AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(Approved by AICTE | Accredited by NAAC | Affiliated to JNTUA)
Gudur, Nellore Dist - 524101, A.P (India)

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM

MASTER OF TECHNOLOGY

COMPUTER SCIENCE & ENGINEERING

ACADEMIC REGULATIONS
UNDER AUTONOMOUS STATUS

M.Tech Regular Two Year PG Programme
(for the batches admitted from the academic year 2018 - 2019)

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY
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ACADEMIC REGULATIONS (R18) FOR M.TECH. REGULAR STUDENTS WITH EFFECT FROM ACADEMIC YEAR 2018-2019

1.0   Post- Graduate Degree Programme in Engineering & Technology

1.1   These academic rules and regulations are applicable to the students admitted from the academic year 2018-19 onwards into 2 year (4 Semesters) M.Tech Programmes under Choice Based Credit System(CBCS) at its autonomous institution with effect from the academic year 2018-19 in the following specializations of Engineering:

M.Tech Specializations offered
1. Embedded Systems (ES)
2. VLSI (VL)
3. Electrical Power Systems (EP)
4. Power Electronics (PE)
5. Computer Science & Engineering (CO)
6. Software Engineering (SE)
7. Structural Engineering (ST)

2.0	**Eligibility for admission**
2.1	Admission to the post graduate programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test PGECET conducted by the Andhra Pradesh State Government as per the norms of Andhra Pradesh State Council of Higher Education (APSCHE)
2.2	The medium of instructions for the entire post graduate programme in Engineering & Technology will be English only.
3.0	**M.Tech. Programme Pattern**
3.1	A student after securing admission shall pursue the post graduate programme in M.Tech in a minimum period of two academic years (4 semesters), and a maximum period of four academic years (8 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit the M.Tech course. Each semester is structured to around 20 credits, totaling to 78 credits for the entire M.Tech programme. Each student shall secure 78 credits required for the completion of the post graduate programme and award of the M.Tech degree.
3.2	A student eligible to appear for the end examination in a course, but absent or has failed in the end examination may appear for that course at the next supplementary examination when offered
3.3	When a student is detained due to lack of shortage of attendance he/she may be re-admitted when the semester is offered after fulfillment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

3.4	UGC/ AICTE specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms, which are listed below.
3.5	**Semester scheme** Each under graduate programme is of 2 academic years (4 semesters) with the academic year being divided into two semesters of 16 weeks (around 90 instructional days) each and semester having – Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). Choice based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and curriculum / course structure as suggested by AICTE are followed.
3.6	**Credit courses** All subjects/ courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: Tutorial 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 or Tutorials (T).
3.7	**Subject Course Classification** All subjects/ courses offered for the post graduate programme in Engineering & Technology (M.Tech. degree programmes) are broadly classified as follows. The ASCET has followed almost all the guidelines issued by AICTE/UGC.
4.0	**Attendance requirements:**
4.1	A student shall be eligible to appear for the semester end examinations, if student acquires a minimum of 75% of attendance in aggregate of all the subjects/ courses for that semester.
4.2	Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.
4.3	A stipulated fee shall be payable towards condonation for shortage of attendance to the institute as decided by the College Academic Committee.
4.4	Shortage of attendance below 65% in aggregate shall in no case be condoned.
4.5	Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester. They may seek re-registration for all those subjects registered in that semester in which student was detained, by seeking re-admission into that semester as and when offered; in case if there are any professional electives and/ or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the same set of elective subjects offered under that category.
4.6	A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.
5.0	**Academic requirements** The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no.4.

5.1	A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 40% of marks (i.e., 24) in the end semester examination and a minimum of 50% of marks (i.e., 50) in the sum total of the internal evaluation and end examination taken together.
5.6	A student shall register and put up minimum attendance in all 78 credits and earn all the 78 credits. Marks obtained in all 78 credits shall be considered for the calculation of aggregate percentage of marks obtained
5.7	Students who fail to earn 78 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in M.Tech. Course and their admission shall stand cancelled
6.0	**Distribution and Weightage of marks**
6.1	The performance of a student in each semester shall be evaluated through internal evaluation and /or an external evaluation conducted semester wise.
6.2	The performance of a student in every theory course shall be evaluated for total of 100 marks each, of which the relative weightage for Continuous Internal Evaluation and Semester End Examination shall be 40 marks and 60 marks respectively.
6.3	The performance of a student in every practical course shall be evaluated for total of 75 marks each, of which the relative weightage for Continuous Internal Evaluation and Semester End Examination shall be 25 marks and 50 marks respectively.

6.4	**Internal Evaluation for Theory Course:**
	The total internal weightage for theory courses is 40 marks with the following distribution.
	    ➢ 30 marks for Mid-Term Examination
	    ➢ 10 marks for Assignment Test
	While the first mid-term examination shall be conducted on the 50% of the syllabus (Unit-I, Unit-II, & 50% of Unit-III), the second mid-term examination shall be conducted on the remaining 50% of the syllabus (50 % of Unit III, Unit-IV & Unit-V).
	10 marks are allocated for assignment test (as specified by the subject teacher concerned). The first assignment should be conducted after completion of Unit-I for 5 marks and the second assignment should be conducted after completion of Unit- IV for 5 marks. The final Assignment Test marks will be the addition of these two.
	Two midterm examinations each for **30 marks** with the duration of 90 minutes each will be conducted for every theory course in a semester. The midterm examination marks shall be awarded giving a weightage of 80% in the midterm examination in which the student scores better performance and 20% in the remaining midterm examination.
	The final mid-term marks obtain by the addition of these two (80% + 20%).
	Example: If a student scores 33 marks and 34 marks in the first and second mid-term examinations respectively, then Weighted Average Marks = 34 x 0.8 + 33 x 0.2 = 33.8, rounded to 34 Marks.
	Note: The marks of any fraction shall be rounded off to the next higher mark.

6.5	**Pattern of the midterm examination question paper is as follows:**
	    ➢ A total of three questions
	    ➢ Question paper contains six questions are to be designed taking three questions from

each unit (Unit Wise - Either or type) of the three units. (3X10=30 Marks)

Pattern of the Assignment Test is as follows:

- ➢ Five assignment questions are given in advance, out of which two questions given by the concerned teacher has to be answered during the assignment test
- ➢ Sum of Assignment Tests marks is considered.

Note: A student who is absent for any Mid-Term Examination/ Assignment Test, for any reason whatsoever, shall be deemed to have scored zero marks in that Mid-Term Examination/ Assignment Test and no make-up test shall be conducted.

6.6	**Internal Evaluation for Practical Course:** For practical subjects there shall be a Continuous Internal Evaluation during the semester for 25 internal marks. Out of the 25 marks for internal evaluation, day-today assessment in the laboratory shall be evaluated for 10 marks and internal practical examination shall be evaluated for 15 marks conducted by the laboratory teacher concerned.
6.7	**Internal Evaluation for Term Paper:** The Term Paper is a self study report and shall be carried out either during II semester along with other lab courses. Every student will take up this term paper individually and submit a report. The scope of the term paper could be an exhaustive literature review choosing any engineering concept with reference to standard research papers or an extension of the concept of earlier course work in consultation with the term paper supervisor. The term paper reports submitted by the individual students during the II semester shall be evaluated for a total of 50 marks for continuous assessment; it shall be conducted by two Examiners, one of them being term paper supervisor as internal examiner and an external examiner nominated by the Principal from the panel of experts recommended by HOD.
6.8	**Project Work:** The Project work is spread over to two semesters having Project Work Phase-I and Project Work Phase-II. Project Work Phase-I is included in III Semester and Project Work Phase-II in IV Semester as detailed below: A student has to select topic of his Project Work based on his interest and available facilities, in the III semester which he will continue through IV semester also.
6.9	**External Evaluation for Theory Course - Semester End Examination:** The Semester End Examination in each theory subject shall be conducted for 3 hours duration at the end of the semester for 60 marks. **Pattern of the Semester End Examination question paper is as follows:** ➢ Question Paper contains ten questions are to be designed taking two questions from each unit (Unit Wise - Either or type) of the total five units. (5X12=60 Marks) A student has to secure not less than a minimum of 40% of marks (24 marks) exclusively at the Semester End Examinations in each of the theory subjects in which the candidate had appeared. However, the candidate shall have to secure a minimum of 50% of marks (50 marks) in both external and internal components put together to become eligible for passing in the subject.
6.10	**External Evaluation for Practical Course** Out of 50 marks **35** marks are allocated for experiment (procedure for conducting the experiment carries 15 marks & readings, calculation and result-20) and **10** marks for viva-

voce examination with **5** marks for the record.

Each Semester External Lab Examination shall be evaluated by an Internal Examiner along with an External Examiner appointed by the Principal.

A candidate shall be declared to have passed in individual lab course if he secures a minimum of 50% aggregate marks (38 marks) (Internal & Semester External Examination marks put together), subject to a minimum of 50% marks (25 marks) in the semester external examination.

6.11	**Project Work Phase-I:**

Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the college/ concerned department.

- ➢ **Registration of Project work**: A candidate is permitted to register for the project work phase-I after satisfying the attendance requirement of all the courses (theory and practical courses of I & II Semesters).
- ➢ An Internal Departmental Committee (I.D.C) consisting of HOD, Supervisor/ Guide and one Internal senior expert shall monitor the progress of the project work.
- ➢ The work on the project work phase-I shall be initiated in the III semester and continued in the final semester. The candidate can submit Project work phase-I dissertation with the approval of I.D.C. after 18 weeks from the date of registration at the earliest from the date of registration for the project work phase-I.
- ● The student must submit status report at least in three different phases during the project work period. These reports must be approved by the I.D.C before submission of the Project Report.
- ● Three copies of the Dissertation certified in the prescribed form by the supervisor and HOD shall be submitted to the HOD.
- ● The semester end examination for project work phase-I done during III Semester, shall be conducted by a Project Review Committee (PRC). The evaluation of project work shall be conducted at the end of the III Semester.
- ● The PRC comprises of an External examiner appointed by the Principal, Head of the Department and Project Guide/Supervisor to adjudicate the dissertation. The PRC shall jointly evaluate candidates work and award grades as given below.

S.No	Description	Grade	Grade Point (GP) Assigned
1	Very Good	Grade A	10
2	Good	Grade B	9
3	Satisfactory	Grade C	8
4	Not satisfactory	Grade D	0

If the report of the viva-voce is not satisfactory (Grade D) the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination he will not be eligible for the award of the degree unless the candidate is permitted to revise and resubmit the dissertation.

6.12	**Project Work Phase-II:**
	Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the college/ concerned department.

> **Registration of Project work**: A candidate is permitted to register for the project work phase-I after satisfying the attendance requirement of all the courses (theory and practical courses of I & II Semesters)

> An Internal Departmental Committee (I.D.C) consisting of HOD, Supervisor/ Guide and one Internal senior expert shall monitor the progress of the project work.

> The work on the project work phase-II shall be initiated in the IV semester. The candidate can submit Project work phase-II dissertation with the approval of I.D.C. after 18 weeks from the date of registration at the earliest from the date of registration for the project work phase-I.

- The student must submit status report at least in three different phases during the project work period. These reports must be approved by the I.D.C before submission of the Project Report.

- Three copies of the Dissertation certified in the prescribed form by the supervisor and HOD shall be submitted to the HOD.

- The semester end examination for project work phase-I done during III Semester, shall be conducted by a Project Review Committee (PRC). The evaluation of project work shall be conducted at the end of the IV Semester.

- The PRC comprises of an External examiner appointed by the Principal, Head of the Department and Project Guide/Supervisor to adjudicate the dissertation. The PRC shall jointly evaluate candidates work and award grades as given below

S.No	Description	Grade	Grade Point (GP) Assigned
1	Very Good	Grade A	10
2	Good	Grade B	9
3	Satisfactory	Grade C	8
4	Not satisfactory	Grade D	0

If the report of the viva-voce is not satisfactory (Grade D) the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination he will not be eligible for the award of the degree unless the candidate is permitted to revise and resubmit the dissertation.

6.13	<u>**Re-Registration For Improvement of Internal Evaluation Marks:**</u>

Following are the conditions to avail the benefit of improvement of internal evaluation marks.

- ❖ The candidate should have completed the course work and obtained examinations results for I, II & III semesters.
- ❖ He should have passed all the subjects for which the internal evaluation marks secured are more than 50%.
- ❖ Out of the subjects the candidate has failed in the examination due to Internal evaluation marks secured being less than 50%, the candidate shall be given one more chance for each Theory subject and for a maximum of **three** Theory subjects for Improvement of

- Internal evaluation marks.
- ❖ The candidate has to re-register for the subjects so chosen and fulfill all the academic requirements.
- ❖ For each subject, the candidate has to pay a fee equivalent to one third of the semester tuition fee and the amount is to be remitted in the form of D.D. in favour of **'The Principal, Audisankara College of Engineering & Technology'** payable at Gudur along with the requisition through the Controller of the Examinations of the college.
- ❖ In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects stand cancelled.

7.0	SEMESTER – WISE DISTRIBUTION OF CREDITS			
	Semester	Theory	Practicals	Credits
	M.Tech I Semester	5	2	22
	M.Tech II Semester	4	2 + Term Paper	22
	M.Tech III Semester	2	Project Work Phase-I	18
	M.Tech IV Semester	0	Project Work Phase-II	16
			Total	78

8.0	**GRADING PROCEDURE**
	Grades will be awarded to indicate the performance of students in each theory subject, laboratory / practicals, Term Paper and project Work Phase-I & II. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 6 above, a corresponding letter grade shall be given.
8.1	As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

Marks Range	Letter Grade	Grade Points
91-100	S (Superior)	10
81-90	A (Excellent)	9
70-80	B (Very Good)	8
60-69	C (Good)	7
55-59	D (Average)	6
50-54	E (Pass)	5
<50	F (FAIL)	0
Ab (Absent)	Ab	0

8.2	A student who has obtained an 'F' grade in any subject shall be deemed to have 'failed' and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier
8.3	To a student who has not appeared for an examination in any subject, 'Ab' grade will be allocated in that subject, and he is deemed to have 'failed'. A student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remain the same as those obtained earlier.
8.4	A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.
8.5	A student earns grade point (GP) in each subject/ course, on the basis of the letter grade secured in that subject/ course. The corresponding 'credit points' (CP) are computed by multiplying the grade point with credits for that particular subject/ course. Credit points (CP) = grade point (GP) x credits …. For a course
8.6	A student passes the subject/ course only when GP ≥ 5 ('E' grade or above)
8.7	➢ A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered. ➢ For Mandatory courses "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.
8.8	**Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):** The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e. $$SGPA = \sum_{i=1}^{n}(C_i \times G_i) / \sum_{i=1}^{n} C_i$$ Where, C_i is the number of credits of the ith subject, G_i is the grade point scored by the student in the ith course and n is the number of subjects. The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e. $$CGPA = \sum_{i=1}^{n}(C_i \times S_i) / \sum_{i=1}^{n} C_i$$ Where 'S_i' is the SGPA of the ith semester, C_i is the total number of credits in that semester and n is the number of semesters. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts. While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included. *Grade Point:* It is a numerical weight allotted to each letter grade on a 10-point scale.

	Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters as mentioned in the above table.
9.0	**Award of Class**
9.1	After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of M.Tech. Degree he/she shall be placed in one of the following four classes: | Class Awarded	CGPA Secured
First class with Distinction	>= 8
First class	>= 7 and < 8
Second class	>= 5 and < 7	
10.0	**Transitory regulations**
10.1	For students detained due to shortage of attendance: 1. A Student who has been detained in I year of R16 Regulations due to lack of attendance, shall be permitted to join I year I Semester of R18 Regulations and he is required to complete the study of M.Tech/ programme with in the stipulated period of eight academic years from the date of first admission in I year. 2. A student who has been detained in any semester of II, III and IV years of R16 regulations for want of attendance, shall be permitted to join the corresponding semester of R18 regulations and is required to complete the study of M.Tech within the stipulated period of eight academic years from the date of first admission in I Year. The R18 Academic Regulations under which a student has been readmitted shall be see rule 10.3 for further Transitory Regulations.
10.2	For students detained due to shortage of credits: A student of R16 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of R18 Regulations only after acquiring the required credits as per the corresponding regulations of his/her first admission. The student is required to complete the study of M.Tech. within the stipulated period of eight academic years from the year of first admission. The R18 Academic Regulations are applicable to a student from the year of readmission onwards. See rule 10.3 for further Transitory Regulations.
10.3	For readmitted students in R18 Regulations: 1. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations. 2. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R18 Regulations. 3. If a student readmitted to R18 Regulations, has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R18 Regulations will be substituted by another subject to be suggested by the College standing committee. Note: If a student readmitted to R18 Regulations, has not studied any subjects/topics in

		his/her earlier regulations of study which is prerequisite for further subjects in R18 Regulations, the department HOD concerned shall conduct remedial classes to cover those subjects/topics for the benefit of the students.
11.0	**Supplementary Examinations:** Apart from the regular End Examinations the institute may also schedule and conduct supplementary examinations for all subjects for the benefit of students with backlogs. Such students writing supplementary examinations as supplementary candidates may have to write more than one examination per day.	
12.0	**Student Transfers** Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh from time to time.	
13.0	**With–Holding of Results** If the candidate has any dues not paid to the institute or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld and he/she will not be allowed / promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.	
12.0	**Conduct and Discipline** ➢ Students shall conduct themselves within and outside the premises of the Institute in a descent and dignified manner befitting the students of Audisankara College of Engineering & Technology. ➢ As per the order of the Honorable Supreme Court of India, ragging in any form is considered a criminal offence and is totally banned. Any form of ragging will be severely dealt with The following acts of omission and / or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging. (i) Lack of courtesy and decorum; indecent behavior anywhere within or outside the college campus. (ii) Damage of college property or distribution of alcoholic drinks or any kind of narcotics to fellow students / citizens. ➢ Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs. ➢ Mutilation or unauthorized possession of library books. ➢ Noisy and unruly behavior, disturbing studies of fellow students. ➢ Hacking in computer systems (such as entering into other person's areas without prior permission, manipulation and / or damage of computer hardware and software or any other cyber crime etc. ➢ Usage of camera /cell phones in the campus. ➢ Plagiarism of any nature. ➢ Any other act of gross indiscipline as decided by the college academic council from time to time.	

	- Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute/ hostel, debarring from examination, disallowing the use of certain facilities of the Institute, rustication for a specified period or even outright expulsion from the Institute, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances. - For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief Warden, the concern Head of the Department and the Principal respectively, shall have the authority to reprimand or impose fine. - Cases of adoption of unfair means and/ or any malpractice in an examination shall be reported to the principal for taking appropriate corrective action. - All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the Academic council of the college. - The Institute Level Standing Disciplinary Action Committee constituted by the academic council shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed. - The Principal shall deal with any problem, which is not covered under these rules and regulations. **"Grievance and Redressal Committee" (General)** constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters. - All the students must abide by the code and conduct rules prescribed by the college from time to time.
13.0	**General** - s/he represents "she" and "he" both - Where the words 'he', 'him', 'his', occur, they imply 'she', 'her', 'hers' also. - The academic regulations should be read as a whole for the purpose of any interpretation. - In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman, Academic Council will be final. The college may change or amend the academic regulations or syllabi from time to time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the institute.

RULES FOR
DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers, blue tooth or any other form of material concerned with or related to the course of the examination (theory or practical) in which he/she 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.
(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 examination 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/she will 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 for four consecutive semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with for feature of 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 four consecutive Semesters from class work and all Semester end examinations if his involvement is established. Otherwise the candidate is debarred for two consecutive

		semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he/she will 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 Semester end 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 any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walkout 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. If candidate physically assaults the invigilator or/officer in charge of the examination, then the candidate is also barred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the examination hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	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 Semester end 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 Courses of that Semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will 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 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.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that Semester examinations depending on the recommendation of the committee.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Principal for further action to award suitable punishment.	

Note:
   i. All malpractices cases are to be handled by the Chief Controller with a committee consist of Controller of Examinations, HOD concerned and subject expert.

ii. Whenever the performance of a student is cancelled in any course/ courses due to Malpractice, he has to register for the End Examination in those course/courses consequently and has to fulfill all the norms required for award of Degree.

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Gudur, Nellore Dist - 524101, A.P (India)

COURSE STRUCTURE

M.Tech I Semester – Computer Science & Engineering

S.No	Course Code	Course Title	L	T	P	IM	EM	T	Credits
			Hours per Week			**Marks**			**Credits**
1	18CO101	Advanced Data Structures and Algorithms	4	0	0	40	60	100	4
2	18CO102	UML and Design Patterns	4	0	0	40	60	100	4
		Elective-I							
3	18CO103	Cryptanalysis	4	0	0	40	60	100	4
	18CO104	Adhoc Sensor Networks							
	18CO105	Image Processing							
		Elective-II							
4	18CO106	Cloud Computing	4	0	0	40	60	100	4
	18CO107	Soft Computing							
	18CO108	Advanced Data Mining							
5	18AS101	Research Methodology and IPR	2	0	0	40	60	100	2
6	18CO110	Advanced Data Structures And Algorithms Lab	0	0	4	25	50	75	2
7	18CO111	UML and Design Patterns Lab	0	0	4	25	50	75	2
		Total	**18**	**0**	**8**	**250**	**400**	**650**	**22**

M.Tech II Semester – Computer Science & Engineering

S.No	Course Code	Course Title	Hours per Week			Marks			Credits
			L	T	P	IM	EM	T	
1	18CO201	Big Data Analytics	4	0	0	40	60	100	4
2	18CO202	Mobile Application Development	4	0	0	40	60	100	4
		Elective-III							
3	18CO203	Elliptic Curve Cryptography	4	0	0	40	60	100	4
	18CO204	Computer Vision							
	18CO205	Software Oriented Architecture							
		Elective-IV							
4	18CO206	Internet Of Things	4	0	0	40	60	100	4
	18CO207	Information Retrieval							
	18CO208	Advanced Computer Architecture							
5	18CO209	Mobile Application Development Lab	2	0	0	40	60	100	2
6	18CO210	Big Data Analytics Lab	0	0	4	25	50	75	2
7	18CO211	Term Paper	0	0	4	50	-	50	2
		Total	**18**	**0**	**8**	**275**	**350**	**625**	**22**

M.Tech III Semester – Computer Science & Engineering

S.No	Course Code	Course Title	Hours per Week			Marks			Credits
			L	T	P	IM	EM	T	
1		**Open Elective**	4	0	0	40	60	100	4
2		Elective-V							
	18CO304	Machine Learning	4	0	0	40	60	100	4
	18CO305	High Performance Computing							
	18CO306	Information Security and Auditing							
3	18CO307	Project Work Phase-I	0	0	20		Grade		10
		Total	**8**	**0**	**8**	**80**	**120**	**200**	**18**

M.Tech IV Semester – Computer Science & Engineering

S.No	Course Code	Course Title	Hours per Week			Marks			Credits
			L	T	P	IM	EM	T	
1	18CO401	Project Work Phase-II	0	0	32		Grade		16
		Total	**0**	**0**	**32**		**Grade**		**16**

Open Electives – Computer Science & Engineering

S.No	Course Code	Course Title
1	18CO301	Business Analytics
2	18CO302	Operations Research
3	18CO303	Cost Management of Engineering projects

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ADVANCED DATA STRUCTURES & ALGORITHMS

M.Tech I Semester: Computer Science & Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
18CO101	Core	L	T	P	C	CIA	SEE	TOTAL
		4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes:60			

OBJECTIVES:

The course should enable the students to:

1. To impart the basic concepts of data structures and algorithms
2. To understand concepts about searching and sorting techniques
3. To Understand basic concepts about stacks, queues, linked lists, etc
4. To analyze the algorithms

UNIT-I	OVERVIEW OF DATA STRUCTURES AND ALGORITHMS	Classes:12

Overview of Data Structures: Review of Arrays, Stacks, Queues, linked lists, Linked stacks and Linked queues, Applications.

Algorithm Analysis: Efficiency of algorithms, Apriori Analysis, Asymptotic Notations, Time complexity of an algorithm using O notation, Polynomial Vs Exponential Algorithms, Average, Best, and Worst Case Complexities, Analyzing Recursive Programs.

UNIT-II	TREES AND GRAPHS	Classes:12

Trees and Graphs: Introduction, Definition and Basic terminologies of trees and binary trees, Representation of trees and Binary trees, Binary tree Traversals, Threaded binary trees, Graphs-basic concepts, representation and traversals.

Binary Search Trees, AVL Trees and B Trees: Introduction **Binary Search Trees:** Definition, Operations and applications.

UNIT-III	BALANCED TREES	Classes:12

AVL Trees: Definition, Operations and applications.
B Trees: Definition, Operations and applications.
Red – Black Trees, Splay Trees and Hash Tables: Red – Black Trees, Splay Trees and its applications. Hash Tables: Introduction, Hash Tables, Hash Functions and its applications.

UNIT-IV	DIVIDE AND CONQUER & GREEDY METHOD	Classes:12

Divide – and – Conquer & Greedy Method: General Method, Binary Search, Finding Maximum and Minimum, Quick Sort, Merge sort, Stassen's Matrix Multiplication, Greedy Method- General Method, Minimum Cost Spanning Trees, Single Source Shortest Path.

UNIT-V	DYNAMIC PROGRAMMING , BRANCH AND BOUND	Classes:12

Dynamic Programming: General Method, All Pairs Shortest Path, Single Source Shortest Path, Knapsack problem, Reliability Design, Traveling Sales Person's Problem.

Back Tracking and Branch – and – Bound: General Method, 8 – Queen's Problem, Graph Coloring.

Branch – and – Bound: The Method, LC Search, Control Abstraction, Bounding, 0/1 Knapsack Problem.

Text Books:
1. G.A.V. Pai ,Data Structures and Algorithms, TMH, 2009.
2. Fundamentals of Computer Algorithms by Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, 2nd Edition, University Press

Reference Books:
1. D. Samanta, Classic Data Structures ,PHI, 2005.
2. Aho, Hopcraft, Ullman, Design and Analysis of Computer Algorithms, PEA, 1998.
3. Goodman, Hedetniemi, Introduction to the Design and Analysis of Algorithms TMG.
4. E. Horowitz, S. Sahani, Design and Analysis of Algorithms 3rd Edition, Galgotia.

Web References:
1. https://www.geeksforgeeks.org/category/advanced-data-structure/
2. https://www.iith.ac.in/~aravind/cs6010.html
3. cs361a.stanford.edu/

Outcomes:
At the end of the course students able to
1. Ability to analyze algorithms and algorithm correctness.
2. Ability to summarize searching and sorting techniques
3. Ability to describe various types of data structures
4. Ability to analysis of algorithms

UML & DESIGN PATTERNS

M.Tech I Semester: Computer Science & Engineering

Course code	Category	Hours/week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
18CO102	**Core**	4	0	0	4	40	60	100

Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes:60

OBJECTIVES:

The course should enable the students to:

1. Possess an ability to practically apply knowledge software engineering methods, such as object-oriented analysis and design methods with a clear emphasis on UML
2. Have a capacity to analyze and design software systems, components to meet desired needs.
3. Understand common design patterns
4. Be able to refactor poorly designed program by using appropriate design patterns.

UNIT-I	INTRODUCTION TO UML	Classes:12

Introduction to UML: Importance of Modeling, Principles of Modeling, Object Oriented Modeling, Conceptual model of the UML, Architecture, Software Development Life Cycle.
Structural Modeling: Classes, Relationships, Common Mechanisms, and Diagrams.

UNIT-II	STRUCTURAL AND BEHAVIORAL MODELING	Classes:12

Structural Modeling: Basic Behavioral Modeling, Use cases, Use case Diagrams, Interactions, Interaction Diagrams, Activity Diagrams.
Behavioral Modeling: Interactions, Interaction diagrams, Use cases, Use case diagrams, Activity diagrams, Events and signals, State machines, State chart diagrams.

UNIT-III	ARCHITECTURAL MODELING	Classes:12

Architectural Modeling: Component, Deployment, Component Diagrams and Deployment Diagrams.
Introduction: Basics of Design patterns, Description of design patterns, Catalog and organization of catalog, design patterns to solve design problems, selection of design pattern, Use of design patterns.

UNIT-IV	CREATIONAL AND STRUCTURAL PATTERNS	Classes:12

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Creational Patterns
Structural Patterns: Adapter, Bridge, Composite, Decorator, Façade.

UNIT-V	STRUCTURAL AND BEHAVIORAL PATTERNS	Classes:12

Structural Patterns: Flyweight, Proxy, Discussion of Structural Patterns
Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns

Text Books:

1. Booch G., Rumbaugh J. & Jacobsons I., "The Unified Modeling Language User Guide", Addison Wesley, 2002.
2. Head First Design Patterns, by Eric Freeman and Elisabeth Freeman
3. Design Patterns Explained, by Shalloway and Trott

Reference Books:
1. Meilir Page-Jones, "Fundamentals of Object Oriented Design in UML", 4th ed., Pearson Education, 2008.
2. Erich Gamma, Design Patterns, Addison-Wesley, 1994
3. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, Pattern-Oriented Software Architecture: A System of Pattern, John Wiley & Sons, 1996.

Web References:
1. www.expertsnotes.com/2018/08/uml-dp-material-for-jntuk-r13.html
2. https://www.thesisscientist.com/Docs/Study Notes/6f3e213f-c133-4342-ac15-5bbfc7b7194a

Outcomes:
At the end of the course students able to
1. Analyzing and Designing Problems Using Object-Oriented Analysis and Design Techniques
2. Analyzing and Designing Problems Using UML
3. To learn importance of Design Patterns
4. About Principles and Strategies of Design Patterns

CRYPTANALYSIS
(ELECTIVE-I)

M.Tech I Semester: Computer Science & Engineering							
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**	
18CO103	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**

Course code	Category	L	T	P	C	CIA	SEE	TOTAL
18CO103	Core	4	0	0	4	40	60	100

Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes:60

OBJECTIVES:

The course should enable the students to:

1. Understanding the maths, the security design principles, the internal structure and important properties of major cryptosystems.
2. Study of major computational hard problems in cryptography (symmetric and public key).
3. Step by step analysis of mathematical/algebraic/statistical attacks, methods and algorithms in cryptanalysis.

UNIT-I	HISTORICAL CRYPTANALYSIS	Classes:12

Historical cryptanalysis. LFSR-based stream ciphers. Modern block ciphers(DES/AES/other). Differential cryptanalysis, linear cryptanalysis.

UNIT-II	ALGEBRAIC CRYPTANALYSIS	Classes:12

Algebraic cryptanalysis in block and stream ciphers Self-similarity attacks. Groups, finite fields. Number theory. Attacks on public key cryptosystems.

UNIT-III	ATTACKS	Classes:12

RSA, factoring, discrete logarithms, elliptic curves, lattice attacks. Cryptographic explorations with software. Protocol/mode/initialization attacks. Side channel attacks.

UNIT-IV	ANALYSIS OF CIPHERS	Classes:12

Solving affine ciphers, Brute force solutions, Using frequency data, Probable word method , Pattern words, Use of I.C. and Kasiski analysis, Reduction to a monoalphabet.

UNIT-V	ATTACKS	Classes:12

Solving Hill ciphers by algebra, Paper and scissors methods, Factorization attacks.

Text Books:

1. Cryptanalysis: A Study of Ciphers and Their Solution by Helen F. Gaines.
2. Applied Cryptanalysis: Breaking Ciphers in the Real World 1st Edition, Richard M. Low.

Reference Books:

1. Cryptography And Security by C. K. Shyamala N Harini Dr T R Padmanabhan.
2. Elementary Cryptanalysis: A Mathematical Approach by Abraham Sinkov.

Web References:

1. www.cs.miami.edu/~burt/learning/Csc609.011/DES/differentialCrypto.html
2. https://cseweb.ucsd.edu/~mihir/papers/gb.pdf

Outcomes:

At the end of the course students able to

1. Knowledge and understanding of how current cryptographic security technologies are built with individual components and their interaction
2. Understanding security goals, attacks and defenses and other requirements in cryptographic systems
3. Understanding different types of attacks (e.g. key recovery vs. decryption)
4. Learning how to evaluate the practical feasibility of attacks in terms of time, memory, pre-computation, data and the protocol / context in which they can be executed.

ADHOC SENSOR NETWORKS
(ELECTIVE-I)

M.Tech I Semester: Computer Science & Engineering

Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
18CO104	Core	4	0	0	4	40	60	100

Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes:60

OBJECTIVES:

The course should enable the students to:

1. Provide knowledge of mobile ad hoc networks, design and implementation issues,and available solutions.
2. Provide knowledge of routing mechanisms and the three classes of approaches:proactive, on-demand, and hybrid.
3. Provide knowledge of clustering mechanisms and the different schemes that have been employed, e.g., hierarchical, flat, and leaderless.

UNIT-I	INTRODUCTION TO WIRELESS NETWORKS	Classes:12

Introduction: Basic communication Technologies, Introduction to Mobile Networks
Types of Wireless networks: MANET: Mobile ad-hoc networks, WSN: Wireless Sensor Networks, VANET: Vehicular Ad-hoc Networks,

UNIT-II	FUNDAMENTALS OF WIRELESS COMMUNICATION	Classes:12

Types of Wireless networks: PAN: Personal Area Networks, DTN: Delay Tolerant Network.
Wireless Communication: Wireless Communication Fundamentals, Cellular Wireless Networks, Mobile Ad-hoc Networks.

UNIT-III	MEDIUM ACCESS LAYER	Classes:12

Layers: Medium Access Control Layer: MACA, MACAW, Wireless LAN, Mobile Network Layer (Mobile IP), DHCP.

UNIT-IV	ROUTING	Classes:12

Routing in Mobile Ad hoc Networks (MANET): AODV (Ad-hoc On Demand Distance Vector Routing Protocol), DSR (Dynamic Source Routing), Secure routing protocols in MANET.

UNIT-V	WIRELESS SENSOR NETWORKS	Classes:12

Wireless Sensor Networks: Routing protocols, Localization methods, Sensor Deployment Strategies), Delay Tolerant Networks, Vehicular Ad-hoc Networks, Wireless Access Protocol, GPS, RFID.

Text Books:

1. C D M Cordeiro, D. P. Agarwal, "Adhoc and Sensor Networks: Theory and applications", World Scientific, 2006.
2. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2003.

Reference Books:

1. Asoke K Talukder and Roopa R. Yavagal; Mobile Computing – Technology,Applications and Service Creation; TMH Pub., New Delhi, 2006.

Web References:

1. https://www.rejinpaul.com/2016/10/cs6003-adhoc-and-sensor-networks-syllabus-notes
2. https://learnengineering.in/cs6003-ad-hoc-and-sensor-networks

Outcomes:

At the end of the course students able to

1. Identify issues related to environment, communication, protocols in mobile computing
2. Evaluate the performance of mobile IPv and IPv6 architectures
3. Analyze performance of transport layer protocols in mobile Ad-hoc networks
4. Design and analyze routing protocols for multi-hop wireless networks

IMAGE PROCESSING
(ELECTIVE-I)

M.Tech I Semester: Computer Science & Engineering							
Course code	Category	Hours/week			Credits	Maximum Marks	
18CO105	Core	L	T	P	C	CIA	SEE	TOTAL
		4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes:60		

OBJECTIVES:

The course should enable the students to:

1. To study the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image enhancement techniques
3. To study image restoration procedures.
4. To study the image compression procedures.

UNIT-I	INTRODUCTION TO IMAGE PROCESSING	Classes:12

Fundamental steps of image processing, components of an image processing of system, the image model and image acquisition, sampling and quantization, station ship between pixels, distance functions, scanner..

UNIT-II	SPATIAL OPERATIONS	Classes:12

Statistical and spatial operations, Grey level transformations, histogram equalization, smoothing & Sharpening-spatial filters, frequency domain filters, homomorphic filtering, image filtering & restoration. Inverse and weiner filtering. FIR weiner filter. Filtering using image transforms, smoothing splines and interpolation.

UNIT-III	MORPHOLOGICAL AND OTHER AREA OPERATIONS	Classes:12

Morphological and other area operations, basic morphological operations, opening and closing operations, dilation erosion, Hit or Miss transform, morphological algorithms, extension to grey scale images. Segmentation and Edge detection region operations, basic edge detection, second order detection.

UNIT-IV	EDGE OPERATORS	Classes:12

Crack edge detection, gradient operators, compass and laplace operators, edge linking and boundary detection, thresholding, region based segmentation, segmentation by morphological watersheds.

UNIT-V	IMAGE COMPRESSION	Classes:12

Image compression: Types and requirements, statistical compression, spatial compression, contour coding, quantizing compression, image data compression-predictive technique, pixel coding, transfer coding theory, lossy and lossless predictive type coding. Basics of color image processing, pseudocolor image processing, color transformation, color smoothing and sharpening, color segmentation, color image compression, compression standards.

Text Books:

1. Digital Image Processing – by Rafael.C.Gonzalez & Richard E.Woods, 3rd edition, Pearson Education, 2008.
2. Digital Image Processing, M.Anji Reddy, Y.Hari Shankar, BS Publications.
3. Fundamentals of Digital Image Processing – by A.K. Jain, PHI.

Reference Books:

1. Digital Image Processing – William K, Part I - John Wiley edition.
2. Digital Image Processing using MATLAB – by Rafael.C.Gonzalez, Richard E.Woods, &

Steven L.Eddins, Pearson Education, 2006
3. Digital Image Processing, Kenneth R. Castleman, Pearson Education, 2007

Web References:
1. https://www.ccdware.com/Files/CCDStack Tutorial.pdf
2. https://www.cs.dartmouth.edu/farid/downloads/tutorials/fip.pdf
3. www.imageprocessingplace.com/downloads_V3/root_downloads/tutorials/Image Processing

Outcomes:

At the end of the course students able to
1. Review the fundamental concepts of a image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques.
5. Interpret Image compression standards.

<p style="text-align:center">**CLOUD COMPUTING**</p>
<p style="text-align:center">**(ELECTIVE-II)**</p>

M.Tech I Semester: **Computer Science & Engineering**							
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
18CO106	**Core**	4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: Nil**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to:

1. Learn the Basics of cloud computing.
2. Understand the Key concepts of virtualization.
3. Understand Different Cloud Computing services
4. Apply Cloud Implementation, Programming and Mobile cloud computing
5. Apply Cloud Backup and Security solutions.
6. Know different open source tools for cloud services.

UNIT-I	**HISTORY OF CENTRALIZED AND DISTRIBUTED COMPUTING**	**Classes:12**

History of Centralized and Distributed Computing - Overview of Distributed Computing, Cluster computing, Grid computing. Technologies for Network based systems- System models for Distributed and cloud computing- Software environments for distributed systems and clouds.

UNIT-II	**INTRODUCTION TO CLOUD COMPUTING**	**Classes:12**

Introduction to Cloud Computing- Cloud issues and challenges - Properties - Characteristics – Service models, Deployment models. Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage. Virtualization concepts -

UNIT-III	**VIRTUALIZATION**	**Classes:12**

Types of Virtualization- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs .
Service models - Infrastructure as a Service (IaaS) - Resource Virtualization: Server, Storage, Network - Case studies.

UNIT-IV	**SERVICES OF CLOUD COMPUTING**	**Classes:12**

Platform as a Service (PaaS) - Cloud platform & Management: Computation, Storage - Case studies. Software as a Service (SaaS) - Web services - Web 2.0 - Web OS – Case studies – Anything as a service (XaaS). Cloud Programming and Software Environments – Programming on Amazon AWS and Microsoft Azure

UNIT-V	**PROGRAMMING SUPPORT OF GOOGLE APP ENGINE**	**Classes:12**

Programming support of Google App Engine – Emerging Cloud software Environment. Cloud Access: authentication, authorization and accounting - Cloud Provenance and meta-data – Cloud Reliability and fault-tolerance - Cloud Security, privacy, policy and compliance- Cloud federation, interoperability and standards.

Text Books:

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009

Reference Books: 1. Anthony T.Velte, TobeJ.Velte, Robert Elsenpeter, Cloud Computing: A Practical Aprroach, Publication Person Education, 2009   2. Tom Clark,Addison ,Storage Virtualization: Technologies for Simplifying Data Storage and Management, -Wesley, 2005   3. Curtis Franklin Jr.Brian J.S. Chee,Cloud Computing Technologies and Strategies of the Ubiquitous DataCenter, 2010   4. Timothy Chou,Introduction to Cloud Computing: Business & Technology, 2009
Web References: 1. https://www.guru99.com/cloud-computing-for-beginners.html   **2.** https://www.smartzworld.com/notes/cloud-computing-pdf-notes-cc/
E-Text Books: 1. https://ndl.iitkgp.ac.in/
Outcomes: At the end of the course students able to   1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing   2. Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.   3. Explain the core issues of cloud computing such as security, privacy, and interoperability.   4. Provide the appropriate cloud computing solutions and recommendations according to the applications used.   5. Collaboratively research and write a research paper, and present the research online.

SOFT COMPUTING
(ELECTIVE-II)

M.Tech I Semester: Computer Science & Engineering

Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
18CO107	Core	4	0	0	4	40	60	100

Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes:60

OBJECTIVES:

The course should enable the students to:

1. Get idea on Artificial Intelligence, Various types of production systems, characteristics of production systems.
2. Knowledge on Neural Networks, architecture, functions and various algorithms involved.
3. Emphasis on Genetic algorithms, its applications and advances.
4. Knowledge on Fuzzy Logic, Various fuzzy systems and their functions.

UNIT-I	INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS	Classes:12

Introduction To Soft Computing And Neural Networks - Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics.

UNIT-II	GENETIC ALGORITHMS	Classes:12

Genetic Algorithms-Introduction to Genetic Algorithms (GA) – Applications of GA in Machine Learning - Machine Learning Approach to Knowledge Acquisition.

UNIT-III	SUPERVISED LEARNING	Classes:12

Neural Networks-Machine Learning Using Neural Network, Adaptive Networks – Feed forward Networks –Supervised Learning Neural Networks – Radial Basis Function Networks.

UNIT-IV	UNSUPERVISED LEARNING	Classes:12

Neural Networks- Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance architectures – Advances in Neural networks.

UNIT-V	FUZZY LOGIC	Classes:12

Fuzzy Logic- Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions- Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.

Text Books:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003.
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1995.
3. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edn., 2003.

Reference Books:

1. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.
2. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 1997.
3. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using

MATLAB", Springer, 2007.
4. S.N.Sivanandam • S.N.Deepa, " Introduction to Genetic Algorithms", Springer, 2007.

Web References:
1. https://nptel.ac.in/courses/106105173/
2. https://sites.google.com/site/7csesoftcomputing/course/lecture-note
3. http://www.soft-computing.de/def.html

E-Text Books:
1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students able to
1. Learn about soft computing techniques and their applications
2. Analyze various neural network architectures
3. Understand perceptrons and counter propagation networks.
4. Define the fuzzy systems
5. Analyze the genetic algorithms and their applications.

ADVANCED DATA MINING
(ELECTIVE-II)

M.Tech I Semester: Computer Science & Engineering							
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**	
18CO108	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:60**		

OBJECTIVES:

The course should enable the students to:

1. To introduce the basic concepts on advanced data mining.
2. To learn mining social networking sites, data in multiple relations and with distributed computing solutions for data intensive applications.

UNIT-I	**INCREMENTAL & STREAM DATA MINING**	**Classes:12**

Incremental & Stream Data Mining: Incremental Algorithms for Data Mining ,Characteristics of Streaming Data, Issues and Challenges, Streaming Data Mining Algorithms, Any time stream Mining.

UNIT-II	**DISTRIBUTED COMPUTING SOLUTIONS and MINING COMPLEX STRUCTURES**	**Classes:12**

Distributed computing solutions for data mining: MapReduce/Hadoop and Spark, Cluster Computing.
Mining Complex Structures: Algorithmic Development Issues, Mining trees, Mining Graphs.

UNIT-III	**SEQUENCE MINING**	**Classes:12**

Case study: Mining Social Networks.
Sequence Mining: Characteristics of Sequence Data, Problem Modeling**,** Sequential Pattern Discovery**,** Timing Constraints**,** Applications in Bioinformatics.

UNIT-IV	**TEXT MINING and WEB SEARCH**	**Classes:12**

Text Mining: Text Classification, Vector Space Model, Flat and Hierarchical Clustering.
Web Search: Crawling & Indexing**,** Hyperlink Analysis**,** Page Rank algorithm**,** Web Search and Information Retrieval, Case Study: Query Recommender System.

UNIT-V	**TIME SERIES**	**Classes:12**

Multivariate Time Series (MVTS) Mining: Importance of MVTS data, Sources of MVTS data**,** Mining MVTS data**,** Sign Language Data**,** Agro-meteorological Data

Text Books:

1. Hadzic F., Tan H. & Dillon T. S. "Mining data with Complex Structures" Springer, 2011
2. Yates R. B. and Neto B. R. "Modern Information Retrieval" Pearson Education, 2005

Reference Books:

1. Tan P. N., Steinbach M & Kumar V. "Introduction to Data Mining" Pearson Education, 2006
2. Han J. & Kamber M., "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, Second Edition, 2006
3. Christopher D.M., Prabhakar R. & Hinrich S. "Introduction to Information Retrieval" Cambridge UP Online edition, 2009

Web References:

1. www.cs.iit.edu/~mbilgic/classes/spring11/cs522/index.html
2. http://www.appliedmaterials.com/nanochip/nanochip-fab-solutions/december-2014/data-mining-techniques

Outcomes:

At the end of the course students able to

1. The role of distributed computing in data intensive data mining
2. Know how to mine complex structures other than records
3. To understand the characteristics of MVTS data and the need for mining MVTS data

RESEARCH METHODOLOGY AND IPR

M.Tech I Semester:	**Common to all Branches**						
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**	
18AS101	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: -**	**Practical Classes: Nil**			**Total Classes:60**		

OBJECTIVES:

The course should enable the students to:

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand the IOR protection provides an incentive to inventors for further research work and investment in R&D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT-I	**Classes:12**

Research Methodology:

Meaning of research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowledge how Research is done, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.

Research Design:

Meaning of Research Design, Need for Research Design, Features of Good Design, Important concepts relating to Research Design, Different Research Designs, Basic principles of experimental designs.

UNIT-II	**Classes:12**

Methods of Data Collection:

Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Some other methods of data collection, Collection of secondary data, Selection of appropriate method for data collection, Case study method.

UNIT-III	**Classes:12**

Testing of Hypotheses:

What is a Hypothesis, Basic concepts concerning testing of hypothesis, Procedure for hypothesis testing, Flow diagram for hypothesis testing, Measuring the power of a hypothesis test, Tests of hypotheses, Importance of Parametric Tests, Hypothesis testing of means, Hypothesis testing for differences between means, Hypothesis testing for comparing two related samples, Hypothesis testing of proportions, Hypothesis testing for difference between proportions, Hypothesis testing for comparing a variance some hypothesized population variance, Testing and equality of variances of two normal populations, Hypothesis testing of correlation coefficients, Limitations of the tests of Hypotheses.

UNIT-IV	Classes:12

Interpretation and Report Writing:

Meaning of Interpretation, Why Interpretation?, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different steps in writing report, Layout of the Research Project, Types of reports, Oral presentation, Mechanics of writing a research report, Precautions for writing research reports.

UNIT-V	Classes:12

Intellectual Property Rights:

Module I- Introduction

1) Intellectual property: meaning, nature and significance

2) Various forms of intellectual properties: copyright, patent, trademark, design, geographical indication, semiconductor and plant variety

3) Major international instruments relating to the protection of intellectual properties

Module II- Copyright

1) Copyright: meaning ,scope

2) Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings

3) Ownership of copyright , Assignment and licence of copyright

4) Infringement and exceptions of infringement of copyright and remedies against infringment of copyright: civil, criminal and administrative.

Module III – Trade Marks

1. Trade mark: meaning,scope

2. Absolute and relative grounds of refusal

3. Doctrine of honest concurrent user

4. Procedure for registration and term of protection

5. Rights of holder and assignment and licensing of marks

6. Infringement and remedies

7. Trade marks registry and appellate board

Module IV- Patents

1. Patent: meaning

2. Criteria for patentability and non-patentable inventions

3. Procedure for registration and term of protection

4. Grants of patent, rights of patentee and revocation of patent

5. Compulsory licence and government use of patent

6. Infringement, exceptions to infringement of patent and remedies

7. Patent office and Appellate Board

Text Books

1. Kothari. C.R, 1990,"Research methodology: Methods and Techniques. New Age International, 418P
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A step by Step Guide for beginers"

Reference Books:

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd. 2007
2. Mayall, "Industrial Design", McGraw Hill, 1974.
3. Niebel, "Product Design", McGraw Hill, 1974.
4. Asimov, "Introduction to Design", Prentice Hall, 1962.
5. Robert P.Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
6. T.Ramappa, "Intellectual Property Rights Under WTO", S.Chand, 2008

ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY

M.Tech I Semester: Computer Science & Engineering								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
18CO110	**Core**	-	-	4	2	25	50	75
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

1. Gain knowledge on Quicksort technique
2. Solving 0/1 Knapsack problem
3. Have knowledge on Graph algorithms
4. BFS & DFS Implementation

LIST OF EXPERIMENTS

Expt. 1	QUICK SORT

Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.

Expt. 2	MERGESORT

Using Open, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.

Expt. 3	WARSHALL'S ALGORITHM

a. Obtain the Topological ordering of vertices in a given digraph.
b. Compute the transitive closure of a given directed graph using Warshall's algorithm

Expt. 4	0/1 KNAPSACK PROBLEM

Implement 0/1 Knapsack problem using Dynamic Programming.

Expt. 5	DIJIKSTRAS ALGORITHM

From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijikstras algorithm.

Expt. 6	MINIMUM COST SPANNING TREE

Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.

Expt.7	BFS AND DFS

a. Print all the nodes reachable from a given starting node in a digraph using BFS method.
 b. Check whether a given graph is connected or not using DFS method.

Expt. 8	TRAVELLING SALES PERSON PROBLEM

Find a subset of a given set S = {sl,s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1,2,6}and{1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.

Expt. 9	TRAVELLING SALES PERSON PROBLEM

Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.

Expt. 10	MINIMUM COST SPANNING TREE

Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

Reference Books:

1. D. Samanta, Classic Data Structures ,PHI, 2005.
2. Aho, Hopcraft, Ullman, Design and Analysis of Computer Algorithms, PEA, 1998.
3. Goodman, Hedetniemi, Introduction to the Design and Analysis of Algorithms TMG.
4. E. Horowitz, S. Sahani, Design and Analysis of Algorithms 3rd Edition, Galgotia.

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR STUDENTS:
SOFTWARE: Dev C++, Turbo C
HARDWARE: Desktop Computers

Course Outcome:
At the end of the course, a student will be able to:
1. Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2. Understand necessary mathematical abstraction to solve problems

UML & DESIGN PATTERNS LABORATORY

M.Tech I Semester: Computer Science & Engineering

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
18CO111	**Core**	-	-	4	2	25	50	75

Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 45	Total Classes: 45

OBJECTIVES:

The course should enable the students to:
1. Construct UML diagrams for static view and dynamic view of the system.
2. Generate creational patterns by applicable patterns for given context.
3. Create refined model for given Scenario using structural patterns.
4. Construct behavioral patterns for given applications.

LIST OF EXPERIMENTS

Expt. 1	ATM APPLICATION
ATM Application	
Expt. 2	LIBRARY MANAGEMENT SYSTEM
Library Management System	
Expt. 3	ONLINE BOOK SHOP
Online Book Shop	
Expt. 4	RAILWAY RESERVATION SYSTEM
Railway Reservation System	
Expt. 5	BANKING SYSTEM
Banking System	
Expt. 6	DOCUMENT EDITOR
Document Editor	
Expt.7	ABSTRACT FACTORY DESIGN PATTERN
Abstract Factory design pattern	
Expt. 8	BUILDER DESIGN PATTERN
Builder design pattern	
Expt. 9	FACADE DESIGN PATTERN
Facade design pattern	
Expt. 10	BRIDGE DESIGN PATTERN
Bridge design pattern	
Expt. 11	DECORATOR DESIGN PATTERN
Decorator design pattern	
Expt. 12	CHAIN OF RESPONSIBILITY
Chain of responsibility	

Reference Books:

1. Booch G., Rumbaugh J. & Jacobsons I., "The Unified Modeling Language User Guide", Addison Wesley, 2002.
   2. Head First Design Patterns, by Eric Freeman and Elisabeth Freeman
   3. Design Patterns Explained, by Shalloway and Trott

Course Home Page:
SOFTWARE AND HARDWARE REQUIREMENTS FOR STUDENTS: **SOFTWARE:** STAR UML, JDK 1.8.0 **HARDWARE:** Desktop Computers

Course Outcome:
At the end of the course, a student will be able to:
   1. Understand the Case studies and design the Model..
   2. Understand how design patterns solve design problems.
   3. Develop design solutions using creational patterns.
   4. Construct design solutions by using structural and behavioral patterns

BIG DATA ANALYTICS

M.Tech II Semester – Computer Science & Engineering							
Course code	Category	Hours/week			Credits	Maximum Marks	
18CO201	Core	L	T	P	C	CIA	SEE	TOTAL
		4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes:60		

OBJECTIVES:

The course should enable the students to:

1. Discuss the challenges traditional data mining algorithms face when analyzing Big Data.
2. Introduce the tools required to manage and analyze big data like Hadoop, NoSql Map Reduce.
3. Teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability using HIVE and PIG.
4. Introduce to the students several types of big data like social media, web graphs and data streams.
5. Enable students to have skills that will help them to solve complex real-world problems in for decision support.

UNIT-I	INTRODUCTION TO ANALYTICS	Classes:12

Introduction to Analytics and R programming: Introduction to R, RStudio (GUI): R Windows Environment, introduction to various data types, Numeric, Character, date, data frame, array, matrix etc., Reading Datasets, Working with different file types .txt,.csv etc. Outliers, Combining Datasets, R Functions and loops.

UNIT-II	WORKING WITH R PROGRAMMING	Classes:12

Manage your work to meet requirements: Understanding Learning objectives, Introduction to work & meeting requirements, Time Management, Work management & prioritization, Quality & Standards Adherence.

Summarizing Data & Revisiting Probability (NOS 2101): Summary Statistics - Summarizing data with R, Probability, Expected, Random, Bivariate Random variables, Probability distribution. Central Limit Theorem etc.

UNIT-III	SQL USING R	Classes:12

Work effectively with Colleagues (NOS 9002): Introduction to work effectively, Team Work, Professionalism, Effective Communication skills, etc.

SQL using R: Introduction to NoSQL, Connecting R to NoSQL databases. Excel and R integration with R connector.

UNIT-IV	CORRELATION AND REGRESSION ANALYSIS	Classes:12

Correlation and Regression Analysis: Regression Analysis, Assumptions of OLS Regression, Regression Modeling. Correlation, ANOVA, Forecasting, Heteroscedasticity, Autocorrelation, Introduction to Multiple Regression etc.

UNIT-V	UNDERSTAND THE VERTICALS	Classes:12

Understand the Verticals - Engineering, Financial and others: Understanding systems viz. Engineering Design, Manufacturing, Smart Utilities, Production lines, Automotive, Technology etc. Understanding Business problems related to various businesses

Text Books:

1. Student's Handbook for Associate Analytics.
2. Time Series Analysis and Mining with R,Yanchang Zhao**.**

Reference Books:

1. Introduction to Probability and Statistics Using R, ISBN: 978-0-557-24979-4, is a textbook written for an undergraduate course in probability and statistics.

2. An Introduction to R, by Venables and Smith and the R Development Core Team. This may be downloaded for free from the R Project website (http://www.r-project.org/, see Manuals). There are plenty of other free references available from the R Project website.

3. Montgomery, Douglas C., and George C. Runger, Applied statistics and probability for engineers. John Wiley & Sons, 2010

Web References:

1. http://anson.ucdavis.edu/~azari/sta137/AuNotes.pdf
2. https://www.edx.org/course/big-data-analytics-adelaidex-analyticsx
3. https://intellipaat.com/blog/big-data-tutorial-for-beginners/
4. https://www.analyticsvidhya.com/blog/2015/.../big-data-analytics-youtube-ted-resourc...

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students able to

1. Identify the need for big data analytics for a domain.
2. Apply big data analytics for a given problem.
3. Suggest areas to apply big data to increase business outcome.
4. Use Hadoop, Map Reduce Framework handle massive data.

MOBILE APPLICATION DEVELOPMENT

M.Tech II Semester: Computer Science & Engineering

Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
18CO202	**Core**	4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: Nil**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to:

1. Understand the characteristics of mobile applications.
2. Know the history of mobile application frameworks.
3. Evaluate the application models of mobile application frameworks.
4. Knowledge on Integrating networking, the OS and hardware into mobile-applications.

UNIT-I	INTRODUCTION	Classes:12

Introduction

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

UNIT-II	BASIC DESIGN	Classes:12

Basic Design

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications.

UNIT-III	TOUCH EVENTS AND GESTURES	Classes:12

Basic Design: Touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability

UNIT-IV	ADVANCED DESIGN	Classes:12

Advanced Design

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT-V	TECHNOLOGY I - ANDROID	Classes:12

Technology I - Android

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

Text Books:

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.
2. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012.

Reference Books:

1. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012.
2. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.

Web References:
1. http://developer.android.com/develop/index.html
2. https://developer.android.com/
3. https://www.tutorialspoint.com/android/
4. https://www.vogella.com/tutorials/android.html
5. https://developer.android.com/guide
6. https://www.codingninjas.in/courses/classroom-android-app-development-course
7. https://www.edx.org/learn/app-development

E-Text Books:
1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students able to
1. Be exposed to technology and business trends impacting mobile applications
2. Be competent with the characterization and architecture of mobile applications
3. Be competent with understanding enterprise scale requirements of mobile applications.
4. Be competent with designing and developing mobile applications using one application development framework.

ELLIPTIC CURVE CRYPTOGRAPHY
(ELECTIVE-III)

M.Tech II Semester: Computer Science & Engineering

Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
18CO203	Core	4	0	0	4	40	60	100

Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes:60

OBJECTIVES:

The course should enable the students to:

1. Basic concepts, facts and algorithms concerning elliptic curves over the rational numbers
2. Finite fields and their applications in cryptography and algorithmic number theory.

UNIT-I	INTRODUCTION	Classes:12

Introduction: Wierstrauss Equation,The Group Law, Projective Space and the Point at Infinity, Proof of Associativity, Equations for Elliptic Curves, Coordinate Systems, The j-invariant, Endomorphisms, Singular Curves, Elliptic Curves mod n.

Tortion Points: Introduction about Torsion Points, Division Polynomials, TheWeil Pairing, The Tate-Lichtenbaum Pairing

UNIT-II	ZETA AND DISCRETE LOGARITHM PROBLEM	Classes:12

Elliptic Curve over Finite Fields- Zeta Functions: Introduvtion, The Frobenius Endomorphism, Determining the Group Order,A Family of Curves, Schoof's Algorithm, Supersingular Curves.

Discrete Logarithm Problem: Introduction, The Index Calculus, General Attacks on Discrete Logs, Attacks with Pairings, Anomalous Curves, Other Attacks.

UNIT-III	PRIMALITY AND FACTORIZATION	Classes:12

Elliptic Curve Cryptography: Introduction, The Basic Setup, Diffie-Hellman Key Exchange, Massey-Omura Encryption, ElGamal Public Key Encryption.

Primality and Factorization of Integers: Primality, Complexity of factoring, RSA

UNIT-IV	ELLIPTIC CURVE OVER Q - LUTZ-NAGELL THEORM	Classes:12

Elliptic Curve OVER Q - LUTZ-NAGELL Theorm: The Torsion Subgroup. The Lutz-Nagell Theorem, Descent and the Weak Mordell-Weil, Theorem Heights and theMordell-Weil Theorem, Heights and theMordell-Weil Theorem, The Height Pairing, Fermat's Infinite Descent, 2-Selmer Groups; Shafarevich-Tate Groups, A Nontrivial Shafarevich-Tate Group, Galois Cohomology, Mordel-Weil Theorem.

UNIT-V	ELLIPTIC CURVE OVER C	Classes:12

Elliptic Curve OVER C: Doubly Periodic Functions, Tori are Elliptic Curves, Elliptic Curves over C, Computing Periods, Division Polynomials, The Torsion Subgroup: Doud's Method, Division Polynomials.

Text Books:

1. L.C. Washington, Elliptic curves: Number Theory and Cryptography, CRC Press, 2008.
2. H. Cohen and G.Frey, Handbook of Elliptic curve and Hyperelliptic Curve Cryptography, CRC Press, 2006.

Reference Books:

1. Jhajharia Smita, Implementation of Elliptic Curve Cryptosystem, LAP Lambert Academic Publishing 2 Jul 2015
2. Chakraborty Satarupa, GSM Security Using Elliptic Curve Cryptography

Web References:

1. https://www.raymondvanbommel.nl/LectureNotes_EllipticCurveCryptography.pdf
2. https://engineering.purdue.edu/kak/compsec/NewLectures/Lecture14.pdf
3. https://crypto.stanford.edu/pbc/notes/elliptic

E-Text Books:

1. https://www.ebookphp.com/advances-in-elliptic-curve-cryptography-london-mathematical-society-lecture-note-serie

Outcomes:

At the end of the course students able to

1. Identify group properties of elliptic curves
2. Compute order of elliptic curve group
3. Design Public key cryptosystems
4. Analyse elliptic curves over C

COMPUTER VISION
(ELECTIVE-III)

M.Tech II Semester: Computer Science & Engineering							
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**	
18CO204	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**

Course code	Category	L	T	P	C	CIA	SEE	TOTAL
18CO204	Core							
		4	0	0	4	40	60	100

Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes:60

OBJECTIVES:

The course should enable the students to:

1. To introduce students the fundamentals of image formation.
2. To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition.
3. To develop an appreciation for various issues in the design of computer vision and object recognition systems.
4. To provide the student with programming experience from implementing computer vision and object recognition applications.

UNIT-I	FEATURES AND FILTERS	Classes:12

Features and filters: low-level vision, Linear filters, Edges and contours, Binary image analysis, Background subtraction, Texture, Motion and optical flow.

UNIT-II	GROUPING AND FITTING: MID-LEVEL VISION	Classes:12

Grouping and fitting: mid-level vision: Segmentation and clustering algorithms, Hough transform, Fitting lines and curves, Robust fitting, RANSAC, Deformable contours, Interactive segmentation.

UNIT-III	MULTIPLE VIEWS	Classes:12

Multiple views: Local invariant feature detection and description, Image transformations and alignment, Planar homography, Epipolar geometry and stereo, Object instance recognition.

UNIT-IV	RECOGNITION	Classes:12

Recognition: high-level vision, Object/scene/activity categorization, Object detection, Supervised classification algorithms, Probabilistic models for sequence data, Visual attributes.

UNIT-V	DEEP AND ACTIVE LEARNING	Classes:12

Recognition: Active learning, Dimensionality reduction, Non-parametric methods and big data Deep learning, convolutional neural networks, Other advanced topics as time permits.

Text Books:
1. Computer Vision: Algorithms and Applications, by Rick Szeliski.
2. Computer Vision: A Modern Approach, David A. Forsyth and Jean Ponce

Reference Books:
1. Computer Vision, Linda G. Shapiro and George C. Stockman
2. Introductory Techniques for 3-D Computer Vision, Emanuele Trucco and Alessandro Verri.
3. Multiple View Geometry in Computer Vision, Richard Hartley and Andrew Zisserman.

Web References:
1. https://www.coursera.org › Browse › Computer Science › Algorithms
2. https://www.cl.cam.ac.uk/teaching/0809/CompVision/CompVisNotes.pdf

E-Text Books:

1. szeliski.org/Book/drafts/SzeliskiBook_20100903_draft.pdf

Outcomes:

At the end of the course students able to

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

SERVICE ORIENTED ARCHITECTURE
(ELECTIVE-III)

M.Tech II Semester: Computer Science & Engineering							
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18CO205	**Core**	L	T	P	C	CIA	SEE	TOTAL
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: Nil**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to:

1. Learn about the fundamentals of SOA and Web services.
2. Able to study about the activity management, composition, messaging, metadata and security
3. Gain knowledge on service layers and principles of service oriented
4. Understand how to build service oriented architectures.

UNIT-I	SOA AND WEB SERVICES FUNDAMENTALS	Classes:12

SOA and Web Services Fundamentals: Introducing SOA- Fundamental SOA, Common Characteristics of Contemporary SOA, Common tangible benefits of SOA, Common pitfalls of adopting SOA. The Evolution of SOA – An SOA timeline, The continuing evolution of SOA, The roots of SOA. Web Services and primitive SOA-The Web Services frame work, Services, Service descriptions, Messaging.

UNIT-II	WEB SERVICES AND CONTEMPORARY SOA	Classes:12

Web Services and Contemporary SOA (Part I-Activity management and Composition) Message exchange patterns, Service Activity Coordination, Atomic transactions, Business Activities, Orchestration, Choreography.
Web Services and Contemporary SOA: (Part-II-Advanced Messaging, Metadata, and Security) Addressing , Reliable messaging, Correlation, Policies, Metadata exchange, Security, Notification and eventing.

UNIT-III	PRINCIPLES OF SERVICE-ORIENTATION	Classes:12

Principles of Service-Orientation: Service – Orientation and the enterprise, Anatomy of SOA, Common Principles of Service – Orientation, interrelation between Principles of Service-Orientation, Service Orientation and Object Orientation, Native Web Services support for Principles of Service- Orientation.
Service Layers: Service-Orientation and Contemporary SOA, Service Layer abstraction, Application Service Layer , Business Service Layer, Orchestration Service Layer, Agnostic Services, Service Layer Configuration Scenarios.

UNIT-IV	BUILDING SOA (PLANNING AND ANALYSIS)	Classes:12

Building SOA (Planning and Analysis): SOA Delivery Strategies-SOA delivery lifecycle phases, the top-down strategy, the bottom-up strategy, the agile strategy. Service Oriented Analysis (Part I- Introduction)-Introduction to Service Oriented Analysis, Benefits of a Business Centric SOA, Deriving Business Services. Service Oriented Analysis (Part-II-Service Modeling)-Service Modeling, Service Modeling guidelines, Classifying Service model logic, Contrasting Service modeling approaches.

UNIT-V	BUILDING SOA (TECHNOLOGY AND DESIGN)	Classes:12

Building SOA (Technology and Design): Service Oriented Design (Part I-Introduction)-
Introduction to Service-Oriented design, WSDL related XML Schema language basics,
WSDL language basics, Service interface design tools. Service Oriented Design (Part II-
SOA Composition Guidelines)-SOA Composing steps, Considerations for choosing service

layers, Considerations for positioning core SOA standards, Considerations for choosing SOA extensions.

Service Oriented Design (Part III- Service Design): Service Design overview, Entity-centric business Service   Design, Application Service Design, Task-centric business Service Design, Service Design guidelines..

Text Books:

1. Thomas Erl, Service-Oriented Architecture-Concepts, Technology, and Design, Pearson Education.
2. Eric Newcomer, Greg Lomow, Understanding SOA with Web Services, Pearson Education.

Reference Books:

1. Jeff Davies & others, The Definitive guide to SOA, Apress, Dreamtech. E.Hewitt, Java SOA Cook book, SPD.
2. M.Rosen and others, Applied SOA, Wiley India pvt. Ltd.
3. J.Mc Govern, and others, Java Web Services Architecture, Morgan Kaufmann Publishers, Elsevier.
4. Shankar.K, SOA for Enterprise Applications, Wiley India Edition.
5. W.Roshen, SOA-Based Enterprise Integration, TMH.

Web References:

1. https://www.cs.colorado.edu/~kena/classes/5828/s10/presentations/soa.pdf
2. https://www.csc2.ncsu.edu/faculty/mpsingh/books/SOC/SOC-Chapter5.pdf

E-Text Books:

1. https://ixn.es/Service%20Oriented%20Architecture%20For%20Dummies.pdf
2. https://www.redbooks.ibm.com/redbooks/pdfs/sg246303.pdf

Outcomes:

At the end of the course students able to

1. Learn standards related to Web services: Web Services Description Language (WSDL), Simple Object Access Protocol (SOAP), and Universal Description, Discovery and Integration (UDDI).
2. Learn basic principles of Service-Oriented Architecture and apply these concepts to develop a sample application
3. Conceptually model Web services and formulate specifications of them in the Resource Description Framework (RDF) and the Web Ontology Language (OWL).
4. Evaluate emerging and proposed standards for the main components of Web services architectures
5. Design, develop and test Web services.

INTERNET OF THINGS
(ELECTIVE-IV)

M.Tech II Semester: Computer Science & Engineering							
Course code	Category	Hours/week			Credits	Maximum Marks		
18CO206	Core	L	T	P	C	CIA	SEE	TOTAL
		4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: Nil		Practical Classes: Nil		Total Classes:60			

OBJECTIVES:

The course should enable the students to:

1. Know the concepts of IOT.
2. Understand different applications in IOT.
3. Know different protocols used in IOT.
4. Learn the concepts of smart city development in IOT.

UNIT-I	INTRODUCTION TO IOT	Classes:12

The IoT Networking Core : Technologies involved in IoT Development:
Internet/Web and Networking Basics: OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting.

UNIT-II	IOT ARCHITCTURE	Classes:12

Internet/Web and Networking Basics: Network Topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing
IoT Architecture:
History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols **Applications:** Remote Monitoring & Sensing, Remote Controlling, and Performance Analysis.

UNIT-III	IOT APPLICATION DEVELOPMENT	Classes:12

The Architecture The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, Security aspects in IoT
IoT Application Development:
Application Protocols MQTT, REST/HTTP, CoAP, MySQL .

UNIT-IV	BACK-END APPLICATION DESIGNING	Classes:12

Back-end Application Designing Apache for handling HTTP Requests, PHP & MySQL for data processing, MongoDB Object type Database, HTML, CSS & jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application Development for mobile Platforms: Overview of Android / IOS App Development tools**.**

UNIT-V	CASE STUDY & ADVANCED IOT APPLICATIONS	Classes:12

Case Study & advanced IoT Applications:
IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)

Text Books:

1. Zach Shelby, Carsten Bormann, The Wireless Embedded Internet Wiley
2. Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems
3. Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur,Adam Dunkels, Morgan Kuffmann

Reference Books:
  1. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning
  2. Internet of Things (A Hands-on-Approach) , Vijay Madisetti , Arshdeep Bahga
  3. Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally

Web References:
  1. https://nptel.ac.in/courses/106105166
  2. https://lecturenotes.in/subject/370/internet-of-things-iot
  3. https://karkare.github.io/cs664

E-Text Books: 1. https://ndl.iitkgp.ac.in/

Outcomes:
At the end of the course students able to
  1. Understand the vision of IoT from a global context
  2. Determine the Market perspective of IoT
  3. Use of Devices, Gateways and Data Management in IoT
  4. Building state of the art architecture in IoT.
  5. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

INFORMATION RETRIEVAL
(ELECTIVE- IV)

M.Tech II Semester: Computer Science & Engineering							
Course code	Category	Hours/week			Credits	Maximum Marks	
18CO207	Core	L	T	P	C	CIA	SEE	TOTAL
		4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes:60		

OBJECTIVES:

The course should enable the students to:

1. To present the basic concepts in information retrieval and more advance techniques of multi modal based information systems.
2. understand the underlined problems related to IR
3. Acquired the necessary experience to design, and implement real applications using information Retrieval systems**.**

UNIT-I	INTRODUCTION	Classes:12

INTRODUCTION

Introduction, History of IR, Components of IR, Issues, Open source Search engine Frameworks, The impact of the web on IR, The role of artificial intelligence (AI) in IR, IR Versus Web Search, Components of a Search engine, Characterizing the web.

UNIT-II	INFORMATION RETRIEVAL	Classes:12

INFORMATION RETRIEVAL

Boolean and vector space retrieval models, Term weighting, TF, IDF weighting, cosine similarity, Preprocessing, Inverted indices, efficient processing with sparse vectors , Language Model based IR, Probabilistic IR, Latent Semantic Indexing, Relevance feedback and query expansion.

UNIT-III	WEB SEARCH ENGINE	Classes:12

WEB SEARCH ENGINE – INTRODUCTION AND CRAWLING

Web search overview, web structure, the user, paid placement, search engine optimization/ spam, Web size measurement, search engine optimization/spam, Web Search Architectures.

UNIT-IV	INTRODUCTION AND CRAWLING	Classes:12

WEB SEARCH ENGINE – INTRODUCTION AND CRAWLING

Crawling metacrawlers, Focused Crawling, web indexes, Near duplicate detection, Index Compression, XML retrieval.

DOCUMENT TEXT MINING

Information filtering, organization and relevance feedback , Text Mining, Text classification and clustering.

UNIT-V	DOCUMENT TEXT MINING	Classes:12

DOCUMENT TEXT MINING

Categorization algorithms: naive Bayes; decision trees; and nearest neighbor -
Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

Text Books:

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval , Cambridge University Press, 2008.
2. Ricardo Baeza -Yates and Berthier Ribeiro - Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2 nd Edition, ACM Press Books 2011.
3. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1 st Edition Addison Wesley, 2009.

Reference Books:
1. Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.
2. Ophir Frieder "Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series ", 2 nd Edition, Springer, 2004.
3. Manu Konchady, "Building Search Applications: Lucene, Ling Pipe", and First Edition, Gate Mustru Publishing, 2008.

Web References:
1. www.bii.a-star.edu.sg/docs/education/lsm5191_03/notes/04%20InfoRetriev.pdf
2. https://www.cse.iitb.ac.in/~cs621-2011/IR_basics_lec28_oct_3_2011.pdf

E-Text Books:
1. https://nlp.stanford.edu/IR-book/pdf/01bool.pdf

Outcomes:
At the end of the course students able to
1. Apply information retrieval models.
2. Design Web Search Engine.
3. Use Link Analysis.
4. Use Hadoop and Map Reduce.
5. Apply document text mining techniques

ADVANCED COMPUTER ARCHITECTURE
(ELECTIVE-IV)

M.Tech II Semester: Computer Science & Engineering							
Course code	Category	Hours/week			Credits	Maximum Marks	
18CO208	Core	L	T	P	C	CIA	SEE	TOTAL
		4	0	0	4	40	60	100

Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes:60

OBJECTIVES:

The course should enable the students to:

1. Understand knowledge of contemporary computer architecture issues and techniques.
2. Knowledge of advanced hardware-based techniques for exploiting instruction level parallelism.
3. Gain Knowledge on various architectures and techniques used for building high performance scalable multithreaded and multiprocessor systems.
4. Able to apply the learned knowledge to conduct computer architecture research using performance simulators.

UNIT-I	INSTRUCTION LEVEL PARALLELISM	Classes:12

Instruction Level Parallelism

ILP – Concepts and challenges – Hardware and software approaches – Dynamic
Scheduling – Speculation - Compiler techniques for exposing ILP – Branch prediction.

UNIT-II	MULTIPLE ISSUE PROCESSORS	Classes:12

Multiple Issue Processors

VLIW & EPIC – Advanced compiler support – Hardware support for exposing parallelism
– Hardware versus software speculation mechanisms – IA 64 and Itanium processors –
Limits on ILP.

UNIT-III	MULTIPROCESSORS AND THREAD LEVEL PARALLELISM	Classes:12

Multiprocessors And Thread Level Parallelism

Symmetric and distributed shared memory architectures – Performance issues –
Synchronization – Models of memory consistency – Introduction to Multithreading.

UNIT-IV	MEMORY AND I/O	Classes:12

Memory And I/O

Cache performance – Reducing cache miss penalty and miss rate – Reducing hit time –
Main memory and performance – Memory technology.

UNIT-V	STORAGE BUSES AND PERFORMANCE	Classes:12

Memory And I/O

Types of storage devices –Buses – RAID – Reliability, availability and dependability – I/O
performance measures –Designing an I/O system.

Text Books:

1. John L. Hennessey and David A. Patterson, " Computer architecture – A quantitative approach", Morgan Kaufmann / Elsevier Publishers, 4th. edition, 2007
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications",Prentice Hall, 1995.
3. James A. Freeman and David M. Skapura, "Neural Networks Algorithms,Applications, and Programming Techniques", Pearson Edn., 2003.

Reference Books:

1. David E. Culler, Jaswinder Pal Singh, "Parallel computing architecture : A

hardware/software approach" , Morgan Kaufmann /Elsevier Publishers, 1999.
2. Kai Hwang and Zhi.Wei Xu, "Scalable Parallel Computing", Tata McGraw Hill, New Delhi, 2003.

Web References:
1. cs.baylor.edu/~maurer/aida/courses/archintro.pdf
2. 164.100.133.129:81/eCONTENT/Uploads/Advanced_Computer_Architecture.pdf
3. https://nptel.ac.in/courses/106102062

Outcomes:
At the end of the course students able to
1. Identify the factors affecting performance in superscalar processors and the key components, options and tradeoffs that a designer has to consider when designing such processors.
2. Identify various simulation techniques used to study superscalar processor performance.
3. Compare checkpoint architectures to conventional speculative execution methods, such as reorder buffer.
4. Explain how Multiscalar and other speculative multithreading architectures work, and the methods for designing speculative multithreading processors.

MOBILE APPLICATION DEVELOPMENT LABORATORY

M.Tech II Semester: Computer Science & Engineering								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
18CO209	**Core**	-	-	4	2	25	50	75
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		

OBJECTIVES:

The course should enable the students to:

1. Develop an application that uses GUI components, Font, Colors, Layout Managers and event listeners.
2. Develop calculator application, to draw basic graphical primitives on the screen.
3. Develop an application that makes use of database and RSS Feed.
4. Implement Multi threading and GPS location information.
5. Design an application that creates an alert upon receiving a message and creates alarm clock

LIST OF EXPERIMENTS

Expt. 1	**GUI Components**

Develop an application that uses GUI components, Font and Colors.

Expt. 2	**Layout Managers**

Develop an application that uses Layout Managers and event listeners.

Expt. 3	**Calculator**

Develop a native calculator application.

Expt. 4	**Graphical Primitives**

Write an application that draws basic graphical primitives on the screen.

Expt. 5	**Database**

Develop an application that makes use of database.

Expt. 6	**RSS Feed**

Develop an application that makes use of RSS Feed.

Expt.7	**Multithreading**

Implement an application that implements Multi threading.

Expt. 8	**GPS Location**

Develop a native application that uses GPS location information.

Expt. 9	**Data to the SD card.**

Implement an application that writes data to the SD card.

Expt. 10	**Alert on message**

Implement an application that creates an alert upon receiving a message.

Expt. 11	Alarm Clock

Write a mobile application that creates alarm clock

Reference Books:

1. Android application Development for Java Programmers, James C Sheusi, Cengage Learning
2. Android In Action by w.Frank Ableson, Robi Sen, Chris King, C. Enrique Ortiz., Dreamtech.
3. Professional Android 4 applications development, Reto Meier, Wiley India, 2012.
4. Android Programming by B.M Harwani, Pearson Education, 2013.

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR STUDENTS:
SOFTWARE: Android Studio
HARDWARE: Desktop Computers

Course Outcome:

1. Build a native application using GUI components and Mobile application development framework
2. Develop an application using basic graphical primitives and databases
3. Construct an application using multi threading and RSS feed
4. Model new applications to hand held devices

BIG DATA ANALYTICS LABORATORY

M.Tech II Semester: Computer Science & Engineering

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
18CO210	**Core**	-	-	4	2	25	50	75

Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 45	Total Classes: 45

OBJECTIVES:

The course should enable the students to:

1. Know about the tools required to manage and analyze big data like Hadoop, NoSql
2. Impart knowledge of Map reduce paradigm to solve complex problems Map-Reduce.
3. Introduce several new algorithms for big data mining like classification, clustering and finding frequent patterns.
4. Know about several types of big data like social media, web graphs and data Streams.
5. Identify various sources of Big data

LIST OF EXPERIMENTS

Expt. 1   DATA STRUCTURES

Implement the following Data structures in Java a)Linked Lists b) Stacks c) Queues d) Set e) Map

Expt. 2   HADOOP

(i)Perform setting up and Installing Hadoop in its three operating modes:
   • Standalone, • Pseudo distributed, • Fully distributed.
(ii)Use web based tools to monitor your Hadoop setup

Expt. 3   FILE MANAGEMENT

Implement the following file management tasks in Hadoop:
   • Adding files and directories • Retrieving files • Deleting files

Expt. 4   WORD COUNT

Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

Expt. 5   MAP REDUCE

Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented.

Expt. 6   MATRIX MULTIPLICATION

Implement Matrix Multiplication with Hadoop Map Reduce

Expt.7   INSTALLATION AND RUNNING OF PIG

Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

Expt. 8	**INSTALLATION AND RUNNING OF HIVE**

Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes

Reference Books:

1. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley Publications, 2014.
2. Tom White, Hadoop: The Definitive Guide, 3rd Edition, O'Reilly Publications, 2012.
3. Paul Zikopoulos, Chris Eaton, and Paul, Understanding Big Data: Analytics for Enterprise Class Hadoop and streaming Data, The McGraw-Hill Companies, 2012.

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR STUDENTS:
SOFTWARE: Hadoop , Hive
HARDWARE: Desktop Computers

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

1. Remember the Big Data Fundamentals, including the evolution of Big Data, the characteristics of Big Data and the challenges introduced.
2. Apply non-relational databases, the techniques for storing and processing large volumes of structured and unstructured data, as well as streaming data.
3. Apply the novel architectures and platforms introduced for Big data, in particular Hadoop and Map Reduce.
4. Classify the challenges of analyzing Big data
5. Implement Large scale analytical tools for solving Big data applications.

TERM PAPER

M.Tech II Semester: Computer Science & Engineering							
Course code	Category	Hours/week			Credits	Maximum Marks	
18CO211	Core	L	T	P	C	CIA	SEE	TOTAL
		0	0	4	2	50	-	50
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes:20			Total Classes:20		

The Term Paper is a self study report and shall be carried out either during II semester along with other lab courses. Every student will take up this term paper individually and submit a report. The scope of the term paper could be an exhaustive literature review choosing any engineering concept with reference to standard research papers or an extension of the concept of earlier course work in consultation with the term paper supervisor. The term paper reports submitted by the individual students during the II semester shall be evaluated for a total of 50 marks for continuous assessment; it shall be conducted by two Examiners, one of them being term paper supervisor as internal examiner and an external examiner nominated by the Principal from the panel of experts recommended by HOD.

BUSINESS ANALYTICS
(OPEN ELECTIVE)

M.Tech III Semester: Computer Science & Engineering							
Course code	Category	Hours/week			Credits	Maximum Marks	
18CO301	Core	L	T	P	C	CIA	SEE	TOTAL
		4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes:60		

OBJECTIVES:

The course should enable the students to:

1. To inculcate research based knowledge in the minds of students.
2. To make them to get awareness regarding analytical tools in the contemporary world.
3. To create knowledge over SPSS and R- Programming.

UNIT-I	INTRODUCTION TO BUSINESS ANALYTICS	Classes:12

Introduction to Business Analytics: Evolution and Scope of Business Analytics. Data for Business Analytics. Analyzing uncertainty and model assumptions – What if analysis, Data tables, Scenario manager and Goal Seek. Regression modeling.

UNIT-II	STATISTICS FOR BUSINESS ANALYTICS	Classes:12

Statistics for Business Analytics: Brief overview of descriptive statistics, graphical representation of data, and overview of hypothesis Testing, Introduction to R-statistical software

UNIT-III	PREDICTIVE ANALYTIC METHODS	Classes:12

Predictive Analytic Methods: Forecasting techniques – Statistical forecasting techniques. Decomposition model – Estimation of trend, seasonality and cyclical components. Smoothing models for forecasting – moving average, Exponential smoothing methods, time series analysis

UNIT-IV	SIMULATION, RISK ANALYSIS, DATA MINING	Classes:12

Simulation, Risk Analysis, Data Mining: Simulation and Risk Analysis – Monte Carlo simulation Examples of simulation models, Introduction to Data Mining – Scope of Data Mining. Data exploration and reduction. Classification – Measuring classification performance. Classification techniques – K nearest neighbor, Discriminate Analysis, factor analysis, and Logistic regression.

UNIT-V	DECISION ANALYSIS	Classes:12

Decision Analysis: Decision making with uncertain information. Decision strategies for a minimize objective. Decision strategies for a maximize objective. Decision Trees, Building a decision tree. Decision trees and risk. Sensitivity analysis, Baye's Rule.

Text Books:

1. Albright C. S., Winston Wayne L. and Zappe C. J (2009). Decision Making Using Microsoft Excel (India Edition). Cengage Learning.
2. Evans J. R (2013). Business Analytics Methods, Models and Decisions. Pearson, Upper Saddle River, New Jersey.

Reference Books:

1. Essentials of Business Analytics, Jeffrey Camm, James Cochran, Michael Fry, Jeffrey Ohlmann, David Anderson .
2. U Dinesh Kumar,Business Analytics: The Science of Data - Driven Decision Making,Wiley (2017)

Web References:

1.www.businessanalytics.com

2. www.spss.com

E-Text Books:
1. https://www.springer.com/in/book/9783319688367

Outcomes:

At the end of the course students able to
 	
    1. Understand the need and significance of business analytics for decision making
    2. Use statistical tools to extract information from raw data.
    3. Use regression technique to build predictive models.
    4. Apply simulation technique to predict business scenarios

OPERATION RESEARCH
(OPEN ELECTIVE)

M.Tech III Semester: Computer Science & Engineering

Course code	Category	Hours/week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
18CO302	**Core**	4	0	0	4	40	60	100

Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes:60

OBJECTIVES:

The course should enable the students to:

1. To provide a formal quantitative approach to problem solving and an intuition about situations where such an approach is appropriate.
2. To introduce some widely-used mathematical models. The understanding of these models will allow the students to communicate with persons who run them and to evaluate the results they present
3. To provide a tool that the students can use to solve management problems.

UNIT-I	LINEAR PROGRAMMING PROBLEMS	Classes:12

Linear programming problems: Linear programming problems - Formulation - Graphical Solution LP problems - Simplex method – Big – M and Artificial variables methods.

UNIT-II	TRANSPORTATION & ASSIGNMENT PROBLEMS	Classes:12

Transportation & Assignment Problems: Definition and application of transportation problem – Initial Basic Feasible solutions by North – West corner, least cost, and Vogel's approximation methods - Solution of the transportation problem – Optimality test-Hungarian Algorithm for balanced and unbalanced problems - Travelling salesman problem.

UNIT-III	SEQUENCING PROBLEMS	Classes:12

Sequencing problems : Introduction to Sequencing - n' jobs on two and three machines, two jobs on 'n' machines

UNIT-IV	GAME THEORY	Classes:12

Game Theory: Two - person zero - sum game - Pure strategy - Games with saddle point - mixed strategies – 2 X 2 games without saddle point - Arithmetic Methods for 2 x 2 games - Rules of Dominance – Algebraic method.

UNIT-V	INTRODUCTION TO NETWORKS	Classes:12

Introduction to networks - Network diagram construction – PERT- calculations of estimated time - standard deviation and probability - CPM - Identification of critical path.

Text Books:

1. S.D. Sharma, "Operations Research" - S. Chand (For 1, 2, and 3 units)
2. Kanti Swarup, P.K. Gupta, and Man Mohan - "Operations Research" – Sultan Chand & Sons – 8th thoroughly revised edition

Reference Books:

1. Prem kumar Gupta, Hira, "Operations Research", - S.Chand, 2008
2. Hamdy, A.Taha, "Operations Research" - An Introduction, - Person Education

Web References:

1.www.advancedanalytical.com

2.www.caseeducation.com

E-Text Books:
1. https://faculty.psau.edu.sa/.../doc-6-pdf-14b14198b6e26157b7eba06b390ab763

Outcomes:

At the end of the course students able to
    1. Get the various methods of simplex methods to industrial applications
    2. Handle the practical situations of transport, assignment, and sequencing problem
    3. Gain the decision making analysis using game theory
    4. Solve the problems related to CPM and PERT using the network construction

COST MANAGEMENT OF ENGINEERING PROJECTS
(OPEN ELECTIVE)

M.Tech III Semester: Computer Science & Engineering

Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
18CO303	Core	4	0	0	4	40	60	100

Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes:60

OBJECTIVES:

The course should enable the students to:

1. To apply modern software packages to conduct analysis of real world data.
2. To understand the technical underpinning of engineering economic analysis.
3. To develop knowledge over project management concepts and other issues.

UNIT-I	UNDERSTANDING COST	Classes:12

Understanding Cost: Introduction, Meaning of Cost, Objective of Costing, Methods of Costing, Technique of Costing, Classification of Cost, Elements of Cost, and Statement of Cost Sheet.

UNIT-II	INTRODUCTION TO MANAGEMENT ACCOUNTING	Classes:12

Introduction to Management Accounting: Introduction, Meaning of Management accounting ,The Role of Management Accounting , Management Accounting Framework , Functions of Management Accounting , Merits of Management Accounting , Demerits of Management Accounting , Distinction between Management Accounting and Financial Accounting

UNIT-III	MARGINAL COSTING AND BREAK EVEN ANALYSIS	Classes:12

Marginal Costing and Break Even Analysis: Introduction , Concept of Marginal Costing Characteristics of Marginal Costing , Difference between Absorption Costing and Marginal Costing , Marginal Cost,   Contribution , Cost Volume Profit (CVP) Analysis , Break Even Chart , Break Even Point, Profit Volume ratio or MCSR , Target profit , Margin of Safety , Application of Marginal cost , Limitations of Marginal cost , Solved Problems

UNIT-IV	BASICS OF PROJECT MANAGEMENT	Classes:12

Basics of Project Management: Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes,   Impact of Delays in Project Completions, Essentials of Project Management Philosophy, Project Management Principles.

UNIT-V	PROJECT MANAGEMENT	Classes:12

Project Management: Introduction – Role of Project Manager - Project Selection – Technical Feasibility – Project Financing – Project Control and Scheduling through Networks (PERT, CPM).

Text Books:

1. A Text book of Cost and Management Accounting – Arora M. N, 11/e, Vikas.
2. Varshney & Maheswari, Managerial Economics, Sultan chand, 2003.

Reference Books:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education.
2. Prasanna Chandra, Project planning and Analysis, TATA MC graw hill, New Delhi

Web References:

1. https://medcraveonline.com/MOJCE/MOJCE-03-00070.pdf
2. https://www.costengineering.eu/images/papers/CEE_2015_Magazine.pdf
3. https://www.cmu.edu/cee/projects/PMbook/12_Cost_Control,_Monitoring,_and_Accounn

ng.html
4. https://bbamantra.com/cost-of-project/

Outcomes:

At the end of the course students able to

1. Understand the concepts in Cost.
2. Know about The Difference Between Cost accounting and management accounting
3. Know about the Marginal Costing and Break Even Analysis
4. Will understand project management concept.
5. Able to do simple problems in PERT, CPM and crashing.

<h1 style="text-align:center; color:red">MACHINE LEARNING
(ELECTIVE-V)</h1>

M.Tech III Semester: Computer Science & Engineering								
Course code	Category	Hours/week			Credits	Maximum Marks		
18CO305	Core	L	T	P	C	CIA	SEE	TOTAL
		4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:60		

OBJECTIVES:

The course should enable the students to:

1. Introduce to the central approaches of machine learning
2. Define a class of problems that encompasses interesting forms of learning
3. Explore algorithms that solve such problems
4. Provide understanding of the fundamental structure of learning problems and processes

UNIT-I	INTRODUCTION	Classes:12

Well defined learning problems, Designing a Learning System, Issues in Machine Learning.

UNIT-II	THE CONCEPT LEARNING TASK	Classes:12

General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias.

UNIT-III	DECISION TREE LEARNING and ANN	Classes:12

DECISION TREE LEARNING : Decision tree learning algorithm, Inductive bias, Issues in Decision tree learning.
ARTIFICIAL NEURAL NETWORKS : Perceptrons, Gradient descent and the Delta rule, Adaline, Multilayer networks, Derivation of back propagation rule Back propagation Algorithm-Convergence, Generalization.

UNIT-IV	EVALUATING HYPOTHESES and BAYESIAN LEARNING	Classes:12

EVALUATING HYPOTHESES: Estimating Hypotheses Accuracy, Basics of sampling Theory, Comparing Learning Algorithms.
BAYESIAN LEARNING: Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm.

UNIT-V	COMPUTATIONAL LEARNING THEORY and INSTANCE-BASED LEARNING	Classes:12

COMPUTATIONAL LEARNING THEORY: Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning.
INSTANCE-BASED LEARNING : k-Nearest Neighbor Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning

Text Books:

1. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017.
2. The Elements of Statistical Learning. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Second Edition. 2009.
3. Foundations of Data Science. Avrim Blum, John Hopcroft and Ravindran Kannan. January 2017.
4. Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2006.

Reference Books:
1. Tom.M.Mitchell, Machine Learning, McGraw Hill International Edition
2. Ethern Alpaydin, Introduction to Machine Learning. Eastern Economy Edition,Prentice Hall of India, 2005.

Web References:
1. www.holehouse.org/mlclass
2. www.ai.mit.edu/courses/6.867-f04/lectures.htm

Outcomes:
At the end of the course students able to
1. Identify instance based learning algorithms
2. Design neural network to solve classification and function approximation problems
3. Build optimal classifiers using genetic algorithms
4. Analyze probabilistic methods for learning

HIGH PERFORMANCE COMPUTING
(ELECTIVE-V)

M.Tech III Semester: Computer Science & Engineering							
Course code	Category	Hours/week			Credits	Maximum Marks	
18CO305	Core	L	T	P	C	CIA	SEE	TOTAL
		4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: Nil		Practical Classes: Nil			Total Classes:60	

OBJECTIVES:

The course should enable the students to:

1. Design and analyze the parallel algorithms for real world problems and implement them on available parallel computer systems.
2. Optimize the performance of a parallel program to suit a particular hardware and software environment.
3. Design algorithms suited for Multicore processor systems using OpenCL, OpenMP, Threading techniques.
4. Analyze the communication overhead of interconnection networks and modify the algorithms to meet the requirements.

UNIT-I	INTRODUCTION	Classes:12

Introduction: Implicit parallelism, Limitations of memory system performance, control structure, communication model, physical organization, communication costs of parallel platforms, Routing mechanisms for interconnection networks, Mapping techniques.

UNIT-II	PARALLEL ALGORITHM DESIGN	Classes:12

Parallel algorithm design: Preliminaries, decomposition techniques, tasks and interactions, mapping techniques for load balancing, methods for reducing interaction overheads, parallel algorithm models**.**

UNIT-III	ANALYTICAL MODELING OF PARALLEL PROGRAMS	Classes:12

Basic communication operations: Meaning of all-to-all, all-reduce, scatter, gather, circular shift and splitting routing messages in parts.

Analytical modeling of parallel programs: sources of overhead, performance metrics, the effect of granularity on performance, scalability of parallel systems, minimum execution time, minimum cost optimal execution time, asymptotic analysis of parallel programs.

UNIT-IV	AN OVERVIEW OF BRIEF HISTORY OF GPUS	Classes:12

Programming using message passing paradigm: Principles, building blocks, MPI, Topologies and embedding, Overlapping communication and computation, collective communication operations, Groups and communicators

An Overview of Brief History of GPUs: An Overview of GPU Programming; An Overview of GPU Memory Hierarchy Features; Introduction to Heterogeneous Computing – OpenCL; The OpenCL Kernel, The OpenCL Memory Model, The OpenCL Execution Model; OpenCL Platform and Devices.

UNIT-V	AN OVERVIEW OF CUDA ENABLED NVIDIA GPUS	Classes:12

An Overview of CUDA enabled NVIDIA GPUs: Introduction to CUDA C, Parallel Programming in CUDA C;

Dense Matrix Algorithms: matrix vector multiplication, matrix-matrix multiplication, solving system of linear equations.

Text Books:
1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar : Introduction to Parallel Computing, Second Edition Pearson Education, 2007
2. Benedict R Gaster, Lee Howes, David R Kaeli Perhaad Mistry Dana Schaa, Heterogeneous Computing with OpenCL McGraw-Hill, Inc. Newyork , 2011
3. Michael J. Quinn, Parallel Programming in C with MPI and OpenMP McGraw-Hill International Editions, Computer Science Series, 2004
Reference Books:
1. Jason Sanders, Edward Kandrot, CUDA By Example – An Introduction to General Purpose GPU Programming, Addison Wesley, 2011.
Web References:
1. https://open.umich.edu/sites/default/files/downloads/col11136-1.5.pdf
2. https://hpcugent.github.io/vsc_user_docs/pdf/intro-HPC-mac-gent.pdf
Outcomes:
At the end of the course students able to
1. Design and analyze the parallel algorithms for real world problems and implement them on available parallel computer systems.
2. Optimize the performance of a parallel program to suit a particular hardware and software environment.
3. Analyze the communication overhead of interconnection networks and modify the algorithms to meet the requirements.

INFORMATION SECURITY & AUDITING
(ELECTIVE-V)

M.Tech III Semester: Computer Science & Engineering							
Course code	Category	Hours/week			Credits	Maximum Marks		
18CO306	Core	L	T	P	C	CIA	SEE	TOTAL
		4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: Nil		Practical Classes: Nil		Total Classes:60			

OBJECTIVES:

The course should enable the students to:

1. To introduce the fundamental concepts and techniques in computer and network security.
2. Giving students an overview of information security and auditing.
3. Expose students to the latest trend of computer attack and defense.
4. Expose students to other advanced topics on information security such as mobile computing security, security and privacy of cloud computing.

UNIT-I	INTRODUCTION	Classes:12

Introduction to Information Security and IS Auditing: Objectives of IS audit and control, The structure of an IS audit and audit reports, IS auditing standards, Computer assisted audit tools.

Organization Security and Controls: Physical security controls, Logical security controls, Operating controls, Personnel security and management practices, Application software control.

UNIT-II	BASICS OF CRYPTOGRAPHIC TECHNOLOGIES	Classes:12

Basics of Cryptographic Technologies: Symmetric encryption, Asymmetric encryption Basics of message authentication and cryptographic hash functions, Digital signatures and digital certificates, Public-key Infrastructure & Web of Trust.

UNIT-III	HOST SECURITY – ATTACK & DEFENSE	Classes:12

Host Security – Attack & Defense: Virus, Worm, Trojan Horse Rootkit & Stealth, Stack-based Buffer Overflow.

UNIT-IV	USER AUTHENTICATION	Classes:12

User Authentication: User Authentication, Access Control and Identity Management.
Network Security – Attack & Defense: Network Attacks, Network Defense.

UNIT-V	INFORMATION SYSTEM SECURITY	Classes:12

Information System Security Auditing, Computer Forensic and Other Security Technologies : Security auditing and security standards, Incident handling and computer forensic, Other security technologies including blockchain.

Text Books:

1. William Stallings and Lawrie Brown, Computer Security Principles and Practice, (3rd Edition), Pearson, 2014
2. Bruce Schneier, Applied Cryptography: Protocols, Algorithms and Source Code in C, Wiley, 2015
3. Niels Ferguson, Bruce Schneier, and Tadayoshi Kohno,Cryptography Engineering: Design Principles and Practical Applications, John Wiley & Sons, 2010.

Reference Books:

1. Ross J. Anderson, Security Engineering: A Guide to Building Dependable Distributed Systems, 2nd Edition, Wiley, 2008.
2. Michael E. Whitman, Herbert J. Mattord, Readings and Cases in the Management of Information Security, 3rd Edition, Course Technology, 2005.

Web References:
1. Https://www.cert-in.org.in/PDF/guideline_auditee.pdf
2. gswan.gov.in/PDF/D3-1-Security-Audit-Concepts-and-Importance-60min.pdf

Outcomes:

At the end of the course students able to
1. Describe fundamental concepts of information security and systems auditing.
2. Analyze the latest trend of computer security threats and defense.
3. Identify security weaknesses in information systems, and rectify them with appropriate security mechanisms.
4. Critically evaluate the security of information systems

PROJECT WORK PHASE – I

M.Tech III Semester: Computer Science & Engineering							
Course code	Category	\multicolumn{3}{c}{Hours/week}	Credits	\multicolumn{3}{c}{Maximum Marks}

Course code	Category	L	T	P	C	CIA	SEE	TOTAL
18CO307	**Core**	0	0	20	10	Grade
Contact Classes:-	Tutorial Classes: -	\multicolumn{4}{l}{Practical Classes: 40}	\multicolumn{3}{c}{Total Classes:40}

Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the college/ concerned department.

➢ **Registration of Project work**: A candidate is permitted to register for the project work phase-I after satisfying the attendance requirement of all the courses (theory and practical courses of I & II Semesters).

➢ An Internal Departmental Committee (I.D.C) consisting of HOD, Supervisor/ Guide and one Internal senior expert shall monitor the progress of the project work.

➢ The work on the project work phase-I shall be initiated in the III semester and continued in the final semester. The candidate can submit Project work phase-I dissertation with the approval of I.D.C. after 18 weeks from the date of registration at the earliest from the date of registration for the project work phase-I.

• The student must submit status report at least in three different phases during the project work period. These reports must be approved by the I.D.C before submission of the Project Report.

• Three copies of the Dissertation certified in the prescribed form by the supervisor and HOD shall be submitted to the HOD.

• The semester end examination for project work phase-I done during III Semester, shall be conducted by a Project Review Committee (PRC). The evaluation of project work shall be conducted at the end of the III Semester.

• The PRC comprises of an External examiner appointed by the Principal, Head of the Department and Project Guide/Supervisor to adjudicate the dissertation. The PRC shall jointly evaluate candidates work and award grades as given below.

S.No	Description	Grade	Grade Point (GP) Assigned
1	Very Good	Grade A	10
2	Good	Grade B	9
3	Satisfactory	Grade C	8
4	Not satisfactory	Grade D	0

If the report of the viva-voce is not satisfactory (Grade D) the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination he will not be eligible for the award of the degree unless the candidate is permitted to revise and resubmit the dissertation.

PROJECT WORK PHASE – II

M.Tech IV Semester: Computer Science & Engineering							
Course code	Category	Hours/week			Credits	Maximum Marks		
18CO401	**Core**	L	T	P	C	CIA	SEE	TOTAL
		0	0	32	16	Grade		
Contact Classes:-	Tutorial Classes: -	Practical Classes: 60			Total Classes:60			

Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the college/ concerned department.

➤ **Registration of Project work**: A candidate is permitted to register for the project work phase-I after satisfying the attendance requirement of all the courses (theory and practical courses of I & II Semesters)

➤ An Internal Departmental Committee (I.D.C) consisting of HOD, Supervisor/ Guide and one Internal senior expert shall monitor the progress of the project work.

➤ The work on the project work phase-II shall be initiated in the IV semester. The candidate can submit Project work phase-II dissertation with the approval of I.D.C. after 18 weeks from the date of registration at the earliest from the date of registration for the project work phase-I.

• The student must submit status report at least in three different phases during the project work period. These reports must be approved by the I.D.C before submission of the Project Report.

• Three copies of the Dissertation certified in the prescribed form by the supervisor and HOD shall be submitted to the HOD.

• The semester end examination for project work phase-I done during III Semester, shall be conducted by a Project Review Committee (PRC). The evaluation of project work shall be conducted at the end of the IV Semester.

• The PRC comprises of an External examiner appointed by the Principal, Head of the Department and Project Guide/Supervisor to adjudicate the dissertation. The PRC shall jointly evaluate candidates work and award grades as given below

S.No	Description	Grade	Grade Point (GP) Assigned
1	Very Good	Grade A	10
2	Good	Grade B	9
3	Satisfactory	Grade C	8
4	Not satisfactory	Grade D	0

If the report of the viva-voce is not satisfactory (Grade D) the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination he will not be eligible for the award of the degree unless the candidate is permitted to revise and resubmit the dissertation.