

# **ACADEMIC REGULATIONS, PROGRAM STRUCTURE AND DETAILED SYLLABUS**

**COMPUTER SCIENCE AND ENGINEERING**

**For CBCS BASED M.TECH – TWO YEAR PROGRAM  
(Applicable for the batches admitted from AY 2022-23)**



**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY  
(Autonomous)**

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**Academic Regulations of M.Tech (CSE) Programme (AR22)**

(Effective for the students admitted into I year from the Academic Year 2022-23 and onwards)

**1.0 Post-Graduate Degree Programme (PGP) in M.Tech Geethanjali College of Engineering and Technology** offers Two-Year (Four-Semester) full-time Master of Technology (M.Tech) Degree Programme in Computer Science and Engineering, under Choice Based Credit System (CBCS).

**2.0 Eligibility for Admissions**

**2.1** Admission to the PGP shall be made subject to eligibility, qualification and specializations prescribed by the GCET from time to time.

**2.2** Admission to the post graduate programme shall be made on the basis of either the merit rank or Percentile obtained by the qualified student in the relevant qualifying GATE Examination / the merit rank obtained by the qualified student in an entrance test conducted by Telangana State Government (PGECET) for M.Tech programme / on the basis of any other exams approved by the University, subject to reservations as laid down by the Govt. from time to time.

**2.3** The medium of instruction for the M.Tech Programme shall be **ENGLISH** only.

**3.0 M.Tech Programme Structure**

**3.1** The M.Tech Programme is of Semester pattern, with Four Semesters consisting of Two academic years, each academic year having Two Semesters (First / Odd and Second / Even Semesters). Each Semester shall be of 20 weeks duration (inclusive of Examinations), with a minimum of 90 instructional days per Semester.

**3.2** The two-year M.Tech. program consists of **68** credits and the student has to register for all **68** credits and earn all **68** credits for the award of M.Tech. degree. There is **NO** exemption of credits in any case.

**3.3** The student shall not take more than four academic years to fulfill all the academic requirements for the award of M.Tech degree from the date of commencement of first year first semester, failing which the student shall forfeit the seat in M.Tech programme.

**3.4** UGC / AICTE specified definitions / descriptions are adopted appropriately for various terms and abbreviations used in these PG academic regulations, as listed below:

**3.4.1 Semester Scheme**

Each Semester shall have 'Continuous Internal Evaluation (CIE)' and 'Semester End

Examination (SEE)'. Choice Based Credit System (CBCS) is taken as 'reference' for the present set of Regulations. The term 'COURSE' refers to 'Theory Course', or 'Lab Course', or 'Design / Drawing Course', or 'Seminar', or 'Project', as the case may be.

### 3.4.2 Credit Courses

All courses are to be registered by the student in a semester to earn credits which shall be assigned to each course in an L: P: C (Lecture Periods: Practical Periods: Credits) structure based on the following general pattern:

- One credit for one hour / week / semester for theory / lecture (L) courses
- One credit for two hours / week / semester for laboratory/ practical (P) courses
- Other student activities like study tour, guest lecture, conference/workshop participations, technical paper presentations, and Mandatory courses (Non credit Audit Courses), if any, shall not carry credits.

### 3.4.3 Course Classification

All courses offered for the Post-Graduate (M.Tech Degree) Programme are broadly classified as follows. GCET has followed in general the guidelines issued by AICTE / UGC.

S.No	Broad Course Classification	Course Group/ Category	Course Description
1	Core Courses (CoC)	PC- Professional Core	Includes courses related to the parent discipline/department/ branch of Engineering
		Dissertation	M.Tech. Project or PG Project or Major Project
		Mini Project with Seminar	Seminar based on core contents related to Parent Discipline/ Department/ Branch of Engineering
2	Elective Courses (EIE)	PE- Professional Electives	Includes elective courses related to the parent discipline/department/ branch of Engineering
		OE- Open Electives	Elective courses which include inter-disciplinary courses or courses in an area outside the parent discipline/department/ branch of Engineering
3	Mandatory Courses	--	Non-Credit Audit Courses

## 4.0 Course Registration

4.1 A 'Faculty Advisor' shall be assigned to the M.Tech. Programme, who will advise the Students about the M.Tech Course Structure and Curriculum, Choice/ Option for Courses, based on the competence, progress, pre-requisites and interest of the

students.

- 4.2** The Academic department of the College offering the programme invites 'Registration Forms' from students within 15 days from the commencement of class work. The Registration Requests for any 'SEMESTER' shall be completed BEFORE the commencement of SEEs of 'PRECEDING SEMESTER'.
- 4.3** A Student can apply for Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his Faculty Advisor, which should be submitted to the department.
- 4.4** If the Student submits ambiguous choices or multiple options or erroneous entries during Registration for the Course(s) under a given / specified Course Group / Category as listed in the Course Structure, only the first mentioned Course in that Category will be taken into consideration.
- 4.5** Course Options exercised through Registration are final and CANNOT be changed, nor can they be interchanged; further, alternate choices also will not be considered. However, if the Course that has already been listed for Registration by GCET in a Semester could not be offered due to unforeseen or unexpected reasons, then the Student will be allowed to have alternate choice either for a new course, if it is offered, or for another existing course (subject to availability of seats). Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

## **5.0 Attendance Requirements**

The programmes are offered on the basis of a unit system with each course being considered a unit. Attendance is calculated separately for each Course.

- 5.1** Attendance in all classes (Lectures / Laboratories / audit courses) is compulsory. The minimum required attendance in each course including the attendance of mid-term examination / Laboratory etc. is 75%. Two periods of attendance for each theory course shall be considered, if the student appears for the mid-term examination of that course. A student shall not be permitted to appear for the SEE, if his attendance is less than 75%.
- 5.2** A student's seminar report and seminar presentation in Mini Project shall be eligible for evaluation, only if he ensures a minimum of 75% of his attendance in seminar presentation classes in Mini Project during that semester.
- 5.3** **Condoning of shortage of attendance** (between 65% and 75%) up to a maximum of 10% in each course of a semester shall be granted by the College

Academic Committee on genuine reasons.

- 5.4** A prescribed fee per course shall be payable for condoning shortage of attendance. after getting the approval of College Academic Committee for the same. The College Academic Committee shall maintain relevant documents along with the request from the student.
- 5.5** Shortage of attendance below 65% in any course shall in 'NO' case be condoned.
- 5.6** A Student, whose shortage of attendance is not condoned in any course(s) (Theory/Lab/Mini Project with Seminar) in any semester, is considered detained in that course(s) and is not eligible to write Semester End Examination(s) (in case of Mini Project with Seminar, his/her Mini Project with Seminar Report or Presentation are not eligible for evaluation) of such course(s) in that semester, and he has to seek re-registration for those course(s) in subsequent semesters, and attend the same as and when offered.
- 5.7** A student fulfills the attendance requirement in the present semester shall not be eligible for readmission into the same class.
- 5.8** a) A student shall put in a minimum required attendance in at least three theory courses (**excluding mandatory (non-credit audit) course**) in I Year I semester for promotion to I Year II Semester.  
b) A student shall put in a minimum required attendance in at least **three theory courses (excluding mandatory (non-credit audit) course)** in I Year II semester for promotion to II Year I Semester.

#### **6.0 Academic Requirements**

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in section 5. The performance of the student in each semester shall be evaluated course-wise, with a maximum of 100 marks per course (theory / practical), on the basis of CIE and SEE.

- 6.1** A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course, if he secures not less than
- 40% of Marks (24 out of 60 marks) in the Semester End Examination;
  - 40% of Marks (Average of 10 out of 25 marks) from two mid-term examinations;
  - 40% of Marks in the internal examinations (16 out of 40 marks allotted for CIE); and

- A minimum of 50% of marks in the sum total of CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades this implies securing 'B' Grade or above in a course.

**6.2** A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Mini Project with seminar, if student secures not less than 50% marks (i.e. 50 out of 100 allotted marks). The student would be treated as failed, if student (i) does not submit a seminar report on Mini Project or does not make a presentation of the same before the evaluation committee as per schedule or (ii) secures less than 50% marks in Mini Project with seminar evaluation. The failed student shall reappear for the above evaluation when the notification for supplementary examination is issued.

**6.3** A student shall register for all courses for a total of 68 credits as specified and listed in the Programme structure, put in required attendance and fulfill the academic requirements for securing 68 credits, obtaining a minimum of 'B' Grade or above in each course, and all 68 credits securing Semester Grade Point Average (SGPA)  $\geq 6.0$  (in each semester) and final Cumulative Grade Point Average (CGPA) (i.e., CGPA at the end of PGP)  $\geq 6.0$ , and shall *pass all the mandatory audit courses* to complete the PGP successfully.

**Note: (1) The SGPA shall be computed and printed on the memorandum of grades only if the student passes all the courses offered and gets a minimum B grade in all the courses.**

**(2) CGPA is calculated only when the student passes in all the courses offered in all the semesters.**

**6.4** Marks and Letter Grades obtained in all those courses covering the above specified 68 credits alone shall be considered for the calculation of final CGPA, which will be indicated in the Grade Card /Marks Memo of second year second semester

**6.5** If a student registers for extra course(s) (in the parent department or other departments/branches of Engineering) other than those listed courses totaling to 68 credits as specified in the programme structure, the performance in extra course(s) (although evaluated and graded using the same procedure as that of the required 68 credits) shall not be taken into account while calculating the SGPA and CGPA.

For such extra course(s) registered, percentage of marks and Letter Grade alone shall be indicated in the Grade Card, as a performance measure, subject to completion of the attendance and academic requirements as stated in sections 5 and 6.1 - 6.3.

**6.6** When a student is detained due to shortage of attendance in any course(s) in any

semester, no Grade allotment shall be made for such course(s). However, he is eligible for re-registration of such course(s) in the subsequent semester(s), as and when next offered, with the academic regulations of the batch into which he is re-registered, by paying the prescribed fees per course. In all these re-registration cases, the student shall have to secure a fresh set of internal marks and Semester End Examination marks for performance evaluation in such course(s), and SGPA / CGPA calculations.

- 6.7** A student eligible to appear for the Semester End Examination in any course, but absent from it or failed (failing to secure 'B' Grade or above), may reappear for that course at the supplementary examination as and when conducted. In such cases, his Internal Marks assessed earlier for that course will be carried over, and added to the marks secured in the supplementary examination, for the purpose of evaluating his performance in that course.
- 6.8** A Student who fails to earn 68 credits as per the specified programme structure, and as indicated above, within four academic years from the date of commencement of his first year first semester, shall forfeit his seat in M.Tech programme and his admission shall stand cancelled.

#### **7.0 Evaluation - Distribution and Weightage of Marks**

The performance of a student in each semester shall be evaluated course-wise (irrespective of credits assigned) for a maximum of 100 marks.

- 7.1** The performance of a student in every course (including practicals and Project) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination). The Continuous Internal Evaluation shall be made based on the average of the marks secured in the two Mid-Term Examinations conducted, first Mid-Term examinations in the middle of the Semester and second Mid-Term examinations during the last week of instruction.
- 7.2** In CIE, for theory courses, during a semester, there shall be two mid-term examinations. Each Mid- Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 15 marks with a total duration of 2 hours as follows:

1. Mid-Term Examination for 25 marks:
  - a. Part - A: Objective/quiz paper for 10 marks.
  - b. Part – B: Descriptive paper for 15 marks.

The objective/quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks. The descriptive paper shall

contain 5 full questions out of which, the student has to answer 3 questions, each carrying 5 marks. Student shall have to earn 40%, i.e 10 marks out of 25 marks from average of two mid-term examinations (I Mid-Term & II Mid-Term).

The remaining 15 marks of Continuous Internal Assessment (out of 40) are distributed as:

2. Assignment for 5 marks. (Average of 2 Assignments each for 5 marks)
3. Course Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned course for 10 marks.

The student has to get minimum of 40% of Marks in the internal examinations (16 out of 40 marks allotted for CIE).

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

Five (5) marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shall be taken as the final marks for assignment (for 5 marks).

Course Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned course for 10 marks before II Mid-Term Examination.

The details of the end semester question paper pattern are as follows:

- 7.3** The Semester End Examinations (SEE), for theory courses, will be conducted for 60 marks consisting of two parts viz. i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.
- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
  - Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an“either” “or” choice, which means that there will be two questions from each unit and the student should answer either of the two questions.
  - The duration of Semester End Examination is 3 hours.

**7.4** For practical courses there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of aim, components/procedure, expected outcome) which shall be evaluated for 10 marks
2. 10 marks for viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 10 marks.
4. The remaining 10 marks are for Laboratory Project, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

In the Semester End Examination, held for 3 hours, total 60 marks are divided and allocated as shown below:

1. 10 marks for write-up
2. 15 for experiment/program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment/program in the same laboratory course and
5. 10 marks for viva-voce on concerned laboratory course

**7.5** The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the other reputed colleges which will be decided/approved by the examination branch/Chief Controller of Examinations of the Institution.

**7.6** There shall be Mini Project with Seminar during I year II semester for internal evaluation of 100 marks. The Departmental Academic Committee (DAC) will review the progress of the mini project during the seminar presentations and evaluate the same for 50 marks. Mini Project Viva Voce will be evaluated by the DAC for another 50 marks before the semester end examinations. Student shall carryout the mini project in consultation with the mini project supervisor which may include critically reviewing the literature, project implementation and submit it to the department in the

form of a report and shall make an oral presentation before the DAC consisting of Head of the Department, Mini Project supervisor and two other senior faculty members of the department. The student has to secure a minimum of 50% of marks in i) seminar presentation and ii) mini project viva voce, to be declared successful. If he fails to obtain the minimum marks, he has to reappear for the same as and when scheduled.

- 7.7** Every student shall be required to submit a thesis or dissertation on a topic approved by the Dissertation Review Committee (DRC).
- 7.8** DRC shall be constituted with the Head of the Department as Chairperson, Dissertation Supervisor and one senior faculty member of the Department offering the M. Tech programme.
- 7.9** Registration of Dissertation Work: A student is permitted to register for the Dissertation work after satisfying the attendance requirement in all the courses, both theory and practicals up to I year M.Tech II Semester.
- 7.10** After satisfying 7.9, a student must present in Dissertation Work Review-I, in consultation with his Dissertation Supervisor: the title, objective, and plan of action of his Dissertation work to the DRC for approval within four weeks from the commencement of Second year First Semester. Only after obtaining the approval of the DRC, the student shall initiate the Dissertation work.
- 7.11** If a student wishes to change his supervisor or topic of the dissertation, he can do so with the approval of the DRC. However, the DRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of dissertation proposal. If yes, his date of registration for the dissertation work starts from the date of change of Supervisor or topic as the case may be.
- 7.12** A student shall submit his dissertation progress report in two stages at least with a gap of three months between them.

- 7.13** The work on the dissertation shall be initiated at the beginning of the II year and the duration of the dissertation is two semesters. A student is permitted to submit Dissertation Thesis only after successful completion of all theory and practical courses with the approval of DRC not earlier than 40 weeks from the date of approval of the dissertation work. For the approval of DRC the student shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the DRC.
- 7.14** The Dissertation Work Review II (Project / Dissertation Phase-I) in II Year I Semester carries internal marks of 100. Evaluation shall be done by the DRC for 50 marks and the Supervisor shall evaluate the work for the other 50 marks. The Supervisor and DRC shall examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain and progress of the Dissertation Work. A student has to secure a minimum of 50% of marks to be declared successful in Dissertation Work Review II. If he fails to obtain the minimum required marks, he has to reappear for Dissertation Work Review-II as and when conducted.
- 7.15** The Dissertation Work Review III (Project / Dissertation Phase-II) in II Year II Semester carries 40 internal marks. Evaluation should be done by the DRC for 20 marks and the Supervisor shall evaluate the work for the other 20 marks. The DRC shall examine the overall progress of the Dissertation Work and decide whether or not the Dissertation is eligible for final submission. A student has to secure a minimum of 50% of marks to be declared successful in Dissertation Work Review III. If he fails to obtain the required minimum marks, he has to reappear for Dissertation Work Review III as and when conducted. For final Dissertation Evaluation (Viva Voce) in II Year II Semester shall be evaluated by an External Examiner, appointed by Principal of the college, for 60 marks. The student has to secure a minimum of 50% marks in Project Evaluation (Viva-Voce) examination.
- 7.16** Dissertation Work Reviews - II and III shall be conducted in phase I (Regular) and Phase II (Supplementary). Phase II shall be conducted only for unsuccessful students in Phase I. The unsuccessful students in Dissertation Work Review - II (Phase II) shall reappear for the same at the time of Dissertation Work Review - III (Phase I). These students shall reappear for Dissertation Work Review - III in the next academic year at the time of Dissertation Work Review – II, only after completion of Dissertation Work Review - II, and subsequently, Dissertation Work Review - III follows. The unsuccessful students in Dissertation Work Review - III (Phase II) shall

reappear for the same in the next academic year only at the time of Dissertation Work Review - II (Phase I).

- 7.17** After approval from the DRC, a soft copy of the thesis should be submitted for ANTI-PLAGIARISM check and the plagiarism report should be submitted to the Examination Branch and be included in the final thesis. The Thesis will be accepted for submission, if the similarity index is less than **30%**. If the similarity index has more than the required percentage, the student is advised to modify accordingly and resubmit the soft copy of the thesis after one month. The maximum number of re-submissions of thesis after plagiarism check is limited to **TWO**. The candidate has to register for the Dissertation work and work for two semesters. After three attempts, the admission is liable to be cancelled. The college authorities are advised to make plagiarism check of every soft copy of theses before submissions.
- 7.18** Three copies of the Dissertation certified by the supervisor shall be submitted to the Department, after submission of a research paper related to the Dissertation work in a UGC approved journal. A copy of the submitted research paper shall be attached to the thesis.
- 7.19** The Dissertation thesis shall be adjudicated by an external examiner appointed by Chief Controller of Examinations. The Supervisor in association with the Head of the Department provides a panel of three examiners, from which the Chief Controller of Examinations shall select one of the three examiners.
- 7.20** If the report of external examiner is unsatisfactory, the student shall revise and resubmit the dissertation. If the report of external examiner is unsatisfactory again, the dissertation shall be rejected. Subsequent actions for such dissertation may be considered, only on the specific recommendations of the external examiner and DRC. No further correspondence in this matter will be entertained, if there is no specific recommendation for resubmission.
- 7.21** If the report of the external examiner is satisfactory, the Head of the Department shall coordinate and make arrangements for the conduct of Dissertation Viva-Voce examination. The Dissertation Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who adjudicated the thesis. The student has to secure a minimum of 50% of marks in dissertation Evaluation (Viva-Voce) examination.
- 7.22** If he fails to fulfill the requirements as specified in 7.21, he shall reappear for the Viva-Voce examination **only after three months**. In the reappeared examination also, if he fails to fulfill the requirements, he shall not be eligible for the award of the

degree, unless he is asked to revise and resubmit his dissertation work by the board within a specified time period (within four years from the date of commencement of his first year first semester).

**7.23** The Dissertation Viva-Voce External examination marks must be submitted to the Examination Branch on the day of the examination.

**7.24** *For mandatory non-credit Audit courses, a student has to secure 40 marks out of 100 marks (i.e. 40% of the marks allotted) in the continuous internal evaluation for passing the subject/course. These marks should be submitted to Examination Branch along with the internal marks of other courses.*

**7.25** *No marks or letter grades shall be allotted for mandatory non-credit Audit Courses. Only Pass/Fail shall be indicated in Grade Card.*

## **8.0 Re-Admission / Re-Registration**

### **8.1 Re-Admission for Discontinued Student**

A student, who has discontinued the M.Tech degree programme due to any reason whatsoever, may be considered for 'readmission' into the same degree programme (with the same specialization) with the academic regulations of the batch into which he gets readmitted, with prior permission from the authorities concerned, subject to sections 3.2 and 6.6.

**8.2** If a student is detained in a course(s) due to shortage of attendance in any semester, he may be permitted to re-register for the same course(s) in the same category (core or elective group) or equivalent course, if the same course is not available, as suggested by the Board of Studies of that department, as and when offered in the subsequent semester(s), with the academic regulations of the batch into which he seeks re-registration, with prior permission from the authorities concerned, subject to condition specified in section 3.2.

**8.3** A student shall be given one chance to re-register and attend the classes for a maximum of two courses, if the internal marks secured by a student are less than 50% and failed in those courses. A student must re-register for failed courses within four weeks of commencement of the class work and secure the required minimum attendance. In the event of the student exercising this choice, his CIE (internal) marks and SEE marks obtained in the previous attempt stand cancelled.

## **9.0 Examinations and Assessment - The Grading System**

**9.1** Grades shall be awarded to indicate the performance of each student in each Theory Course, or Lab / Practicals, or Mini Project with Seminar, or Dissertation, etc., based on the % of marks obtained in CIE + SEE (both taken together) as specified in Section

7 above, and a corresponding Letter Grade shall be given.

- 9.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
90% and above ( $\geq 90\%$ , $\leq 100\%$ )	O (Outstanding)	10
Below 90% but not less than 80% ( $\geq 80\%$ , $< 90\%$ )	A <sup>+</sup> (Excellent)	9
Below 80% but not less than 70% ( $\geq 70\%$ , $< 80\%$ )	A (Very Good)	8
Below 70% but not less than 60% ( $\geq 60\%$ , $< 70\%$ )	B <sup>+</sup> (Good)	7
Below 60% but not less than 50% ( $\geq 50\%$ , $< 60\%$ )	B (above Average)	6
Below 50% ( $< 50\%$ )	F (FAIL)	0
<b>Absent</b>	<b>Ab</b>	<b>0</b>

- 9.3 A student obtaining F Grade in any Course is deemed to have 'failed' and is required to reappear as 'Supplementary Student' for the SEE, as and when conducted. In such cases, his CIE (Internal) Marks in those courses shall remain as obtained earlier.
- 9.4 If a student has not appeared for the examinations, 'Ab' Grade shall be allocated to him for any course and shall be considered 'failed' and shall be required to reappear as 'Supplementary Student' for the SEE, as and when conducted.
- 9.5 A Letter Grade does not imply any specific marks percentage; it is only the range of percentage of marks.
- 9.6 In general, a student shall not be permitted to repeat any Course(s) only for the sake of 'Grade Improvement' or 'SGPA / CGPA Improvement'.
- 9.7 A student earns Grade Point (GP) in each Course, on the basis of the Letter Grade obtained by him in that Course. The corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Course.

**Credit Points (CP) = Grade Point (GP) x Credits .... For a Course**

- 9.8 The student passes the Course only when he gets  $GP \geq 6$  (B Grade or above).
- 9.9 The SGPA is calculated by dividing the Sum of Credit Points ( $\Sigma CP$ ) secured from

ALL Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

$$\text{SGPA} = \{ \sum_{i=1}^N C_i G_i \} / \{ \sum_{i=1}^N C_i \} \dots \text{For each Semester,}$$

where 'i' is the course indicator index (taking into account all Courses in a Semester), 'N' is the no. of Courses 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department),  $C_i$  is the no. of Credits allotted to the  $i^{\text{th}}$  Course, and  $G_i$  represents the GP corresponding to the Letter Grade awarded for that  $i^{\text{th}}$  Course.

- 9.10** The CGPA is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, at the end of each Semester, as per the formula

$$\text{CGPA} = \{ \sum_{j=1}^M C_j G_j \} / \{ \sum_{j=1}^M C_j \} \dots \text{for all S Semesters registered}$$

**(ie., upto and inclusive of S Semesters,  $S \geq 2$ ),**

where 'M' is the TOTAL no. of Courses (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' for from the 1<sup>st</sup> Semester onwards up to and inclusive of the Semester S ( obviously  $M > N$  ), 'j' is the Course indicator index (taking into account all Courses from 1 to S Semesters),  $C_j$  is the no. of Credits allotted to the  $j^{\text{th}}$  Course, and  $G_j$  represents the Grade Points (GP) corresponding to the Letter Grade awarded for that  $j^{\text{th}}$  Course. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

**Illustration of calculation of SGPA**

Course/Subject	Credits	Letter Grade	Grade points	Credit Points
Course 1	4	A	8	4*8 = 32
Course 2	4	O	10	4*10 = 40
Course 3	4	B	6	4*6 = 24
Course 4	3	B	6	3*6 = 18
Course 5	3	A+	9	3*9 = 27
Course 6	3	B	6	3*6 = 18
	21			159

$$\text{SGPA} = 159/21 = 7.57$$

**Illustration of calculation of CGPA**

Semester	Credits	SGPA	Credits * SGPA
Semester I	24	7	24*7 = 168
Semester II	24	6	24*6 = 144
Semester III	24	6.5	24*6.5 = 156
Semester IV	24	6	24*6 = 144
	96		612

$$\text{CGPA} = 612/96 = 6.37$$

**10.0 Award of Degree and Class**

**10.1** If a student who registers for all the specified Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme, and secures the required number of 68 Credits (with CGPA  $\geq 6.0$ ), shall be declared to have 'QUALIFIED' for the award of the M.Tech Degree in Computer Science and Engineering that he was admitted into.

**10.2 Award of Class**

After a student has earned the requirements prescribed for the completion of the programme and is eligible for the award of M.Tech Degree, he shall be placed in one of the following three classes based on the CGPA:

Class Awarded	CGPA
First Class with Distinction	$\geq 7.75$
First Class	$6.75 \leq \text{CGPA} < 7.75$
Second Class	$6.00 \leq \text{CGPA} < 6.75$

A student with final CGPA (at the end of the PGP)  $< 6.00$  shall not be eligible for the Award of Degree.

**11.0 Withholding of Results**

If the student has not paid the dues, if any, to the GCET or if any case of indiscipline is pending against him, the result and degree of the student shall be withheld and he shall not be allowed into the next semester.

**12.0 General**

- 12.1 Credit:** A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work / field work per week.
- 12.2 Credit Point:** It is the product of grade point and number of credits for a course.
- 12.3** Wherever the words “he”, “him”, “his”, occur in the regulations, they shall include “she”, “her”.
- 12.4** The academic regulation should be read as a whole for the purpose of any interpretation.
- 12.5** In case of any doubt or ambiguity in the interpretation of the above rules, the decision of GCET is final.
- 12.6** GCET may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by GCET.

## PUNISHMENT FOR MALPRACTICE

	Nature of Malpractices	Punishment
	<b>If the candidate:</b>	
1 (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the course of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
1 (b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he shall be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the impostor is an outsider, he shall be handed over to the police and a case is registered against him.

4	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	Refuses to obey the orders of the Chief Superintendent / Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they shall be handed over to the police and a police case is registered against them.

7	Leaves the exam hall taking away answer script or tears of the script or any part thereof inside or outside the examination hall with the mala fide intention of destroying any evidence of use of unfair means.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College shall be handed over to police and, a police case shall be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.

12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the chief controller of examinations for further action to award suitable punishment.	
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**GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY**

**(AUTONOMOUS)**

**Cheeryal (V), Keesara (M), Medchal Dist., Telengana-501301**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**M.TECH. PROGRAM IN COMPUTER SCIENCE AND ENGINEERING**

**VISION OF THE INSTITUTE**

Geethanjali visualizes dissemination of knowledge and skills to students, who would eventually contribute to well being of the people of the nation and global

community.

#### **MISSION OF THE INSTITUTE**

1. To impart adequate fundamental knowledge in all basic sciences and engineering, technical and Inter-personal skills to students.
2. To bring out creativity in students that would promote innovation, research and entrepreneurship.
3. To Preserve and promote cultural heritage, humanistic and spiritual values promoting peace and harmony in society.

#### **VISION OF THE DEPARTMENT**

To produce globally competent and socially responsible computer science engineers contributing to the advancement of engineering and technology which involves creativity and innovation by providing excellent learning environment with world class facilities.

#### **MISSION OF THE DEPARTMENT**

1. To be a center of excellence in instruction, innovation in research and scholarship and service to the stake holders, the profession, and the public.
2. To prepare graduates to enter rapidly changing field as a competent computer science engineer.
3. To prepare graduates capable in all phases of software development, possess a firm understanding of hardware technologies, have the strong mathematical background necessary for scientific computing, be sufficiently well versed in general theory and practice to allow growth within the discipline as it advances.
4. To prepare graduates to assume leadership roles by possessing good communication skills, ability to work effectively as team members, appreciation for their social and ethical responsibility in a global setting.

**PROGRAM EDUCATION OBJECTIVES (PEOs)**

**PEO-I:** Perform with dominance in scholastics, business, design and development in computing technology, or exploration in a specific area of Computer Science and Engineering to pursue research and an appreciation for lifelong learning.

**PEO-II:** Demonstrate methodically scientific concepts and problem solving skills by applying research principles for effective decision making in handling real life problems within realistic constraints.

**PEO-III:** Ability to convey the scientific exploration or express inventive thoughts in a powerful way with familiarity, social and economic obligation with the support of domain expertise.

**PROGRAM OUTCOMES (Pos)**

Students would be able to:

<b>PO 1</b>	Apply knowledge of recent computing technologies, skills and current tools of computer science and engineering.
<b>PO 2</b>	Design and conduct experiments, as well as to analyze and interpret data.
<b>PO 3</b>	Apply knowledge of contemporary research issues in the different areas of computer science & engineering
<b>PO 4</b>	Explore research gaps, analyze and carry out research in the specialized/emerging areas of computer science and engineering.
<b>PO 5</b>	Design software systems, components, or processes to meet identified needs within economic, environmental and social constraints.
<b>PO 6</b>	Express/present ideas in an impressive and professional manner.
<b>PO 7</b>	Recognize the need to engage in lifelong learning through continuing education and research.
<b>PO 8</b>	Work in multidisciplinary and multicultural environment.
<b>PO 9</b>	Become entrepreneur based upon societal needs.
<b>PO 10</b>	Exhibit professional, social and ethical responsibilities.

**GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF CSE**

**M.Tech (COMPUTER SCIENCE AND ENGINEERING)**

**PROGRAM STRUCTURE**

(Applicable for the Batch admitted from the Academic Year 2020-21 onwards)

**FIRST YEAR SEMESTER-I**

S.No	Course Code	Subject	Category	L	T	P	CIE	SEE	Total	Credits
1.	20MCS102	Advanced Data Structures	PC 1	3	-	-	40	60	100	3
2.	20MCS103	Mathematical Foundations of Computer Science	PC 2	3	-	-	40	60	100	3
3.	<b>Program Specific Elective - I</b>		PSE I	3	-	-	40	60	100	3
	20MCS104	Machine Learning								
	20MCS105	Cryptography & Network Security								
	20MCS106	Internet of Things								
	20MCS107	Advanced Computer Networks								
4.	<b>Program Specific Elective - II</b>		PSE II	3	-	-	40	60	100	3
	20MCS108	Software Architectures								
	20MCS109	Information Retrieval Systems								
	20MCS110	Distributed Systems								
	20MCS111	Mobile Application Development								
5.	20MCS1L1	Advanced Data Structures Lab	Laboratory 1	-	-	4	40	60	100	2
6.	<b>Based on Program Specific Elective-I</b>		Laboratory 2	-	-	4	40	60	100	2
	20MCS1L2	Machine Learning Lab								
	20MCS1L3	Cryptography & Network Security Lab								
	20MCS1L4	Internet of Things Lab								
	20MCS1L5	Advanced Computer Networks Lab								
7.	20MCS101	Research Methodology & IPR	PW	2	-	-	40	60	100	2
8.	20MAC101	Indian Constitution	Audit I	2	-	-	-	-	-	-
	20MAC102	Soft Skills								
<b>Total</b>				<b>16</b>	<b>0</b>	<b>8</b>				<b>18</b>
<b>Total Periods Per Week</b>				24						

## FIRST YEAR SEMESTER-II

S.No	Course Code	Subject	Category	L	T	P	CIE	SEE	Total	Credits	
1.	20MCS202	Advanced Algorithms	PC3	3	-	-	40	60	100	3	
2.	20MCS203	Soft Computing	PC4	3	-	-	40	60	100	3	
3.	<b>Program Specific Elective - III</b>		PSE III	3	-	-	40	60	100	3	
	20MCS204	Digital Forensics									
	20MCS205	Data Analytics									
	20MCS206	Parallel Computing									
	20MCS207	Blockchain Technology									
4.	<b>Program Specific Elective - IV</b>		PSE IV	3	-	-	40	60	100	3	
	20MCS208	Human Computer Interaction									
	20MCS209	Computer Vision									
	20MCS210	Distributed Databases									
	20MCS211	SOA & Micro-services									
5.	20MCS2L1	Advanced Algorithms Lab	Laboratory 3	-	-	4	40	60	100	2	
6.	<b>Based on Program Specific Elective - III</b>		Laboratory 4	-	-	4	40	60	100	2	
	20MCS2L2	Digital Forensics									
	20MCS2L3	Data Analytics									
	20MCS2L4	Parallel Computing									
	20MCS2L5	Blockchain Technology									
7.	20MCS201	MINI PROJECT with Seminar	PW	-	-	4	100	-	100	2	
8.	20MAC201	Professional Ethics	Audit II	2	-	-	-	-	-	-	
	20MAC202	Disaster Management									
<b>Total</b>				<b>14</b>	<b>0</b>	<b>12</b>				<b>18</b>	
<b>Total Periods Per Week</b>						<b>26</b>					

**SECOND YEAR SEMESTER-I**

S.No	Course Code	Subject	Category	L	T	P	CIE	SEE	Total	Credits
1.	<b>Program Specific Elective - V</b>		PSE V	3	-	-	40	60	100	3
	20MCS302	Optimization Techniques								
	20MCS303	High Performance Computing								
	20MCS304	Ad hoc and Sensor Networks								
	20MCS305	Social, Web and Mobile Analytics								
2.	<b>Open Electives</b>		OE	3	-	-	40	60	100	3
	20MOE301	Business Analytics								
	20MOE302	Industrial Safety								
	20MOE303	Operations Research								
	20MOE304	Cost Management of Engineering Projects								
	20MOE305	Composite Materials								
	20MOE306	Energy from Waste								
	20MOE307	Power from Renewable Energy Sources								
3.	20MCS301	PROJECT/ DISSERTATION PHASE - I	PW	-	-	20	100	-	100	10
<b>Total</b>				6	0	20				16
<b>Total Periods Per Week</b>				26						

**SECOND YEAR SEMESTER-II**

S.No	Course Code	Subject	Category	L	T	P	CIE	SEE	Total	Credits
1.	20MCS401	PROJECT/ DISSERTATION PHASE - II	PW	-	-	32	40	60	100	16
<b>Total</b>				0	0	32				16
<b>Total Periods Per Week</b>				32						

**GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY  
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**20MCS102 - ADVANCED DATA STRUCTURES**

**M.Tech. CSE I Year, I Semester**

L	T	P	C
3	0	0	3

**Prerequisites**

1. A course on “Data Structures”

**Course Objectives:**

1. Introduces the heap data structures such as leftist heaps, binomial heaps, fibonacci and min-max heaps
2. Introduces a variety of data structures such as disjoint sets, hash tables, search structures and digital search structures

**Course Outcomes:**

1. Ability to select the data structures that efficiently model the information in a problem
2. Ability to understand how the choice of data structures impact the performance of programs
3. Can Design programs using a variety of data structures, including hash tables, search structures and digital search structures

**UNIT - I**

**Heap Structures** - Introduction, Min-Max Heaps, Leftist trees, Binomial Heaps, Fibonacciheaps.

**UNIT - II**

**Hashing and Collisions** - Introduction, Hash Tables, Hash Functions, different HashFunctions:- Division Method, Multiplication Method, Mid-Square Method, Folding Method, Collisions

**UNIT - III**

**Search Structures** - OBST, AVL trees, Red-Black trees, Splay trees,  
**Multiway Search Trees** - B-trees., 2-3 trees

**UNIT - IV**

**Digital Search Structures**

Digital Search trees, Binary tries and Patricia, Multiway Tries, Suffix trees, Standard Tries, Compressed Tries

**UNIT - V**

**Pattern matching** Introduction, Brute force, the Boyer –Moore algorithm, Knuth-Morris-Pratt algorithm, Naïve String , Harspool, Rabin Karp

**Textbooks:**

1. Fundamentals of data structures in C++ Sahni, Horowitz, Mehatha, Universities Press. Introduction to Algorithms, TH Cormen, PHI

**References:**

1. Design methods and analysis of Algorithms, SK Basu, PHI.
2. Data Structures & Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education.
3. Fundamentals of Computer Algorithms, 2<sup>nd</sup> Edition, Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, Universities Press.

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**20MCS103 - MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**  
M.Tech. CSE I Year, I Semester

L	T	P	C
3	0	0	3

**Pre-requisites:**

1. No prerequisites
2. An understanding of Mathematics in general is sufficient.

**Course Objectives:**

1. Introduces the elementary discrete mathematics for computer science and engineering.
2. Topics include formal logic notation, methods of proof, induction, sets, relations, graph theory, permutations and combinations, counting principles; recurrence relations and generating functions.

**Course Outcomes:**

1. Ability to understand and construct precise mathematical proofs
2. Ability to use logic and set theory to formulate precise statements
3. Ability to analyze and solve counting problems on finite and discrete structures
4. Ability to describe and manipulate sequences
5. Ability to apply graph theory in solving computing problems

**UNIT - I****The Foundations: Logic and Proofs**

Propositional Logic, Applications of Propositional Logic, Propositional Equivalence, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.

**UNIT - II****Basic Structures, Sets, Functions, Sequences, Sums, Matrices and Relations**

Sets, Functions, Sequences & Summations, Cardinality of Sets and Matrices Relations, Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings.

**UNIT - III****Algorithms, Induction and Recursion**

Algorithms, The Growth of Functions, Complexity of Algorithms.

**Induction and Recursion**

Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness.

**UNIT - IV****Discrete Probability and Advanced Counting Techniques**

An Introduction to Discrete Probability . Probability Theory, Bayes' Theorem, Expected Value and Variance.

**Advanced Counting Techniques**

Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion-Exclusion, Applications of

Inclusion-Exclusion.

**UNIT - V**

**Graphs**

Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring.

**Trees**

Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

**Textbook:**

1. Discrete Mathematics and Its Applications with Combinatorics and Graph Theory- Kenneth H Rosen, 7<sup>th</sup> Edition, TMH.

**References:**

1. Discrete Mathematical Structures with Applications to Computer Science-J.P. Tremblay and R. Manohar, TMH,
2. Discrete Mathematics for Computer Scientists & Mathematicians: Joe L. Mott, Abraham Kandel, Theodore P. Baker, 2<sup>nd</sup> ed. , Pearson Education.
3. Discrete Mathematics- Richard Johnsonbaugh, 7<sup>th</sup>Edtn., Pearson Education.
4. Discrete Mathematics with Graph Theory- Edgar G. Goodaire, Michael M. Parmenter.
5. Discrete and Combinatorial Mathematics - an applied introduction: Ralph.P. Grimald, 5<sup>th</sup> edition , Pearson Education,.

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**20MCS104- MACHINE LEARNING**

**M.Tech. CSE I Year, I Semester**

L	T	P	C
3	0	0	3

**Pre-requisites:**

1. A Course on "Data Structures" Knowledge on statistical methods

**Course Objectives:**

1. This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
2. To understand computational learning theory.
3. To study the pattern comparison techniques.

**Course Outcomes:**

1. Understand the concepts of computational intelligence like machine learning
2. Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
3. Understand the Neural Networks and its usage in machine learning application.

**UNIT - I**

**Introduction**

Well-posed learning problems, designing a learning system Perspectives and issues in machine learning

**Concept learning and the general to specific ordering**

Introduction, A concept learning task, concept learning as search, Find -S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination algorithm, Remarks on Version Spaces and Candidate Elimination, Inductive Bias.

**Decision Tree Learning**

Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning.

**UNIT - II**

**Artificial Neural Networks:** Introduction, Neural Network Representation, Appropriate Problems for Neural Network Learning, Perceptions, Multilayer Networks and the Back propagation Algorithm. Discussion on the Back Propagation Algorithm, An illustrative Example: Face Recognition

**Evaluation Hypotheses:** Motivation, Estimation Hypothesis Accuracy, Basics of Sampling Theory, A General Approach for Deriving Confidence Intervals, Difference in Error of Two Hypotheses, Comparing Learning Algorithms.

**UNIT - III**

**Bayesian learning**

Introduction, Bayes Theorem, Bayes Theorem and Concept Learning Maximum Likelihood and Least Squared Error Hypotheses, Maximum Likelihood Hypotheses for Predicting Probabilities, Minimum Description Length Principle , Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier, An Example: Learning to Classify Text, Bayesian Belief

Networks, EM Algorithm.

**Computational Learning Theory**

Introduction, Probably Learning an Approximately Correct Hypothesis, Sample Complexity for Finite Hypothesis Space, Sample Complexity for Infinite Hypothesis Spaces, The Mistake Bound Model of Learning.

**Instance-Based Learning**

Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.

**UNIT - IV****Pattern Comparison Techniques**

Temporal patterns, Dynamic Time Warping Methods, Clustering, Codebook Generation, Vector Quantization

**Pattern Classification**

Introduction to HMMS, Training and Testing of Discrete Hidden Markov Models and Continuous Hidden Markov Models, Viterbi Algorithm, Different Case Studies in Speech recognition and Image Processing

**UNIT – V**

**Analytical Learning:** Introduction, Learning with Perfect Domain Theories : PROLOG-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operations.

**Combining Inductive and Analytical Learning**

Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis.

**Textbooks:**

1. Machine Learning – Tom M.Mitchell,-MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biing – Hwang Juang.

**References:**

1. Machine Learning : An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

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**20MCS105 - CRYPTOGRAPHY & NETWORK SECURITY**

M.Tech. CSE I Year, I Semester

L	T	P	C
3	0	0	3

**Prerequisites:**

1. A Course on “Computer Networks”

**Course Objectives:**

1. To impart knowledge on network security issues, services, goals and mechanisms.
2. To analyze the security of communication systems, networks and protocols.
3. To apply algorithms used for secure transactions in real world applications

**Course Outcomes:**

1. Demonstrate the knowledge of cryptography and network security concepts and applications.
2. Ability to apply security principles in system design.
3. Ability to identify and investigate vulnerabilities and security threats and mechanisms to counter them.

**UNIT - I**

Security Attacks, Security Services and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

**UNIT - II**

**Conventional Encryption** - Principles, Conventional encryption algorithms (DES, AES, RC4, Blowfish), cipher block modes of operation, location of encryption devices, key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC.

**UNIT - III**

**Number Theory** - Modular Arithmetic, Euclid’s Algorithm, Fermat’s and Euler’s Theorem, Chinese Remainder Theorem, Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos, X.509 Directory Authentication Service.

**UNIT - IV**

**Email privacy** - Pretty Good Privacy (PGP) and S/MIME.

**IP Security** - Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

**UNIT - V**

**Web Security** - Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

Intruders, Viruses and related threats, Firewall Design principles, Trusted Systems, Intrusion Detection Systems.

**Textbooks:**

1. Cryptography and Network Security, William Stallings, 4<sup>th</sup> Edition, Pearson Education.
2. Applied Cryptography, Bruce Schneier, 2<sup>nd</sup> Edition, Wiley Publisher.

**Reference:**

1. Cryptography and Network Security, Behrouz A. Forouzan, 2<sup>nd</sup> edition, Tata McGraw-Hill Education.

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**20MCS106 - INTERNET OF THINGS**

**M.Tech. CSE I Year, I Semester**

L	T	P	C
3	0	0	3

**Prerequisites: NIL**

**Course Objectives:**

1. To introduce the terminology, technology and its applications
2. To introduce the raspberry PI platform, that is widely used in IoT applications
3. To introduce the implementation of web based services on IoT devices

**Course Outcomes:**

1. Understand the new computing technologies
2. Able to apply the latest computing technologies like cloud computing technology and Big Data
3. Ability to introduce the concept of M2M (machine to machine) with necessary protocols
4. Get the skill to program using python scripting language which is used in many IoT devices

**UNIT – I**

**Introduction to Internet of Things** Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

**UNIT - II**

**IoT and M2M** Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG-NETCONF, YANG, SNMP NETOPEER

**UNIT - III**

**Introduction to Python** Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

**UNIT - IV**

**IoT Physical Devices and Endpoints**

Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

**UNIT - V**

**IoT Physical Servers and Cloud Offerings**

Introduction to Cloud Storage models and communication APIs Web server – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

**Textbooks:**

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

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**20MCS107 - ADVANCED COMPUTER NETWORKS**

**M.Tech. CSE I Year, I Semester**

L	T	P	C
3	0	0	3

**Prerequisites:**

1. Data Communication, Basic Networking Principles

**Course Objective:**

1. This course aims to provide advanced background on relevant computer networking topics to have a comprehensive and deep knowledge in computer networks.

**Course Outcomes:**

1. Understanding of holistic approach to computer networking
2. Ability to understand the computer networks and their application
3. Ability to design simulation concepts related to packet forwarding in networks

**UNIT – I**

Review of Computer Networks, Devices and the Internet: Internet, Network edge, Network core, Access Networks and Physical media, ISPs and Internet Backbones, Delay and Loss in Packet-Switched Networks, Networking and Internet - Foundation of Networking Protocols: 5-layer TCP/IP Model, 7-Layer OSI Model, Internet Protocols and Addressing. Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, Router Structure. The Link Layer and Local Area Networks-Link Layer, Introduction and Services, Error-Detection and Error-Correction techniques, Multiple Access Protocols, Link Layer Addressing, Ethernet, Interconnections: Hubs and Switches, PPP: The Point-to-Point Protocol, Link Virtualization

**UNIT – II**

Data-link protocols: Ethernet, Token Ring and Wireless (802.11). Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs), Multiple access schemes.

Routing and Internetworking: Network-Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Intra-domain Routing Protocols, Inter-domain Routing Protocols, Congestion Control at Network Layer.

**UNIT – III**

Logical Addressing: IPv4 Addresses, IPv6 Addresses - Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6 – Multicasting Techniques and Protocols: Basic Definitions and Techniques, Intra-domain Multicast Protocols, Inter-domain Multicast Protocols, Node-Level Multicast algorithms

**UNIT – IV**

Transport and Application Layer Protocols: Client-Server and Peer-To-Peer Application Communication, Protocols on the transport layer, reliable communication. Routing packets through a LAN and WAN. Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport Protocols, TCP Congestion Control. Principles

of Network Applications,

**UNIT – V**

The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, Building a Simple Web Server.

Creating simulated networks and passing packets through them using different routing techniques. Installing and using network monitoring tools.

**Textbooks:**

1. Computer Networking: A Top-Down Approach, James F. Kurosu and Keith W. Ross, Pearson, 6th Edition, 2012.
2. Computer Networks and Internets, Douglas E. Comer, 6<sup>th</sup> Edition, Pearson.

**References:**

1. A Practical Guide to Advanced Networking , Jeffrey S. Beasley and PiyasatNilkaew, Pearson, 3rd Edition,2012
2. Computer Networks , Andrew S. Tanenbaum, David J. Wetherall,Prentice Hall.

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**20MCS108 - SOFTWARE ARCHITECTURES**

**M.Tech. CSE I Year, I Semester**

L	T	P	C
3	0	0	3

**Pre Requisite:**

1. A course on “Software Engineering”

**Course Objectives:**

1. To understand the concept of software architecture
2. To understand the design, documentation of software Architecture and Reconstruct.
3. To understand importance of Architecture Evaluation and Methods.
4. To understand reusability of Architecture

**Course Outcomes:**

1. Students can Design, document and Reconstruct Software Architecture
2. Students have profound knowledge on Software Architecture
3. Students can evaluate Architecture
4. Students can reuse the Architecture

**UNIT - I**

**Envisioning Architecture**

The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views. A-7E – A case study in utilizing architectural structures

**UNIT - II**

**Creating an Architecture**

Understanding Quality Attributes, Achieving qualities, Architectural styles and patterns Air Traffic Control – a case study in designing for high availability

**UNIT – III**

**Designing the Architecture**

Documenting software architectures, Reconstructing Software architecture Flight Simulation – a case study in Architecture for Integrability

**UNIT – IV**

**Analyzing Architectures**

Architecture Evaluation, Architecture design decision making, ATAM, CBAM. The Nightingale System - a case study in Applying the ATAM The NASA ECS Project – a case study in Applying the CBAM

**UNIT – V**

**Moving from one system to many**

Software Product Lines, Building systems from off the shelf components, Software architecture in future.

Celsius Tech – a case study in product line development

**Textbook:**

1. Software Architecture in Practice, , Len Bass, Pau Clements & Rick Kazman, second edition Pearson Education,2003.

**References:**

1. Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Software Design, David Budgen, second edition, Pearson education, 2003

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**20MCS109 - INFORMATION RETRIEVAL SYSTEMS**

**M.Tech. CSE I Year, I Semester**

L	T	P	C
3	0	0	3

**Prerequisites:**

1. A Course on “Data Structures”

**Course Objectives:**

1. To learn the important concepts and algorithms in IRS
2. To understand the data/file structures that are necessary to design, and implement information retrieval (IR) systems.

**Course Outcomes:**

1. Ability to apply IR principles to locate relevant information large collections of data
2. Ability to design different document clustering algorithms
3. Implement retrieval systems for web search tasks.
4. Design an Information Retrieval System for web search tasks.

**UNIT - I**

**Introduction:** Motivation, Basic Concepts, Past-Present and Future, the Retrieval Process

**Modelling:** Introduction, A Taxonomy of Information retrieval Models, Retrieval: Ad hoc and Filtering, A Formal Characteristics of IR Models, Classic Information Retrieval, Alternative Set Theory Models, Alternative Probabilistic Models, Structured Text Retrieval Models, Model for Browsing

**UNIT - II**

**Retrieval Evaluation:** Introduction, retrieval Performance Evaluation, Reference Collections

**Query languages:** Introduction, Keyword-Based Querying, Pattern Matching, Structural Queries, Query Protocols

**Query Operations:** Introduction, User Relevance Feedback, Automatic Local Analysis, Automatic global Analysis

**Text Operations:** Introduction, Document Preprocessing, Document Clustering, Text Compression, Comparing text Compression Techniques

**UNIT - III**

**Indexing and Searching:** Introduction, Inverted Files, Other Indices for Text, Boolean queries, Sequential Searching, pattern Matching, Structural Queries, Compression Searching the Web

Introduction, Challenges, Characterizing the Web, Search Engines, Browsing, Metasearches, Finding the Needle in the Haystack, Searching using Hyperlinks

**UNIT - IV**

**User Interfaces and Visualization**

Introduction, human- Computer Interaction, The Information Access Process, Starting Points, Query Specification, Context, User Relevance Judgments, Interface Support for the Search Process

**UNIT - V**

Multimedia IR: Models and Languages

Introduction, Data Modeling, Query Languages

Multimedia IR: Indexing and Searching

Introduction, Background-Spatial Access Methods, A Generic Multimedia Indexing Approach, One Dimensional Time Series, Two Dimensional Color Images, Automatic Feature Extraction.

**Textbook:**

1. Modern Information Retrieval By Yates and Neto Pearson Education.

**References:**

1. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.
2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
3. Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons.

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**20MCS110 - DISTRIBUTED SYSTEMS**

**M.Tech. CSE I Year, I Semester**

L	T	P	C
3	0	0	3

**Prerequisites:**

1. A course on “Operating Systems”
2. A course on “Computer Networks”

**Course Objectives:**

1. This course provides an insight into Distributed systems.
2. Topics include- Peer to Peer Systems, Transactions and Concurrency control, Security and Distributed shared memory

**Course Outcomes:**

1. Ability to understand Transactions and Concurrency control.
2. Ability to understand Security issues.
3. Understanding Distributed shared memory.
4. Ability to design distributed systems for basic level applications.

**UNIT - I**

**Characterization of Distributed Systems**

Introduction, Examples of Distributed systems, Resource sharing and web, challenges, System models-Introduction, Architectural and Fundamental models, Networking and Internetworking, Interprocess Communication, Distributed objects and Remote Invocation-Introduction, Communication between distributed objects, RPC, Events and notifications, Case study-Java RMI.

**UNIT - II**

**Operating System Support**

Introduction, OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture, Distributed File Systems-Introduction, File Service architecture

**Case study**

SUN network file systems.

**Name Services**

Introduction, Name Services and the Domain Name System, Case study of the Global Name Service, Case study of the X.500 Directory Service.

**UNIT - III**

**Peer to Peer Systems**

Introduction, Napster and its legacy, Peer to Peer middleware, Routing overlays, Overlay case studies-Pastry, Tapestry, Application case studies-Squirrel, OceanStore.

**Time and Global States**

Introduction, Clocks, events and Process states, Synchronizing physical clocks, logical time and logical clocks, global states, distributed debugging.

**Coordination and Agreement**

Introduction, Distributed mutual exclusion, Elections, Multicast communication, consensus

and related problems.

#### **UNIT - IV**

##### **Transactions and Concurrency control**

Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering, Comparison of methods for concurrency control.

##### **Distributed Transactions**

Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery

##### **Replication**

Introduction, System model and group communication, Fault tolerant services, Transactions with replicated data.

#### **UNIT - V**

##### **Security**

Introduction, Overview of Security techniques, Cryptographic algorithms, Digital signatures

##### **Case studies**

Kerberos, TLS, 802.11 WiFi.

Distributed shared memory, Design and Implementation issues, Sequential consistency and Ivy case study, Release consistency and Munin case study, Other consistency models, CORBA case study-Introduction, CORBA RMI, CORBA Services.

#### **Textbooks:**

1. Distributed Systems Concepts and Design, G Coulouris, J Dollimore and T Kindberg, Fourth Edition, Pearson Education.
2. Distributed Systems, S.Ghosh, Chapman&Hall/CRC, Taylor&Francis Group,2010.

#### **References:**

1. Distributed Computing, S.Mahajan and S.Shah, Oxford University Press.
2. Distributed Operating Systems Concepts and Design, Pradeep K.Sinha, PHI.
3. Advanced Concepts in Operating Systems, M Singhal, N G Shivarathri, TMH.
4. Reliable Distributed Systems, K.P.Birman, Springer.
5. Distributed Systems – Principles and Paradigms, A.S. Tanenbaum and M.V. Steen, Pearson Education.
6. Distributed Operating Systems and Algorithm Analysis, R.Chow, T.Johnson, Pearson.
7. Distributed Operating Systems, A.S.Tanenbaum, Pearson education.
8. Distributed Computing, Principles, Algorithms and Systems, Ajay D.Kshema kalyani and Mukesh Singhal, Cambridge, rp 2010.

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**20MCS110 - MOBILE APPLICATION DEVELOPMENT**

**M.Tech. CSE I Year, I Semester**

L	T	P	C
3	0	0	3

**Prerequisites:**

1. Acquaintance with JAVA programming
2. A Course on DBMS

**Course Objectives:**

1. To demonstrate their understanding of the fundamentals of Android operating systems
2. To improve their skills of using Android software development tools
3. To demonstrate their ability to develop software with reasonable complexity on mobile platform
4. To demonstrate their ability to deploy software to mobile devices
5. To demonstrate their ability to debug programs running on mobile devices

**Course Outcomes:**

1. Student understands the working of Android OS Practically.
2. Student will be able to develop Android user interfaces
3. Student will be able to develop, deploy and maintain the Android Applications.

**UNIT - I**

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools

Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes

Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

**UNIT - II**

Android User Interface: Measurements – Device and pixel density independent measuring units Layouts – Linear, Relative, Grid and Table Layouts User Interface (UI) Components – Editable and non editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers

Event Handling – Handling clicks or changes of various UI components

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

**UNIT - III**

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS

Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters,

finding and using Intents received within an Activity

Notifications – Creating and Displaying notifications, Displaying Toasts

**UNIT – IV**

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference

**UNIT - V**

Database: Introduction to SQLite database, creating and opening a database, creating tables, inserting, retrieving and editing data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

**Textbooks:**

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox) , 2012
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

**Reference:**

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013

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**20MCS1L1– ADVANCED DATA STRUCTURES LAB**

**M.Tech. CSE I Year, I Semester**

L	T	P	C
0	0	4	2

**Prerequisites:**

1. A course on Computer Programming & Data Structures”

**Course Objectives:**

1. Introduces the basic concepts of Abstract Data Types.
2. Reviews basic data structures such as stacks and queues.
3. Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs, and B-trees.
4. Introduces sorting and pattern matching algorithms

**Course Outcomes:**

1. Ability to select the data structures that efficiently model the information in a problem.
2. Ability to assess efficiency trade-offs among different data structure implementations or combinations.
3. Implement and know the application of algorithms for sorting and pattern matching.
4. Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and B-trees.

**List of Programs**

1. Write a program to perform the following operations:
  - a. Insert an element into a binary search tree.
  - b. Delete an element from a binary search tree.
  - c. Search for a key element in a binary search tree.
2. Write a program for implementing the following sorting methods:
  - a. Merge sort
  - b. Heap sort
  - c. Quick sort
3. Write a program to perform the following operations:
  - a. Insert an element into a B- tree.
  - b. Delete an element from a B- tree.
  - c. Search for a key element in a B- tree.
4. Write a program to perform the following operations:
  - a. Insert an element into a Min-Max heap
  - b. Delete an element from a Min-Max heap
  - c. Search for a key element in a Min-Max heap
5. Write a program to perform the following operations:
  - a. Insert an element into a Leftist tree
  - b. Delete an element from a Leftist tree
  - c. Search for a key element in a Leftist tree
6. Write a program to perform the following operations:
  - a. Insert an element into a binomial heap
  - b. Delete an element from a binomial heap.

- c. Search for a key element in a binomial heap
7. Write a program to perform the following operations:
  - a. Insert an element into a AVL tree.
  - b. Delete an element from a AVL search tree.
  - c. Search for a key element in a AVL search tree.
8. Write a program to perform the following operations:
  - a. Insert an element into a Red-Black tree.
  - b. Delete an element from a Red-Black tree.
  - c. Search for a key element in a Red-Black tree.
9. Write a program to implement all the functions of a dictionary using hashing.
10. Write a program for implementing Knuth-Morris-Pratt pattern matching algorithm.
11. Write a program for implementing Brute Force pattern matching algorithm.
12. Write a program for implementing Boyer pattern matching algorithm.

**Textbooks:**

1. Fundamentals of Data structures in C, E.Horowitz, S.Sahni and Susan Anderson Freed, 2<sup>nd</sup> Edition, Universities Press
2. Data Structures Using C – A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.
3. Introduction to Data Structures in C, Ashok Kamthane, 1<sup>st</sup> Edition, Pearson.

**References:**

1. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3. Data structures: A Pseudo code Approach with C, R.F.Gilberg And B.A.Forouzan, 2<sup>nd</sup> Edition, Cengage Learning.

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**20MCS1L2 - MACHINE LEARNING LAB**

M.Tech. CSE I Year, I Semester

L	T	P	C
0	0	4	2

**Pre-requisites: None**

**Course Objectives:**

1. To get an overview of the various machine learning techniques.
2. Understand complexity of Machine Learning algorithms and their limitations;

**Course Outcomes:**

1. Understand modern notions in data analysis oriented computing;
2. Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
3. Be capable of performing experiments in Machine Learning using real-world data.

**List of Experiments**

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday?
2. Extract the data from database.
3. Implement k-nearest neighbours classification.
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3 centroids)

VAR1	VAR2	CLASS
1.713	1.586	0
0.180	1.786	1
0.353	1.240	1
0.940	1.566	0
1.486	0.759	1
1.266	1.106	0
1.540	0.419	1
0.459	1.799	1
0.773	0.186	1

5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

medium skiing design single twenties no ->highRisk  
 high golf trading married forties yes ->lowRisk  
 low speedway transport married thirties yes ->medRisk  
 medium football banking single thirties yes ->lowRisk  
 high flying media married fifties yes ->highRisk  
 low football security single twenties no ->medRisk  
 medium golf media single thirties yes ->medRisk  
 medium golf transport married forties yes ->lowRisk  
 high skiing banking single thirties yes ->highRisk  
 low golf unemployed married forties yes ->highRisk

Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of 'golf' and the conditional probability of 'single' given 'medRisk' in the dataset?

6. Implement linear regression.
7. Implement Naïve Bayes theorem to classify the English text
8. Implement an algorithm to demonstrate the significance of genetic algorithm
9. Implement the finite words classification system using Back-propagation algorithm

**Textbooks:**

1. Machine Learning – Tom M. Mitchell-MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biing – Hwang Juang.

**Reference:**

1. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

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**20MCS1L3 - CRYPTOGRAPHY & NETWORK SECURITY LAB**

**M.Tech. CSE I Year, I Semester**

L	T	P	C
0	0	4	2

**Course Objectives:**

1. To know about various encryption techniques.
2. To understand the concept of Public key cryptography.
  1. To study about message authentication and hash functions
2. To impart knowledge on Network security

**Course Outcomes:**

1. Identify some of the factors driving the need for network security
2. Identify and classify particular examples of attacks
3. Define the terms vulnerability, threat and attack
4. Identify physical points of vulnerability in simple networks
5. Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems.

**List of Experiments**

1. Write a client-server program where client sends a text message to server and server sends the text message to client by changing the case(uppercase and lowercase) of each character in the message.
2. Write a client-server program to implement following classical encryption techniques:
  - a. ceaser cipher
  - b. transposition cipher
  - c. row substitution cipher
  - d. hill cipher
3. Install JCrypt tool (or any other equivalent) and demonstrate Asymmetric, Symmetric crypto algorithm, Hash and Digital/PKI signatures studied in theory
4. Network Security and Management Tools:
5. Perform an experiment to demonstrate how to sniff for router traffic by using the tool wireshark
6. Using nmap
  - a. Find open ports on a system
  - b. Find the machines which are active
  - c. Find the version of remote os on other systems
  - d. Find the version of s/w installed on other system
7. Ethical Hacking:
  - a. Setup a honey pot and monitor the honey pot on network
  - b. Write a script or code to demonstrate SQL injection attacks
  - c. Create a social networking website login page using phishing techniques
  - d. Write a code to demonstrate DoS attacks
  - e. Install rootkits and study variety of options

**Textbooks:**

1. Cryptography and Network Security, William Stallings, 3rd Edition, Pearson Education.
2. Applied Cryptography, Bruce Schneier, 2<sup>nd</sup> Edition, Wiley Publisher.

**Reference:**

1. Cryptography and Network Security, Behrouz A. Forouzan, 2<sup>nd</sup> edition, Tata McGraw-Hill Education.

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**20MCS1L4 - INTERNET OF THINGS LAB**

**M.Tech. CSE I Year, I Semester**

L	T	P	C
0	0	4	2

**Course Objectives:**

1. To introduce the raspberry PI platform, that is widely used in IoT applications
2. To introduce the implementation of distance sensor on IoT devices

**Course Outcomes:**

1. Ability to introduce the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor
2. Get the skill to program using python scripting language which is used in many IoT devices

**List of Experiments**

1. Using raspberry pi
  - a. Calculate the distance using distance sensor.
  - b. Basic LED functionality.
2. Using Arduino
  - a. Calculate the distance using distance sensor.
  - b. Basic LED functionality.
  - c. Calculate temperature using temperature sensor.
3. Using Node MCU
  - a. Calculate the distance using distance sensor.
  - b. Basic LED functionality.
  - c. Calculate temperature using temperature sensor.

**Textbooks:**

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madiseti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

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**20MCS1L5 - ADVANCED COMPUTER NETWORKS LAB**

**M.Tech. CSE I Year, I Semester**

	T	P	C
	0	4	2

**Prerequisites:**

1. Data communication, Basic networking principles

**Course Objectives:**

1. Understand and analyze the existing protocols
2. Understand the use of network packet capturing tools

**Course Outcome:**

1. Ability of acquiring the practical exposure to existing protocols

**List of Experiments:**

1. Implement the IP fragmentation and reassembly algorithm.
2. Implement the IP forwarding algorithm.
3. Implement the simplest sliding window protocol of TCP.
4. Connect two systems using a switch and configure private IP addresses to the systems and ping them from each other. Using Wireshark, capture packets and analyze all the header information in the packets captured.
5. Install Telnet on one of the systems connected by a switch and telnet to it from the
6. other system. Using Wireshark, capture the packets and analyze the TCP 3-way Handshake for connection establishment and tear down.
7. Start packet capture in wireshark application and then open your web browser and type in an URL of website of your choice. How long did it take from when the HTTP GET message was sent until the HTTP OK reply was received for the webpage you visited in your web browser.

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**20MCS101 - RESEARCH METHODOLOGIES & IPR**

**M.Tech. CSE I Year, I Semester**

L	T	P	C
2	0	0	2

**Course Objectives:**

1. Introduce research paper writing and induce paper publication skills.
2. Give the introduction to Intellectual Property Rights

**Course Outcomes:**

1. Ability to distinguish research methods
2. Ability to write and publish a technical research paper
3. Ability to review papers effectively
4. IPR and Patent filing

**UNIT - I**

**Introduction**

Objective of Research; Definition and Motivation; Types of Research; Research Approaches; Steps in Research Process; Criteria of Good Research; Ethics in Research. Research Formulation and Literature Review:

Problem Definition and Formulation; Literature Review; Characteristics of Good Research Question; Literature Review Process.

**UNIT - II**

**Data Collection**

Primary and Secondary Data; Primary and Secondary Data Sources; Data Collection Methods; Data Processing; Classification of Data.

**Data Analysis**

Statistical Analysis; Multivariate Analysis; Correlation Analysis; Regression Analysis; Principle Component Analysis; Samplings

**UNIT - III**

**Research Design**

Need for Research Design; Features of a Good Design; Types of Research Designs; Induction and Deduction.

**Hypothesis Formulation and Testing**

Hypothesis; Important Terms; Types of Research Hypothesis; Hypothesis Testing; Z-Test; t-Test; f-Test; Making a Decision; Types of Errors; ROC Graphics.

**UNIT - IV**

**Test Procedures**

Parametric and Non Parametric Tests; ANOVA; Mann-Whitney Test; Kruskal-Wallis Test; Chi-Square Test; Multi-Variate Analysis

**Presentation of the Research Work**

Business Report; Technical Report; Research Report; General Tips for Writing Report; Presentation of Data; Oral Presentation; Bibliography and References; Intellectual Property Rights; Open-Access Initiatives; Plagiarism.

**UNIT - V****Law of Patents, Patent Searches, Ownership, Transfer Patentability Design Patents**

Double Patenting – Patent Searching – Patent Application Process – Prosecuting the Application, Post-issuance Actions, Term and Maintenance of Patents. Ownership Rights – Sole and Joint Inventors – Inventions Made by Employees and Independent Contractors – Assignment of Patent Rights – Licensing of Patent Rights – Invention Developers and Promoters.

**Patent Infringement, New Developments and International Patent Law**

Direct Infringement - Inducement to Infringe – Contributory Infringement – First Sale Doctrine– Claims Interpretation – Defenses to Infringement – Remedies for Infringement – Resolving an Infringement Dispute – Patent Infringement Litigation. New Developments in Patent Law

**Textbooks:**

1. Research Methodology. Methods & Technique : Kothari. C.R.
2. Research Methodology, S.S Vinod Chandra, S AnandHareendran, Pearson
3. Intellectual Property – Copyrights, Trademarks, and Patents by Richard Stim, Cengage Learning

**References:**

1. Practical Research : planning and Design( 8th Edition) – Paul D. Leedy and Jeanne E. Ormrod.
2. A Hand Book of Education Research – NCTE
3. Methodology of Education Research – K.S. Sidhu.
4. Tests, Measurements and Research methods in Behavioural Sciences- A.K. Singh.
5. Statistical Methods- Y.P. Agarwal.
6. Methods of Statistical Ananalysis- P.S Grewal.
7. Fundamentals of Statistics – S.C. Gupta, V.K. Kapoor.
8. Intellectual Property Rights by Deborah E. Bouchoux, Cengage Learning.
9. Managing Intellectual Property – The Strategic Imperative, VinodV.Sople, 2<sup>nd</sup> Edition, PHI Learning Private Limited.
10. Research methodology – S.S. Vinod Chandra, S. AnandHareendran

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**20MAC101 – INDIAN CONSTITUTION  
(AUDITCOURSE-1)**

M.Tech. CSE I Year, I Semester

L	T	P	C
2	0	0	0

Prerequisite(s): None

**Course Objectives:**

Develop ability to

1. Understand the need for a constitution
2. Appreciate the fundamental duties and rights of the citizens of India
3. Explain the role of constitution in a democratic society
4. Describe the Directive Principles of State Policy and their significance
5. List the key features of the constitution, Union Government, and State Governments.

**Course Outcomes (COs):**

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

- CO1. Create awareness about the constitutional values and objectives written in the Indian Constitution.
- CO2. List the fundamental rights and fundamental duties of Indian citizens.
- CO3. Identify the division of legislative, executive and financial powers between the union and the state governments.
- CO4. Understand the working of Indian democracy, its institutions and processes at the local, state and union levels.
- CO5. Explain the functions and responsibilities of Election commission of India and Union Public Service Commission.

**Unit I: Introduction to Indian Constitution**

Meaning of the term Constitution, Preamble of the Constitution, Constituent Assembly, The Salient Features of Indian Constitution

**Unit II: Fundamental Rights of citizen**

Fundamental Rights of citizen, Fundamental Duties of citizen, The Directive Principles of State Policy

**Unit III: Union Government**

Union Government, Union Legislature (Parliament), Lok Sabha and Rajya Sabha (with Powers and Functions), Union Executive, President of India (with Powers and Functions), Prime Minister of India (with Powers and Functions), Union Judiciary (Supreme Court), Jurisdiction of the Supreme Court.

**Unit IV: State Government**

State Government, State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council / Vidhan Parishad), Powers and Functions of the State Legislature, State Executive, Governor of the State (with Powers and Functions), The Chief Minister of the State (with Powers and Functions) State Judiciary (High Courts)

**Unit V: Local Self Government**

Election Commission of India (with Powers and Functions) , The Union Public Service Commission (with Powers and Functions)

**TEXT BOOKS:**

1. P.M. Bakshi, The Constitution of India, Universal Law Publishing co.,
2. Dr Durga Das Basu, Introduction to the Constitution of India, LexisNexis Publishers
3. NCERT, Indian Constitution at work

**REFERENCE BOOKS:**

1. M. Laxmikanth, Constitution of India, Cengage Publications.
2. Granville Austin, The Indian Constitution, Oxford India Paperback Edition.

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**20MAC102 – SOFT SKILLS  
(AUDITCOURSE-1)**

**M.Tech. CSE I Year, I Semester**

L	T	P	C
2	0	0	0

**Prerequisite(s):** None

**Course Objectives:**

Develop ability to

1. To improve the fluency of students in English
2. To facilitate learning through interaction
3. To illustrate the role of skills in real-life situations with case studies, role plays etc.
4. To train students in group dynamics, body language and various other activities which boost their confidence levels and help in their overall personality development
5. To encourage students develop behavioral skills and personal management skills
6. To impart training for empowerment, thereby preparing students to become successful professionals

**Course Outcomes (COs):**

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

- CO1. Developed critical acumen and creative ability besides making them industry-ready.
- CO2. Appropriate use of English language while clearly articulating ideas.
- CO3. Developing insights into Language and enrich the professional competence of the students.
- CO4. Enable students to meet challenges in job and career advancement.

**INTRODUCTION**

Definition and Introduction to Soft Skills – Hard Skills vs Soft Skills – Significance of Soft/Life/Self Skills – Self and SWOT Analysis *and*

**1. Exercises on Productivity Development**

Effective/ Assertive Communication Skills (Activity based)  
Time Management (Case Study)  
Creativity & Critical Thinking (Case Study)  
Decision Making and Problem Solving (Case Study)  
Stress Management (Case Study)

**2. Exercises on Personality Development Skills**

Self-esteem (Case Study)  
Positive Thinking (Case Study)  
Emotional Intelligence (Case Study)  
Team building and Leadership Skills (Case Study)  
Conflict Management (Case Study)

**3. Exercises on Presentation Skills**

Netiquette

Importance of Oral Presentation – Defining Purpose- Analyzing the audience-Planning Outline and Preparing the Presentation- Individual & Group Presentation- Graphical Organizers- Tools and Multi-media Visuals

One Minute Presentations (Warming up)

PPT on Project Work- Understanding the Nuances of Delivery- Body Language – Closing and Handling Questions – Rubrics for Individual Evaluation (Practice Sessions)

#### **4. Exercises on Professional Etiquette and Communication**

Role-Play and Simulation- Introducing oneself and others, Greetings, Apologies, Requests, Agreement & Disagreement....etc.

Telephone Etiquette

Active Listening

Group Discussions (Case study) - Group Discussion as a part of Selection Procedure - Checklist of GDs

Analysis of Selected Interviews (Objectives of Interview)

Mock-Interviews (Practice Sessions)

Job Application and Preparing Resume

Process Writing (Technical Vocabulary) – Writing a Project Report-Assignments

#### **5. Exercises on Ethics and Values**

Introduction — Types of Values - Personal, Social and Cultural Values - Importance of Values in Various Contexts

Significance of Modern and Professional Etiquette – Etiquette (Formal and Informal Situations with Examples)

Attitude, Good Manners and Work Culture (Live Examples)

Social Skills - Dealing with the Challenged (Live Examples)

Professional Responsibility – Adaptability (Live Examples)

Corporate Expectations

Note: Hand-outs are to be prepared and given to students.

Training plan will be integrated in the syllabus.

Topics mentioned in the syllabus are activity-based.

#### **SUGGESTED READING:**

1. Alex, K. 2012. Soft Skills. S. Chand Publishers
2. Management Shapers. 2011. Collection of 28 Books by different Authors. Universities Press.
3. Sherfield, Robert M. 2005. et al Cornerstone: Developing Soft Skills. Pearson
4. Suresh Kumar,E; Sreehari, P. & Savithri, J. 2011. Communication Skills and Soft Skills
5. An Integrated Approach. New Delhi: Pearson
6. The ACE of Soft Skills by Gopalaswamy Ramesh & Mahadevan Ramesh. 2013. Pearson Publishers. New Delhi.
7. Patnaik, P. 2011. Group Discussion and Interview Skills. New Delhi: Foundation
8. Sudhir Andrews. 2009. How to Succeed at Interviews. New Delhi: Tata McGraw Hill
9. Sasikumar, V & Dhamija, P.V. 1993. Spoken English - A Self-Learning Guide to Conversation Practice. New Delhi: Tata McGraw-Hill
10. Dixso, Richard J. Everyday Dialogues in English. Prentice Hall India Pvt Ltd
11. Mukhopadhyay. L et al. 2012. Polyskills. New Delhi: CUP India Pvt Ltd

12. Rizvi, M. A. 2005. Effective Technical Communication. New Delhi: Tata McGraw Hill
13. The Hindu Speaks on Education by the Hindu Newspaper
14. Naterop, B. Jean and Revell, Rod. 2004. Telephoning in English. Cambridge: CUP

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**20MCS202–ADVANCED ALGORITHMS**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
3	0	0	3

**Prerequisites:**

1. A course on “Computer Programming & Data Structures”
2. A course on “Advanced Data Structures & Algorithms”

**Course Objectives:**

1. Introduces the recurrence relations for analyzing the algorithms
2. Introduces the graphs and their traversals.
3. Describes major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force , Transform and Conquer approaches) and mention problems for which each technique is appropriate;
4. Describes how to evaluate and compare different algorithms using worst-case, average-case and best-case analysis.
5. Introduces string matching algorithms
6. Introduces linear programming.

**Course Outcomes:**

1. Ability to analyze the performance of algorithms
2. Ability to choose appropriate data structures and algorithm design methods for a specified application
3. Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs

**UNIT - I**

Classification of algorithms, Algorithm Specifications, Mathematical analysis of Recursive Algorithms

Introduction to recurrence equations, formulation of recurrence equations, Techniques for solving recurrence equations, Solving recurrence equations, Solving Recurrence Equations using polynomial reduction, Divide and conquer recurrences

**UNIT - II**

**Graphs**

Graph representations, Graph traversals

**Brute Force Approaches**

Computational Geometry Problems-Closest pair problem, Convex Hull Problem, Exhaustive Searching- Magic Squares problem, Container Loading problem, Knapsack Problem, Assignment Problem

**UNIT - III**

**Divide and Conquer approach**

Multiplication of long integers, Strassen’s matrix multiplication, Fourier Transform

Greedy algorithms:- Coin change problem, Scheduling problems, knapsack problem, optimal storage on tapes, optimal tree problems, optimal graph problems

**UNIT - IV**

**Transform and Conquer approach**

Matrix operations- Gaussian Elimination method, LU decomposition, Crout's method of decomposition

**Dynamic Programming**

Computing binomial coefficients, Multistage graph problem, Transitive Closure and Warshall algorithm, Floyd warshall all pairs shortest path problem, TSP, Flow shop scheduling algorithm

**UNIT - V**

**String algorithms**

Basic string algorithms, Longest Common Subsequences.

Linear Programming, Graphical method for solving LPP, Simplex method, Minimization problems, Principle of Duality, Max Flow problem

**Textbook:**

1. Design and Analysis of Algorithms, S.Sridhar, OXFORD University Press

**References:**

1. Introduction to Algorithms, second edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest and C.Stein, PHI Pvt. Ltd./ Pearson Education.
2. Fundamentals of Computer Algorithms, Ellis Horowitz, SatrajSahni and Rajasekharam, Universities Press.
3. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education

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**20MCS203 – SOFT COMPUTING**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
3	0	0	3

**Course Objectives:**

1. Familiarize with soft computing concepts
2. Introduce and use the idea of fuzzy logic and use of heuristics based on human experience
3. Familiarize the Neuro-Fuzzy modeling using Classification and Clustering techniques
4. Learn the concepts of Genetic algorithm and its applications
5. Acquire the knowledge of Rough Sets.

**Course Outcomes:**

1. Identify the difference between Conventional Artificial Intelligence to Computational Intelligence.
2. Understand fuzzy logic and reasoning to handle and solve engineering problems
3. Apply the Classification and clustering techniques on various applications.
4. Understand the advanced neural networks and its applications
5. Perform various operations of genetic algorithms, Rough Sets.
6. Comprehend various techniques to build model for various applications

**UNIT-I**

**Introduction to Soft Computing:** Evolutionary Computing, "Soft" computing versus "Hard" computing, Soft Computing Methods, Recent Trends in Soft Computing, Characteristics of Soft computing, Applications of Soft Computing Techniques.

**UNIT-II**

**Fuzzy Systems:** Fuzzy Sets, Fuzzy Relations, Fuzzy Logic, Fuzzy Rule-Based Systems

**UNIT-III**

Fuzzy Decision Making, Particle Swarm Optimization,

**UNIT-IV**

**Genetic Algorithms:** Basic Concepts, Basic Operators for Genetic Algorithms, Crossover and Mutation Properties, Genetic Algorithm Cycle, Fitness Function, Applications of Genetic Algorithm.

**UNIT-V**

Rough Sets, Rule Induction, and Discernibility Matrix, Integration of Soft Computing Techniques.

**Text Books:**

1. Soft Computing – Advances and Applications - Jan 2015 by B.K. Tripathy and J. Anuradha– Cengage Learning

**References:**

1. S. N. Sivanandam & S.N.Deepa, “Principles of Soft Computing”, 2nd edition, Wiley India, 2008.
2. David E. Goldberg, “Genetic Algorithms-In Search, optimization and Machine learning”, Pearson Education.
3. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, Pearson Education 2004.
4. G.J. Klir& B. Yuan, “Fuzzy Sets & Fuzzy Logic”, PHI, 1995.
5. Melanie Mitchell, “An Introduction to Genetic Algorithm”, PHI, 1998.
6. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, McGraw- Hill International ditions, 1995

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**20MCS204 – DIGITAL FORENSICS**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
3	0	0	3

**Course Objectives:**

1. Know the history and evaluation of digital forensics
2. Describe various types of cyber crime
3. Understand benefits of forensics
4. Implement forensics readiness plan

**Course Outcomes:**

1. Interpret and appropriately apply the laws and procedures associated with identifying, acquiring, examining and presenting digital evidence.
2. Create a method for gathering, assessing and applying new and existing legislation and industry trends specific to the practice of digital forensics

**UNIT - I**

**Computer Forensics Fundamentals**

Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement — Computer Forensic Technology — Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined — Data Back-up and Recovery — The Role of Back-up in Data Recovery — The Data-Recovery Solution.

**UNIT - II**

**Evidence Collection and Data Seizure**

Why Collect Evidence? Collection Options — Obstacles — Types of Evidence — The Rules of Evidence — Volatile Evidence — General Procedure — Collection and Archiving — Methods of Collection — Artifacts — Collection Steps — Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene — Computer Evidence Processing Steps — Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication — Practical Consideration — Practical Implementation.

**UNIT - III**

**Computer Forensics analysis and validation**

Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions

**Network Forensics**

Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project.

**Processing Crime and Incident Scenes**

Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case

**UNIT - IV****Current Computer Forensic tools**

Evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

**Cell phone and mobile device forensics**

Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

**UNIT - V****Working with Windows and DOS Systems**

Understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

**Textbooks:**

1. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
2. Computer Forensics and Investigations by Nelson, Phillips Enfinger, Steuart, CENGAGE Learning

**References:**

1. Real Digital Forensics by Keith J. Jones, Richard Bejtlich, Curtis W. Rose, Addison-Wesley Pearson Education
2. Forensic Compiling, A Tractitioneris Guide by Tony Sammes and Brian Jenkinson, Springer International edition.
3. Computer Evidence Collection & Presentation by Christopher L.T. Brown, Firewall Media.
4. Homeland Security, Techniques & Technologies by Jesus Mena, Firewall Media.
5. Software Forensics Collecting Evidence from the Scene of a Digital Crime by Robert M. Slade, TMH 2005
6. Windows Forensics by Chad Steel, Wiley India Edition.

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**20MCS205 – DATA ANALYTICS**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
3	0	0	3

**Course Objectives:**

1. To explore the fundamental concepts of data analytics.
2. To learn the principles and methods of statistical analysis
3. Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.
4. To understand the various search methods and visualization techniques.

**Course Outcomes:**

1. Understand the impact of data analytics for business decisions and strategy
2. Carry out data analysis/statistical analysis
3. To carry out standard data visualization and formal inference procedures
4. Design Data Architecture
5. Understand various Data Sources

**UNIT - I**

**Data Management**

Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality(noise, outliers, missing values, duplicate data) and Data Processing & Processing.

**UNIT - II**

**Data Analytics**

Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and variables, Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

**UNIT - III**

**Regression**

Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc.

Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

**UNIT - IV**

**Object Segmentation**

Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees etc. Time Series Methods: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and Analyze for prediction

**UNIT - V**

**Data Visualization**

Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

**Textbooks:**

1. Student's Handbook for Associate Analytics – II, III.
2. Data Mining Concepts and Techniques, Han, Kamber, 3<sup>rd</sup> Edition, Morgan Kaufmann Publishers.

**References:**

1. Introduction to Data Mining, Tan, Steinbach and Kumar, AddisonWiseley, 2006.
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira
3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Millway Labs Jeffrey D Ullman Stanford Univ.

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**20MCS206 – PARALLEL COMPUTING**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
3	0	0	3

**Prerequisites:**

1. A Course on “Computer Organization & Architecture”
2. A Course on “Operating Systems”
3. A Course on “Computer Programming”

**Course Objectives:**

1. To introduce the foundations of parallel Computing
2. To learn various parallel computing architectures and programming models
3. To gain knowledge of writing efficient parallel programs

**Course Outcomes:**

1. Ability to understand the concepts of parallel architectures
2. Ability to select the data structures that efficiently model the information in a problem.
3. Ability to develop an efficient parallel algorithm to solve it.
4. Ability to implement an efficient and correct code to solve it, analyse its performance

**UNIT – I**

**Parallel Computing**

Introduction, Motivation and scope - Parallel Programming Platforms – Basic Communication Operations

**UNIT - II**

**Principles of Parallel Algorithm Design**

Analytical Modelling of Parallel Programs

**UNIT - III**

**Programming using Message Passing Paradigm (MPI)**

Programming Shared Address Space Platforms (PThreads)

**UNIT - IV**

**Dense Matrix Algorithms (Matrix-Vector Multiplication, Matrix-Matrix Multiplication)**

Sorting Algorithms (Insertion Sort, Bubble Sort, Quick Sort, Bucket Sort, Enumeration Sort, Radix Sort)

**UNIT - V**

**Graph Algorithms (Minimum Spanning Tree: Prim's Algorithm**

Single-Source Shortest Paths: Dijkstra's Algorithm) Search Algorithms ( DFS, BFS)

**Textbook:**

1. Introduction to Parallel Computing, Second Edition, Ananth Grama, George Karypis, Vipin Kumar, Anshul Gupta, Addison-Wesley, 2003, ISBN: 0201648652

**References:**

1. Parallel Computing – Theory and Practice, Second Edition, Michael J. Quinn, Tata McGraw-Hill Edition.
2. Parallel Computers – Architectures and Programming, V. Rajaraman, C. Siva Ram Murthy, PHI.

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**20MCS207 – BLOCKCHAIN TECHNOLOGY**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
3	0	0	3

**Prerequisites:**

1. Knowledge in security and applied cryptography
2. Knowledge in distributed databases

**Course Objectives:**

1. Give an introduction to block chain technology and Cryptocurrency

**Course Outcomes:**

1. Familiarise the functional/operational aspects of Cryptocurrency ECOSYSTEM.
2. Understand emerging abstract models for Blockchain Technology.
3. Identify major research challenges and technical gaps existing between theory and practice in Cryptocurrency domain

**UNIT- I**

**Introduction**

Block chain or distributed trust, Protocol, Currency, Cryptocurrency,  
How a Cryptocurrency works, Crowdfunding

**UNIT- II**

**Extensibility of Blockchain concepts**

Digital Identity verification , Block chain Neutrality , Digital art , Blockchain Environment

**UNIT- III**

**Blockchain Science**

Gridcoin , Folding coin, Blockchain Genomics ,Bitcoin MOOCs

**UNIT - IV**

**Currency**

Token ,Tokenizing ,Campuscoin , Coindrop as a strategy for Public adoption, Currency  
Mutiplicity , Demurrage currency

**UNIT - V**

**Technical challenges**

Business model challenges, Scandals and Public perception, Government Regulations

**Textbook:**

1. Blockchain Blue print for Economy, Melanie Swan, SPD Oreilly.

**Reference:**

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps 1<sup>st</sup>Edition, by Daniel Drescher

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**20MCS208 – HUMAN COMPUTER INTERACTION**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
3	0	0	3

**Course Objectives:**

1. To understand the design principles of developing a Human Computer Interface (HCI).
2. To learn tools and devices required for designing a good interface

**Course Outcomes:**

1. Acquire knowledge on principles and components of HCI.
2. Analyze product usability evaluations and testing methods
3. Design an effective user interface for software application using the building tools and techniques

**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, direct manipulation, graphical system, Characteristics, Web user – interface popularity, characteristics- Principles of user interface.

**UNIT - II**

**Design process**

Human interaction with computers, important of human characteristics in design, human considerations in design, Human interaction speeds, understanding business junctions.

**UNIT - III**

**Screen Designing**

Interface design goals, Screen meaning and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presenting information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design.

**UNIT - IV**

**Windows** - Window characteristics, components of a window, presentation styles, types, management, organizing window functions, operations Selection of device based and screen based controls.

**UNIT - V**

**Write clear text and messages** - Create meaningful Graphics, Icons, Images, Choose proper colors

**Interaction Devices** - Keyboard and function keys, pointing devices, speech recognition digitization and generation, image and video displays, drivers.

**Text Books:**

1. Wilbent. O. Galitz ,“The Essential Guide To User Interface Design”, Second Edition, Wiley India Edition
2. Ben Sheiderman, “Designing The User Interface”, Third Edition, Addison-Wesley

**Reference:**

1. Alan Cooper, “The Essential Of User Interface Design”, Wiley – Dream Tech Ltd., 2002.

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**20MCS209 – COMPUTER VISION**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
3	0	0	3

**Course Objectives:**

1. To review image processing techniques for computer vision
2. To understand shape and region analysis
3. To understand Hough Transform and its applications to detect lines, circles, ellipses
4. To understand three-dimensional image analysis techniques
5. To understand motion analysis
6. To study some applications of computer vision algorithms

**Course Outcomes:**

1. Identify basic concepts, terminology, theories, models and methods in the field of computer vision.
2. Describe known principles of human visual system.
3. Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition,
4. Suggest a design of a computer vision system for a specific problem

**UNIT - I**

**Image Processing Foundations**

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture

**UNIT - II**

**Shapes and regions**

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments

**UNIT - III**

**Hough Transform**

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation

**UNIT - IV**

**3D Vision And Motion**

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D

reconstruction– introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline based motion – optical flow – layered motion

**UNIT - V****Applications**

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians

**Textbook:**

1. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.

**References:**

1. R. Szeliski, “Computer Vision: Algorithms and Applications”, Springer 2011.
2. Simon J. D. Prince, “Computer Vision: Models, Learning, and Inference”, Cambridge University Press, 2012.
3. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, 2012.
4. D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012.
5. Jan Erik Solem, “Programming Computer Vision with Python: Tools and algorithms for analyzing images”, O'Reilly Media, 2012.

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**20MCS210 – DISTRIBUTED DATABASES**

M.Tech. CSE I Year, II Semester

L	T	P	C
3	0	0	3

**Prerequisites :**

1. A course on “Database Management Systems”

**Course Objectives:**

1. To acquire knowledge on parallel and distributed databases and its applications.
2. To study the usage and applications of Object Oriented databases.
3. To learn the modeling and design of databases
4. To acquire knowledge on parallel and distributed databases and its applications.
5. Equip students with principles and knowledge of parallel and object oriented databases.
6. Topics include distributed DBMS architecture and design; query processing and optimization; distributed transaction management and reliability; parallel and object database management systems.

**Course Outcomes:**

1. Understand theoretical and practical aspects of distributed database systems.
2. Study and identify various issues related to the development of distributed database system.
3. Understand the design aspects of object oriented database system and related development.
4. Ability to write global queries for distributed databases.

**UNIT - I**

**Distributed Databases: An Overview**

Features of Distributed versus Centralized Databases, Principles of Distributed Databases, Levels Of Distribution Transparency  
Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed Databases, Distributed Database Design

**UNIT - II**

**Translation of Global Queries to Fragment Queries**

Equivalence transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries, Optimization of Access Strategies, A Framework for Query Optimization, Join Queries, General Queries

**UNIT - III**

**The Management of Distributed Transactions**

A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural Aspects of Distributed Transactions

Concurrency Control, Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

**UNIT - IV****Reliability**

Basic Concepts, 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, Catalog Management in Distributed Databases, Authorization and Protection

**UNIT - V****Architectural Issues**

Alternative Client/Server Architectures, Cache Consistency, Object Management, Object Identifier Management, Pointer Swizzling, Object Migration, Distributed Object Storage, Object Query Processing, Object Query Processor Architectures, Query Processing Issues, Query Execution, Transaction Management, Transaction Management in Object DBMSs, Transactions as Objects.

Database Integration, Scheme Translation, Scheme Integration, Query Processing Query Processing Layers in Distributed Multi-DBMSs, Query Optimization Issues Transaction Management Transaction and Computation Model, Multidatabase Concurrency Control, Multidatabase Recovery, Object Orientation and Interoperability, Object Management Architecture CORBA and Database interoperability, Distributed Component Object Model, COM/OLE and Database Interoperability, PUSH-Based Technologies

**Textbooks:**

1. Distributed Databases Principles & Systems, Stefano Ceri, Giuseppe Pelagatti, TMH.
2. Principles of Distributed Database Systems, M. Tamer Ozsu, Patrick Valduriez, Pearson Education, 2nd Edition.

**References:**

1. Distributed Database Systems, Chanda Ray, Pearson.
2. Distributed Database Management Systems, S.K.Rahimi and Frank.S.Haug, Wiley.

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**20MCS211 – SOA & MICRO-SERVICES**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
3	0	0	3

**Pre-requisites:**

1. The course assumes a reasonable comfort and background about Information Technology and Management Information Systems.

**Course Objectives:**

1. To gain understanding of the basic principles of service orientation
2. To learn service oriented analysis techniques
3. To learn technology underlying the service design
4. To learn the concepts such as SOAP, Registering and Discovering Services.

**Course Outcomes:**

At the end of this course, students are expected to gain the following learning:

1. Get the foundations and concepts of service based computing
2. Advocate the importance and means of technology alignment with business
3. Understanding the basic operational model of web services,
4. Gain the knowledge of key technologies in the service oriented computing arena
5. Apply and practice the learning through a real or illustrative project/case study.

**UNIT - I**

**Software Architecture:** Need for Software Architecture , Objectives of Software Architecture, Types of Information Technology (IT) Architecture, Architectural Patterns and Styles **Architecting Process for Software Applications** :Architectural Considerations ,Architecting Process for Software Applications , Level 0: High-Level Architecture , Level 1: Solution Architecture Detailed Design

**UNIT - II**

**SOA and MSA Basics:** Service Orientation in Daily Life, Evolution of SOA and MSA Service-oriented Architecture and Microservices architecture –Drivers for SOA, Dimensions of SOA, Conceptual Model of SOA, Standards And Guidelines for SOA, Emergence of MSA **Service-Oriented Architecture:** Considerations for Enterprise-wide SOA, Strawman Architecture for Enterprise- wide SOA, Enterprise SOA Reference Architecture, Object-oriented Analysis and Design (OOAD) Process, Service-oriented Analysis and Design (SOAD) Process

**UNIT - III**

**Service-Oriented Applications:** Considerations for Service-oriented Applications, Patterns for SOA, Pattern-based Architecture for Service-oriented Applications, Composite Applications, Composite Application Programming Model

**Service-Oriented Analysis and Design:** Need for Models, Principles of Service Design Non-functional Properties for Services, Design of Activity Services (or Business Services) Design of Data Services, Design of Client Services, Design of Business Process Services

**UNIT - IV**

**Microservices Architecture:** Trend in SOA – Microservices Architecture (MSA): Services Model for Cloud and Mobile Solutions, API Adoption on the Rise, Challenges and Takeways from SOA Implementations Architecture Trend – Microservices Architecture, Microservices Architecture in Action

**Cloud and MSA:** Cloud Services, Hybrid Cloud Services, Considerations for Hybrid Cloud Services, Cloud Services and MSA, MSA for SMAC Solutions

**UNIT - V**

**Mobile and MSA:** Mobile Technologies, Types of Mobile Applications, MSA for mobile solutions

Case Study: SOA – Loan Management System (LMS) PoC, MSA – APIaryPoC

**Text book:**

1. Shankar Kambhampaty, Service - Oriented Architecture & Microservices Architecture, 3ed: For Enterprise, Cloud, Big Data and Mobile , ISBN: 9788126564064, Wiley

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**20MCS2L1 – ADVANCED ALGORITHMS LAB**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
0	0	4	2

**Course Objective:**

1. The student can able to attain knowledge in advance algorithms.

**Course Outcome:**

1. The student can able to analyze the performance of algorithms

**List of Experiments**

1. Implement assignment problem using Brute Force method
2. Perform multiplication of long integers using divide and conquer method.
3. Implement solution for knapsack problem using Greedy method.
4. Implement Gaussian elimination method.
5. Implement LU decomposition
6. Implement Warshall algorithm
7. Implement Rabin Karp algorithm.
8. Implement KMP algorithm.
9. Implement Harspool algorithm
10. Implement max-flow problem.

**Textbook:**

1. Design and Analysis of Algorithms, S.Sridhar, OXFORD University Press

**References:**

1. Introduction to Algorithms, second edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest and C.Stein, PHI Pvt. Ltd./ Pearson Education.
2. Fundamentals of Computer Algorithms, Ellis Horowitz, SatrajSahni and Rajasekharam, Universities Press.
3. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education

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**20MCS2L2 – DIGITAL FORENSICS LAB**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
0	0	4	2

**Course Objectives:**

1. To provide students with a comprehensive overview of collecting, investigating, preserving, and presenting evidence of cyber crime left in digital storage devices, emails, browsers, mobile devices using different Forensics tools
2. To Understand file system basics and where hidden files may lie on the disk, as well as how to extract the data and preserve it for analysis.
3. Understand some of the tools of e-discovery.
4. To understand the network analysis ,Registry analysis and analyse attacks using different forensics tools

**Course Outcomes:**

1. Learn the importance of a systematic procedure for investigation of data found on digital storage media that might provide evidence of wrong-doing
2. To Learn the file system storage mechanisms and retrieve files in hidden format
3. Learn the use of computer forensics tools used in data analysis.
4. Learn how to find data that may be clear or hidden on a computer disk, find our the open ports for the attackers through network analysis , Registry analysis.

**List of Experiments**

1. **Perform email analysis** using the tools like Exchange EDB viewer , MBOX viewer andView user mailboxes and public folders , Filter the mailbox data based on various criteria, Search for particular items in user mailboxes and public folders
2. **Perform Browser history analysis** and get the downloaded content , history ,savedlogins,searches ,websites visited etc using Foxtton Forensics tool, Dumpzilla .
3. **Perform mobile analysis** in the form of retrieving call logs ,SMS log ,all contacts listusing the forensics tool like SAFT
4. **Perfrom Registry analysis** and get boottime logging using process monitor tool
5. **Perform Disk imaging and cloning the** using the X-way Forensics tools
6. **Perform Data Analysis i.e.** History about open file and folder, and view folder actions using Lastview activity tool
7. **Perform Network analysis** using the Network Miner tool .
8. **Perform information for incident response** using the crowd Response tool
9. **Perform File type detection using** Autospy tool
10. **Perform Memory capture and analysis** using the Live RAM capture or any forensic tool

**Textbooks:**

1. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
2. Computer Forensics and Investigations by Nelson, Phillips Enfinger, Steuart, CENGAGE Learning

**References:**

1. Real Digital Forensics by Keith J. Jones, Richard Bejtlich, Curtis W. Rose, Addison-Wesley Pearson Education
2. Forensic Compiling, A Tractitioneris Guide by Tony Sammes and Brian Jenkinson, Springer International edition.
3. Computer Evidence Collection & Presentation by Christopher L.T. Brown, Firewall Media.
4. Homeland Security, Techniques & Technologies by Jesus Mena, Firewall Media.
5. Software Forensics Collecting Evidence from the Scene of a Digital Crime by Robert M. Slade, TMH 2005
6. Windows Forensics by Chad Steel, Wiley India Edition.

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**20MCS2L3 – DATA ANALYTICS LAB**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
0	0	4	2

**Course Objectives:**

1. To provide an overview of a new language R used for data Analytics.
2. To present the basic techniques for extracting information from large datasets
3. To familiarize students with how various statistics like mean median etc. can be collected for data exploration.
4. Predict outcomes with supervised learning techniques and Unearth the patterns with unsupervised techniques

**Course Outcomes:**

After completion of this course students will be able to

1. Understand different files formats like .csv and .txt and learn how access these files.
2. Work on Data preprocessing methods
3. Understand various Data Sources
4. Carry out statistical analysis
5. Understand various techniques to visualize results of data.

**List of Experiments**

1. Demonstrate data cleaning – missing values
2. Implement data normalization (min-max, z-score)
3. Implement attribute subset selection for data reduction
4. Demonstrate outlier detection
5. Perform analytics on any standard data set
6. Implement linear regression
7. Implement logistic regression
8. Construct decision tree for weather data set
9. Analyze time-series data
10. Work on any data visualization tool

**Textbooks:**

1. Student's Handbook for Associate Analytics – II, III.
2. Data Mining Concepts and Techniques, Han, Kamber, 3<sup>rd</sup> Edition, Morgan Kaufmann Publishers.

**References:**

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addison Wisley, 2006.
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira
3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman  
Milliway Labs Jeffrey D Ullman Stanford Univ.

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**20MCS2L4 – PARALLEL COMPUTING LAB**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
0	0	4	2

**Prerequisites:**

1. A Course on “Computer Organization & Architecture”
2. A Course on “Operating Systems”
3. A Course on “Computer Programming”

**Course Objectives:**

1. To introduce the foundations of parallel computing
2. To learn various parallel computing architectures and programming models
3. To gain knowledge of writing efficient parallel programs

**Course Outcomes:**

1. Ability to understand the concepts of parallel architectures
2. Ability to select the data structures that efficiently model the information in a problem.
3. Ability to develop an efficient parallel algorithm to solve it.
4. Ability to implement an efficient and correct code to solve it, analyze its performance

**List of Programs**

1. Design a parallel program to implement Matrix-Vector and Matrix-Matrix Multiplication using MPI library.
2. Design a parallel program to implement Bubble Sort using OpenMP and Pthread Programming Constructs.
3. Design a parallel program to implement Quick Sort using OpenMP and Pthread Programming Constructs.
4. Design a parallel program to implement Bucket Sort using OpenMP and Pthread Programming Constructs.
5. Design a parallel program to implement Prim's Algorithm using OpenMP and Pthread Programming Constructs.
6. Design a parallel program to implement DFS Algorithm using OpenMP and Pthread Programming Constructs.
7. Design a parallel program to implement BFS Algorithm using OpenMP and Pthread Programming Constructs.
8. Design a parallel program to implement Dijkstra's Algorithm using MPI library.

**Textbook:**

1. Introduction to Parallel Computing, Second Edition, Ananth Grama, George Karypis, Vipin Kumar, Anshul Gupta, Addison-Wesley, 2003, ISBN: 0201648652

**References:**

1. Parallel Computing – Theory and Practice, Second Edition, Michael J. Quinn, Tata McGraw-Hill Edition.
2. Parallel Computers – Architectures and Programming, V. Rajaraman, C. Siva Ram Murthy, PHI.

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**20MCS2L5 – BLOCKCHAIN TECHNOLOGY LAB**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
0	0	4	2

**Course Objective:**

1. The main objective of this course is to provide the knowledge in implementing Block chains using hash algorithms and bitcoins generation

**Course Outcome:**

1. By the end of this course students will be able to learn various Hash Algorithms and generation of Bitcoins.

**List of Experiments**

1. Implement Block hash using SHA-256 algorithm using java code or python code
2. Implement Message authentication using Java code or Python code.
3. Implement MD5 algorithm using Java code or python code
4. Implement RIPEMD-160 algorithm using Java code or python code
5. Implement Whirlpool algorithm using Java code or python code
6. Write a case study how the Bitcoins were generated and implemented .

**Textbook:**

1. Blockchain Blue print for Economy, Melanie Swan, SPD Oreilly.

**Reference:**

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps 1<sup>st</sup> Edition, by Daniel Drescher

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**20MAC201 – PROFESSIONAL ETHICS  
(AUDITCOURSE-1)**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
2	0	0	0

**Prerequisite(s):** None

**Course Objectives:**

Develop ability to

1. Imbibe and internalize the Values and Ethical Behavior
2. Understand the basic theories of Ethics
3. Practice as a professional engineer.
4. Identify work place ethics.
5. Understand international ethical practices.

**Course Outcomes (COs):**

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

- CO1. Understand the importance of Values and Ethics in their personal lives
- CO2. Understand ethics in professional careers.
- CO3. Learn the rights and responsibilities as an employee.
- CO4. Understand work ethics
- CO5. Understand Global ethics

**UNIT - I : Introduction to Professional Ethics**

Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

**UNIT – II : Basic Theories**

Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

**UNIT - III : Professional Practices in Engineering**

Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession. Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

**UNIT - IV : Work Place Rights & Responsibilities**

Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation. Ethics in changing domains of research - The US

government wide definition of research misconduct, research misconduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.

**UNIT - V : Global issues in Professional Ethics**

Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights.

**TEXT BOOKS:**

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

**REFERENCE BOOKS:**

1. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e , Cengage learning, 2015.
2. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

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**20MAC202 – DISASTER MANAGEMENT  
(AUDITCOURSE-1)**

**M.Tech. CSE I Year, II Semester**

L	T	P	C
2	0	0	0

**Prerequisite(s):** None.

**Course Objectives:**

Develop ability to

1. Acquire knowledge on disasters and assess their impact.
2. Comprehend the monitoring techniques of disasters
3. Understand the issues and policies involved in the disaster management.
4. Evaluate the pre-disaster risk and vulnerability reduction strategies.
5. Assess the role of NGO's, Government bodies and Public in the disaster mitigation and Management.

**Course Outcomes (COs):**

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

- CO1. Explain the different types of disasters.
- CO2. Evaluate the impact of disasters on the community.
- CO3. Suggest a suitable monitoring technique for disasters.
- CO4. Recommend appropriate vulnerability reduction strategy and risk reducing techniques.
- CO5. Estimate the disaster infrastructure development and role of NGO's, Government bodies and Public in the disaster mitigation and management.

**UNIT-I**

**Introduction:** Meaning and Concept of Environmental hazards, Environmental Disasters and Environmental stress. Different approaches and relation with human Ecology - Landscape Approach – Ecosystem Approach – Perception approach – Human ecology and its application in geographical researches.

**UNIT-II**

**Types of Environmental hazards & Disasters:** Natural and Man induced. Natural Hazards – Planetary Hazards/ Disasters – Extra Planetary Hazards/ disasters – Planetary Hazards – Endogenous Hazards – Exogenous Hazards.

**UNIT-III**

**Endogeneous Hazards/ Disasters: Volcanos** –Earthquakes - Landslides – Earthquake Hazards/ disasters – Causes of Earthquakes – Distribution of Earthquakes – Hazardous effects of earthquakes – Earthquake Hazards in India – Human adjustment, perception & mitigation of earthquake.

**UNIT-IV**

**Exogenous Hazards/ Disasters: Infrequent events** – Cumulative atmospheric hazards/ disasters.

**Infrequent events:** Cyclones – Lightning – Hailstorms.

**Cyclones:** Tropical cyclones & Local storms – Destruction by tropical cyclones & local storms (causes, distribution, human adjustment, perception & mitigation)

**Cumulative Atmospheric Hazards/ Disasters:** Floods – Droughts – Cold waves – Heat waves.

**Floods:** Causes of floods – Flood hazards – Flood control measures (Human adjustment, perception & mitigation).

**Droughts:** Impacts of droughts – Drought hazards in India – Drought control measures.

**Extra Planetary Hazards/ Disasters** – Man induced Hazards/ Disasters – Physical hazards/ Disasters – Soil Erosion.

**Soil Erosion:** Mechanics & forms of Soil Erosion – Factors & causes of soil erosion – Conservation measures of Soil Erosion.

**Chemical Hazards/ Disasters:** Release of toxic chemicals, nuclear explosion – Sedimentation processes:- Global Sedimentation problems – Regional Sedimentation problems – Sedimentation & Environmental problems – Corrective measures of Erosion & Sedimentation.

**Biological hazards/ disasters:** Population Explosion.

## UNIT–V

**Emerging approaches in Disaster Management** – Three Stages

- 1) Pre-disaster stage (preparedness)
- 2) Emergency Stage
- 3) Post Disaster stage – Rehabilitation

## TEXT BOOKS:

1. Manual on National Disaster Management Plan, National Disaster Management Authority, Ministry of Home affairs, Government of India.
2. Disaster Management, Dr.Mrinalini Pandey, Wiley India Pvt Ltd., 2014.

## REFERENCE BOOKS:

1. Disaster Science and Management, Tushar Bhattacharya, McGraw Hill Education, 2015.
2. Disaster Mitigation: Experiences and Reflections, PardeepSahni, PHI Learning, 2010.
3. Natural Hazards and Disasters, Donald Hyndman and David Hyndman, Cengage Learning, 2013.
4. Disaster Management Global Challenges and Local Solutions, Rajib, S and Krishna Murthy, R.R, Universities Press Hyderabad, 2012.
5. Earth and Atmospheric Disaster Management: Nature and Manmade,NavalePandharinath& C.K. Rajan, B.S. Publications, Hyderabad, 2009.
6. Disaster Risk Reduction in South Asia, Sahni and Pardeep, PHI learning Pvt Ltd, 2003.
7. Handbook of Disaster Management: Techniques and Guidelines, B.K. Singh, Rajat Publications, 2008.
8. Disaster Management, G.K. Ghosh, APH Publishing Corporation, 2006.
9. Natural Hazards and Disaster Management: Vulnerability and Mitigation, R.B. Singh, Rawat Publication, 2006.

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**20MCS302 – OPTIMIZATION TECHNIQUES**

**M.Tech. CSE II Year, I Semester**

L	T	P	C
3	0	0	3

**Prerequisites:**

1. A course on “Mathematics”

**Course Objectives:**

1. This course explains various optimization problems and the techniques to address those problems.
2. To study Linear Programming, dynamic programming and optimization Techniques etc.
3. To understand the theory of games.

**Course Outcomes:**

1. Gain the knowledge of optimization techniques
2. Get the skill to apply Optimization techniques to address the real time problems.

**UNIT – I**

**Introduction**

Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

**Allocation**

Linear Programming Problem - Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

**UNIT – II**

**Transportation Problem**

Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.

**Assignment problem**

Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

**UNIT - III**

**Sequencing**

Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through ‘m’ machines

**Replacement**

Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

**UNIT - IV**

**Theory Of Games**

Introduction –Terminology– Solution of games with saddle points and without saddle points- 2x 2 games –m x 2 & 2 x n games - graphical method – m x n games - dominance principle.

**Inventory**

Introduction – Single item, Deterministic models – Types - Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

**UNIT - V**

**Waiting Lines**

Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.

**Dynamic Programming** Introduction – Terminology- Bellman’s Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

**Textbooks:**

1. Operation Research, J.K.Sharma, MacMilan.
2. Introduction to Operations Research, Taha, PHI

**References:**

1. Operations Research: Methods and Problems, Maurice Saseini, ArhurYaspan and Lawrence Friedman
2. Operations Research, A.M.Natarajan, P.Balasubramaniam, A. Tamilarasi, Pearson Education.
3. Operations Research, Wagner, PHI Publications.
4. Introduction to Operations Research, Hillier &Libermann (TMH).

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**20MCS303 – HIGH PERFORMANCE COMPUTING**

**M.Tech. CSE II Year, I Semester**

L	T	P	C
3	0	0	3

**Prerequisites:**

1. A Course on “Computer Organization & Architecture”
2. Operating System Programming

**Course Objectives:**

1. To Improve the system performance
2. To learn various distributed and parallel computing architecture
3. To learn different computing technologies

**Course Outcomes:**

1. Understanding the concepts in grid computing
2. Ability to set up cluster and run parallel applications
3. Ability to understand the cluster projects and cluster OS
4. Understanding the concepts of pervasive computing & quantum computing.

**UNIT - I**

**Grid Computing:** Data & Computational Grids, Grid Architectures And Its Relations To Various Distributed Technologies. Autonomic Computing, Examples Of The Grid Computing Efforts (IBM).

**UNIT - II**

**Cluster Computing at a Glance:** Introduction, A Cluster Computer and its Architecture, Cluster Classifications, Commodity Components for clusters, Network Services/Communication SW, Cluster Middleware and SSI, RMS, Programming Environments and Tools, Cluster Applications

**Cluster Setup & Its Administration :** Introduction, Setting up the cluster, Example Cluster System – Beowlf;

**Lightweight Messaging Systems:** Introduction, Latency Bandwidth Evaluation of Communication performance, Traditional Communication Mechanisms for clusters, Lightweight Communication Mechanisms

**UNIT - III**

**Job and Resource Management Systems :** Need of Job management, Components and Architecture. **Scheduling Parallel Jobs on Clusters :** Introduction, Rigid Jobs with process migration, Malleable Jobs with Dynamic Parallelism, Communication-Based Coscheduling, Batch Scheduling. **Cluster Operating Systems:** COMPaS

**UNIT - IV**

**Pervasive Computing Concepts & Scenarios:** Hardware & Software; Human – Machine Interface.

**Device Connectivity:** Java For Pervasive Devices; Application Examples.

**UNIT - V**

Classical Vs Quantum Logic Gates; One, Two & Three Qubit Quantum Gates; Fredkin & Toffoli Gates; Quantum Circuits; Quantum Algorithms.

**Textbooks:**

1. Grid Computing, J. Joseph & C. Fellenstien, Pearson Education
2. High Performance Cluster Computing, Raj kumarBuyya, pearson Education.
3. Pervasive Computing, J. Burkhardt et.al, Pearson Education
4. Approaching Quantum Computing Marivesar, Pearson Education.

**References:**

1. The Grid 2: Blue Print for a New Computing Infrastructure, Ian Foster and Carl Kesselman, 2<sup>nd</sup> Edition, The Elsevier Series.
2. Quantum computing and Quantum Information, Nielsen& Chung L., Cambridge University Press.
3. A networking approach to Grid Computing , Minoli , Wiley

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**20MCS304 – ADHOC & SENSOR NETWORKS**

**M.Tech. CSE II Year, I Semester**

L	T	P	C
3	0	0	3

**Pre-requisites:**

1. A Course on “Computer Networks”
2. A Course on “Distributed Systems”
3. A Course on “Mobile Computing”

**Course Objectives:**

1. To understand the concepts of sensor networks
2. To understand the MAC and transport protocols for adhoc networks
3. To understand the security of sensor networks
4. To understand the applications of adhoc and sensor networks

**Course Outcomes:**

1. Understanding the state of the art research in emerging subject of ad hoc and wireless sensor networks (ASN)
2. Ability to solve the issues in real-time application development based on ASN
3. Ability to conduct further research in the ASN domain

**UNIT - I**

**Introduction to Ad Hoc Networks**

Characteristics of MANETs, Applications of MANETs and Challenges of MANETs.

**Routing in MANETs**

Criteria for classification, Taxonomy of MANET routing algorithms, Topology-based routing algorithms-Proactive: DSDV, WRP; Reactive: DSR, AODV, TORA; Hybrid: ZRP; Position-based routing algorithms-Location Services-DREAM, Quorum-based, GLS; Forwarding

**Strategies**

Greedy Packet, Restricted Directional Flooding-DREAM, LAR; Other routing algorithms-QoS Routing, CEDAR.

**UNIT - II**

**Data Transmission**

Broadcast Storm Problem, Rebroadcasting Schemes-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbour Knowledge-based: SBA, Multipoint Relaying, AHBP. Multicasting: Tree- based: AMRIS, MAODV; Mesh-based: ODMRP, CAMP; Hybrid: AMRoute, MCDAR and Geocasting: Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR.

**UNIT - III**

**Geocasting**

Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR. TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

**UNIT - IV**

**Basics of Wireless, Sensors and Lower Layer Issues**

Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer, Routing Layer.

**UNIT - V**

**Upper Layer Issues of WSN**

Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.

**Textbooks:**

1. Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P. Aggarwal, World Scientific Publications, March 2006, ISBN – 981-256-681-3
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 ( Morgan Kauffman)

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**20MCS305 – SOCIAL, WEB AND MOBILE ANALYTICS**

**M.Tech. CSE II Year, I Semester**

L	T	P	C
3	0	0	3

**Course Objective:**

1. Students must demonstrate knowledge of collecting and managing the relevant data of web and Social media analytics,
2. Identify the social business analytics and analyzing mobile data analytics with respect to publishers, operators and e-mail marketing.

**Course Outcomes:**

1. Understand the basic concepts of Web and Social Analytics.
2. Explain the process of collecting relevant data.
3. Identify the common business objectives.
4. Understand the concepts of mobile analytics.
5. Explain the concepts of mobile customer experience.
6. Analyze the mobile analytics for publisher, operator and email marketing.

**UNIT - I**

**Social Network Data:** Introduction: What Are Network Data? , Structural and Composition Variables, Modes, Affiliation Variables, Boundary Specification and Sampling, What Is Your Population?, Sampling, Types of Networks, One-Mode Networks, Two-Mode Networks, Ego-centered and Special Dyadic Networks, Network Data, Measurement and Collection, Measurement, Collection, Longitudinal Data Collection, Measurement Validity, Reliability, Accuracy, Error

**UNIT - II**

Rethinking Web Analytics: Meet Web Analytics 2.0, The What: Clickstream, The How Much: Multiple Outcomes Analysis, The Why: Experimentation and Testing.

**The Awesome World of Click Stream Analysis:** Metrics, Standard Metrics Revisited: Eight Critical Web Metrics, Visits and Visitors, Time on Page and Time on Site, Bounce Rate, Exit Rate, Conversion Rate, Engagement, Web Metrics Demystified, Four Attributes of Great Metrics, Example of a Great Web Metric, Strategically-aligned Tactics for Impactful Web Metrics, Diagnosing the Root Cause of a Metric's Performance—Conversion, Leveraging Custom Reporting, Starting with Macro Insights

**UNIT - III**

**The Key to Glory: Measuring Success:** Focus on the “Critical Few”, Five Examples of Actionable Outcome KPIs, Task Completion Rate, Share of Search, Visitor Loyalty and Recency, RSS/Feed Subscribers, % of Valuable Exits, Moving Beyond Conversion Rates, Cart and Checkout Abandonment, Days and Visits to Purchase, Average Order Value, Primary Purpose (Identify the Convertible), Measuring Macro and Micro Conversions, Examples of Macro and Micro Conversions, Quantifying Economic Value, Measuring Success for a Non-ecommerce Website, Visitor Loyalty, Visitor Recency, Length of Visit, Depth of Visit, Measuring B2B Websites.

**UNIT - IV**

**Emerging Analytics: Social, Mobile, and Video:** Measuring the New Social Web: The Data Challenge, The Content Democracy Evolution, The Twitter Revolution, Analyzing Offline Customer Experiences (Applications), Analyzing Mobile Customer Experiences, Mobile Data Collection: Options, Mobile Reporting and Analysis, Measuring the Success of Blogs, Raw Author Contribution, Holistic Audience Growth, Citations and Ripple Index, Cost of Blogging, Benefit (ROI) from Blogging, Quantifying the Impact of Twitter, Growth in Number of Followers, Message Amplification, Click-Through Rates and Conversions, Conversation Rate, Emerging Twitter Metrics, Analyzing Performance of Videos, Data Collection for Videos, Key Video Metrics and Analysis, Advanced Video Analysis.

**UNIT - V****Mobile Analytics: How Mobile Is Different than Other Digital Channels**

Understanding the Current Mobile Market Landscape, Growth in Smartphone Adoption, The Battle Between iOS and Android, The Explosion of Global Mobile Web Traffic, The Introduction of Mobile Advertising, Identifying What Is Next for Mobile Marketing, Increased Use of Apple Passbook, Improvements in Facebook's Mobile Functionality, Expansion of Location-Based Technologies, Increased Strength of Mobile Measurement, The Current State of Measuring Mobile, Marketing Activities, Mobile Device Reporting, Audience/Visitor Metrics, Mobile App Performance, The Future State of Measuring Mobile Marketing, Activities

**Textbooks:**

1. Stanley Wasserman, Katherine Faust, "Social Network Analysis: Methods And Applications" **Cambridge** University Press. (Chapter -1)
2. Avinash Kaushik, Web Analytics 2.0, The Art of Online Accountability & Science of Customer Centricity, Wiley Publishing, Inc., (Chapter-2, Chapter-3 & chapter-4)
3. Chuck Hemann, Ken Burbary, **Digital Marketing Analytics: Making Sense of Consumer Data in a Digital World**, Que Publishing, (Chapter-5)

**References:**

1. Social, Web and Mobile Analytics (IBM ICE Publication)
2. Robert A. Hanneman and Mark Riddle, "Introduction to social network methods", University of California, 2005.
3. Jure Leskovec, Stanford Univ. Anand Rajaraman, Milliway Labs, Jeffrey D. Ullman, "Mining of Massive Datasets", Cambridge University Press, 2 edition, 2014.
4. Wasserman, S., & Faust, K, "Social Network Analysis: Methods and Applications", Cambridge University Press; 1 edition, 1994.

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**20MOE301-BUSINESS ANALYTICS (OPEN ELECTIVE)**

**M.Tech. CSE II Year, I Semester**

L	T	P/D	C
3	-	-/-	3

**Prerequisite(s):** None

**Course Objectives:**

Develop ability to

1. Understand the different methods of Business analysis
2. Understand how to categorize and classify data
3. Understand the process of classification using predictive analytics
4. Understand the process of decision making using decision analysis techniques
5. Understand the concept of big data and big data processing architectures and technologies

**Course Outcomes (COs):**

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

- CO1: Identify various methods of business analysis
- CO2: Use the concept of categorization and classification on different types of data.
- CO3: Use predictive analytics techniques to classify the given data
- CO4: Apply various decision analysis techniques on given data
- CO5: Describe big data, big data architectures and technologies

**UNIT I: INTRODUCTION**

Business Analytics- Define Business Analytics, Importance of Business Analytics, Resources Important to Support Business Analytics, A categorization of Analytical Methods and Model- Predictive Analytics, Descriptive Analytics, Prescriptive Analytics.

Business Analytics in Practice- Marketing Analytics, Human Resource Analytics, Financial Analytics.

**UNIT II: DESCRIPTIVE STATISTICS**

**Overview using Data-**Definition and Goals, Types of Data-Population and Sample Data, Quantitative and categorical data, Cross Sectional and Time Series Data, Sources of data. Data Preparation: treatment of missing data, identification of outliers and erroneous data.

Creating Distribution from Data- Frequency distribution for Quantitative and Categorical Data, Relative and Frequency Distribution, Cumulative Distributions, Measures of Dispersion and Skewness.

**UNIT III: PREDICTIVE ANALYTICS**

**Probability- an Introduction to modelling uncertainty-** Conditional Probability, Random variables Discrete Probability distribution, Continuous Probability Distribution

**Simple linear regression:** Coefficient of determination, Significance tests for predictor variables, Residual analysis, **Application of predictive analytics** in retail, direct marketing, health care, financial services, insurance, supply chain, etc. Regression estimates types and models.

#### **UNIT IV: DECISION ANALYSIS**

**Problem Formulation-** Decision Trees, Payoff Table, Decision Analysis with Probabilities, Decision Analysis without Probabilities, Decision Analysis with sample information.

**Computing Branch Probabilities-** Using Bayes Theorem, Utility Theory – Utility and Decision Analysis, Utility Functions.

Business Intelligence Tools.

#### **UNIT V: BIG DATA**

**Introduction to Big Data;** Defining Big Data, Big Data examples, **Working with Big Data-** Introduction, Data Volume, Data Velocity, Data Variety

**Processing Architectures-** Introduction, data processing infrastructure challenges, shared everything and shared nothing architectures, big data processing, **Big Data Technologies-** Introduction, big data processing requirements, Technologies for big data processing: Google file system, Hadoop, Hadoop core components.

#### **TEXT BOOKS:**

1. Essentials of Business Analytics (Book Only), Camm, J.D., Cochran, J.J., Fry, M.J., Ohlmann, J.W. and Anderson D.R. Nelson Education, 2014. (Unit-I to IV)
2. Data warehousing in the age of Big Data, Krish Krishnan, Elsevier, ISBN: 9780124058910, 1st Edition.(Unit-V)
3. Business Intelligence and Analytics: Systems for Decision Support, Ramesh Sharda, Dursun Delen, Efraim Turban, 10<sup>th</sup> Edition, Pearson, 2015.

#### **REFERENCE BOOKS:**

1. The Kimball Group Reader: Practical Tools for Data Warehousing and Business Intelligence by Ralph Kimball and Margy Ross
2. Business Analytics, James Evans, Pearson, Second Edition, 2017.
3. Business Analytics- Data Analysis-Data Analysis and Decision Making, Albright Winston, Cengage Learning, Reprint 2016.
4. Business Analytics, Sahil Raj, Cengage Learning

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**20MOE302 - INDUSTRIAL SAFETY (OPEN ELECTIVE)**

**M.Tech. CSE II Year, I Semester**

L	T	P/D	C
3	-	-/-	3

**Prerequisite(s):** None

**Course Objectives:**

Develop ability to

1. Determine responsibility for safety in the workplace.
2. Learn to recognize workplace hazards.
3. Learn how to develop procedures to eliminate or lessen those hazards.
4. Apply basic Federal and State Safety Rules to the workplace.

**Course Outcomes (COs):**

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

- CO1: Understand the fundamental concepts of accident prevention with a basic knowledge of safe work rules designed to promote an accident free workplace.
- CO2: Understand the relief systems.
- CO3: Understand the electrical hazards and safety handling of equipments.
- CO4: Understand the effects of momentum and buoyancy.
- CO5: Understand different case studies.

**UNIT I**

**FIRE AND EXPLOSION:** Introduction-Industrial processes and hazards potential, mechanical electrical, thermal and process hazards. Safety and hazards regulations, Industrial hygiene. Factories Act, 1948 and Environment (Protection) Act, 1986 and rules thereof. Types of explosions in industries-vapour cloud and boiling liquid expanding vapours explosion (VCE and BLEVE), mechanical and chemical explosion.

**UNIT II**

**RELIEF SYSTEMS:** Preventive and protective management from fires and explosion-inerting, static electricity passivation, ventilation, and sprinkling, proofing, relief systems – relief valves, flares, scrubbers.

**UNIT III**

**ELECTRICAL HAZARDS:** Primary and secondary hazards-shocks, burns, scalds, falls-human safety in the use of electricity. Energy leakage-clearances and insulation-classes of insulation- voltage classifications, over current and short circuit current-heating effects of current- electromagnetic forces-corona effect-static electricity –definition, sources, hazardous conditions, control, electrical causes of fire and explosion. Lightning, hazards, lightning arrestor, installation–earthing, specifications, earth resistance, earth pit maintenance.

**UNIT IV**

**LEAKS AND LEAKAGES:** Spill and leakage of liquids, vapors, gases and their mixture from storage tanks and equipment; Estimation of leakage/spill rate through hole, pipes and vessel burst. Mitigation measures for leaks and releases.

Electrical safety management in the IT sector - Maintaining the electrical safety of computer equipment, Employee electrical safety at work.

**UNIT V**

**CASE STUDIES:** Flix borough, Bhopal, Texas, ONGC offshore, HPCL Vizag and Jaipur IOC oil-storage depot incident; Oil, natural gas, chlorine and ammonia storage and transportation hazards.

**TEXT BOOK(S)**

1. Electrical Safety Engineering, Fordham Cooper, W., Butterworth and Company, London, 1986.

**REFERENCE BOOK(S)**

1. Chemical Process Safety: Fundamentals with Applications, Crowl D.A. and Louvar J.F., 2nd Ed., Prentice Hall.2001
2. Loss Prevention in the Process Industries, Mannan S., Lee's Vol.I, 3rdEd., Butterworth- Heinemann.2004.
3. Loss Prevention in the Process Industries, Mannan S., Lee's Vol.II, 3rdEd., Butterworth- Heinemann.2005.
4. Indian Electricity Act and Rules, Government of India.
5. Power Engineers- Handbook of TNEB, Chennai, 1989.
6. Electrostatic Hazards in powder handling, Martin Glov Research Studies Pvt. LTd., England, 1988.

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**20MOE303 – OPERATIONS RESEARCH (OPEN ELECTIVE)**

M.Tech. CSE II Year, I Semester

L	T	P/D	C
3	-	-/-	3

**Prerequisite(s):** None

**Course Objectives:**

Develop ability to

1. Understand the significance of Operations Research and formulation of LPP models.
2. Understand the Algorithms of Graphical and Simplex Methods.
3. Understand the Transportation and Assignment techniques.
4. Understand the concepts of sequencing and replacement models.
5. Understand the concepts of Game theory and Inventory Control.
6. Students will understand the concepts of queuing theory and DPP.

**Course Outcomes (COs):**

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

- CO1: Describe the importance of Operations Research, Formulate a managerial decision problem into a mathematical model to solve by simplex method;
- CO2: Formulate and apply transportation and assignment problems for engineering and managerial situations.
- CO3: Apply sequencing and replacement concepts in industry applications
- CO4: Apply game theory and inventory concepts in industry applications
- CO5: Apply dynamic programming technique and queuing theory in industry applications

**UNIT I**

**Introduction:** Definition– Characteristics and Phases – Types of models – Scope and applications, limitations.

**Linear Programming Problem:** Formulation – Graphical solution – Simplex method – Artificial variables techniques: Big M Method, Two–phase method, Duality Principle.

**UNIT II**

**Transportation Problem:** Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Special cases in Transportation problems - Unbalanced Transportation problem, Degeneracy in Transportation, Profit Maximization in Transportation.

**Assignment Problem:** Introduction, Hungarian technique of Assignment problems, unbalanced problems, problems with restrictions, Maximization in Assignment problems. Travelling salesman problem

**UNIT III**

**Job Sequencing:** Introduction – Flow Shop sequencing, n jobs through 2 machines, n jobs through 3 machines, Job shop sequencing, 2 jobs through 'm' machines-graphical model.

**Replacement Model:** Introduction – Replacement of items that deteriorate with time, when money value is not counted and counted, Replacement of items that fail completely, Group Replacement.

#### UNIT IV

**Theory of Games:** Introduction –Terminology– Solution of games with saddle points and without saddle points, 2 x 2 games, m x 2 and 2 x n games - graphical method, m x n games, dominance principle.

**Inventory Models:** Introduction – Concept of EOQ, Single item - Deterministic models – Types

- Purchase inventory models with one price break and multiple price breaks, Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

#### UNIT V

**Queuing Theory:** Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel

– Poisson arrivals and exponential service times with infinite population.

**Dynamic Programming:** Introduction – Terminology- Bellman's Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

#### TEXT BOOK(S)

1. Operations Research-An Introduction, Hamdy, A.Taha, Sixth Edition, Prentice Hall of India Pvt. Ltd., 1997
2. Operations Research, S.D.Sharma, Kedarnath, Ramnath & Co., Meerut, 2009

#### REFERENCE BOOK(S)

1. Operations Research, A. M. Natarajan, P. Balasubramaniam, A. Tamilarasi, Pearson Education,2009
2. Operations Research, V. K. Kapoor, S. Chand Publishers, New Delhi, 2004

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**20MOE304 – COST MANAGEMENT OF ENGINEERING PROJECTS  
(OPEN ELECTIVE)**

**M.Tech. CSE II Year, I Semester**

L	T	P/D	C
3	-	-/-	3

**Prerequisite(s):** None

**Course objectives:**

Develop ability to

1. Understand the principles of resource planning and value management.
2. Understand the different methods of project cost estimation.
3. Learn the concepts of cost and budgeting.
4. Gain knowledge of cost variance and network analysis.
5. Learn about capital management and network techniques.

**Course Outcomes (COs):**

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

- CO1: Explain the principles of resource planning and value management.
- CO2: Apply the methods of project cost estimation.
- CO3: Prepare the budget for an engineering project.
- CO4: Analyze cost variance and network in projects.
- CO5: Identify the critical path and determine the capital cost.

**UNIT I**

Resources planning schedules, cost planning, cost budgeting, cost controlling. Collection of cost related information – Labour cost- Material cost – Plan and Equipment Cost- Subcontractor Cost. Overhead cost- Value management in construction- Steps in the application of Value Engineering.

**UNIT II**

Approximate methods of estimation- preliminary estimate for buildings- preliminary estimate for industrial structures. Types of estimates, Rough order of magnitude estimates, clients preliminary cost estimate and client detailed estimate, Project closure cost.

**UNIT III**

Cost concepts, break even analysis, Budgeting and budgeting control system, classification and types of budgets, fixed and flexible budgets, sales budget, production budget, cost of production budget, materials budget, direct labor budget, overhead cost budget, selling and distribution overhead budget.

**UNIT IV**

Standard costing and variance analysis in relation to construction, direct material variance, direct labor variance, overhead variances, job, batch and contract costing- procedures, determination of economic batch, Network analysis as a basis for cost control.

**UNIT V**

Working capital, working capital at project level management of cash, Receivable management, Inventory management, price level accounting (Inflation Accounting), project management network techniques- program evaluation review techniques and critical path method.

**TEXT BOOK(S)**

1. Construction Project Management Theory and Practice, Kumar Neeraj Jha, Pearson, 2017.
2. Construction Project Management Planning, Scheduling and controlling, K.K.Chitkara, Tata McGraw Hill, Third Edition, 2014.

**REFERENCE BOOK(S)**

1. Project Cost Control in Construction, Collins, Roy Pilcher, Professional and technical books, London,1985.
2. Basic Cost Engineering, Humphreys, K.K., and Wellman, P., Marcel Dekker, Inc. New York,1996.

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**20MOE305 – COMPOSITE MATERIALS (OPEN ELECTIVE)**

**M.Tech. CSE II Year, I Semester**

L	T	P/D	C
3	-	-/-	3

**Prerequisite(s):** None

**Course objectives:** Develop ability to

1. Overview engineering materials
2. Understand the concept of tailored properties of materials
3. Select or devise a manufacturing method to synthesize composite materials
4. Test and evaluate mechanical properties of composite materials

**Course Outcomes (COs):**

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

- CO1: Classify the materials and identify the necessity to adopt composite materials
- CO2: Identify the role of reinforcement in the composites to enhance mechanical properties of materials
- CO3: Comprehend on reinforced composites and select application specific composite
- CO4: Select a manufacturing method for synthesis of composite material
- CO5: Infer on testing of composite materials in the evaluation of mechanical properties of composite materials

### UNIT I

**Introduction:** Classifications of Engineering Materials, Concept of composite materials, Matrix materials, Functions of a Matrix, Desired Properties of a Matrix, Polymer Matrix (Thermosets and Thermoplastics), Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc.

### UNIT II

**Types of Reinforcements/Fibers:** Role and Selection or reinforcement materials, Types of fibres, Glass fibers, Carbon fibers, Aramid fibers, Metal fibers, Alumina fibers, Boron Fibers, Silicon carbide fibers, Quartz and Silica fibers, Multiphase fibers, Whiskers, Flakes etc., Mechanical properties of fibres. Material properties that can be improved by forming a composite material and its engineering potential

### UNIT III

**Various types of composites:** Classification based on Matrix Material: Organic Matrix composites, Polymer matrix composites (PMC), Carbon matrix Composites or Carbon-Carbon Composites, Metal matrix composites (MMC), Ceramic matrix composites (CMC); Classification based on reinforcements: Fiber Reinforced Composites, Fiber Reinforced Polymer (FRP) Composites, Laminar Composites, Particulate Composites, Comparison with Metals, Advantages & limitations of Composites

**UNIT IV**

**Fabrication methods:** Processing of Composite Materials: Overall considerations, Autoclave curing, Other Manufacturing Processes like filament winding, compression molding, resin- transplant method, Pultrusion, pre-peg layer, Fiber-only performs, Combined Fiber-Matrix performs, Manufacturing Techniques: Tooling and Specialty materials, Release agents, Peel plies, release films and fabrics, Bleeder and breather plies, bagging films

**UNIT V**

**Testing of Composites:** Mechanical testing of composites, tensile testing, Compressive testing, Intra-laminar shear testing, Inter-laminar shear testing, Fracture testing etc.

**TEXT BOOK(S)**

1. Materials characterization, Vol. 10, ASM hand book
2. Mechanical Metallurgy, G. E. Dieter, Mc-Graw Hill

**REFERENCE BOOK(S)**

1. Thermal Analysis of Materials, R.F. Speyer, Marcel Decker,
2. Engineering Materials: Polymers, Ceramics and Composites, A.K Bhargava, Prentice Hall India

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**20MOE306 – ENERGY FROM WASTE (OPEN ELECTIVE)**

**M.Tech. CSE II Year, I Semester**

L	T	P/D	C
3	-	-/-	3

**Prerequisite(s):** None

**Course objectives:**

Develop ability to

1. Identify various sources of solid waste generation.
2. Compare various methods of solid waste disposal.
3. Understand various energy generation methods.
4. Process various solid wastes so as to produce generate renewable energy.
5. Use methods of recycling the e-waste.

**Course Outcomes (COs):**

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

- CO1: Explain principles of integrated solid waste management.
- CO2: Examine the land fill method of solid waste disposal.
- CO3: Explain energy generation from bio-chemical conversion of solid waste.
- CO4: Explain energy generation from thermo-chemical conversion of solid waste.
- CO5: Explain management of e-waste.

**UNIT I**

Solid Waste Sources Solid Waste Sources, types, composition, Properties, Global warming, Municipal Solid Waste: Physical, chemical and biological properties, Waste Collection and, Transfer stations, Waste minimization and recycling of municipal waste, Segregation of waste, Size Reduction, Managing Waste. Status of technologies for generation of Energy from Waste Treatment and Disposal Aerobic composting, incineration, Furnace type and design, Medical waste /Pharmaceutical waste treatment Technologies, incineration, Environmental impacts, Measures to mitigate environmental effects due to incineration.

**UNIT II**

Land Fill method of Solid waste disposal Land fill classification, Types, methods and Sitting consideration, Layout and preliminary design of landfills: Composition, characteristics, generation, Movement and control of landfill leach ate and gases, Environmental monitoring system for land fill gases.

**UNIT III**

Energy Generation from Waste Bio-chemical Conversion: Sources of energy generation, anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solid fuel, Industrial waste, agro residues, Anaerobic Digestion.

**UNIT IV**

Biogas production, Land fill gas generation and utilization, Thermo-chemical conversion: Sources of energy generation, Gasification of waste using Gasifiers, Briquetting, Utilization and advantages of briquetting, Environmental benefits of Bio-chemical and Thermo-chemical conversion.

**UNIT V**

E-waste: E-waste in the global context – Growth of Electrical and Electronics Industry in India – Environmental concerns and health hazards – Recycling e-waste: a thriving economy of the unorganized sector – Global trade in hazardous waste – impact of hazardous e-waste in India. Management of e-waste: e-waste legislation, Government regulations on e-waste management – International experience – need for stringent health safeguards and environmental protection laws of India.

**TEXT BOOK(S)**

1. Handbook of Solid Waste Management and Waste Minimization Technologies, Nicholas P. Cheremisinoff, An Imprint of Elsevier, 2003.
2. Solid Waste Engineering, P. Aarne Vesilind, William A. Worrell and Debra R. Reinhart, Thomson Asia Pte Ltd. Singapore, 2002.

**REFERENCE BOOK(S)**

1. E-waste in India: Research unit, Rajya Sabha Secretariat, New Delhi, June 2011.
2. Solid Waste Management, Hagerty, D. Joseph; Pavoni, Joseph L; Heer, John E., New York, Van Nostrand, 1973
3. Integrated Solid Waste management: Engineering Principles and Management issues, George Tchobanoglous, Hilary Theisen and Samuel Vigil Prsl: Tchobanoglous, George Theisen, Hillary Vigil, Samuel, New York, McGraw Hill, 1993.
4. Energy from Waste – An Evaluation of Conversion Technologies, C Parker and T Roberts (Ed), Elsevier Applied Science, London, 1985
5. Basics of Solid and Hazardous Waste Management Technology, KL Shah, Prentice Hall, 2000 3.
6. Waste Disposal in Engineered Landfills, M Datta, Narosa Publishing House, 1997.

**GOOGLE BOOKS:**

1. e-waste Management: From waste to Resource Klaus Hieronymi, Ramzy Kahnat, Eric williams Tech. & Engg. -2013 (Publisher: Earthscan 2013).
2. What is the impact of E-waste: Tamara Thompson
3. E-waste poses a Health Hazard: Sairudeen Pattazhy

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**20MOE307 – POWER FROM RENEWABLE ENERGY SOURCES  
(OPEN ELECTIVE)**

**M.Tech. CSE II Year, I Semester**

L	T	P/D	C
3	-	-/-	3

**Prerequisite(s):** None

**Course Objectives:**

Develop ability to

1. Provide knowledge of solar energy concept and applications.
2. Impart knowledge of geothermal, ocean and tidal energy and their applications.
3. Understand the design of wind mills and applications.
4. Understand the turbines and generators for small scale hydroelectric generation.
5. Understand the important parts of a biogas plant, design and principle of bio-diesel.

**Course Outcomes (COs):**

At the end of the course student will be able to

- CO1: Attain the knowledge of solar concepts, solar collector and solar desalination.
- CO2: Attain the knowledge of geothermal applications, energy generation, power generation by tidal energy.
- CO3: Attain the knowledge of design of wind mills and energy estimations and also wind energy applications.
- CO4: Attain the knowledge the turbines and generators for small scale hydroelectric generation and advantages and limitations of small scale hydro-electric.
- CO5: Attain the knowledge of design of bio gas plant and bio diesel applications.

**UNIT I: SOLAR ENERGY**

History of solar energy, introduction and scope of solar energy. Solar collectors and their applications. Solar tower concept for power generation. Maximum power point tracking algorithms.

**UNIT II: BIO ENERGY**

Introduction and scope of bio energy, biogas, bio fuels, bio gasifiers-applications,

**UNIT III: WIND ENERGY**

Introduction to wind energy, wind energy potential in India and world, wind farms and mills & their applications,

**UNIT IV: GEOTHERMAL AND OCEANS ENERGY**

Potential sites, estimations of geothermal power, nature of geothermal sites, hot-dry rocks resources, magma resources, systems for energy generation, applications of geothermal energy, environmental issues, basic theory of ocean thermal energy conversion, potential and application of technologies, basic theory of wave energy, potential and technologies, basic theory of tidal energy, potential and technologies, methods of ocean thermal electric power generation.

**UNIT V: FUEL CELLS AND HYDROGEN ENERGY**

Introduction, principle of fuel cells, thermodynamic analysis of fuel cells, types of fuel cells, fuel cell batteries, applications of fuel cells.

Hydrogen as a renewable energy source, sources of hydrogen, fuel for vehicles, hydrogen production-direct electrolysis of water, thermal decomposition of water, biological and biochemical methods of hydrogen production.

**TEXT BOOK(S)**

1. Renewable Conversion Technology, N. K. Bansal, M. Kleeman & M. Mielee, Tata Mc Graw Hill, New Delhi.
2. Renewable Energy Resources, T. John and W. Tony, Taylor & Francis.

**REFERENCE BOOK(S)**

1. Solar Thermal Engineering Systems, G.N. Tiwari and S. Suneja, Narosa Publishers.
2. Solar Energy, S.P. Sukhatme, Tata McGraw Hill Company Ltd., New Delhi.
3. Advancement in Solar Energy Technology, H.P. Garg, D. Reidel Publishing Co.
4. Solar Thermal Energy Storage, H. P. Garg, D. Reidel Publishing Company (1985).
5. Physics of Solar Energy, C. Julian Chen, John Wiley and Sons.