate the working of a HTTP server

**Apply**

1. When user opens a website, the underlying web application wants to store browser specific data. What is a good approach for saving the data?
2. Give an example of a scenario that might benefit from browser storage instead of backend storage.

**Analyze**

1. There is a common body parsing workflow that every request to a server must obey. What is a good way to implement it?
2. Compare Servlet and Java Server Page
3. Analyze the general strategy behind cookies and session management.

**Evaluate**

1. Assuming the server received a permission error from the database, what is the best way to propagate it to the user?
2. Describe how to implement user authentication in a web server.

**Open Book Exam Questions**

1. A file is to be stored in the web server. However, the access to this file is to be limited to specific set of users. How can once achieve this using a web server?
2. Consider a request that yields data of high cardinality. How can one send the data without affecting the performance of the website?

**19ITC31 Fundamentals of Security****3 1 0 3****Course Outcomes**

1. Understand 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 <sub>1</sub>	PO <sub>2</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
1	3	1	3	3
2	3	3	3	2
3	1	2	2	2
4	2	3	3	3
5	3	2	2	3
6	3	2	3	3

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

**Unit I****Security concepts****11+4 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, networking, benefits of networking.

*protocols suite, hacking, network sniffing, social engineering*

**Unit II****Cryptography****11+4 Hours**

Introduction to cryptography, Cryptographic functions (Authentication, Nonrepudiation, confidentiality, integrity), Cryptanalysis. Types of Cryptography: Symmetric key and Asymmetric Key Cryptography, 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****11+4 Hours**

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..

*Types of firewalls, advanced persistent threat, Buffer Overflow*

**Unit IV****Network Security****12 + 3 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: 45+15 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, 3<sup>rd</sup> Edition, John Wiley & Sons Inc, 2021.
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 (%)
<b>Remember</b>	50	40	--
<b>Understand</b>	30	40	--
<b>Apply</b>	20	20	50
<b>Analyze</b>	--	--	50
<b>Evaluate</b>	--	--	--
<b>Create</b>	--	--	--
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?

**19IT004 Computer Graphics and Multimedia****3 1 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 <sub>2</sub>	PO <sub>3</sub>	PO <sub>5</sub>
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****11+4 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****11+4 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****11+4 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+3 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: 45+15 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, 2<sup>nd</sup> 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, Addison Wesley, London, 1993.

**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
<b>Remember</b>	20	35	--
<b>Understand</b>	35	35	--
<b>Apply</b>	35	20	40
<b>Analyze</b>	10	10	40
<b>Evaluate</b>	--	--	20
<b>Create</b>	--	--	--
<b>Total (%)</b>	100	100	100

**Sample Question (S)**

**Remember**

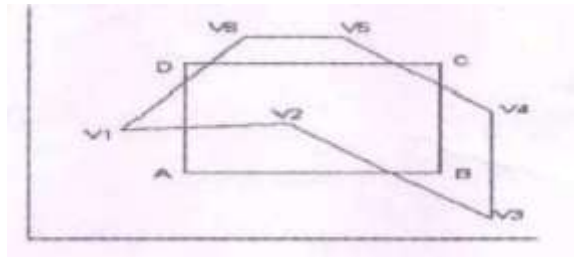
1. List the applications of computer graphics
2. Write 2D transformation matrix for translation, rotation and scaling
3. Define parallel projection
4. List the steps to design computer animation

**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.

**19IT005 Information Theory and Coding****3 1 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 <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>6</sub>	PO <sub>8</sub>
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+4 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****11+3 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****11+3 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****11+5 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: 45+15 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	--	--	--
<b>Total (%)</b>	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.



**19IT006 Data Warehousing and Data Mining****3 1 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 <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>	PO <sub>5</sub>	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+4 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+4 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****11+4Hours****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****10+3 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*

**Textbook (s)**

1. Pang, Ning Tan, Michael Steinbach, Vipin Kumar Introduction to Data Mining, 2<sup>nd</sup> Edition, Pearson Addison Wesley, 2018
2. Jiawei Han & Micheline Kamber, Data Mining Concepts and Techniques, 3<sup>rd</sup> Edition, Morgan Kaufmann, 2016

**Reference (s)**

1. Margaret H Dunham, Data Mining Introductory and advanced topics, 2<sup>nd</sup> Edition, Pearson Education, 2004
2. Arun K Pujari, Data Mining Techniques, 2<sup>nd</sup> 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
<b>Remember</b>	35	15	---
<b>Understand</b>	40	25	---
<b>Apply</b>	25	30	40
<b>Analyze</b>		20	30
<b>Evaluate</b>	--	10	30
<b>Create</b>	--	--	---
<b>Total (%)</b>	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**

2. 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 debts, age ect. The problem is categorize applications into those who have good credit, bad credit or fall into a grey area.

**19IT507 Cloud Computing Laboratory****00315****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	PO <sub>1</sub>	PO <sub>2</sub>
1	2	2
2	2	3
3	2	3
4	2	3
5	2	2
6	2	2

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

**List of Experiments**

1. Study of Cloud Computing & Architecture.
2. Install KVM/VMware Workstation for creating a virtual environment on windowsplatform. Concept: Virtualization
3. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.
4. Install Google App Engine. Create hello world app and other simple web applications using python/java.
5. Use GAE launcher to launch the web applications.
6. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
7. Find a procedure to transfer the files from one virtual machine to another virtual machine.
8. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
9. Install Hadoop single node cluster and run simple applications like wordcount.
10. Working and installation of Microsoft Azure.
11. Working with Mangrasoft Aneka Software.
12. Installation and Configuration of Justcloud.

**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

**19IT508 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**

	PO <sub>11</sub>	PO <sub>12</sub>
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	3	3
Co6	3	3

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

**19IT609 Employability Skills III****1 1 1 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****Soft Skills:**

Sl. No.	5 <sup>th</sup> Semester (Topic & Content)	No. of Periods
1.	<b>Introduction to Campus Placements:</b> Stages of Campus Placement, Skills assessed in Campus Placements & How to get ready?	01
2.	<b>Motivational Talk on Positive Thinking:</b> Beliefs, Thoughts, Actions, Habits & Results (Success)	01
3.	<b>Resume Preparation:</b> Resume? Templates? Mistakes to be avoided in a Resume, Steps to be followed in preparing it.(with examples)	02
4.	<b>Group Discussions (Recap):</b> 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.	<b>Psychometric Tests:</b> Definition, Types of Psychometric Tests: Numerical Computation, Data Interpretation, Verbal Comprehension, Verbal Critical Reasoning and Personality Questionnaires	01
6.	<b>Exercises related to Communication:</b> Story Writing, TAT etc	01
<b>Total Periods</b>		<b>08</b>

**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
<b>Total Periods</b>		<b>08</b>

**Domain Specific:**

<b>Sl. No.</b>	<b>Topic</b>	<b>No. of Periods</b>
1.	Flutter Basics	02
2.	Running Apps on Different Devices& Debugging Apps	02
3.	Widgets	01
4.	Styling, Adding Logic-Building a Real App	02
5.	Responsive & Adaptive User Interfaces and Apps	01
6.	Widget & Flutter Internals- Deep Dive	02
<b>Total Periods</b>		<b>08</b>

**Total 30 Hours**

**19HSX12 CC & EC Activities II****0 0 1 1****Course Outcomes**

At the end of the CC&amp;EC activities students will be able to

1. Interpret and present the abstractive technical information through an activity
2. Think critically in providing solutions to the generic and common problems
3. Demonstrate the creative thinking in dealing with liberal arts
4. Instill team sprit through active engagement with the peer
5. Develop programs of common interest having social impact
6. Empower the under privileged through motivational activities

**Co-Po Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
C01										3
C02						3	2			
C03						3				
C04									3	
C05						3				
C06						3				

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



**19IT511 Summer Internship #1**

**Course Outcomes**

At the end of the summer internship students will be able to

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.

**Co-Po Mapping**

	PO1	PO2	PO3
C01	3	2	2
C02	3	2	2
C03	3	1	2
C04	2	2	1
C05	3	2	2
C06	3	2	3

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

**19HSX10 Engineering Economics and Project Management****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**

COs	PO <sub>2</sub>	PO <sub>5</sub>
1	1	1
2	2	2
3	3	3
4	2	2
5	1	2
6	2	1

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

**Unit-I****10 + 3 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****13 + 4 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****10 + 4 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 + 4 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: 45+15 Hours**

**Textbook (s)**

1. Pravin Kumar, Fundamentals of Engineering Economics, Wiley India Pvt. Ltd. New Delhi, 2015
2. Rajeev M Gupta, Project Management, 2<sup>nd</sup> Ed., PHI Learning Pvt. Ltd. New Delhi, 2014
3. Panneer Selvam. R, Engineering economics, 2<sup>nd</sup> 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, 4<sup>th</sup> Ed., Tata McGraw Hill, 2014
4. A. Aryasri, Managerial Economics and Financial Analysis, 4<sup>th</sup> Ed., Tata McGraw Hill, 2014
5. Koontz & Weihrich, Essentials of Management, 6<sup>th</sup> Ed., TMH, 2010
6. Chuck Williams and Mukherjee, Principle of Management 7<sup>th</sup> 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
<b>Total</b>	<b>2,32,500</b>	<b>2,32,500</b>

**Adjustments:**

Closing Stock Rs.60,000    b ) Outstanding wages Rs.500

3. From the following balances as on the date March 31<sup>st</sup>, 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 <sub>o</sub>	t <sub>m</sub>	t <sub>p</sub>
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.

<b>Particular</b>	<b>Company - A</b>	<b>Company - B</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)**

**19IT602 Automata and Compiler Design****3 1 0 3****Course Outcomes:**

At the end of the course students are able to:

1. Analyse 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 <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>
1	1	3	2
2	2	3	3
3	3	2	2
4	2	1	3
5	2	1	3
6	2	1	3

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

**Syllabus****Unit I****13+5 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+4 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****10+3 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****10+3 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: 45+15 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 Louden, Compiler Construction, Principles and Practice, 1st Edition, Cengage, 1997.

**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
<b>Remember</b>	20	20	--
<b>Understand</b>	50	40	--
<b>Apply</b>	30	40	70
<b>Analyze</b>	--	--	20
<b>Evaluate</b>	--	--	10
<b>Create</b>	--	--	--
Total (%)	100	100	100

**Sample Question (S)**

**Remember**

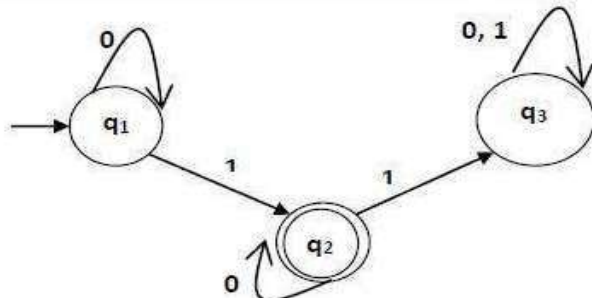
1. List out the different tuples of Deterministic Finite Automata
2. List out the closure properties of regular sets
3. State some software tools that manipulate source program.
4. List out the cousins of compiler.

**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  $L = \{ a^n b^n c^n / n \geq 1 \}$  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  $L = \{ a^n b^n c^n / n \geq 1 \}$ " 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 ( $\epsilon$ ), character classes denoting a single character ( $[...]$  and  $[^...]$ ), concatenation ( $xy$ ), alternation ( $x|y$ ), repetition ( $x^*$  and  $x^+$ ), and optional ( $x?$ ). You may also give names to subexpressions ( $\text{name=re}$ ) 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;
```



**19IT603 Machine Learning****3 1 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	PO <sub>2</sub>	PO <sub>5</sub>
1	3	3
2	2	3
3	3	1
4	2	2
5	2	3
6	3	3

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

**Syllabus****Unit I****11+3 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+4 Hours****Supervised Learning**

Regression: Linear Regression, Linear Regression with Multiple Variables, Logistic Regression; Learning with Trees: Constructing Decision Trees, 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****11+4 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.

*Density Based Clustering, DBSCAN.*

**Unit IV****11+4 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).

*Linear Separability, The Perceptron, Sigmoid Function and its properties.*

**Total: 45+15 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 (%)
<b>Remember</b>	40	30	--
<b>Understand</b>	40	40	--
<b>Apply</b>	20	30	80
<b>Analyze</b>	--	--	20
<b>Evaluate</b>	--	--	--
<b>Create</b>	--	--	--
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**

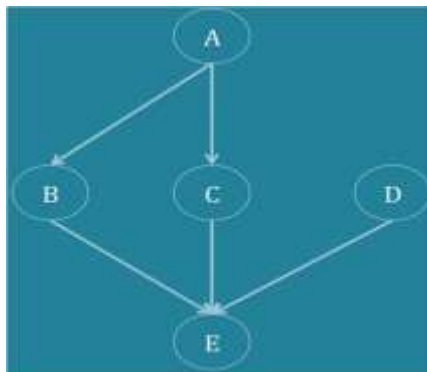
1. Apply the concept of Regularization to solve overfitting problem.
2. Build a Linear Regression for a given dataset.
3. Apply k-Means algorithm on a given dataset to identify clusters.

**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

**19CSC12 Deep Learning****3 0 2 4****Course Outcomes**

1. Explain the fundamental of Artificial Neural Networks
2. Identify different data representations for Neural Networks
3. Mak use of different CNN models.
4. Compare different character encoding techniques.
5. Exemplify different Deep unsupervised models
6. Examine different deep learning applications.

**CO-PO Mapping**

CO	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>4</sub>	PSO <sub>1</sub>
1	3	2	1	1
2	2	3	1	1
3	3	2	2	2
4	2	3	1	3
5	1	3	2	3
6	1	2	3	1

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

**Unit I****11+7 Hours****Introduction to Neural Networks**

Artificial Neural Networks: Introduction, Neuron Model, Neural Network Architecture, Learning Rules, Single Layer Perceptrons, Multilayer Perceptrons, adaptive resonance theory (ART), Back propagation Networks : Kohnen's self organizing networks, Hopfield network, Applications of NN, Data representations for neural networks : 0D tensors, 1D tensors, 2D tensors, tensor attributes, data tensors (Vector data, Timeseries data,images,video), tensor operations.

*Model Parameters vs Hyperparameters, Types of activation functions, Gradient descent ,delta rule*

**Practical Component:**

1. Build a Neural Network with backpropagation algorithm and test the same using appropriate dataset.
2. The implementation of tensors and various operations on tensors.

**Unit II****11+8 Hours**

**Convolution networks:** Building blocks of CNNs, Architectures, Filters and Feature Maps, pooling layers, Convolutions over volumes, Softmax regression, Deep Learning frameworks, Training and testing on different distributions, Bias and Variance with mismatched data distributions, Transfer learning, Multi-task learning, end-to-end deep learning.

CNN models: AlexNet, VGG -16, Residual Networks,YOLO

*Keras ,tensorflow, data augmentation, Batch Normalization, Dropout*

**Practical Component:**

1. Digit and Character recognizer using CNN
2. Explore AlexNet
3. Explore YOLO

**Unit III****Recurrent Networks**

One-hot encoding of words and charcters, using word embeddings, Recurrent Neural Network Model, Vanishing gradients with RNNs, Gated Recurrent Unit (GRU), LSTM (long short term memory), Encoder Decoder sequence to sequence architectures,

Deep Unsupervised Learning: Autoencoders, variational Autoencoders, Generative adversarial network, Deep Boltzmann Machines

*n-grams ,bag-of-words, Bi directional RNN, Exploding gradient*

**Practical Componet:**

1. One-hot encoding of words and characters using word embeddings.
2. Study the construction and working of Recurrent Neural Network
3. Explore LSTM and GRU to predict stock prices based on historic data.

**Unit IV**

**12 + 8 Hours**

**Applications of Deep Learning**

Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models. Attention models for computer vision tasks

*Batch Gradient Descent vs Stochastic Gradient Descent, limitations of deep learning*

**Practical Component:**

1. Explore applications like Image segmenation and object detection.
2. Automatic image captioning and video to text models.

**Total: 45+30 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. Yegnanrayana , "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, 2019)
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	40	40
Understand	30	40
Apply	30	20
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 autoencoders
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.

**Open Book Exam Questions**

**Question 1:**

List out any four datasets available in keras API and explain the features of each dataset and take an handwritten “mnist” numeric numbers dataset from keras API to classify handwritten digits.

**Question 2:**

Take a dataset which consists student photos and apply appropriate CNN models to display name of each student or object which appears on image. Note: Each image in a dataset consists group of mixed objects.

**19CSC22 Web Application Developments Framework****3 0 2 4****Course Outcomes**

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

1. Understand the fundamentals of web framework.
2. Classify model, view and controller layers of a web application.
3. Design a web application using a framework.
4. Know the concept of Java web framework.
5. Understand and analyze how modern-day web applications are different from web sites.
6. Learn the technologies of Python web framework.

**CO-PO Mapping**

COs	PO <sub>1</sub>	PO <sub>3</sub>	PO <sub>4</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
1	3	3	2	3	3
2	3	2	2	2	2
3	3	3	3	3	3
4	3	3	2	3	3
5	3	2	3	2	2
6	2	3	3	3	3

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

**UNIT- I****10+6 Hours****Fundamentals of Web Framework**

Web framework- History, Types of framework architectures, Model-view-controller (MVC), Three-tier organization

Introduction to frameworks- Framework applications, General-purpose website frameworks-Server-side, Client-side features

*MVC, Three-tier organisation, Framework***Practical Components**

1. Realisation of separation of data, data fetch and representation logics
2. Realization of mark-up language and it's styling

**UNIT- II****12+8 Hours****Angular – JavaScript web framework**

Introduction – Angular MVC, Model, View, Controller, Ajax, Data binding

Angular concepts - Directives, Scopes, Controllers, Modules, Expressions

Developing a simple To-Do application using AngularJS (Developing a single page application)

*MVC, Ajax, Data binding***Practical Components**

1. Implementation of angular directives
2. Implementation of scope and controller
3. Implementation of custom/user-defined directive

**Unit III****12+6 Hours****React framework**

Introduction to React: What is Full-Stack Web Development?, Node.js and NPM, Front-end JavaScript Frameworks and Libraries Overview, Introduction to React, React App Overview, Introduction to JSX, React Components, React Components: State and Props, React Components: Lifecycle Methods Part 1

React Router and Single Page Applications: Presentational and Container Components, React Components: Lifecycle Methods Part 2, Functional Components, React Virtual DOM, React Router, Single Page Applications, React Router: Parameters

React Forms, Flow Architecture and Introduction to Redux: Controlled Forms, Uncontrolled Components, The Model-View-Controller Framework, The Flux Architecture, Introduction to Redux, React Redux Forms

**Practical Components**

1. React Components
2. React Router and Single Page Applications
3. Controlled Form Validation, Uncontrolled Forms

**Unit IV**

**11+10 Hours**

**Django – Python web framework**

Introduction to Django- History-Django Components-Alternate Components-MVC Architecture in Django MVC creation in Django – Configuring Django, Creating model, view and controller in Django, REST in Django and templates  
*MVC, Django, REST*

**Practical Components**

1. Creating models for database queries
2. Writing Django templates for rendering data
3. Implementation of REST API using Django

**Total: 45+30 Hours**

**Textbook (s)**

1. Angular: Up and Running, Shyam Seshadri, 1st Edition, O’Reilly, 2018
2. Struts the Complete Reference, James Holmes, 2nd Edition, Mc. Graw Hill Professional, 2006.
3. Programming with Django, Wiley Publishing

**Reference (s)**

1. Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 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 (%)	Open Book Exam (%)
<b>Remember</b>	20	10	--
<b>Understand</b>	50	40	--
<b>Apply</b>	30	30	--
<b>Analyze</b>	--	20	--
<b>Evaluate</b>	--	--	--
<b>Create</b>	--	--	--
Total (%)	100	100	--

**Sample Question (S)**

**Remember**

1. Explain model, view and controller
2. List any 4 directives in Angular
3. List the Struts Tag Libraries.
4. Define a scope in Angular
5. Define a template in Django

**Understand**

1. Write a template in Django that conditionally renders data.
2. Write an example custom tag in Struts
3. Illustrate form validation in Struts.
4. Illustrate the use of ng-filter directive in AngularJS
5. Write an example snippet for ng-if directive in AngularJS
6. Differentiate between plain-validator and field-validator in Struts.



7. For a single Struts application, can we have multiple struts-config.xml files?

**Apply**

1. Write a snippet that uses ng-for, ng-if and compare it with usage of ng-filter directives in AngularJS
2. Write a sample code for creating a User model in Django that has the following properties:
  - a. Name (string)
  - b. Age (number)
  - c. Email (email)
  - d. Phone number (number)
3. Write a sample Django template that renders the User data whose age is > 15.
4. Create an actionForm bean in Struts.
5. Illustrate the steps required for setting up validator framework in Struts.

**Analyse**

1. What does the following code snippet in struts-config.xml do?

```
<exception
    key="stockdataBase.error.invalidCurrencyType"
    path="/AvailbleCurrency.jsp"
    type="Stock.account.illegalCurrencyTypeException">
</exception>
```
2. When can global scope be used over local scope in AngularJS?
3. Why is ng-filter more preferable than ng-if in AngularJS?
4. What happens to existing data in the database when models are edited in Django?
5. Write User and Group models with relevant attributes, where a User can be part of multiple groups. Ensure that when a User is queried, the groups he belongs too are also part of the response.

**19ITC32 Cyber Security****3 0 2 4****Course Outcomes**

1. Understand 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 <sub>1</sub>	PO <sub>3</sub>	PO <sub>4</sub>	PO <sub>5</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
1	3	3	1	2	2	2
2	3	3	1	3	2	1
3	1	2	3	2	2	2
4	3	1	1	2	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****11+7 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 cyber crimes, 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.

**Unit II****11+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****11+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: Use Snort as packet sniffer and write your own IDS rules

**Unit IV**

**12 + 7 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: Case Study on Indian IT ACT 2000

**Total: 45+30 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**

6. What is cyber security.
7. Define security policy.
8. List classification in cyber security.
9. Define network scanning.
10. 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 port 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).

**19IT007 The Internet of Things****3 0 2 4****Course Outcomes**

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

1. Understand the definition and significance of the Internet of Things
2. Discuss the architecture, operation, and business benefits of an IoT solution
3. Use of Devices, Gateways and Data Management in IoT.
4. Identify the IOT network protocols for web and message communication
5. Design an IoT device to work with a Cloud Computing infrastructure
6. Identifying the security vulnerabilities and security methods in IOT

**Co-Po Mapping**

COs	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>5</sub>	PO <sub>10</sub>
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+6 Hours**

**The Overview of IoT:** Overview of Wireless Sensor Networks, Overview of Internet of Things, IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M Communication, IOT examples.

*Types of sensors, Examples of M2M.*

**Practical Components:**

1. Study of Sensory Elements and the installation of required compiler in Linux

**Unit II****11+8 Hours**

IoT/M2M systems LAYERS AND designs standardizations ,Modified OSI Stack for the IoT/M2M Systems ,ETSI M2M domains and High-level capabilities ,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability .

*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 III****11+10 Hours**

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

*Open mobile alliance, XMPP*

**Practical Components:**

**1. RF experiments**

1.1. Point to point communication of two Ubimotes over the radio frequency.

**2. Experiments on interfacing with UbiSense**

2.1 Reading Temperature, Light Intensity and Relative Humidity value from the sensor.

2.2 Proximity detection with IR LED.

2.3 Generation of alarm through Buzzer.

2.4 Transmitting the measured physical value from the UbiSense over the Air.

**Unit IV**

**11+6 Hours**

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models.

IoT Privacy, Security and Vulnerabilities Solutions: Security and Privacy Requirements, Threat Analysis, , Access Control and Secure Message Communication.

*Types of computing, Tomography*

**Practical Components:**

**1. WSN Applications**

1.1 Demonstration of a peer to peer network topology using coordinator and end device

1.2 Establishing different Network Topologies

**2. IOT applications**

2.1 IP Based sensor monitoring through Ubimote and Ubi-sense

**Total: 45 + 30 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

**Refernce 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. Identify two major differences between Internet of Everything and Industrial IoT.
2. List the dominant technologies behind IoT development
3. Write the major significance of Internet of Things
4. Recognizes an alternative approach that results in better adaptivity in case of network fluctuations and increased latency
5. Write about the data-center based cloud tools that use to run the machine learning algorithm internally.

**Understand**

1. Illustrate the service-oriented architecture of IoT that ensures the interoperability among the heterogeneous devices
2. Identify the evolutionary terms of Internet of Things (IoT) that use to interact and live with the physical objects.
3. Discuss the resource capacity, selecting and provisioning the resources that greatly impact Quality of Service (QoS) of the IoT applications.
4. Illustrate the reference architecture of IoT that unifies the smart objects and human beings to provide the ubiquitous communication
5. Report the standard requirement of real time analytics to fulfill the demand of real-time stream processing engine. Department

**Apply**

1. Execute the two-tier data dissemination model for large-scale wireless sensor network
2. Demonstrate SPARQL query caching in order to improve the performance of semantic web applications
3. Implement a suitable OPENIoT Architecture for IoT/Cloud Convergence that provides an abstract presentation of the functional elements of architecture.
4. Illustrations a technique to cluster semantically similar QA pairs for retrieving an answer for a newly given query without asking the QA engine on the cloud side
5. Interpret a study analysis on open-source prototyping platform for the industrial IoT.

**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 AMPQ, CoAP, DDS, MQTT, UPnP and XMPP in terms of Transport Layer Protocols.
4. Comparative analysis on real-time analytics in Cloud-IoT and fog computing.
5. Relate a set of minimal features to be fulfilled by the programming frameworks for IoT.

**Evaluate**

1. Critique on fog-computing assisted distributed analytics system that uses a set of fall-detection algorithms, including algorithms based on acceleration measurements and time-series analysis methods, as well as filtering techniques to facilitate the fall-detection process.
2. Appraise a semantic QA cache that implement the device/cloud collaboration framework to compute the probability of the on-device semantic QA cache to answer a given query correctly.
3. Select an example that utilizes the device-collaboration framework for the proactive suggestion application
4. Defend the augmented reality applications in terms of Game based on Fog Computing and Linked Data
5. Select a suitable example that use automatically tagging recognized images to display the additional information such as social sentiment in order to achieve similar performance improvement for speech-recognition application with DL through device/cloud collaboration framework.

**Open Book Exam Questions**

1. Draw an architectural view of an IoT application for a post parcel tracking service with each parcel marked with a bar code. What will be the conceptual equation for the application?
2. How will an alarm device be made smart and alive using the internet? Assume that publish, subscribe services for the flight Expected Arrival (ETA) and train ETA are available

**19IT008 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**

COs	PO <sub>5</sub>	PO <sub>6</sub>	PO <sub>8</sub>
1	2	3	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

**Syllabus****UNIT – I****12+10Hours**

**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, Advanced Encryption Standard (AES).

*Blowfish, CAST-128.***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.

**Unit II****11+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 scheme.

*Digital Signature Standards.***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****11+6 Hours**

**Authentication Applications:** Kerberos, Key Management and Distribution, X.509 Directory Authentication service, 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. Lab Activity: Use iptables in linux to create firewalls..
2. Lab Activity: Use Snort as packet sniffer and write your own IDS rules

**Unit IV**

**11+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. Lab Activity: Write a security policy for password protection
2. Lab Activity: Case Study on Indian IT ACT 2000

**Total: 45+30 Hours**

**Text Books:**

1. William Stallings, "Cryptography And Network Security – Principles and Practices", 7<sup>th</sup> edition, Pearson Education Limited 2017.
2. Atul Kahate, "Cryptography and Network Security", 2<sup>nd</sup> edition, Tata McGraw-Hill, 2003.
3. Behourz A Forouzan, Cryptography and Network Security, 2<sup>nd</sup> edition, Tata McGraw-Hill, 2011.

**Reference Books:**

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 (%)	Open Book Exam (%)
Remember	30	30	--
Understand	40	40	--
Apply	30	30	--
Analyze	--	--	50
Evaluate	--	--	50
Create	--	--	--
Total (%)	100	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?

**19IT009 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 <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>5</sub>	PO <sub>10</sub>
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+6 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.

**Unit II****11+10 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

**Unit III****11+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

**Unit IV**

**11+6 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

**Total: 45+30 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 (%)
<b>Remember</b>	20	20
<b>Understand</b>	30	10
<b>Apply</b>	30	30
<b>Analyze</b>	10	20
<b>Evaluate</b>	10	20
<b>Create</b>	--	--
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.

**19IT606 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**

CO	PO <sub>3</sub>	PO <sub>5</sub>	PO <sub>9</sub>
1	2	3	2
2	3	3	1
3	3	3	2
4	2	3	1
5	3	3	2
6	2	3	2

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 KNN algorithm for classification.
5. Implement simple linear regression.
6. Implement logistic regression.
7. Design non-linear model using support vector machines.
8. Implement k-means clustering algorithm.
9. Implement random forest ensemble method.
10. Build an Artificial Neural Network (ANN) by implementing the back propagation algorithm and test the same using appropriate dataset.
11. Sentiment analysis on tweets – a case study.
12. 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.

**19IT607 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**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	2				3	2						3	3
CO2	3	3			3								3	3
CO3	3	3	3	2							2		3	3
CO4										3		2	3	3
CO5								3					3	3
CO6									3				3	3

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

**19IT609 Employability Skills IV****1 1 1 3****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****Soft Skills:**

Sl No.	6 <sup>th</sup> Semester (Topic & Content)	No. of Periods
1.	<b>Resume (Recap):</b> Resume? Templates? Mistakes to be avoided in a Resume and Steps to be followed in preparing it.	<b>01</b>
2.	<b>Group Discussions (Recap) &amp; Practice:</b> 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)	<b>01</b>
3.	<b>Interview Skills:</b> 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)	<b>03</b>
4.	<b>Mock Interviews:</b> Practice sessions with Feedback.	<b>02</b>
5.	<b>Exercises related to Communication:</b> Email Writing, Voice Versant, etc.	<b>01</b>
<b>Total Periods</b>		<b>08</b>

**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
<b>Total Periods</b>		<b>08</b>

**Domain Specific:**

<b>Sl. No.</b>	<b>Topic</b>	<b>No. of Periods</b>
1.	Navigation & Multiple Screens	02
2.	State Management	01
3.	Working with User Input & Form	02
4.	Sending Http Request	02
5.	Adding User Authentication	01
<b>Total Periods</b>		<b>08</b>

**Total 30 Hours**

**19HSX12 CC & EC Activities II**

**0 0 1 1**

**Course Outcomes**

At the end of the CC&EC activities students will be able to

1. Interpret and present the abstractive technical information through an activity
2. Think critically in providing solutions to the generic and common problems
3. Demonstrate the creative thinking in dealing with liberal arts
4. Instill team sprit through active engagement with the peer
5. Develop programs of common interest having social impact
6. Empower the under privileged through motivational activities

**Co-Po Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01										3		
C02						3	2					
C03						3						
C04									3			
C05						3						
C06						3						

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



### 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.

#### COs-POs Mapping

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
C01												3		
C02												3		
C03												3		
C04												2		
C05												3		
C06												2		

**19IT701 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	PSO1	PSO2
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

**19IT702 Summer Internship #II****0 0 0 1.5****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	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>5</sub>	PO <sub>6</sub>	PO <sub>7</sub>
1					3
2	3	1			
3	3				
4	3	1	3		
5	3	1	3	3	
6	3	1	3		

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

**19CSC13 Natural Language Processing (Elective V)****3 1 0 3****Course Outcomes**

1. Understand the fundamentals & building blocks of Natural Language Processing
2. Understand different text representations and labeling methods
3. Apply different Natural Language models and named entities
4. Understand Recurrent neural network for NLP
5. Make use of GRUs and LSTM models for translation
6. Understand different applications of NLP

**CO-PO Mapping:**

CO	PO <sub>1</sub>	PO <sub>4</sub>	PO <sub>12</sub>
1	3	2	1
2	3	3	2
3	3	2	2
4	2	3	1
5	3	3	2
6	3	2	2

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

**Unit I****Introduction to NLP:****11+4 Hours**

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****Text Representation and Sequence Labelling****11+4 Hours**

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 labelling 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****Deep learning architectures for NLP:****11+4 Hours**

RNN for language model, Sequence Labeling and Sequence Classification, Encoder-Decoder with RNNs and Transformers, GRUs and LSTMs for machine translation, Convolutional neural networks for sentence classification.  
*Transformers as Autoregressive Language Models, Potential Harms from Language Models.*

**Unit IV****Case Study on NLP:****12 + 3 Hours**

Sentiment analysis, machine translation, automated speech recognition systems, question-answering based systems, topic modelling, Text Generation and Summarization.  
*Semantic Role Labeling Lexicons for Sentiment, Affect, and Connotat.*

**Total: 45+15 Hours****Textbook (s)**

1. Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft)
2. Yoav Goldberg. Neural Network Methods for Natural Language Processing

- 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)

- Rajesh Arumugam, Rajalingappaa Shanmugamani :Hands-On Natural Language Processing with Python
- Manning C.,SchützeH ,Foundations of Statistical Natural Language Processing--.(MITPress)
- 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

- What is Natural Language Processing.
- Define purpose of different building blocks of NLP
- List any two challenges in NLP.

#### Understand

- Explain different Basic Vectorization approaches
- Explain the role of various Named Entities
- Explain purpose of Viterbi algorithm

#### Apply

- Apply various Deep learning models for NLP
- Make use of RNN for text translation

#### Analyze

- Compare and contrast GRUs and LSTMs for machine translation.
- Distinguish various methods to Convolutional neural networks for sentence classification.

#### Evaluate

- Evaluate the statistics of a sentiment analysis
- Design an automated speech recognition systems

#### Open book Question:

- Design a model to analyze a given sentence is negative, positive or neutral for a given dataset.
- Design and develop a model to translate a text to speech for a given set of statements.

**19CSC23 Web Application Databases (Elective V)****3 1 0 3****Course Outcomes**

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

1. Understand how web-based client-server applications work
2. Analyze architecture of various web-based applications
3. Examine the requirements of structured and un-structured data
4. Identify the structure of modern-day web applications
5. Identify the use advanced querying techniques to enable faster data transfer
6. Analyze the security issues in data transfer via the web

**CO – PO Mapping**

COs	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>7</sub>	PO <sub>12</sub>
1	3	3	2	2
2	3	3	2	2
3	3	3	2	2
4	3	3	2	2
5	3	3	1	2
6	3	1	1	1

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

**Syllabus****Unit I****12+4 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, Overview of different  
 databases like Oracle, MySql, MS SQL Server, Postgre SQL, MongoDB, IBM DB2, Redis, Elastic search, Cassandra.  
*Database gateways, CGI, Browser extensions*

**Unit II****11+4 Hours****Structured and unstructured Web databases**

Structured databases: Structured data, Data models, Relational database management systems, MySQL –  
 Introduction, querying, updating and deleting data, Challenges of structured data.  
 Unstructured databases: Unstructured data and its usages, NoSQL databases, MongoDB- Introduction, querying,  
 updating and deleting data, Challenges of unstructured data. --- Cassandra, GraphQL.  
*Structured data, unstructured data, Relational database, Document-based database*

**Unit III****11+4 Hours****Database connections & data operations (Testing the home page)**

Connecting to database: Native database APIs, Database-independent APIs, Template-driven database access  
 packages, Third-party class libraries.  
 CRUD operations: Querying web database, User driven querying, writing to web databases – create, delete and  
 update. ORM database, micro-services  
*JDBC, ODBC, template parsing.*

**Unit IV****11+3 Hours****Authentication, Authorization and Communication in web services**

Web requests: Structure of web requests, JavaScript Object Notation (JSON), Request methods – GET, POST, PUT, DELETE, response status codes.

State management: Session management, cookies, request and response headers.

Security: User authentication, User authorisation, Proxy servers, Digital signatures, Digital certificates, SSL and HTTPS. OAuth 2.0, SSO (single sign ON) KAFKA, RabbitMQ

*JSON, User authentication and authorisation*

**Total: 45+15 Hours**

### Textbook (s)

1. Web Database Applications with PHP and MySQL, Hugh E. Williams, David Lane, 2nd Edition, O'Reilly, 2004.
2. NoSQL Distilled, Pramod Sadalage, Martin Fowler, 1st Edition, 2012

### Reference (s)

1. Getting Started with NoSQL, Gaurav Vaish, Paperback, Packt, 2013.
2. Fundamentals of Database Systems, Elmasri Navathe Pearson Education.
3. An Introduction to Database systems, C.J. Date, A.Kannan, S.Swami Nadhan, 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	30	10	--
Apply	30	30	40
Analyze	10	20	30
Evaluate	10	20	30
Create	--	--	--
Total (%)	100	100	100

### Sample Question(s)

#### Remember

1. List various database architecture layers
2. Define structured and unstructured data
3. List various database connections

#### Understand

1. Explain Data models
2. Explain the difference between structured and unstructured data
3. Illustrate how state management is achieved for web database requests

#### Apply

1. When the incoming data varies from request to request, storing and querying it appropriately is a critical problem. Apply the concept of databases to solve this problem.
2. Give an example of a scenario that might benefit from a database that supports authorisation.

#### Analyze

1. Data needs to be secured from various users using authentication. How can this be achieved?
2. Compare various database connection techniques.
3. Analyze the general strategy behind state management and its importance.

#### Evaluate

1. Assuming the database has recognised an unusual activity, what can it do to protect the data?
2. Describe how to implement authorisation using SSL.

### **Open Book Exam Questions**

1. Data is to be shared among various people of an organization with various roles. Data can be viewed by anyone with proper authentication whereas only people with certain designation can update or delete data. Write an authorization technique that can help achieve this.
2. Consider a messaging application that is built using a NoSQL database:
  - a. Suggest a good type of NoSQL storage technique that can help improve performance
  - b. If we use key-value based approach, what are the pitfalls of it?



**19ITC33 Cloud Security (Elective V)****3 1 0 3****Course Outcomes**

1. Understand core concepts of the cloud computing paradigm
2. Demonstrate characteristics, advantages and challenges brought by various models and services in cloud computing
3. identify the known threats, risks, vulnerabilities and privacy issues associated with Cloud based services.
4. understand security challenges, threats and risks involved in the cloud application
5. Analyse the Security Requirements for the Architecture in cloud services
6. understand Data Security and best practices involved in securing the cloud.

**CO-PO Mapping**

CO	PO1	PO2	PO4
1	3	1	1
2	2	2	2
3	2	1	2
4	3	2	2
5	2	3	3
6	3	2	2

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

**Unit I****10+4 Hours**

Cloud Computing Fundamentals and Architecture- Understanding and Roots of Cloud Computing, Essential Characteristics, Cloud Reference Architecture, Cloud Service Models: SaaS, PaaS, IaaS, Cloud Deployment Models, Expected Benefits, Forming Clouds with example.

**Unit II****12+4 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 III****12+4 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 IV****11+3 Hours**

Securing the cloud: Architecture and Data Security 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: 45+15 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**

<b>Cognitive Level</b>	<b>Int. Test 1 (%)</b>	<b>Int. Test 2 (%)</b>	<b>OBE</b>
Remember	50	40	-
Understand	30	40	-
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	-
Create	--	--	-
<b>Total (%)</b>	<b>100</b>	<b>100</b>	<b>100</b>

**19EC602 Digital Signal Processing (Elective V)****3 1 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 <sub>1</sub>	PO <sub>2</sub>	PSO <sub>2</sub>
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+3 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****10+3 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****13+4 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****10+5 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: 45 + 15 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, 4<sup>th</sup> 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 Mc Graw Hill publishers, 3<sup>rd</sup> Edition, 2009.
2. Alan V. Oppenheim, Ronald W. Schafer Digital Signal Processing, PHI, 4<sup>th</sup> Edition, 2007
3. Andreas Antoniou, Digital Signal Processing, TATA McGraw Hill , 2006
4. MH Hayes, Digital Signal Processing, Schaum’s Outlines, Tata Mc-Graw 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**

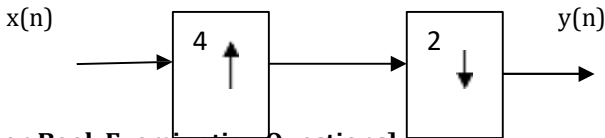
1. Define Signal and System.
2. State the advantages and limitations of DSP?
3. Define about Gibb’s phenomena
4. state the need of Multi rate signal processing
5. List the difference between FIR and IIR filters

**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

$$\begin{aligned} 0.8 |H(\omega)| & \leq 0.1 & 0 \leq \omega \leq 0.2 \\ |H(\omega)| & \leq 0.2 & 0.32 \leq \omega \leq 0.4 \end{aligned}$$

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  
**[Open Book Examination Questions]**
4. Outline the structural realization of linear phase FIR filter for given N  
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]**

**19IT010 Information Retrieval Systems (Elective V)****3 1 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 <sub>3</sub>	PO <sub>6</sub>	PO <sub>8</sub>
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:****11+3 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+4 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****11+4 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****11+4 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: 45+15 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. Korfhage, 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 Korfhage, 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 (%)
<b>Remember</b>	30	30	--
<b>Understand</b>	40	40	--
<b>Apply</b>	10	20	80
<b>Analyze</b>	20	10	20
<b>Evaluate</b>	--	--	--
<b>Create</b>	--	--	--
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?



**19CS005 Mobile Computing (Elective V)****3 1 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	PO <sub>3</sub>	PO <sub>5</sub>	PO <sub>8</sub>
1	3	2	2
2	2	2	2
3	1	1	2
4	2	2	2
5	2	2	2
6	2	3	2

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

**Syllabus****Unit I****Introduction to Mobile Communications****12+4 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****11+4 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)****11+3 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****11+4 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: 45+15 Hour****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](http://www.isi.edu/nsnam/ns/doc/ns_doc.pdf) (NS2 manual)

**Internal Assessment Pattern**

<b>Cognitive Level</b>	<b>Int. Test 1 (%)</b>	<b>Int. Test 2 (%)</b>	<b>Open Book Exam (%)</b>
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 tTDMA 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 DSSM (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?

**19IT010 Social Network Analysis (Elective VI)****3 1 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	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>7</sub>	PO <sub>12</sub>
1	2	2	3	2
2	2	2	3	2
3	2	1	3	3
4	2	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****9+3 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+4 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+4 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+4 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: 45+15 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. BorkoFurht, Handbook of Social Network Technologies and Applications, Springer, 1st Edition, 2010.
2. GuandongXu, 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, VáclavSnášel, 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

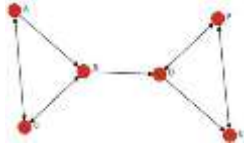
1. What are the limitations of current web?
2. List the statistical properties of social networks
3. Define social similarity.
4. What are the two different measures in influence related statistics

##### Understand

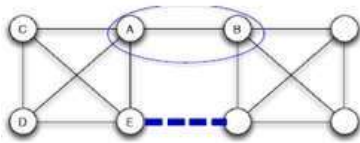
1. Explain about development of semantic web in research.
2. Demonstrate web based networks.
3. Illustrate the ways of visualizing social networks with matrix based representation and node – link diagram.
4. Explain core methods of community detection and mining.
5. Explain algorithms and systems for 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.

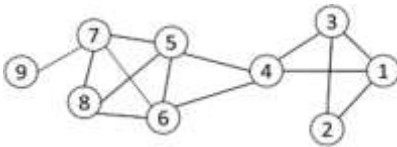


### Analyse

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?](#)

**19IT011 Real Time Operating Systems (Elective VI)**

**3 1 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 <sub>2</sub>	PO <sub>3</sub>
1	3	3
2	3	2
3	3	2
4	3	3
5	2	2
6	2	2

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

**Syllabus**

**Unit I**

**11+4 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**

**11+4 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 µCos*

**Unit III**

**11+4 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+3 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: 45+15 Hours**

#### Textbook (s)

1. Rajib Mall, Real-time Systems Theory and Practice, 1st edition, Pearson Publication, 2008.

#### Reference (s)

2. Jane W. S. Liu, Real-Time Systems, Pearson Education, 2000.
3. 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)
```

**19IT012 Digital Image Processing (Elective VI)****3 1 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 <sub>2</sub>	PO <sub>3</sub>	PSO <sub>2</sub>
1	2	-	2
2	2	-	2
3	2	-	2
4	3	2	3
5	2	-	2
6	3	2	3

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

**Unit I****13+4 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****13+4 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****9+3 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****10+4 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: 45+15 Hours****Textbook (s)**

1. Rafael C.Gonzalez and Richard E.Woods, Digital Image Processing, Pearson Education, 3<sup>rd</sup> Edition 2011
2. S.Sridhar, Digital Image Processing, Oxford publishers, 2<sup>nd</sup> Edition, 2016

**Reference (s)**

1. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson Education, 1<sup>st</sup> 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 <sup>1</sup> (%)
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 N<sub>4</sub>, N<sub>8</sub> 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

- Differentiate region based segmentation and thresholding based segmentation in terms of approach and applications.

**Open Book Exam Questions**

- 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

- 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

**19IT007 Distributed Systems (Elective VI)****3 1 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 <sub>2</sub>	PO <sub>7</sub>	PO <sub>12</sub>
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+4 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****11+4 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****11+4 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****11+3 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: 45+15 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 & Fransis 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?

**19CS012 Wireless Adhoc Network (Elective VI)****3 1 0 3****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	PO <sub>3</sub>	PO <sub>5</sub>	PO <sub>6</sub>
1	2	3	1
2	3	2	2
3	3	3	2
4	2	3	1
5	1	3	1
6	2	3	2

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

**Syllabus****UNIT I****11+4 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+4 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****11+3 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**

**11+4 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: 45+15 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.





**19CS015 Software Project Management (Elective VI)****3 1 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	PO3	PO5	PO6	PO12	PSO2
1	1	1	2	2	1
2	2	2	2	2	2
3	1	1	1	2	3
4	3	3	1	3	2
5	3	3	1	2	3
6	3	3	1	3	3

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

**Unit I****12+4 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****11+4 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****11+4 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****11+3 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.  
*Bugs of testing, Bug tracking tools*

**Total: 45+15 Hours**

**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 ]

**19CS014 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	PO <sub>6</sub>	PO <sub>7</sub>	PO <sub>8</sub>
1	3	3	2
2	3	3	2
3	3	3	2
4	3	3	2
5	3	3	1
6	3	2	1

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

**Syllabus**

**Unit I**

**11+4 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**

**11+3 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**

**11+4 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+4 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.*

**Total: 45+15 Hours**

**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.

**19IT013 Design Patterns (Elective VIII)****0 0 0 3****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 <sub>2</sub>	PO <sub>3</sub>	PO <sub>5</sub>
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****10+4 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****13+3 Hours**

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns. Structural Pattern Part-I: Adapter, Bridge, Composite.

**Unit III****11+4 Hours**

Structural Pattern Part-II: Decorator, Façade, Flyweight, Proxy. Behavioral Patterns Part-I: Chain of Responsibility, Command, Interpreter, Iterator

**Unit IV****11+4 Hours**

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.

**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	--	--	--
<b>Total (%)</b>	<b>100</b>	<b>100</b>	<b>100</b>

**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

**19IT016 Professional Ethics (Elective VIII)**

**0 0 0 3**

**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. Identify 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. Summarize the ethical implications of social networking and impact of IT on living.

**CO - PO Mapping**

COs	PO <sub>5</sub>	PO <sub>8</sub>
1	2	3
2	3	3
3	3	3
4	3	3
5	3	3
6	3	3

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

**Syllabus**

**Unit I**

**10+5 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**

**10+3 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+4 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**

**13+3 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: 45+15 Hours**

**Textbook (s)**

1. George W Reynolds, "Ethics in Information Technology," 5<sup>th</sup> 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," 4<sup>th</sup> 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.

**19IT801 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			2									2	2
C02		2	3										2	2
C03					3	3							2	2
C04								3						
C05									3			2		
C06							2			3	2			

**AUDIT COURSES**

<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Offering Dept.</b>	<b>Page No.</b>
1	19AT001	Communication Etiquette in Workplaces	<b>ME</b>	<b>1</b>
2	19AT002	Contemporary India: Economy, Policy and Society	<b>ME</b>	<b>2</b>
3	19AT003	Design The Thinking	<b>ECE</b>	<b>3</b>
4	19AT004	Ethics and Integrity	<b>CE</b>	<b>4</b>
5	19AT005	Indian Heritage and Culture	<b>EEE</b>	<b>5</b>
6	19AT006	Human Values and Professional Ethics	<b>BSH</b>	<b>6</b>
7	19AT007	Intellectual Property Rights and Patents	<b>ECE</b>	<b>7</b>
8	19AT008	Introduction to Journalism	<b>CSE</b>	<b>8</b>
9	19AT009	Mass Media Communication	<b>CSE</b>	<b>9</b>
10	19AT010	Science, Technology and Development	<b>CHEM</b>	<b>10</b>
11	19AT011	Social Responsibility	<b>CE</b>	<b>11</b>
12	19AT012	The Art of Photography and Film Making	<b>IT</b>	<b>12</b>
13	19AT013	Gender Equality for Sustainability	<b>BSH</b>	<b>13</b>
14	19AT014	Women in Leadership	<b>IT</b>	<b>14</b>
15	19AT015	Introduction to Research Methodology	<b>EEE</b>	<b>15</b>
16	19AT016	Climate Changes and Circular Economy	<b>CHEM</b>	<b>16</b>

## 19AT001 Communication Etiquette in Workplaces

### Unit- I

#### **Introduction to Professional Ethics:**

Ethics In Engineering Profession, Roles of Engineers, Professional Ethics of Engineers and other Roles Played.

#### **Ethical Codes**

Need for Ethical Codes, Prominence of ethical codes and benchmarking, Codes from Other Profession, Advertising Standards of India, Corporate Codes, Knowledge of ethical codes.

### Unit- II

#### **Workplace Ethics:**

Introduction, Needs, Principles, Development of Personal Ethics, Workplace Ethics for Employees-Ethical behavior in workplace- Professionalism, Ethical violations by employees, Employee Attitude and Ethics, Employee Etiquettes. Benefits of ethics in Workplace employee commitment, investor loyalty, customer satisfaction, profits

#### **Professionalism at Workplace:**

Unethical Conduct for employees and employers. Factors leading to Unethical behaviours. Different unethical behaviors. Measures to control unethical behaviors. Rewarding ethical behavior.

### Unit- III

#### **Business Ethics:**

Overview of Business Ethics, Corporate Governance, Ethical issues in human resource management- The principal of ethical hiring, Firing, worker safety, whistle blowing, Equality of opportunity, Discrimination, Ethics and remuneration, Ethics in retrenchment. Ethical Dilemmas at workplace, Ethical issues in global business, corporate responsibility of employers.

#### **Workplace Privacy & Ethics:**

Privacy at workplace, Hardware, Software and Spyware, Plagiarism and Computer Crimes, Convenience and Death of Privacy, Defence of employee privacy rights.

### Unit- IV

#### **Teamwork at Workplace:**

Teams, Elements of team, Stages of team development, team meetings, team rules, and teams work and professional responsibility, rules of professional responsibility, ASME code of ethics. Discrimination, sexual harassment, creating awareness about workplace harassment, Vishaka Dutta vs. State of Rajasthan –Supreme Court directions, Compulsory workplace guidelines.

**Managing Change in Workplace through Ethics:** Introduction to Change Management, Models of change, the Ethics of Managing Change, the role of ethics and responsibilities in leading innovation and change, ethics-based model for change management, ethics and risks of change management

### Textbook(s)

1. R.S. Naagarazan, A Textbook on Professional Ethics and Human Values, New Age International (P) Limited, Publishers, 5<sup>th</sup> Edition, 2019
2. Kurt Stanberry and Stephen M. Byars, Business Ethics Book, Tata Mc Graw Hill Publisher, 6<sup>th</sup> Edition 2020
3. Satish Babu Bachu, A Guide to Corporate Business Etiquette: How to Maintain Effective Communication at Work Paperback, 4<sup>th</sup> Edition, 17 July 2014.
4. Barbara Pachter, The Essentials of Business Etiquette and workplace through ethics, 5<sup>th</sup> Edition, 2018.

### Reference(s)

1. The Etiquette Advantage in Business, Third Edition: Personal Skills for Professional Success, Daniel Post Senning, Peter Post, Anna Post, Lizzie Post, Peggy Post, 3<sup>rd</sup> Edition, 2010
2. Engineering Ethics & Human Values by: M.Govindarajan , S. Natarajan &V.S.Senthilkumar PHI Learning Pvt. Ltd.
3. Professional Ethics by- R. Subramanian
4. Business Etiquette: 101 Ways to Conduct Business with Charm & Savvy Book by Ann Sabath, 2011
5. The Unwritten Rules of Professional Etiquette Book by Ryan Sharma, 4<sup>th</sup> Edition, 2017

## **19AT002 Contemporary India: Economy, Policy and Society**

### **Unit I**

#### **Indian Economy and Population Study**

Basic features of Indian Economy - Trends in National Income – Role of Agriculture Sector – Problems, Remedial measures; Industry – Large scale, small scale – problems and remedial measures; a brief review of Industrial policies in India – Role of Public Sector in the context of globalization.

Population, Poverty, Unemployment, and Income Inequalities – Causes and Consequences – Remedies – Inflation - Causes and Remedies – Indian Tax Structure Globalization, Economic Reforms and their impact on Indian Economy.

### **Unit II**

#### **Indian Political System**

Basic Characteristics of Indian Constitution - Indian Political System, emergence of All India Parties – Regional Parties – Coalition Politics. Centre – State relations – Emerging trends – Various commissions –Rajamannar Committee, Anandpur Sahib Resolutions, Sarkaria Commission. Indian Foreign Policy – Non – Aligned Movement – Local Self Governments in the light of 73<sup>rd</sup> , 74<sup>th</sup> Constitutional amendments. Right to Information Act – Governance – factors influencing Governance – Civil Society.

### **Unit III**

#### **Indian National Movement**

Indian National movement - various Stages – Its legacy. Integration of Native States and Formation of Modern India. Formation of Andhra Pradesh.

### **Unit IV**

#### **Indian Society and Social Life**

Salient features of Indian Social Structure, Social Groups: Primary and Secondary, Association – Institution. Status and Role – Norms, Values and Customs. Concept of Socialization – Agencies of Socialization. Gender Issues – Women Liberation Movements in India – Domestic Violence, Women empowerment – Entrepreneurship Programmes – Child labor. Human Rights – Importance and violation of Human rights.

### **Reference Book(s)**

1. Chandhoke, N. and Priyadarshi, P., Contemporary India: Economy, Society, Politics, 1<sup>st</sup> Ed., Pearson Education India, New Delhi, 2009.
2. Vanaik, A. and Bhargava, R., Understanding Contemporary India: Critical Perspectives, Orient Blackswan, New Delhi, 2010.
3. Deshpande, S., Contemporary India: A Sociological View, Penguin Books, New Delhi, 2003.

## **19AT003 Design the Thinking**

### **Unit I**

#### **Process of Design**

Introduction – Product Life Cycle - Design Ethics - Design Process - Four Step – Five Step - Twelve Step - Creativity and Innovation in Design Process - Design limitation. History of Design Thinking, Multi-Whys, Design Thinking Empathize, Conflict of Interest, Multi-Whys, Elephant and Blind Men.

### **Unit II**

#### **Generating and Developing Ideas**

Introduction - Create Thinking - Generating Design Ideas - Lateral Thinking – Analogies – brainstorming - Mind mapping - National Group Technique – Synectics -Development of work - Analytical Thinking - Group Activities Recommended.

### **UNIT III**

#### **Reverse Engineering**

Introduction - Reverse Engineering Leads to New Understanding about Products - Reasons for Reverse Engineering - Reverse Engineering Process - Step by Step – Case Study.

### **UNIT IV**

#### **Basics of Drawing to Develop Design Ideas**

Introduction - Many Uses of Drawing - Communication through Drawing – Drawing Basis – Line - Shape/ Form – Value – Colour – Texture - Practice using Auto CAD recommended. Perspective Drawing - One Point Perspective - Two Point Perspective -Isometric Drawing - Orthographic Drawing - Sectional Views - Practice using Auto CAD recommended.

#### **Text Books:**

1. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) second Edition, 2013.

#### **References:**

2. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011.

## **19AT004 Ethics and Integrity**

### **Unit I**

#### **Ethics and Interface**

Ethics, Determinants and Consequences of Ethics in - Human Actions; Dimensions of Ethics; Ethics -in Private and Public Relationships. Human Values - Lessons from the Lives and Teachings of Great Leaders, Reformers and Administrators; Role of Family Society and Educational Institutions in Inculcating Values, Human interface.

### **Unit II**

#### **Human Values**

Morals, values and Integrity, Service learning, Civic virtue Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Cooperation, Commitment, Self-confidence, Character, Spirituality

### **Unit III**

#### **Emotional Intelligence**

Concepts, and their Utilities and Application in Administration and Governance. Contributions of Emotional Thinkers and Philosophers from India and World.

### **Unit IV**

#### **Risk Management and Issues**

Engineering as Experimentation, Codes of Ethics, Assessment of Safety and Risk, Risk Benefit Analysis and Reducing Risk, Intellectual Property Rights (IPR), Discrimination, Multinational Corporations, Moral Leadership, Code of Conduct, Corporate Social Responsibility.

### **Reference Book(s)**

1. R.Subramanian, "Professional Ethics", Oxford University Press, New Delhi, 2013.
2. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering" Tata McGraw Hill, New Delhi, 2003.
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.



## **19AT005 Indian Heritage and Culture**

### **Unit I**

#### **Fundamental Unity of India**

Harappan and Vedic Culture- evolution of Caste system – Jainism and Buddhism Gandhara Art. Political unification of India under Mauryas and Guptas –Cultural achievements.

Cultural condition under the Satavahanas – Contribution of Pallavas and Cholas to Art and Letters. Cholas Administrative System. Influence of Islam on the India Culture. The SufiBhakti and Vishnavite movements.

Cultural achievements of Vijayanagara rulers Contribution of Shershah and Akbar to the evolution of Administrative system in India- Cultural Developments under Mughals.

### **Unit II**

#### **Westren Impact on India**

Introduction of Western Education Social and Cultural awakening and social reform movements. Raja Rama Mohan Roy – Dayananda Saraswathi – Theosophical Society – Ramakrishna Paramahansa and Vivekananda – Iswara Chandra Vidyasagar and Veeresalingam-Enancipation of women and struggle against caste – Rise of Indian Nationalism – Mahatma Gandhi – Nonviolence and Satyagraha – Education of untouchability – Legacy of British Rule.

### **Unit III**

#### **Culture and its salient features**

Meaning, Definition and various inter relations of Culture.

The Vedic – Upanishadic Culture and society. Human aspirations inthose societies Values – Chaturvidha Purusharthas – Chaturvarna Theory – Cheturasrama Theory.

The Culture in Artha Sastra, Kautilyan conception of the function of Philosophy, State, Religion and king.

### **Unit IV**

#### **Culture in Ramayana and Mahabharata**

The Ideal Man and Woman, Concepts Maitri, Karuna, Seela, Vinaya, Kshama, Santi, Anuraga – as exemplified in the stories and anecdotes of the Epics.

The Culture of Jainism: Jaina conception of Soul, Kamma and liberation, Buddhism as a Humanistic culture. The four Noble truths of Bhuddhism.

Vedanta and Indian Culture. Religion and Ethical Practices: The Hindu View.

#### **Suggested Books:**

1. Indian Heritage and Culture by P R Rao, Sterling Publishers Pvt. Ltd.
2. Indian Heritage and Culture by D. Singh, APH Publishing Corporation.

## **19AT006 Human Values and Professional Ethics**

### **Unit 1**

#### **Human Values**

Morals, Values and Ethics-Integrity-Work Ethics- Service Learning- Civic Virtues- Respect for Others- Living Peacefully- Caring-Sharing-Honesty-Courage-Valuing Time- Cooperation- Commitment- Empathy- Self Confidence- Spirituality

### **Unit 2**

#### **Professional Ethics**

The History of Ethics-Consensus and Controversy- Professional Roles of an Engineer- Professional and Professionalism- Self Interest, Customs and Religion- Engineering and Ethics-Types of Enquiry

### **Unit 3**

#### **Responsibilities and Rights**

Collegiality- Two Senses of Loyalty- Obligations of Loyalty- Professional Rights- Conflicts of Interest, Solving Conflict Problems- Self Interest, Customs and Religion- Ethical Egoism, Collective Bargaining- Confidentiality- Acceptance of Bribes/Gifts- Interests in other companies- Occupational Crimes- Industrial Espionage- Price Fixing- Endangering Lives- Whistle Blowing.

### **Unit 4**

#### **Global Issues**

Globalization- Environmental Ethics-Computer Ethics- Weapons Development- Intellectual Property Rights (IPR)s

#### **Suggested Books:**

1. A Textbook On Professional Ethics and Human Values by R.S, Naagarazan, New Age International-2007
2. Professional Ethics and Human Values by M.P Raghavan, Scitech Publications-2013
3. A Foundation Course in Human Values and Professional Ethics by R.R. Gaur, R. Sangal, Excel Books -2010

## **19AT007 Intellectual Property Rights and Patents**

### **Unit I**

#### **Intellectual Property**

Introduction to Intellectual Property Law – The Evolutionary Past - The IPR Tool Kit- Para -Legal Tasks in Intellectual Property Law – Ethical obligations in Para Legal Tasks in Intellectual Property Law - Introduction to Cyber Law – Innovations and Inventions Trade related Intellectual Property Right

### **Unit II**

#### **Trade mark**

Introduction to Trade mark – Trade mark Registration Process – Post registration procedures – Trade mark maintenance - Transfer of Rights - Inter parties Proceeding – Infringement - Dilution Ownership of Trade mark –Likelihood of confusion - Trademarks claims – Trademarks Litigations – International Trade mark Law

### **Unit III**

#### **Copyrights**

Introduction to Copyrights – Principles of Copyright Principles -The subjects Matter of Copy right – The Rights Afforded by Copyright Law – Copy right Ownership, Transfer and duration – Right to prepare Derivative works – Rights of Distribution – Rights of Perform the work Publicity Copyright Formalities and Registrations - Limitations - Copyright disputes and International Copyright Law – Semiconductor Chip Protection Act.

### **Unit IV**

#### **Trade Secret**

Introduction to Trade Secret – Maintaining Trade Secret – Physical Security – Employee Limitation - Employee confidentiality agreement - Trade Secret Law - Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law.

#### **Textbook (s)**

1. Deborah E. Bouchoux: "Intellectual Property". Cengage learning, New Delhi.
2. Prabhuddha Ganguli: ' Intellectual Property Rights" Tata Mc-Graw –Hill, New Delhi.

#### **Reference (s)**

1. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
2. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.

## 19AT008 Introduction to Journalism

### Unit I

**Ingredients of News:** meaning, definition, nature the news process: from the event to the reader Hard news vs Soft news, basic components of a news story attribution, embargo, verification, balance and fairness, brevity, dateline, credit line, byline.

### Unit II

**Journalism:** A historical context Basic terminology, concepts in journalism organizing a news story, 5W's and 1H, Inverted pyramid Criteria for news worthiness, principles of news selection use of archives, sources of news, use of internet. Yellow journalism penny press jazz journalism, gonzo journalism alternative journalism

### Unit III

**Language and Principles of Writing:** Basic differences between the print, electronic and online journalism, **Language of news Robert Gunning:** Principles of clear writing, Rudolf Flesch formula ([www.lsrcollegejournalism.org](http://www.lsrcollegejournalism.org))

### Unit IV

**Responsibility to Society:** Press and Democracy, Relationship between the reader/viewer and media, Contemporary debates and issues relating to trial by media

**Changing trends in Journalism:** An overview (with special reference to India)

### Textbooks:

1. Bruce D. Itule and Douglas A. Anderson, News Writing and reporting for today's media, McGraw Hill Publication, 2006.
2. M.L. Stein, Susan Paterno, R. Christopher Burnett, News writer's Handbook: An Introduction to Journalism, Blackwell Publishing, 2006.
3. George Rodmann, Mass Media In a Changing World, McGraw Hill Publication, 2011

## **19AT009 Mass Media Communication**

### **Unit I**

#### **Introduction to Mass Communication:**

Concept of Journalism and mass communication, mass communication in India, History, growth and development of print and electronic media; Major landmarks in print and electronic media in Indian languages. Media's role in formulation of states of India, Media criticism and media literacy, Press Council and Press Commissions of India, status of journalism and media education in India; Media policies of the Government of India since Independence.

#### **Models and Theories of Mass Communication**

Normative theories, administrative and critical traditions in communication, media and journalism studies, communication and theories of socio-cultural, educational and agricultural change, Technological determinism, critique of Marshall McLuhan's views on media and communication and Marxist approaches, Information and knowledge societies.

Indian traditions and approaches to communication from the Vedic era to the 21st century, Western and Eastern philosophical, ethical and aesthetic perceptions of communication – Aristotle and Plato, Hindu, Buddhist, and Islamic traditions.

### **Unit II**

#### **Media and Culture**

Framework for understanding culture in a globalized world, Globalization with respect to politico-economic & socio-cultural developments in India.

#### **Media Laws and Ethics**

Concept of law and ethics in India and rest of the world, The Constitution of India, historical evolution, relevance; Concept of freedom of speech and expression in Indian Constitution; Defamation, Libel, Slanders-Sedition; Various regulatory bodies for print, TV, Advertising, PR, and Internet; Rules, regulations and guidelines for the media as recommended by Press Council of India; Information and Broadcasting ministry and other professional organizations, adversarial role of the media, human rights and media.

### **Unit III**

#### **Media Management and Production**

Definition, concept of media management. Grammar of electronic media; Communication design theories and practice; Media production techniques – print and electronic; Digital media production techniques; Economics and commerce of mass media in India; Principles and management in media industry post liberalization.

### **Unit IV**

#### **ICT and Media**

ICT and media – definition, characteristics and role. Effect of computer mediated communication. Impact of ICT on mass media. Digitization; Social networking; Economics and commerce of web enabled media; Mobile adaption and new generation telephony by media, ethics and new media; ICT in education and development in India, online media and e-governance; Animation – concepts and techniques

#### **Textbooks:**

1. D.S. Mehta, Mass Communication and Journalism in India, Allied Publishers, 2014
2. Keval J. Kumar, Mass Communication in India, Fifth Edition, JAICO Publishing House, Mumbai, 2021
3. B. K. Ahuja, Mass Media Communication, Lotus Press, 2010
4. Jack Rosenberry, Lauren A. Vicker, Applied Mass Communication Theory: A Guide for Media Practitioners, 2<sup>nd</sup> Edition, Routledge, 2017

#### **References:**

1. Peyton Paxson, Mass Communications and Media Studies: An Introduction, 2<sup>nd</sup> Edition, Bloomsbury Academic 2018.
2. Robert S. Fortner, P. Mark Fackler, The Handbook of Media and Mass Communication Theory, Wiley, 2014.
3. Vir Bala Aggarwal, V. S. Gupta, Handbook of Journalism and Mass Communication, Concept Publishing Company, New Delhi, 2002.

## 19AT010 Science, Technology and Development

### Unit-1: Science

**Earth System:** Characteristic features – lithosphere, hydrosphere – Atmosphere, lithosphere-soil characteristic, texture, fertility and its control. **Hydrosphere** –hydrological cycle –water bodies –ponds, lakes, rivers and their Characteristics – water consumption at global level and regional level Management of water bodies. **Atmosphere:** Troposphere, stratosphere, ionosphere composition of air – Ozone - Ozone layer – its importance. **Life Science:** Concept of origin life – evolution and diversity of life- cell Molecular basis of life and living forms – Mendel lean concept on inheritance Impact on society – Blood groups – transfusion – wild life and its

### Unit II: Science

The definition, general awareness and importance of:

**Drugs-** Antibiotic, penicillin, tetracycline, sylphs drugs, Anti malarial, anti Pyretic, analgesics.

**Soaps and Detergents** – sources – mechanism of soap action – development of detergent -application – disadvantages of detergents

**Plastics and Polymers-** polyethylene, poly vinyl chloride (PVC),nylon 66-rubber and synthetic rubber

**Agro Chemicals and Fertilizers-** pesticides-Introduction-DDT, BHC, Marathon, parathion – Fungicides-Rodenticides, Weedicides. Nitrogen and phosphorus fertilizers-Micro fertilizers, Bio pesticides, Neem and bacillus thuringensis.. Bio Fertilizers- Applications and their effects on nature

**Vitamins-** Natural sources- importance- deficiencies

### Unit III: Technology and Development

**Communication:** Definition, nature and concept of communication- role of communication in society

**Types of Communication:** Intrapersonal, Intrapersonal, group and mass communication. Traditional and folk of communication in India New Media technologies- Satellite, Cable and Internet.

**Process of Communication:** Functions of communication, elements and barriers of communication Mass Media-press, Radio, TV and Films, Functions of mass communication

### Unit IV: Technology and Development

**Transport:** Wheel, steam Engine, Automobile, ship, Airplane. Comparison of Road, Rail, Water and Air transport in terms of infrastructure, speed, cost etc.

**Energy:** Sources –Renewable sources of energy – Non- renewable sources of energy –Conventional energy sources-Non Conventional energy sources wind ,water, tidal , solar, geothermal, atomic energy , bio-fuels – sources and their applications- Energy management – energy conservation – Future needs of energy

**Health:** problems – Sex education – venereal Diseases, AIDS, General protozoan, Bacterial & viral diseases

**Bio-Technology:** Introduction – Applications – health and Human Welfare- Agriculture – Mushroom culture - Medical plants

**Green-Revolution:** Introduction - Food processing – Methods of processing-Food preservation and methods of preservation

**National Institutions (Science):** Institutions Imparting Education- Institutions performing research and development – Role of Scientific Institutions in Research, Technology and development

### Reference Book(s)

1. James Smith , “Science and Technology for Development”, Radical International Publishing, 2009.
2. Atul Wad Science, technology and development. Westview press , 1990
3. <http://www.math.buffalo.edu/mad/physics/allotey.science.technology.pdf>
4. Rajeswari S. Raina., Science, technology and development in India: Encountering values. Orient Blackswan 2015
5. Shinn, Terry, Jack Spaapen, and V. V. Krishna, eds. Science and technology in a *developing world*. Vol. 19. Springer Science, 2013.

## **19AT011 Social Responsibility**

### **Unit I**

#### **Introduction to Social Responsibility**

Meaning and Definition, History of Social Responsibility, Concepts of Charity, Social philanthropy, Citizenship, Sustainability and Stakeholder Management, Environmental aspects of social responsibility.

### **Unit II**

#### **International framework for Social Responsibility**

Millennium Development Goals, Sustainable Development Goals, Relationship between Corporate Social Responsibility and Millennium Development Goals. OECD corporate social responsibility policy tool.

### **Unit III**

#### **Drivers of Social Responsibility in India**

Market based pressure and incentives, civil society pressure, the regulatory environment in India Counter trends, Review of current trends and opportunities in social responsibility, Review of successful corporate initiatives and challenges of social responsibility.

### **Unit IV**

#### **Identifying key stakeholders of Social Responsibility**

Role of Public Sector in Corporate, government programs, Non-profit and Local Self Governance in implementing Social Responsibility, Global Compact Self-Assessment Tool, National Voluntary Guidelines by Govt. of India, Roles and responsibilities of corporate foundations.

### **Reference Book (s)**

1. William B. Werther Jr. and David Chandler, Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, Second Edition, Sage Publications, 2011
2. Sanjay K Agarwal, Corporate Social Responsibility in India, Sage Publications, 2008
3. Mark S. Schwartz, Corporate Social Responsibility: An Ethical Approach, Broadview Press, 2011

## 19AT012 The Art of Photography and Film Making

### Unit I

#### Introduction

Development of Photography over the years: Brief History of Photography, early photography methods, switch from film to digital, difference between film and digital photography, formats of images in digital.

Cameras & Techniques: Types of camera, film cameras V/S digital cameras, lenses and their importance, Story Design and Development, Laws of Composition, Gestalt Law and Visual Perception, Semiotic photography.

### Unit II

**Lighting** - Theory & practice: Sources of Lighting, 2 point lighting, 3 point lighting, creating contrast, outdoor natural lighting, related accessories for lighting.

**Post production of Photos, Digital Image Editing** – Photoshop: Processing of Raw images, Introduction to Adobe Photoshop and image ready software, how to enhance the photo digitally.

### Unit III

#### Indian Cinema

History of Indian cinema, history of regional cinema, legends of Indian cinema, Hindi film industry, the Hindi film industry, music and choreography in Indian cinema, contemporary cinema.

#### Basics of Cinematography-1

**Power of a Picture:** Power of a still picture shooting a good Still picture Composition-Framing Understanding & Use of colour, Capturing the Drama, Black and white Photography.

**Light:** Role of light, Lighting techniques, Concept of lighting various planes, Understanding Various types: Tungsten lamps, Cool Lights, HMI, Cyclorama/background lights, Soft Box lights. Use of cutter stand, black cloth and Camera filters, barn doors, use of reflectors, Three point lighting, Ratio lighting: 1:2, 1:3, 1:4.

### Unit IV

**Lenses:** Type of Lenses, Power of Lenses, Understanding the shot requirement and usage of a lens, Idea of perspective: Depth Of Field, Depth of focus, Critical understanding of Fixed Lens Vs. Zoom Lens, Focus pulling, 18% grey card, Metering, Colour temperature meter.

**Camera Movements:** Basic grammar of shots, Camera Movement: Pan, Tilt, Zoom, Character Movement, Usage and need of Track and trolley, Crane, jimmy gip, Poll Cam, Managing Movements, Single camera Setup, Multi camera setup, Continuity Exercise, Do's and don'ts of camera movements, Aesthetics and Psychological.

#### Textbooks:

1. Camera Terms and Concepts by David Elkins
2. The Camera Assistant by Doug Hart
3. Motion Picture Camera and Lighting Equipment by David Samuelson
4. The Art of Photography; by Bruce Barnbaum.
5. Creative Nature & Outdoor Photography; Brenda Tharp.
6. Chasing the Light by Ibarionex Perello.

#### Reference Books:

1. Motion Picture Camera Techniques by David Samuelson
2. The 16mm Camera Book by Douglas Underdahl
3. The Hands On Manual for Cinematographers by David Samuelson
4. The Professional Lighting Handbook by Verne Carlson
5. The Filmmakers Pocket Reference by Blain Brown
6. The Camera by Larry Hills.
7. The Creative Black Book.
8. The Print by Ansel Adams, Robert Baker.
9. 500 poses for Photographing Women by Michelle Perkins.
10. Creative Landscapes: Digital Photography Tips & Techniques by Author: Davis, Harold.



## 19AT013 Gender Equality for Sustainability

### Unit I

#### Understanding Sustainability

The UN 2030 Agenda for Sustainable Development Goals (SDGs); Interrelating SDG 5 (Gender equality) with other SDGs; Economics and Gender: Issues and Concerns; Women and Education: Role of Education in enhancing gender equality--A Case Study of Malala Yousafzai; Need for Gender Equality for Ensuring Sustainability: Why gender equality must be integral to sustainable development; Empowering women and promoting gender equality; Technology and gender equality

### Unit II

#### Gender Equality: Dimensions

Women and Health: Importance of good health for gender equality; Women and Governance: promoting equal rights, opportunities and responsibilities for men and women; Women Empowerment: Inevitable foundation for a peaceful, prosperous and sustainable world; Women and Poverty Reduction: Elimination of socioeconomic inequalities and sustainable production by women; Women and Sustainable Consumption: Strategies to make women play a crucial role for and in a circular economy .

### Unit III

#### Gender and Economic Growth

Role of Women in Economic Growth: productivity, economic diversification, and income equality; Women and Sustainable Production: Role of women as natural resource managers and in waste management; Women and Poverty Eradication through Government Schemes: National/Government and intergovernmental schemes and frameworks to reduce poverty and enhance socioeconomic status of women; Women and Poverty Eradication through Entrepreneurship: Developing and enabling women to be entrepreneurs; Women and Self-Help Groups: Case Studies.

### Unit IV

#### Gender Equality and Public Policy

Role of Women in Governance: Gender equality in public employment and decision-making process in governance; United Nations and Gender Inclusiveness: UN General Assembly discussions; Role of Local Self Government in Inclusive Growth: Panchayati Raj system in India and women representation; Gender equality and environmental sustainability: gender equality for sustainable ecosystem management; Project-based Leadership and Gender Equality

#### Textbooks:

1. *Gender Equality and Sustainable Development* by Melissa Leach (ed), 1st Edition, Routledge, 2015.
2. *Gender Equality in a Global Perspective*, Eds: Anders Ortenblad, Raili Marling, Snjezana Vasiljevic; Routledge; 1st edition (January 24, 2017).
3. *Transitioning to Gender Equality* by Christa Binswanger and Andrea Zimmermann (Eds.), MDPI, 2021. <https://www.mdpi.com/books/pdfdownload/edition/1296>
4. *Gender Equality and Public Policy: Measuring Progress in Europe* by Paola Profeta, Cambridge University Press, 2020.
5. *Gender and Sustainable Development*. OECD: <https://www.oecd.org/social/40881538.pdf>

#### Reference Materials:

1. *Gender equality handbook* by Swedish Civil Contingencies Agency (MSB);2009; <https://www.msb.se/siteassets/dokument/publikationer/english-publications/gender-equality-handbook.pdf>
2. *Turning promises into action: Gender equality in the 2030 Agenda for Sustainable Development*, UN Women Headquarters, 2018. <https://www.climateinvestmentfunds.org/sites/default/files/sdg-report-gender-equality-in-the-2030-agenda-for-sustainable-development-2018-en.pdf>
3. GENDER EQUALITY AS AN ACCELERATOR FOR ACHIEVING THE SUSTAINABLE DEVELOPMENT GOALS. Discussion Paper by The United Nations Development Programme (UNDP), 2018.
4. 2021 Report on Gender Equality in the EU. European Commission, 2021. [https://ec.europa.eu/info/sites/default/files/aid\\_development\\_cooperation\\_fundamental\\_rights/annual\\_report\\_ge\\_2021\\_en.pdf](https://ec.europa.eu/info/sites/default/files/aid_development_cooperation_fundamental_rights/annual_report_ge_2021_en.pdf)
5. Global Gender Gap Report 2021. World Economic Forum, 2021. [https://www3.weforum.org/docs/WEF\\_GGGR\\_2021.pdf](https://www3.weforum.org/docs/WEF_GGGR_2021.pdf)

## **19AT014 Women in Leadership**

### **UNIT-I**

#### **Education, Employment and Empowerment**

Higher education for women, strategies to implement women's education in rural areas - Women's reservation in education sector, Formal and non-formal ways to education, National Literacy Mission, Traditions, maintaining family honour as strategies to curb financial independence

### **Unit-II**

#### **Roles of Women in Family and Society**

Archaeology of the evolution of women's role - Gender roles in the domestic sphere - Kitchen space feminism - Gender roles in the social sphere - Matriarchy and Matrilineal societies

### **Unit-III**

#### **Women in Sports**

Physical and Psychological effects of Sports on women - Socio-cultural and economic factors that deter Women's talent in Sports - Against all the odds- Narratives of Women athletes and Sport Stars – Serena Williams, Saina Nehwal, Sania Mirza, Deepika Palikal, Mary Kom - Gender testing, Drug tests and other issues related to sex determination process in sports

### **UNIT-IV**

#### **Women Entrepreneurship**

Significance of women entrepreneurship, Challenges faced by Women Entrepreneurs, - Relationship between Entrepreneurship and empowerment, Evolution of women entrepreneur development programme, Trends and Patterns of Women Entrepreneurship

#### **Text Books:**

1. Haque, T. 2015. Empowerment of Rural Women in Developing Countries: Challenges and Pathways. New Delhi: Concept Publishing Company. Sen, Amartya. Development and Freedom. New Delhi: Oxford University Press, 2000.
2. Agarwal, Suresh. 2015. Social Problems in India. New Delhi: Rajat Publications. Daly, Mary. Beyond God the Father.

#### **Reference Text Books:**

1. Drinkwater, Barabara, Ed. 2000. Women in Sport. Oxford: Blackwell Science.
2. Hisrich, Robert D., Michael Peters and Dean Shepherded- "Entrepreneurship " 9<sup>th</sup> Tata McGraw Hill 2012.
3. Peter F. Drucker "Innovation and Entrepreneurship", Reprint Heinemann 2006.

## **19AT015 Introduction to Research Methodology**

### **Unit I**

#### **Introduction to Research Methodology**

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research-descriptive vs. analytical research, applied vs. fundamental research, quantitative vs. qualitative research, conceptual vs. empirical research, Research Approaches, Significance of Research

### **Unit II**

#### **Defining the Research Problem**

What is a Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, Research Questions, Research Methods vs. Research Methodology

### **Unit III**

#### **Hypothesis**

Literature Review-Review Concepts and Theories, Formulation of Hypothesis-Sources of Hypothesis, Characteristics of Hypothesis, Role of Hypothesis, Tests of Hypothesis-Research Design, Sampling Design, Data Collection, Observation Method, Interview Method, Current trends in Research- Mono-disciplinary Research, Trans-disciplinary Research, Inter-disciplinary Research

### **Unit IV**

#### **Interpretation and Report Writing**

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Use of Ms-word and Latex for writing technical report.

#### **Suggested Books:**

1. C.R. Kothari and Gaurav Garg, "Research Methodology-methods and techniques", New Age International (P) Limited, 3<sup>rd</sup> Edition, 2012.
2. R. Panneerselvam, "Research Methodology", PHI Learning, 2<sup>nd</sup> Edition, 2014.

## 19AT016 Climate Changes and Circular Economy

### Unit I

**Introduction:** Climate in the Spotlight, -The Spectrum of Scientific Opinion, -Pundits, Advocates and Apocalypse, -The Earth's Natural Greenhouse Effect -, -Why the Earth is a Nice Place to Live, -The Radioactive Balance, -The Importance of Water-Greenhouse Gases-The Role of Carbon Dioxide, -The Role of Methane, -Major Uncertainties CO<sub>2</sub> Emissions -Human Emissions of CO<sub>2</sub>, -How Much Carbon in the Ground?, -Different Concerns of Rich and Poor Countries, the Earths Carbon Reservoirs -What is Biogeochemistry?, -Why is the Atmospheric Carbon Reservoir so Small?, -Breathing of Gaia, -The Missing CO<sub>2</sub> Sink Carbon Cycling: Some Examples -The Physical Carbon Pump, -The Biological Carbon Pump, -The Marine Carbon Cycle, -The Terrestrial Carbon Cycle Climate and Weather -Climate and Weather: Some Definitions, -The Earth's Climate Machine.

### Unit II

**Global Wind Systems:** Trade Winds and the Hadley Cell, -The Highs and Lows of the Westerlies, -The Vital Importance of Monsoon Rains, -Why are there Seasons, Clouds, Storms and Climate -Cloud Formation and Climate, -Hurricanes and Global Warming Global Ocean Circulation -Introduction and Overview, -Strawberries in Norway, -The Icelandic Whirlpool, -Origin of the Gulf Stream, -The Deep Atlantic Conveyor : El Niño and the Southern Oscillation -El Niño and its Effects, -Upwelling and Climate Outlook for the Future -Introduction to Climate Change, -Advances in Computer Modelling, -Physics versus Fudge Factors.

### Unit III

**Introduction to circular economy:** Purpose of circular economy, Circular sustainability, Challenges for circular economy Concept of sustainable development, Sustainable processes technologies and Critical assessment on current sustainable technologies. Circular bio economy, Circular Business Models. Circular business models to create economic and social value.

### Unit IV

**Circular economy policy framework:** Universal circular economy policy goals, role of governments and networks and how policies and sharing best practices can enable the circular economy. Circular economy towards zero waste: circular economy and waste sector, waste management in the context of circular economy

**LCA : An Introduction to Sustainability Concepts and Life Cycle Analysis , Environmental Data Collection and LCA Methodology Life Cycle Assessment** – Detailed Methodology and ISO Framework Life Cycle Inventory and Impact Assessments, Factors for Good LCA Design for Sustainability.

### Reference Book(s)

1. Webster, K. Circular Economy: A Wealth of Flows. Ellen MacArthur Foundation, 2<sup>nd</sup> Edition, 2016.
2. McDonough, William, and Michael Braungart. Cradle to Cradle: Remaking the Way We Make Things. New York: North Point, 2002.
3. Raworth, K. Doughnut Economics. Seven Ways to Think Like a 21<sup>st</sup> -Century Economist. Random House, 2017. Print.
4. Ellen MacArthur Foundation, "Delivering the Circular Economy: A Toolkit for Policymakers" Ellen MacArthur Foundation. 2015.
5. A. Tukker, et al, "The Impacts of Household Consumption and Options for Change," Journal of Industrial Ecology, Vol. 14: 13-39, 2010.

**Course Outcomes**

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

1. Understand key concepts in multimedia technology.
2. Identify basic Animation types and Image data types.
3. Explain image manipulation techniques.
4. Describe transmission of audio and video.
5. Identify various video and audio compression techniques.
6. Demonstrate technical knowledge and limited proficiency in designing production elements.

**COs – POs Mapping**

COs	PO <sub>1</sub>	PO <sub>5</sub>	PO <sub>7</sub>
1	3	3	2
2	3	3	1
3	3	3	2
4	2	3	2
5	3	3	1
6	2	3	3

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

**Syllabus****Unit I****Introduction to multimedia**

What is multimedia?, Multimedia and Hypermedia, World Wide Web, Overview of Multimedia Software Tools, Graphics and Image Data Representations: Graphics/Image Data Types, Color in Image and Video: Color Science, Color Models in Images, Color Models in Video.

*Popular file formats.*

**13+3 Hours**

**Unit II****Fundamental Concepts in Video and Digital Audio**

Types of Video Signals, Analog Video, Digital Video, Digitization of Sound, MIDI, Quantization and Transmission of Audio.

*DPCM, DM, ADPCM*

**10+5 Hours**

**Unit III****Multimedia Data Compression**

Lossless compression algorithms: Run-Length Coding, Variable Length Coding, and Dictionary Based Coding. Lossy compression algorithms: Quantization, Transform Coding, Wavelet-Based Coding

*Arithmetic Coding, Lossless Image Compression*

**12+4 Hours**

**Unit IV****Basics of Video and Audio Compression**

Introduction to Video Compression, Video Compression based on Motion Compensation, Search for Motion Vectors, Video Coding Overview of MPEG-1, MPEG-2, MPEG-4

ADPCM in Speech Coding, MPEG Audio Compression.

*MPEG-7, Basics of Computer and Multimedia networks*

**10+3 Hours**

**Total: 60 Hours**

**Textbook (s)**

1. Ze-Nian Li and Mark S.Drew, "Fundamentals of Multimedia", 1<sup>st</sup> Edition, PHI/Pearson Education, 2009.
2. Weixel, "Multimedia Basics", 2<sup>nd</sup> Edition, Thomson Press, 2006.

**Reference (s)**

1. Nigel Chapman and Jenny Chapman, "Digital Multimedia", 3<sup>rd</sup> Edition, Wiley Dreamtech, 2009.

2. Steve Heath, "Multimedia and Communications Technology", 2<sup>nd</sup> Edition, Elsevier (Focal Press), 1999.
3. Steinmetz, Ralf, Nahrstedt, "Multimedia Applications", 1<sup>st</sup> Edition, Springer, 2004.

**Internal Assessment Pattern**

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

**Sample Question (S)**

**Remember**

1. Define multimedia
2. List some multimedia software.
3. List some multimedia hardware

**Understand**

1. Explain the application of multimedia in education and e-commerce
2. Explain analog and digital video in details
3. Explain the need of multimedia and write down its applications
4. Illustrate the scope of multimedia in e-governance

**Apply**

1. Implement Huffman coding, adaptive Huffman coding, arithmetic coding and LZW coding algorithms using your favorite programming language. Generate at least three types of statistically different artificial data sources to test your implementation of these algorithms. Compare and comment on each algorithm's performance in terms of compression ratio for each type of data source. **(For Open Book Examination and not for semester end examination).**
2. Assume we have an unbounded source we wish to quantize using an M-bit mid-tread uniform quantizer. Derive an expression for the total distortion if the step size. **(For Open Book Examination and not for semester end examination).**

## 19IT002 Fundamentals of Cloud Computing

3 1 0 3

### Course Outcomes

1. Interpret the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
2. Illustrate various problems and evaluate related cloud computing solutions.
3. Apply the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud and hybrid cloud to different problems.
4. Understand cloud provider for a defined environment and to a specific platform in a cost effective way.
5. Apply case studies to derive the best practice model to apply when developing and deploying cloud based applications
6. Understand a virtual machine with a machine image

### Co - Po Mapping

COs	PO <sub>1</sub>	PO <sub>7</sub>
1	3	1
2	3	1
3	3	1
4	2	2
5	3	1
6	2	3

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

### Syllabus

#### Unit I

##### Understanding Cloud Computing

Cloud computing: Introduction, Cloud application architectures, Value of cloud computing, Cloud Infrastructure models, Cloud Services, History of Cloud Computing, Advantages of Cloud Computing, Disadvantages of Cloud Computing, Companies in the Cloud Today, Amazon Web Services, Windows Azure, Google services, IBM Cloud Before the move into the cloud- Know Your Software Licenses, The Shift to a Cloud Cost Model, Service Levels for Cloud Applications Ready for the cloud: Web Application Design, Machine Image Design, Privacy Design, Design, Database Management.

*Tata Cloud- Salesforce.com*

**13+3 Hours**

#### Unit II

##### Virtual Machines and Virtualization of Clusters and Data Centers

Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation Case Studies: Cloud centers in detail, Comparing approaches, Xen, Eucalyptus, Cloud Stack, and Open Stack

*VMware- KVM.*

**10+5 Hours**

#### Unit III

##### Cloud Computing Software Security Fundamentals

Cloud information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Approaches to Cloud Software Requirements Engineering, Cloud Security Policy Implementation. Cloud Computing Risk Issues: The CIA Triad, Privacy and Compliance Risks, Threats to Infrastructure Data and Access Control, Cloud Access Control Issues, Cloud Service Provider Risks.

*Security concepts-Confidentiality-privacy-integrity-authentication-non-repudiation-availability- access control- defense in depth- least privilege*

**12+4 Hours**

#### Unit IV

##### Cloud Programming and Software Environments

Features of Cloud and Grid Platforms, Parallel and Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments.

Ubiquitous Cloud: Cloud Trends in supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud.

**10+3 Hours**  
**Total: 45+15 Hours**

**Textbook (s)**

1. George Reese, Cloud Application Architectures, 1<sup>st</sup> Edition O'Reilly Media, 2009
2. Ronald L.Krutz and Russell Dean Vines, Cloud Security, 1<sup>st</sup> Edition, Wiley Publishing, 2010

**Reference (s)**

1. Michael Miller, Cloud Computing-Web Based Applications that change the way you work and collaborate online, 1<sup>st</sup> 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 , 1<sup>st</sup> Edition, MK Publishing, 2010
3. David S Linthicum, Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide, 1<sup>st</sup> Edition, Addison-Wesley, 2009

**Internal Assessment Pattern**

<b>Cognitive Level</b>	<b>Int. Test 1 (%)</b>	<b>Int. Test 2 (%)</b>	<b>Open Book Exam (%)</b>
<b>Remember</b>	40	45	--
<b>Understand</b>	40	45	60
<b>Apply</b>	20	10	40
<b>Analyze</b>	--	--	
<b>Evaluate</b>	--	--	--
<b>Create</b>	--	--	--
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.

**Apply**

1. Explain any IaaS service provided by Amazon
2. What is cloud Stack?
3. How disaster recovery planning can be done
4. How Web Application Design is used in designing cloud applications



## 19IT003 Fundamentals of Mobile Computing

3 1 0 3

### Course Outcomes

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

1. Interpret the GSM architecture and its services.
2. Understand the various wireless applications and study technical feasibility of various mobile applications.
3. Utilize the mobile network layer protocols and its functionalities.
4. Explain any existing or new models of mobile environments for 4G networks
5. Understand platform, protocols and related concepts of Ad hoc and Enterprise wireless networks
6. Understand IP and TCP layers of Mobile Communications

### CO - PO Mapping

COs	PO <sub>1</sub>	PO <sub>7</sub>
1	3	2
2	3	2
3	3	2
4	3	2
5	3	1
6	3	1

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

### Syllabus

#### Unit I

**Introduction: Mobile Communications and Mobile Computing** – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices. Global System for Mobile Communication (GSM): Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, New Data Services, GPRS Architecture, GPRS Network Nodes.

*Evolution of Mobile computing*

**12+4 Hours**

#### Unit II

**Medium Access Control (MAC)** : Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), Wireless LAN/(IEEE 802.11) architecture, key IEEE802.11 a/b/c/d/e/g/i/n/T/ac/ standards. Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless markup Languages (WML). Wireless Local Loop (WLL): Introduction to WLL Architecture.

*wireless Local Loop Technologies*

**11+4 Hours**

#### Unit III

**Mobile Network Layer** : IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Mobile Transport Layer : Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP. Third Generation (4G) Mobile Services: Comparison of different generations, Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision.

*Wideband Code Division Multiple Access, Time out freezing*

**11+4 Hours**

#### Unit IV

**Mobile Ad hoc Networks (MANETs)** : Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc. , Mobile Agents, Service

Discovery ,case study using NS2 –traffic analysis using CBR and VBR Wireless Enterprise Networks:  
Introduction to Virtual Networks, Blue tooth technology.

*Blue tooth Protocols.*

**11+3 Hours**

**Total: 45+15 Hours**

**Textbook (s)**

1. Jochen Schiller, “Mobile Communications”, Addison-Wesley, Second Edition, 2009.
2. Raj Kamal, “Mobile Computing”, Oxford University Press, 2007, ISBN: 0195686772

**Reference (s)**

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, “Mobile Computing, Technology Applications and Service Creation” Second Edition, 2010 McGraw Hill.
2. Martin Sauter, “From GSM to LTE-Advanced: An Introduction to Mobile Networks and Mobile Broadband,” Second Edition, 2014 Wiley.

**Internal Assessment Pattern**

<b>Cognitive Level</b>	<b>Int. Test 1 (%)</b>	<b>Int. Test 2 (%)</b>	<b>Open Book Exam (%)</b>
Remember	30	30	-
Understand	70	70	40
Apply	-	-	60
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	--
<b>Total (%)</b>	<b>100</b>	<b>100</b>	<b>100</b>

**Sample Question (S)**

**Remember**

1. List any four Application of Mobile Computing
2. Define Mobile Computing

**Understand**

1. Explain Mobile Ad hoc Networks
2. Explain the role Blue tooth technology in Mobile Computing
3. Illustrate Classification of Routing Algorithms

**Apply**

1. Discuss about Mobile transport Layer
2. Illustrate Blue tooth technology
3. Describe classification of Routing algorithms
4. Illustrate challenges of MANET

**Open Book Exam Questions**

1. Why “MAC protocol designed for infrastructure based wireless network may not work satisfactory in infrastructure less environment “ – justify?
2. why the traditional IP cannot be used in a mobile network. What are the main differences between the traditional IP and the mobile IP? How does mobile IP support mobile hubs?

## 20IT015 Human Computer Interaction

0003

### Course Outcomes

At the end of the course students will be able to

1. Demonstrate the capabilities of both humans and computers from the viewpoint of human information processing.
2. Understand typical human-computer interaction (HCI) models, styles, and various historic HCI paradigms.
3. Understand interactive design process and universal design principles to designing HCI systems
4. Apply HCI design principles, standards and guidelines.
5. Understand user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems
6. Understand HCI issues in groupware, ubiquitous computing, virtual reality, multimedia, and WordWide Web-related environments.

### COs - POs Mapping

COs	PO <sub>1</sub>	PO <sub>7</sub>
1	1	3
2	1	3
3	3	1
4	1	2
5	2	3
6	1	2

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

### Syllabus

#### Unit I

##### Introduction

Importance of user Interface-definition, importance of good design, Benefits of good design, A brief history of Screen design, The graphical user interface-popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user-Interface popularity, characteristics-Principles of user interface.

*Design methodologies-participatory design-Usability and tests-Acceptability tests*

**10+5 Hours**

#### Unit II

##### Design process

Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions, Screen Designing:-Design goals-Screen planning and purpose, organizing screen elements, ordering of screen data and content-screen navigation and flow-Visually pleasing composition- amount of information-focus and emphasis-presentation information simply and meaningfully-information retrieval on web-statistical graphics-Technological consideration in interface design.

*Design Visual thinking-virtual-environments-item presentation sequence-layout-form fill-in dialog boxes*

**10+3 Hours**

#### Unit III

##### Windows

New and Navigation schemes selection of window, selection of devices based and screen based controls, Components-text and messages, Icons and increases-Multimedia, uses problems, choosing colors.

*Goals of Co-operation-asynchronous interactions-synchronous distributed-application to education-social uses*

**12+4 Hours**

## Unit IV

### Software Tools and Interaction Devices

Specification methods, interface-Building Tools, Keyboard and function keys, pointing devices-speech recognition digitization and generation-image and video displays-drivers.

*Database query and phase search in documents, multimedia document searches, information visualization*

**13+3 Hours**

**Total: 45+15 Hours**

### Textbook (s)

1. Wilbert O Galitz, Wiley Dream Tech, The essential guide to user interface design, 3<sup>rd</sup> Edition, Wiley Computer Publishing, 2007.
2. Ben Shneidermann, Designing the user interface, 3<sup>rd</sup> Edition, Pearson Education Asia, 2008.

### Reference (s)

1. Alan Dix, Janet Finckay, Gregory, Abowd, Russell Beal, Human Computer Interaction., 3<sup>rd</sup> Edition Pearson Education, 2004.

### Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	60	40	80
Apply	--	20	20
Analyze	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

### Sample Question (S)

#### Remember

1. Define Human Computer Interaction.
2. What is the basic goal of Human Computer Interaction?
3. State the long term goal of HCI
4. List the factors HCI designers must consider for User Interface Design

#### Understand

1. Demonstrate the HCI importance.
2. Extend the Trouble faced by human with Computers.
3. Illustrate Psychological Responses to Poor Design
4. Interpret Human-factor variables used in Comparison of pointing devices

#### Apply

1. Identify the amount of Information need to present in a page.
2. Organize the different Software tool specification methods.
3. Model out the six types interaction tasks properties of Pointing devices (For Open Book Examination and not for semester end examination)

**B. Tech. (Honors)  
Domain I (Modern Computing)  
19ITH11 Advanced Computer Architecture**

**4 0 0 4**

**Course Outcomes**

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

1. Understand the concept of various computer models.
2. Understand the concept of different scalar computers.
3. Understand the various levels of memory hierarchy and concept of virtual memory.
4. Get the knowledge on pipelining and superscalar techniques.
5. Obtain the knowledge on Instruction pipeline design.
6. Obtain the knowledge on interconnection and networks.

**CO – PO Mapping**

COs	PO <sub>2</sub>	PO <sub>3</sub>
1	3	2
2	3	2
3	2	1
4	3	1
5	2	3
6	2	3

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

**Syllabus**

**Unit I**

**Parallel Computer Models**

Evolution of Computer Architecture, System Attributes to Performance, Shared Memory Multiprocessors, Distributed Memory Multicomputer, Vector Super Computers, SIMD Super Computers.

**Unit II**

**Processors and Memory hierarchy**

Advanced Processor Technology: Design Space of Processors, Instruction-Set Architectures, CISC scalar Processors, RISC scalar Processors, Memory Hierarchy, Virtual Memory, Super Scalar and Vector Processors: Superscalar Processors.

**Unit III**

**Pipelining and Superscalar Techniques**

Linear Pipeline Processors: Asynchronous and Synchronous models, Clocking and Timing Control, Speedup, Efficiency and Throughput, Pipeline Schedule Optimization, Instruction Pipeline Design: Instruction Execution Phases, Mechanisms for Instruction Pipelining, Dynamic Instruction Scheduling, Branch Handling Techniques, Vector processing, RISC pipeline.

**Unit IV**

**Inter Connection and Networks**

Introduction, Interconnection network media, Practical issues in interconnecting networks, Examples of inter connection, Cluster, Designing of clusters, Intel Architecture: Intel IA- 64 ILP in embedded and mobile markets Fallacies and pit falls.

**Textbook (s)**

1. Computer System Architecture, Morris M. Mano, 3rd edition, Pearson/Prentice Hall India.
2. Advanced Computer Architecture, Kai Hwang, McGraw-Hill, India.
3. John L. Hennessy, David A. Patterson, “Computer Architecture: A Quantitative Approach”, 3rd Edition, An Imprint of Elsevier

**Reference (s)**

1. Computer Organization and Architecture, William Stallings, 8th edition, PHI
2. Computer Organization, Carl Hamacher, Vranesic, Zaky, 5th edition, McGraw Hill.
3. John P. Shen and Miikko H. Lipasti, "Modern Processor Design : Fundamentals of Super Scalar Processors", 2002, Beta Edition, McGrawHill
4. Kai Hwang, Faye A. Briggs., "Computer Architecture, and Parallel Processing", McGraw Hill,
5. Raj Kamal "Microcontrollers Architecture, Programming, Interfacing and System Design", 1st Edn., Pearson Education, 2005.

**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	--	--
Understand	30	40	--
Apply	30	30	40
Analyze	--	30	40
Evaluate	--	--	20
Create	--	--	--
Total (%)	100	100	100

**Sample Question (S)**

**Remember**

1. What is RISC.
2. Define pipeline processor.
3. Define virtual memory.

**Understand**

1. Explain about evolution of computer architecture.
2. Explain about instruction pipeline with a neat diagram.
3. Explain the practical issues involved in interconnecting network.

**Apply**

1. Give an example of a interconnection network.
2. Explain the instruction execution phases in instruction pipeline with an example..

**Analyze**

1. Differentiate between RISC and CISC architecture.
2. Write briefly about the evolution of a computer Architecture.

**Open Book Exam Questions**

1. A 4 Mhz processor was used to execute a benchmark program with the following instruction mix and clock cycle counts.

Instruction type	Instruction count	Cycles/instruction
Integer arithmetic	45000	1
Data transfer	32000	2
Floating point	15000	2
Control transfer	8000	2

2. Determine the effective CPI, and execution time for this program.
2. Consider the following reservation table for a three-stage pipeline.

	1	2	3	4	5	6	7	8
S1	X					X		X

S2		X		X				
S3			X		X		X	

- i. Draw the state transition diagram.
- ii. Determine the pipeline throughput.
- iii. List all simple cycles and greedy cycles.
- iv. What are forbidden latencies and initial collision vector?

**19ITH12 Microprocessors and Microcontrollers**

**4 0 0 4**

**Course Outcomes**

Upon completion of this course, a student should be able:

1. Understand the architectures and instruction sets of microprocessors and microcontrollers.
2. Develop applications which involve interfacing of peripherals to microprocessors databases.
3. Develop logical programming skills in 8086 assembly language
4. Understand the programming of 8051 on-chip peripherals like timers, serial port.
5. Develop applications which involve Programmable devices and its interfaces.
6. Understand the Data transfer schemes and methods

**CO - PO Mapping**

COs	PO <sub>2</sub>	PO <sub>3</sub>
1	3	2
2	3	2
3	2	3
4	2	1
5	3	2
6	2	3

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

**Syllabus**

**Unit I**

**Intel 8086 microprocessor**

8086 internal architecture, addressing modes, pin diagram, Minimum mode and maximum mode of operation, timing diagrams, Memory interfacing to 8086 (Static RAM & EPROM), 8086 interrupts and interrupt responses.

**Unit II**

**8086 Programming**

Instruction set of 8086, assembler directives, program development Steps, constructing the machine code for 8086 instructions, writing programs for Use with an assembler, writing and using procedures and assembler macros.

**Unit III**

**Programmable Devices and Interfacing Of I/O**

Priority interrupt controller Intel 8259A, programmable peripheral interface 8255A, Interfacing of A/D and D/A converters to 8086 microprocessor, interfacing a microprocessor to keyboards, 7-segment display unit, stepper motor.

**Unit IV**

**Usart, Keyboard/ Display Controller and DMA Interfacing**

Serial data transfer scheme, asynchronous and synchronous data transfer schemes, serial I/O 8251 USART architecture and interfacing, Sample program of serial data transfer, Need for DMA, 8257 DMA controller, 8279 keyboard/display controller.

**Textbook(s)**

1. A.K.Ray and K.M.Bhurchandi, "Advanced Microprocessors and Peripherals", 2nd Edn, TMH, 2006.
2. Mazidi and Mazidi, "The 8051 Microcontroller and Embedded Systems", 2nd Edn, PHI, 2004.

**Reference(s)**

1. Barry B. Brey, "The Intel Microprocessors-Architecture, Programming & Interfacing", 6th Edn., Pearson Education, 2004.



- Liu and GA Gibson, "Micro Computer System 8086/8088 Family Architecture, Programming and Design", 2nd Edn., PHI, 2006.
- Douglas V. Hall, "Micro Processors & Interfacing", 2nd Edn., 2007.
- Raj Kamal "Microcontrollers Architecture, Programming, Interfacing and System Design", 1st Edn., Pearson Education, 2005.

### Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
<b>Remember</b>	40	--	--
<b>Understand</b>	30	40	--
<b>Apply</b>	30	30	40
<b>Analyze</b>	--	30	40
<b>Evaluate</b>	--	--	20
<b>Create</b>	--	--	--
Total (%)	100	100	100

### Sample Questions

#### Remember

- Define Microprocessor and microcontroller
- List out different fields of ALP instruction formats
- State an assembler directive
- Define macro
- State the need for DMA

#### Understand

- Explain various types of 8086 instructions
- Compare 8085 and 8086 microprocessors
- Illustrate the concept of DMA
- Explain the significance of reset circuitry in 8051 microcontrollers
- Explain the architecture of 8086 microprocessors

#### Apply

- Execute an ALP to perform sorting operation in ascending order on 16 bit numbers
- Find the approximate time required to execute an ALP with the help of hardware timers
- Execute an ALP to generate +4V (P-P) of square wave using 8086
- Execute an ALP to blink the LED'S using 8051
- Execute an ALP to find largest number

#### Analyze

- Compare the register organization of 8086 and 80386 microprocessors
- Outline the features of 80386 advanced microprocessor
- Differentiate the features of 8086 microprocessors
- Organize the instruction set for implementing stepper motor application
- Differentiate the modes of operation of 8255

### Open Book Exam Questions

- It is supposed that there are 81 numbers of data in the table. Divide the data coming through P3 to each of the data in the table. According to the result value:
  - If there is a division by zero, the LED connected to P0.3 is turned on.
  - If the result is less than 8, then the LED connected to P0.4 is turned on.
  - Otherwise, the LED connected to the P0.5 is turned on.

- D. In the controls made for each operation, the expressions given in items a, b and c will be updated
  - E. Write the 8051 assembly program code.
2. You are designing a controller for a washing machine. The prior washing machine used a mechanical timer with many contact switches to trigger the various parts of each wash cycle. This timer was very expensive to replace and had a high failure rate. Is it reasonable to think that using a microcontroller for the design is likely to reduce the failure rate?

**19ITH13 Embedded Systems****4 0 0 4****Course Outcomes**

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

1. Understand the basics of an embedded system
2. Identify different components of microcontroller and their interactions.
3. Analyze various Scheduling Algorithms for Process Management.
4. Examine process synchronization and coordination of operating system.
5. Understand the key concepts of embedded systems such as I/O, timers, interrupts and interaction with peripheral devices.
6. Know the trends in the embedded industry

**CO - PO Mapping**

COs	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>7</sub>	PO <sub>12</sub>
1	3	3	2	2
2	3	3	2	2
3	3	3	2	2
4	3	3	2	2
5	3	3	1	2
6	3	1	1	1

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

**Syllabus****Unit I**

**Introduction to Embedded systems:** What is an embedded system Vs. General computing system, history, classification, major application areas, and purpose of embedded systems. Core of embedded system, memory, sensors and actuators, communication interface, embedded firmware, other system components, PCB and passive components.

**Unit II**

**8-bit microcontrollers architecture:** Characteristics, quality attributes application specific, domain specific, embedded systems. Factors to be considered in selecting a controller, 8051 architecture, memory organization, registers, oscillator unit, ports, source current, sinking current, design examples.

**Unit III**

RTOS and Scheduling, Operating basics, types, RTOS, tasks, process and threads, multiprocessing and multitasking, types of multitasking, non preemptive, preemptive scheduling.

Task communication of RTOS, Shared memory, pipes, memory mapped objects, message passing, message queue, mailbox, signaling, RPC and sockets, task communication/synchronization issues, racing, deadlock, live lock, the dining philosopher's problem.

**Unit IV**

The producer-consumer problem, Reader writers problem, Priority Inversion, Priority ceiling, Task Synchronization techniques, busy waiting, sleep and wakery, semaphore, mutex, critical section objects, events, device, device drivers, how to clause an RTOS, Integration and testing of embedded hardware and fire ware.

Simulators, emulators, Debuggers, Embedded Product Development life cycle (EDLC), Trends in embedded Industry, Introduction to ARM family of processor.

**Textbook (s)**

1. Introduction to embedded systems Shibu. K.V, TMH, 2009.

**Reference (s)**

1. Ayala & Gadre: The 8051 Microcontroller & Embedded Systems using Assembly and C, CENGAGE
2. Embedded Systems, Rajkamal, TMH, 2009.
3. Embedded Software Primer, David Simon, Pearson.
4. The 8051 Microcontroller and Embedded Systems, Mazidi, Mazidi, Pearson,.

**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
<b>Remember</b>	20	20	--
<b>Understand</b>	30	10	--
<b>Apply</b>	30	30	40
<b>Analyze</b>	10	20	30
<b>Evaluate</b>	10	20	30
<b>Create</b>	--	--	--
<b>Total (%)</b>	100	100	100

**Sample Question (S)**

**Remember** List the components of embedded system?

1. Define embedded microcontroller.
2. List the important considerations when selecting a processor.

**Understand**

1. Explain the basic processors and hardware units in the embedded system.
2. State the difference between FSM and FSMD models.

**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

**Analyze**

1. Analyze the necessity of RTOS in embedded systems.

**19ITH14 High Performance Computing**

**4 0 0 4**

**Course Outcomes**

1. Understand the concepts and terminology of high performance computing
2. Can write and analyze the behavior of high performance parallel programs for distributed memory architectures (using MPI).
3. Can write and analyze various levels of memory hierarchy and concept of virtual memory . Can write simple programs for the GPU.
4. Can independently study, learn about, and present some aspect of high performance computing.
5. Obtain the knowledge on Instruction pipeline design.
6. Obtain the knowledge on the behavior of high performance parallel programs for shared memory architectures (OpenMP).

**CO - PO Mapping**

COs	PO <sub>2</sub>	PO <sub>3</sub>
1	3	2
2	3	2
3	2	1
4	3	1
5	2	3
6	2	3

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

**Syllabus**

**12+4 Hours**

**UNIT- I**

**Introduction to high performance Computing**

Overview, Flynn's classifications – SISD, SIMD, MISD, MIMD, Examples from Vector & Array Processors, Performance comparison of algorithms for Scalar, Vector and Array Processors, Fundamentals of UMA, NUMA, NORMA architectures, Performance measurement for parallel architectures – Flynn's measure, Feng's measure, Handler's measure, Amadahl's law of limitation for parallel processing, Gustafson's law. Performance measurement parameters – MIPS, MFLOPS, SPEC ratings, CPI etc.

**UNIT - II**

**11+4 Hours**

**Pipelined processor design**

Pipeline performance measurement parameters – speedup factor, efficiency, throughput of a linear pipeline, comparing performance of a N stage pipeline with a N processor architecture, Pipeline design principles – Uniform sub-computations, Identical computations, Independent computations, Examples from design of Arithmetic pipelines – Floating point Adders, Multipliers, Dividers etc., Scheduling in a pipelines with feedback , Pipeline hazards and their solutions, Classifications of Unifunction, Multifunction & Dynamic pipelines

**UNIT-III**

**11+4 Hours**

**RISC architecture & Threading**

Characteristics of RISC instruction set & RISC pipeline, its comparisons with CISC, necessity of using optimizing compilers with RISC architecture, Examples from POWER PC and SPARC architectures , Super pipelining (MIPS architecture), Superscalar architecture , Diversified pipelines and out of order execution, VLIW architecture, Multithreading, Hardware multithreading (Coarse grained, fine grained & simultaneous multithreading).

**UNIT-IV**

**11+3 Hours**

**Memory hierarchy & Open-MP**

Cache memory, Techniques for improving Cache memory performance parameters,( reduce cache miss rate, reduce hit time, reduce miss penalty),Virtual Memory, Main memory performance enhancement – interleaved memory, improvement of memory bandwidth, use of TLB for performance enhancement.

Introduction to OpenMP, Parallel execution, Data scoping, OpenMP work sharing for loops, Synchronization, Reductions, Loop scheduling, Tasking, Miscellaneous, Case study: OpenMP-parallel Jacobi algorithm

**Text Books**

1. An Introduction to Parallel Programming, Peter S Pacheco, Elsevier, 2011
2. Computer Architecture: A Quantitative Approach – Patterson & Hennessy (Elsevier)
3. Computer organization and architecture, designing for performance – Stallings (PHI)

**Reference Books**

1. Computer Organization and Achitecture, William Stallings ,8th edition,PHI
2. Computer Organization, Carl Hamachar, Vranesic,Zaky, 5th edition, McGraw Hill.
3. John P. Shen and Miikko H. Lipasti, “Modern Processor Design : Fundamentals of Super Scalar Processors”, 2002, Beta Edition, McGrawHill
4. Kai Hwang, Faye A.Brigs., “Computer Architecture, and Parallel Processing”, McGraw Hill.,
5. Raj Kamal “Microcontrollers Architecture, Programming, Interfacing and System Design”, 1st Edn., Pearson Education, 2005.

**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	--	--
Understand	30	40	--
Apply	30	30	40
Analyze	--	30	40
Evaluate	--	--	20
Create	--	--	--
Total (%)	100	100	100

**Sample Question (S)**

**Remember**

1. What is RISC.
2. Define pipeline processor.
3. Define virtual memory.

**Understand**

1. Explain about evolution of computer architecture.
2. Explain about instruction pipeline with a neat diagram.
3. Explain the practical issues involved in interconnecting network.

**Apply**

1. Give an example of a interconnection network.
2. Explain the instruction execution phases in instruction pipeline with an example..

**Analyze**

1. Differentiate between RISC and CISC architecture.
2. Write briefly about the evolution of a computer Architecture.

**Open Book Exam Questions**

1. A 4 Mhz processor was used to execute a benchmark program with the following instruction mix and clock cycle counts.

Instruction type	Instruction count	Cycles/instruction
Integer arithmetic	45000	1
Data transfer	32000	2
Floating point	15000	2
Control transfer	8000	2

Determine the effective CPI, and execution time for this program.

2. Consider the following reservation table for a three-stage pipeline.

	1	2	3	4	5	6	7	8
S1	X					X		X
S2		X		X				
S3			X		X		X	

- v. Draw the state transition diagram.
- vi. Determine the pipeline throughput.
- vii. List all simple cycles and greedy cycles.
- viii. What are forbidden latencies and initial collision vector?

**Domain II (Data Engineering)****19CSH11 Advanced Data Structures****4 0 0 4****Course Outcomes**

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

1. Recognize the variations in implementation of fundamental linear data structures
2. Describe and implement different types of search and balanced trees
3. Demonstrate the concepts and implementations of heaps and its types
4. Identify heap data structure for appropriate use cases
5. Outline the applications of hash table data structure
6. Illustrate the use of data structure for strings

**CO-PO Mapping**

CO	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>
1	2	3	2
2	3	3	3
3	3	3	3
4	3	3	3
5	3	3	3
6	2	3	2

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

**Unit I****Elementary Data Structures: Review****10+3 Hours**

List – Stack – Queue – Double Ended Queue – Dynamic Allocation of nodes – Shadow copies of Array based structures – Generic List

**Unit II****Search Trees and Balanced Trees****12+4 Hours**

Two models of search trees – General properties and Transformations – Height of search tree – Basic insert, delete operations – Dealing with non-unique keys – Building Optimal search trees – Converting trees into lists – Height balanced trees – Weight balanced trees – Red-Black trees – Splay trees – Skip lists – Interval trees – Segment trees

**Unit III****Heaps****12+4 Hours**

Balanced search trees as heaps – Array based heaps – Heaps as trees – Leftlist heaps – Skew heaps – Binomial heaps – Changing keys in heaps – Fibonacci heaps – Heaps of optimal complexity – Double ended heap structures

**Unit IV****Hash Tables and Data Structures for Strings****11+4 Hours**

Hash Tables

Basic hash tables and collision resolution – Universal families of hash functions – perfect hash functions – hash trees – Extendible hashing – Bloom filters

Tries and Compressed tries – Dictionaries – Suffix trees – Suffix arrays

**Textbook (s)**

1. Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2008
2. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, “Introduction to Algorithms”, MIT Press, Cambridge, 2009



**Reference (s)**

1. Alfred L Aho, John E Hopcroft, Jeffery D Ullman, "Data Structures and Algorithms, Pearson Publications, 2016
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, 2002
3. Michael Main, Walter Savitch, Data Structures and other objects using C++, 4<sup>th</sup> Edition, Addison Wesley, 2018

**Internal Assessment Pattern**

<b>Cognitive Level</b>	<b>Int. Test 1 (%)</b>	<b>Int. Test 2 (%)</b>	<b>Open Book Test (%)</b>
Remember	20	20	--
Understand	35	35	--
Apply	25	25	40
Analyze	20	20	40
Evaluate	--	--	20
Create	--	--	--
<b>Total (%)</b>	<b>100</b>	<b>100</b>	<b>100</b>

**SAMPLE QUESTION (S)****Remember**

1. List out linear data structures
2. Name the basic operations of stack data structure
3. Define balance factor of AVL tree
4. Define complete binary tree
5. What is self-referential structure?
6. Name two basic operations on stack data structure supports
7. Define a double linked list structure
8. What are advantages and disadvantages of circular linked list?

**Understand**

1. Explain Bubble Sort Process with an example
2. Demonstrate with neat diagram and algorithm to insert a node before the given key
3. Explain Deletion process using an example binary search tree
4. Explain why the selection sort is more efficient than the bubble sort
5. Explain with suitable example of LL rotation after inserting a new node into an AVL tree
6. Demonstrate the application of singly linked lists for the addition of the polynomials P1 and P2

**Apply**

1. Construct a symbol parse tree for the key words of following program

```
void main()
{
    long int n,num,d;
    char prime;
    clrscr();
    printf("Enter the range for prime no");
    scanf("%ld",&n);
    for(num=2;num<=n;num++)
    {
        prime='t';
        for(d=2;d<=sqrt(num);d++)
```

```

    if (num%d==0)
    {
        prime='f';
        break;
    }
    if(prime==t)
        printf("%10ld",num);
}
getch();
}

```

2. Develop an algorithm to concatenate two single linked lists
3. Construct a priority queue and implement all basic operations to demonstrate priority queue
4. Build a recursive procedure to count the number of nodes in a binary tree
5. Develop a queue using single linked list data structure

### Analyze

1. Analyze the efficiency of insertion sort for the following inputs to sort  
A={12, 23, 3, 11, 56, 6, 78, 7} B={12, 14, 23, 45, 56, 67, 78, 81}
2. Analyze the efficiency of BST deletion to delete a node with two children
3. Compare BST deletion and AVL deletion methods according to time efficiency.
4. Choose a suitable data structure to implement a linked stack
5. Analyze the efficiency of BFS graph traversal method

### Evaluate

1. Justify that the height of the AVL tree is  $O(\log n)$  where  $n$  is the no of nodes in the tree
2. Prove that the height of a complete, balanced binary tree of 'n' nodes is " $\log(n+1)$ "
3. The worst time complexity of binary search is  $O(\log n)$ , Justify
4. Choose a suitable data structure to implement double ended queue
5. Compare the height by successive insertion of following numbers if inserted into a BST and AVL tree  
{12, 14, 23, 45, 56, 67, 78, 81}

**19CSH12 Advanced Databases**

**4 0 0 4**

**Course Outcomes**

1. Interpret Distributed Databases and its architectures
2. Utilize various fragmentation techniques given a database
3. Illustrate query optimization and Transaction Management in DDBMS
4. Compare various approaches to concurrency control in Distributed database
5. Choose various algorithms and techniques for deadlock and recovery in Distributed database
6. Explain about data on external storage and indexing

**COs - POs Mapping**

COs	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>
1	3	2	1
2	3	3	2
3	3	2	1
4	2	2	2
5	3	2	1
6	3	3	2

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

**Unit I**

**9+3 Hours**

Introduction to DDBMS: Distributed data processing; what is a DDBS; Features of Distributed versus Centralized Databases, Advantages and disadvantages of DDBS; Principles of Distributed Databases, Levels of Distribution Transparency, Distributed DBMS Architecture.

Distributed Database Design: Top-Down Design Process, Distribution design issues, fragmentation, allocation, Data Directory.

**Unit II**

**7+4 Hours**

Optimization of Access Strategies, A Framework for Query Optimization, Join Queries, General Queries. The Management of Distributed Transactions, A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions.

**Unit III**

**8+3 Hours**

Concurrency Control, Foundation of Distributed Concurrency Control, Distributed Deadlocks, and Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control. Basic Concepts of reliability, Non-blocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart, Distributed Database Administration.

**Unit IV**

**7+4 Hours**

Data on External Storage: File Organization and Indexing, Clustered Indexing, Primary and Secondary Indexes, Index Data Structures, Hash-Based Indexing, Hash Tables, Tree-Based Indexing, B-Tress, Comparison of File Organization.

**Total: 45 Hours**

**Textbook (s)**

1. Principles of Distributed Database Systems, M. Tamer Özsu, and Patrick Valduriez Prentice-Hall, 4th Edition, 2019.
2. Distributed Databases Principles & Systems, Stefano Ceri, Giuseppe Pelagatti, Tata Mcgraw-Hill, 2017.
3. Database System Concepts, Silberschatz Korth, McGraw hill, 7th Edition, 2019

**Reference (s)**

1. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley.
2. Distributed Database Management Systems: A Practical Approach, Saeed K. Rahimi, Frank S. Haug, Willey, 2015.
3. Principles of Transaction Processing, Philip A. Bernstein, Eric Newcomer, 2nd Edition, Elsevier, 2009.
4. Distributed Database Systems, Chhanda Ray, Pearson Education
5. Distributed Database Systems, D. David Arthur Bell, Jane B. Grimson, Addison-Wesley

**Internal Assessment Pattern**

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

**SAMPLE QUESTION (S)**

**Remember**

1. List any two types of fragmentation
2. Define data directory
3. Define clustered indexing
4. List the 4 properties of Transaction

**Understand**

1. Explain advantages and disadvantages of Distributed Databases
2. Explain the levels of distributed transparency
3. Illustrate about join queries
4. Explain about B+ trees

**Apply**

1. Apply fragmentation on any example data and show the results.
2. Illustrate the Commit and Rollback operations of Distributed Transactions
3. Compare various File organizations.

**Open Book Exam Questions**

Question 1:

Consider a database consisting of a single relation R:

A	B
1	10
2	0

(a) The following two transactions run concurrently on this database:

Line	T1	T2
1	begin transaction;	begin transaction;
2	update R set B = B-10 where A=1;	select sum(B) from R;
3	update R set B = B+10 where A=2;	commit;
4	commit;	

Is it ever possible for T2 to see a value of zero in its output? Explain why or why not.

(b) The following two transactions run concurrently on this database:

Line	T1	T2
1	begin transaction;	begin transaction;
2	insert into R values (3,150)	select sum(B) from R;
3	commit	select sum(B) from R;
4		commit;

Is it ever possible for T2 to see a different value as the output of the select sum(B) from R statements?

**Question 2:**

1. SELECT DISTINCT name, address FROM Repayment WHERE borrower\_id = ?;
2. SELECT \* FROM Repayment WHERE borrower\_id = ? AND repayment\_date > ?;
3. SELECT borrower\_id, loanamount FROM Repayment WHERE loanamount BETWEEN ? AND ?;
4. INSERT INTO Request VALUES (?, ?, ?, ?, ?, ?);

Suggest one or more indexes, taking into account of the above. State the indexed attributes for each index, along with the index type (primary or secondary). Argue shortly for your choices. Emphasis is on the suggested indexes supports the SQL commands as effectively as possible.

**19CSH13 Programming, Data Structures and Algorithms Using Python****4 0 0 4****Course Outcomes:**

1. Recall the fundamental Concepts of Python Programming
2. Identify the various data structures in Python
3. Illustrate sorting techniques by using python language
4. Recall the basic algorithmic notations and complexity analysis
5. Differentiate algorithmic approaches for problem solving
6. Experiment exception handling mechanism using Object Oriented paradigm

**CO-PO Mapping**

COs	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>	PO <sub>5</sub>
1	2	2	2	2
2	2	2	2	2
3	3	3	3	3
4	3	3	3	3
5	3	3	3	3
6	2	2	2	2

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

**Unit I****12+4 Hours****Basic Python Fundamentals:**

Introduction to programming, algorithms and data structures; Python: variables, operations, control flow - assignments, conditionals, loops, functions Python: types, expressions, strings, lists, and tuples. Python memory model: names, mutable and immutable values; Inductive function definitions: numerical and structural induction.

**Python functions:** optional arguments, default values Passing functions as arguments Higher order functions on lists: map, filter, and list comprehension.

*local, global, nonlocal names Nested functions.*

**Unit II****11+4 hours**

**Data structures:** lists, Dictionaries, Tuples, Sets, stack, queue, heaps

Linked lists: find, insert, delete; Binary search trees: find, insert, delete; Height-balanced binary search trees

**Sorting Techniques:**

Elementary inductive sorting: selection, Insertion sort In-place sorting, Merge sort, Quicksort, Stable sorting

*Disjoint Sets, heaps*

**Unit-3****12+4 hours**

**Basic algorithmic analysis:** input size, asymptotic Notation and complexity;

**Algorithmic Approaches:** Backtracking: N Queens, recording all solutions; Brute Force: Maximum element;

Divide and Conquer: Maximum Subarray Sum; Greedy Approach: Huffman Coding Dynamic programming:

Longest Common Subsequence, Coin Change Problem;

*Back tracking, Branch and Bound*

**Unit-4****10+3 hours**

**Exception Handling:** Exception handling, Basic input/output, Handling files, String processing

**Object Oriented Programming:** Abstract data types, Classes and Python Object; Inheritance in Python Class, Encapsulation, Polymorphism, Data abstraction, *Operator Overloading, Regular Expression*

**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Test (%)
Remember	30	30	--
Understand	35	35	--
Apply	35	35	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
<b>Total (%)</b>	<b>100</b>	<b>100</b>	<b>100</b>

**Text Books:**

1. Martin C. Brown, 1st Python: The Complete Reference, Edition, Publisher: Osborne/McGraw-Hill , 2018
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.

**References:**

1. Introduction to The Design and Analysis of Algorithms, 3rd Edition, Anany Levitin, Pearson Education, 2017.
2. R. Nageswara Rao, "Core Python Programming", 2nd Edition: DreamTech Press, 2019

**Weblink:**

[Programming, Data Structures and Algorithms Using Python - Course \(nptel.ac.in\)](https://nptel.ac.in/courses/106-106-001/)

**19CSH14 BIOINFORMATICS****4 0 0 4****Course Outcomes**

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

1. Get introduced to the basic concepts of Bioinformatics and its significance in biological data analysis
2. Overview about types and biological data and database search tools
3. Explain about the methods to characterize and manage the different types of biological data.
4. Classify different types of Biological Databases
5. Implement the algorithms for single and multiple sequence alignments
6. Analyze commercial databases, softwares, intranet, and internet packages.

**CO - PO Mapping**

COs	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>5</sub>
1	3	3	2
2	3	3	2
3	1	3	3
4	1	2	2
5	1	2	3
6	3	1	1

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

**Syllabus****Unit I****12+4 Hours****Introduction**

Definition, History and Application areas of Bioinformatics. Major Information Resources: NCBI, EBI, ExPasy, TIGR, JGI, DDBJ Biological Databases: Primary & Secondary; Structure Databases, Specialized Databases, Chemical Databases, Entrez and SRS, Sequin & Bankit.

**File Formats in Bioinformatics-** Genbank, EMBL, Swissprot/Uniprot, PDB, **Clustal, FASTA etc.**

*Protein pattern databases, MSF, GCG file formats*

**Unit II****11+4 Hours****Sequence Similarity Searching**

Basics of sequence alignment, Local and Global Sequence Alignment, similarity, Identity, homology, Sensitivity/Selectivity, Scoring System & Substitution Matrices: Distance and Similarity matrices, Identity Matrices, PAM & BLOSUM matrices & their Derivation

*DNA sequence databases, specialized genomic resources*

**Unit III****11+4 Hours****Similarity Searching Tools**

BLAST and FASTA, Theory and Algorithms, variants of BLAST and FASTA, PSI & PHI Blast, Statistical Significance. Sequence Pattern and Profiles: Concepts of motif, pattern and profile. Profile construction and its application in Bioinformatics.

*Gene Identity and identification tools*

**Unit IV****11+3 Hours****Tools for DNA & Protein Sequence Analysis**

EMBOSS, PHYLIP, Mega2, CLustalX/W etc. Tools at NCBI, EBI, DDBJ, ExPasy

*Microarray data analysis tools*

**Total: 45+15 Hours**



**Textbook (s)**

1. Claverie and Notredame. "Bioinformatics - A Beginners Guide". Wiley-Dreamtech India Pvt Ltd, 2003.
2. T.K Attwood & D.J Parry-Smith. Delhi. "Introduction to Bioinformatics". Pearson Education (Singapore) Pte.Ltd., 2001.
3. A.D Baxevanis & Ouellette, B., F. F. "Bioinformatics: A Practical Guide to the analysis of Genes and Proteins" 2nd Edition, John Wiley & Sons, Inc. Publications, New York, 2002.
4. David W. Mount. "Bioinformatics: Sequence and Genome Analysis", New York, Cold Spring Harbor Laboratory Press, 2004.

**Reference (s) :**

1. Dan E Krane, Elaine Nicpon Marieb, Michael L Raymer. "Fundamental Concepts of Bioinformatics". Indian Edition, Benjamin Cummings Publication
2. David W Mount. "Bioinformatics: Sequence and Genome Analysis" Indian Edition. Cold Spring Harbour Laboratory Press. 2004.
3. Arthur M Lesk. "Introduction to Bioinformatics". Oxford University Press 4<sup>th</sup> edition, 2014
4. Dan E. Krane and Michael L. Raymer. "Fundamental concepts of Bioinformatics" Low Priced Edition, Pearson Education.
5. A.D Davison, D.B. Page & G.A. Petsko "Current Protocols in Bioinformatics" by Baxevanis, New York, John Wiley & Sons Inc., 2004.

**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. What is Bioinformatics?
2. What is BLAST?
3. Write expansion  
(a) EMBL  
(b) DDBJ

**Understand**

1. Which types of issues or problems related to biological data are dealt with the bioinformatics?
2. Illustrate Global alignment with suitable example.
3. Compare PAM & BLOSUM matrices.

**Open Book Exam Questions**

1. If you have a gene sequence of an organism whose genome is yet to be annotated, how will you proceed forward via in silico analysis to trace a specific region with a known function. Which tool will be useful? Explain the concept and different categories of that tool in detail.
2. What are scoring matrices and what are they used for? Name and differentiate between two commonly used amino acid substitution matrices. If you have more divergent sequences then which substitution matrix one should use and with high or low number?

**Domain III (Modern Software Engineering)  
19CSH21 DevOps**

**4 0 0 4**

**Course Outcomes:**

On completion of this course the students are able to:

1. Illustrate the need of Improvement and value of DevOps
2. Outline the Value Stream using DevOps
3. Describe the Organizational Change and transformation
4. Illustrate the Concept and Goal of Accelerate Flow
5. Outline Feedback Loops and its usage
6. Demonstrate the Concept and Goal of Learning

**CO-PO Mapping:**

COs	PO <sub>1</sub>	PO <sub>3</sub>	PO <sub>5</sub>	PO <sub>8</sub>	PO <sub>10</sub>
1	3	3	3	3	3
2	2	2	2	2	2
3	1	2	1	1	2
4	3	2	2	1	2
5	3	3	3	3	2
6	2	3	2	1	2

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

**Unit I**

**12+4 Hours**

**Introduction to DevOps:** Understanding Improvement, The Convergence, History, and Value of DevOps;  
**Understanding the Value Stream using DevOps:** Analyzing the technology Value Stream; The ways of DevOps: Flow, Feedback Loops, Culture of Continual Experimentation and Learning.

**Unit II**

**11+4 Hours**

**Value Stream in DevOps:** Concept and Goals of Streams, Picking a Value Stream, Understanding Organizational Change, Enabling Transformation;

**Unit III**

**12+4 Hours**

**Accelerate Flow:** Concept and Goal of Accelerate Flow, Continuous Delivery Patterns and Practices, the Deployment Pipeline, Creating Consistency in the Pipeline, Automated Testing, Deployment Strategies;  
**Amplifying the Feedback Loops:** Concept and Goals of Feedback Loops, Creating a Service Reliability Culture, Fast Feedback, Understanding Monitoring, Understanding Complexity

**Unit IV**

**10+3 Hours**

**Learning Acceleration with DevOps:** Concept and Goal of Learning, Learning Organizations, Communication, Blameless Culture.

**Text Books:**

1. Kim, G., Behr, K., and Spafford, G. (2013). The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win. IT Revolution Press
2. Kim, G., Humble, J., Debois, P., and Willis, J. (2016). The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations. IT Revolution Press

**Reference Books:**

1. Julian Fish, The Practical Guide to Enterprise DevOps and Continuous Delivery

**Internal Assessment Pattern**

<b>Cognitive Level</b>	<b>Int. Test 1 (%)</b>	<b>Int. Test 2 (%)</b>	<b>OBE Test (%)</b>
Remember	25	25	
Understand	40	30	40
Apply	20	20	30
Analyze	15	20	30
Evaluate	--	--	--
Create	--	--	--
<b>Total (%)</b>	<b>100</b>	<b>100</b>	<b>100</b>

**Sample Questions****Remember**

- 1) What is DevOps
- 2) Define Value Stream
- 3) What is **Accelerate Flow**

**Understand**

- 1) Explain about Ways of DevOps
- 2) Explain Picking Value Stream min DevOps
- 3) Describe Feedback Loops

**Apply**

- 1) Give Some Real Time Applications of DevOps

**19CH22 Design Patterns****4 0 0 4****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 <sub>2</sub>	PO <sub>3</sub>	PO <sub>5</sub>
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****10+4 Hrs**

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****13+3 Hrs**

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns. Structural Pattern Part-I: Adapter, Bridge, Composite.

**Unit III****11+4 Hrs**

Structural Pattern Part-II: Decorator, Façade, Flyweight, Proxy. Behavioral Patterns Part-I: Chain of Responsibility, Command, Interpreter, Iterator

**Unit IV****11+4 Hrs**

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.

**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	--	--	--
<b>Total (%)</b>	<b>100</b>	<b>100</b>	<b>100</b>

**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, 200

**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

**19CSH23 Advanced Software Engineering**

**4 0 0 4**

**Course Outcomes:**

1. Explain various system models, their prototyping and specifications
2. Demonstrate the different phases involved in Agile models
3. Outline and understand Various types of System Architectures
4. Outline Object-Oriented Design Process required for software development
5. Utilise the Verification and Validation techniques to software project
6. Interpret various Agile testing Methods

**CO-PO Mapping:**

CO	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>	PSO <sub>1</sub>
1	3	3	2	2	2
2	3	3	2	2	2
3	3	2	2	2	2
4	2	2	2	2	3
5	2	3	2	2	3
6	2	3	2	2	2

**Unit I**

**10+4 Hours**

**System Models and Software Prototyping and Specifications:** System Models, Software Prototyping and Specifications System models: Context, Behavioural, Data, and Object models, CASE Workbenches; Software Prototyping: Prototyping in the Software Process, Rapid Prototyping Techniques, User Interface Prototyping; Specifications: Formal Specification in the Software Process, Interface Specification, Behavioural Specification.

Agile models, Phases of agile models, When to use the Agile Model?, Advantages and Disadvantages of Agile Method.

**Unit II**

**10+4 Hours**

**Architectural Design:** Introduction: System Structuring; Control Models; Modular Decomposition; Domain-Specific Architectures; Distributed Systems Architectures: Multiprocessor Architectures; Client-Server Architectures, Distributed Object Architectures; CORBA (Common Object Request Broker Architecture)

**Unit III**

**10+3 Hours**

**Software Design:** Object Oriented Design: Objects and Object Classes, Object-Oriented Design Process, Design Evolution; Real Time Software Design: Systems Design, Real-Time Executives, Monitoring and Control Systems, Data Acquisition Systems; Design with Reuse: Component-Based Development, Application Families

**Unit IV**

**10+4 Hours**

**Verification, Validation and Testing:** Verification and Validation (V & V): Static and Dynamic V & V, V & V Goals, V & V vs. Debugging, Software Inspections / Reviews, Clean-Room Software Development; Software Testing: Defect Testing, Integration Testing, Interface Testing, Object-Oriented Testing, Testing Workbenches, Agile testing Methods.

**Total: 45+15 Hours**

**Text Books:**

1. J.F.Peters and W. Pedrycz, Software Engineering: An Engineering Approach, 1st edition, John Wiley and Sons, 2000

2. Roger Pressman and Bruce R. Maxim, Software Engineering: A Practitioner's Approach, 8<sup>th</sup> Edition, McGraw-Hill, 2019
3. Rajesh R V, Becoming an Agile Software Architect: Strategies,

#### Internal Assessment Pattern

<b>Cognitive Level</b>	<b>Int. Test 1 (%)</b>	<b>Int. Test 2 (%)</b>	<b>Open Book Exam (%)</b>
Remember	40	40	--
Understand	50	40	--
Apply	10	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
<b>Total (%)</b>	<b>100</b>	<b>100</b>	<b>100</b>

**19CSH24 Robotic Process Automation**

**4 0 0 4**

**Course Outcomes**

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

1. Outline the Robotic Process Automation technology
2. Illustrate the usage of Recording and advanced UI Interaction
3. Identify UiPath programming techniques to deploy robot configurations
4. Summarize various data extraction techniques and perform integrations with various popular applications
5. Develop a programmed robot that includes logging and exception handling
6. Inspect Deploy and control Bots with UiPath Orchestrator

**CO-PO Mapping**

COs	PO3	PO5	PO8	PSO2
1	3	3	3	1
2	2	2	2	1
3	1	2	2	2
4	3	2	2	2
5	3	3	2	2
6	2	3	2	1

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

**Unit I**

**Introduction to Robotic Process Automation (RPA)**

**11+4 Hours**

Introduction: What is Robotic Process Automation (RPA), Scope & techniques of Automation, Benefits of RPA, Components of RPA,UiPath Studio, Installation of UiPath Studio, Learning UiPath Studio, **Sequence, Flowchart & Control Flow:** Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations

*Applications of RPA,RPA platforms*

**Unit II**

**Controls, Recording and advanced UI Interaction**

**11+4 Hours**

**Controls:** Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events **Recording and advanced UI Interaction** Basic recording, Desktop recording, Web recording, Citrix, Screen Scraping, When to use OCR, How to use OCR Avoiding typical failure points, **Plugins and Extensions:** Terminal plugin, Java plugin, Java plugin with UiPath Studio, Citrix automation, Citrix environment, Mail plugin, , Web integration, Excel and Word plugins, Credential management Extensions

*Types of OCR available, PDF plugin*

**Unit III**

**Handling User Events and Assistant Bots, Debugging, and Logging**

**11+4 Hours**

**Handling User Events and Assistant Bots:** What are assistant bots, Monitoring system event triggers: Hotkey trigger, Mouse trigger, Monitoring image and element triggers, Launching an assistant bot on a keyboard event,

**Exception Handling, Debugging, and Logging:** Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots Debugging techniques, Setting breakpoints, Slow step, Highlighting, Break, Collecting crash dumps: Enabling crash dumps, Disabling crash dumps, Error reporting: Enterprise Edition customers, Community Edition users.

*Exception Handling, System trigger*



**Unit IV****Managing and Maintaining the Code, Deploying and Maintaining the Bot****12 + 3 Hours**

**Managing and Maintaining the Code:** Project organization, Picking an appropriate layout for each workflow, Breaking the process into smaller parts, Using exception handling, Making your workflow readable, Keeping it clean, Nesting workflows, Reusability of workflows, Templates, Commenting techniques, State Machine, When to use Flowcharts State Machines or Sequences.

**Deploying and Maintaining the Bot:** Publishing using publish utility, Overview of Orchestration Server, Using Orchestration Server to control bots, Using Orchestration Server to deploy bots, Activating and uploading a license to Orchestrator, Publishing and managing updates, Packages, Managing packages

*Reusability of workflows, License management*

**Total: 45+15 Hours****Textbook (s)**

1. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: O'Reilly Publishing, 2018, ISBN: 9781788470940.
2. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018

**Reference (s)**

1. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation, 1st Edition, Consulting Opportunity Holdings LLC, 2018
3. <https://www.uipath.com/rpa/robotic-process-automation>
4. <https://www.udemy.com/robotic-process-automation>

**Internal Assessment Pattern**

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

**SAMPLE QUESTION (S)****Remember**

1. List any four application of RPA
2. Define Control flow
3. List RPA platforms

**Understand**

1. Explain Data manipulation with suitable example
2. Explain the Control flow for Decision making
3. Illustrate the techniques of Automation

**Apply**

1. How to use OCR Avoiding typical failure points
2. Give some real-world applications of Recording and Advance UI
3. Create how to Launching an assistant bot on a keyboard even

**Domain IV (Security)**  
**19CSH31 Fundamentals of System Security**

**4 0 0 4**

**Course Outcomes**

1. Explain the fundamental concepts of computer security
2. Illustrate hacking and defense
3. Choose appropriate confidentiality policies
4. Identify different Secure architecture principles
5. Identify various Web security methods
6. Choose appropriate internet security methods

**CO-PO Mapping**

CO	PO <sub>1</sub>	PO <sub>2</sub>
1	3	1
2	3	3
3	1	2
4	2	3
5	3	2
6	3	2

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

**Unit I**

**Computer System Security Introduction:**

**11+4 Hours**

Introduction, What is computer security and what to I earn? , Sample Attacks, The Marketplace for vulnerabilities, Error 404 Hacking digital India part 1 chase.

**Hijacking & Defense:** Control Hijacking ,More Control Hijacking attacks integer overflow ,More Control Hijacking attacks format string vulnerabilities, Defense against Control Hijacking -Platform Defenses, Defense against Control Hijacking - Run-time Defenses, Advanced Control Hijacking attacks.

**Unit II**

**11+4 Hours**

**Confidentiality Policies:**

Confinement Principle ,Detour Unix user IDs process IDs and privileges , More on confinement techniques, System call interposition, Error 404 digital Hacking in India part 2 chase, VM based isolation Confinement principle, Software fault isolation, Rootkits, Intrusion Detection Systems.

**Unit III**

**Secure architecture principles isolation and leas:**

**11+4 Hours**

Access Control Concepts, Unix and windows access control summary,Other issues in access control, Introduction to browser isolation.

**Web security landscape:** Web security definitions goals and threat models , HTTP content rendering. Browser isolation, Security interface, Cookies frames and frame busting, Major web server threats, Cross site request forgery, Cross site scripting, Defenses and protections against XSS, Finding vulnerabilities, Secure development.

**Unit IV**

**Internet Infrastructure:**

**12 + 3 Hours**

Basic security problems, Routing security, DNS revisited, Summary of weaknesses of internet security, Link layer connectivity and TCP IP connectivity, Packet filtering firewall, Intrusion detection.

**Total: 45+15 Hours**

**Textbook (s)**

1. William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010.
2. Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.

**Reference (s)**

1. William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010.
2. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, Handbook of Applied Cryptography, CRC Press, 2001.

**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	40	--
Understand	40	40	--
Apply	10	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. RSA algorithm with example
2. Digital signature
3. Build a firewall mechanism to protect laptop

**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

**19CSH32 Python Programming for Security**

**4 0 0 4**

**Course Outcomes:**

After completion of the course, students are able to:

1. Explain the basic data structures and multithreading in python
2. Outline about Socket Programming
3. Experiment with Client server approach using TCP and UDP.
4. Analyze Network Traffic using python
5. Identify proper Authentication and Authorization.
6. Choose appropriate Password management approach.

**COs-POs Mapping**

Cos	PO <sub>1</sub>	PO <sub>3</sub>	PO <sub>4</sub>
1	3	2	1
2	3	2	2
3	1	1	3
4	3	1	2
5	3	1	2
6	2	1	3

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

**Unit I**

**11+4 Hours**

Python Introduction: python data structures, functions, classes, inheritance, Managing exceptions, modules and packages, managing dependencies and virtual environment, working with file system, managing threads: multi-threading and concurrency, working with socket.

**Unit II**

**10+3 Hours**

Socket Programming: Network Sockets in python, TCP/IP Suite, Implementing a simple TCP client and TCP server, implementing a simple UDP client and UDP server.

**Unit III**

**11+4 Hours**

Network Traffic Analysis with Python: Scapy: Capturing and injecting packets, Port-scanning and traceroute, reading, writing and sniffing a pcap files; network monitoring: PySNMP for SNMP, data visualization pygal, matplotlib, graphviz for network monitoring.

**Unit IV**

**13 + 4 Hours**

Authentication and Authorization: HTTP session management: HTTP session, HTTP cookies, Session-state persistence; User authentication: User registration, authentication and testing; User password management: Password-change workflow, Password storage, configuring password hashing, Password-reset workflow; Authorization: Application-level authorization, enforcing authorization.

**Text Books:**

1. José Manuel Ortega (2018). Mastering Python for Networking and Security. Packt Publishing Ltd
2. Dennis Byrne (2021) Full Stack Python Security by Manning Publications Co
3. Chou, E. (2017). Mastering Python Networking. Packt Publishing Ltd.

**References:**

1. O'Connor, T. J. (2012).Violent Python:A Cookbook for Hackers, Forensic Analysts, Penetration Testers and Security Engineers, Syngress (Elsevier)

2. Sarker, M. F., & Washington, S. (2015). Learning Python Network Programming. Packt Publishing Ltd.

**Internal Assessment Pattern**

<b>Cognitive Level</b>	<b>Int. Test 1 (%)</b>	<b>Int. Test 2 (%)</b>	<b>Open Book Exam (%)</b>
Remember	40	40	--
Understand	50	40	--
Apply	10	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
<b>Total (%)</b>	<b>100</b>	<b>100</b>	<b>100</b>

**19CSH33 Management of Information Security**

**4 0 0 4**

**Course Outcomes:**

After completion of the course, students are able to:

1. Explain the basic requirement of managing security
2. Outline the strategies of planning of security system
3. Define the Security policies.
4. Develop and implement the security programs in an organization
5. Identify a proper framework of security management
6. Define the risk management and ethics of the security management for an organization.

**COs-POs Mapping**

COs	PO <sub>3</sub>	PO <sub>6</sub>	PO <sub>7</sub>
1	3	1	
2	3	2	3
3	2	2	
4	3	1	2
5	1	1	1
6	1	3	2

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

**Unit I**

**12+4 Hours**

**Introduction to ISMS:** what is Security and management definition, Principles of information security management; Project management, applying project management to security; Project management tools.  
**Planning for Security:** Introduction, the role of planning; Precursors to planning; Strategic planning; Information security governance; Planning for information security implementation.

**Unit II**

**11+3 Hours**

**Planning for contingencies:** Introduction, Fundamentals and Components of contingency planning.  
**Information Security Policy:** Introduction, Why policy?, EISP; ISSP, SSSP, Guidelines for effective policy.

**Unit III**

**12+4 Hours**

**Developing the Security Program:** Organizing for security: Placing for information security within an organization, Components of the security program; Information security roles and titles; Implementing Security Education, Training and Awareness Programs.  
**Security Management Models:** Blueprints, Frameworks, and Security Models, Access Control Models, Security Architecture and management Models.

**Unit IV**

**10+4 Hours**

**Risk-Management**

Risk management, Identification and assessment, Documenting the Results of Risk Assessment; Risk control strategies, managing risk; Feasibility and cost benefit analysis, Recommended risk control practices.  
**Laws and Ethics:** InfoSec and the Law, Ethics in InfoSec, Professional Organizations and their Codes of Ethics, Organizational Liability and the Need for Counsel, Managing Investigations in the Organization.

**Text Book:**

1. Michael E. Whitman and Herbert J. Mattord, Management of Information Security, 6th Edition, Cengage Learning. 2018

**Internal Assessment Pattern**

<b>Cognitive Level</b>	<b>Int. Test 1 (%)</b>	<b>Int. Test 2 (%)</b>	<b>Open Book Exam (%)</b>
Remember	40	40	--
Understand	50	40	--
Apply	10	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
<b>Total (%)</b>	<b>100</b>	<b>100</b>	<b>100</b>

**19CSH34 Computer Forensics**

**4 0 0 4**

**Course Outcomes**

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

1. Explain the real time computer forensic issues
2. Outline the data recovery, forensics lab certification and physical requirements
3. Identify different storage formats for data acquisition
4. Classify various data acquisition tools for collecting digital evidence
5. Model various strategies to secure digital evidence
6. Identify and apply various computer forensics tools to solve the computer forensic cases

**CO-PO Mapping:**

COs	PO2	PO3	PO5
1	1	1	2
2	2	1	2
3	2	1	2
4	2	2	2
5	2	2	3
6	2	2	3

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

**UNIT I**

**11+4 Hours**

**Computer Forensics and Investigations & Investor’s Office and Laboratory**

Understanding Computer Forensics, Preparing for Computer Investigations, Taking A Systematic Approach, Procedure for Corporate High-Tech Investigations, Understanding Data Recovery Workstations and Software, Understanding Forensics Lab Certification Requirements, Determining the Physical Requirements for a Computer Forensics Lab, Selecting a Basic Forensic Workstation.

*Nature and scope of cybercrime-categories of cybercrime, social engineering*

**UNIT II**

**11+4 Hours**

**Data Acquisition& Processing Crime and Incident Scenes**

Understanding Storage Formats for Digital Evidence, Determining the Best Acquisition Method, Contingency Planning for Image Acquisitions, Using Acquisition Tools, Validating Data Acquisition, Performing RAID Data Acquisition, Using Remote Network Acquisition Tools, Using Other Forensics Acquisition Tools.

*Open source data acquisition tools*

**UNIT III**

**12+3 Hours**

**Digital Evidence**

Identifying Digital Evidence, Collecting the Evidence in Private-Sector Incident Scenes, Processing law, Enforcement Crime Scenes, Preparing for a Search, Securing a Computer Incident or Crime Scene, Sizing Digital evidence at the Scene, Storing Digital evidence, obtaining a Digital Hash.

*Selecting a basic forensic work station, methodologies to store digital evidence*

**UNIT IV**

**11+4 Hours**

**Current Computer Forensics Tools**

Evaluating Computer Forensics Toll Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software.; Computer Forensics Analysis and Validation: Determining What Data to Collect and Analyze, Validating Forensic Data, Addressing Data-Hiding Techniques, Performing Remote Acquisition.



*Digital evidence handling procedures, Linux system forensics, windows system forensics*

**Total: 45+15 Hours**

**Textbook (s)**

1. Nelson, Phillips Eninger, Steuart, Computer Forensics and Investigations, Cengage Learning, 4th Edition, 2009
2. 2. Man Young Rhee, Internet Security: Cryptographic Principles, Algorithms and Protocols, Wiley Publications, 2003.

**Reference (s)**

1. John R.Vacca, Computer Forensics, Cengage Learning, 2005
2. MarjieT.Britz, Computer Forensics and Cyber Crime: An Introduction, 3rdEd, Prentice Hall, 2013

**SAMPLE QUESTION (S)**

**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	OBE (%)
Remember	30	20	--
Understand	35	30	--
Apply	30	30	50
Analyze	15	20	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

**Remember**

1. List the various disk storage formats
2. List some digital evidences
3. List some tools used for digital evidences
4. List different type of compression methods.

**Understand**

1. Explain RAID Data Acquisition
2. Explain Identification of Digital Evidence,
3. Write about Locating and Recovering Graphics
4. Discuss about Mobile Device Forensics

**Apply**

1. Apply any different digital forensics tool to create OS image.
2. Apply different networking tools to collect evidences.

**Analyze**

1. Compare different digital forensic open source tools to select a suitable tool which identifies hidden data.
2. Examine the performance of dd and dfcldd LINUX commands
2. Examine the performance of Widows based tools when compared with LINUX