CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution)

ACADEMIC REGULATION R-18

FOR CBCS BASED M. TECH. (REGULAR) DEGREE PROGRAMMES

(Applicable for the students of M. Tech. programme admitted into I year from Academic Year 2018-19 and onwards)

1.0 Eligibility for Admissions

Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by Government of Telangana State from time to time.

Admission shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the Government of Telangana or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Government from time to time.

2.0 Award of M. Tech. degree

2.1 A student shall be declared eligible for the award of the M. Tech. Degree, if he pursues a course of study in not less than two and not more than four academic years. However, he is permitted to write the examinations for two more years after four academic years of course work, failing which he shall forfeit his seat in M.Tech. programme.

2.2 The M. Tech. degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the program and who fulfil all the requirements for the award of the degree.

2.3 The student shall register for all 68 credits and secure all the 68 credits.

2.4 The medium of instruction and examination shall be English.

3.0 A. Courses of Study

The following specializations are offered at present for the M. Tech. course of study.

1. Embedded Systems
2. Power Electronics
3. Structural Engineering
4. Computer Science & Engineering

and any other course as approved by the College/ University/AICTE from time to time.

B. Departments offering M.Tech. programmes with specializations mentioned below:

Sl. No.	Department	M.Tech Course
1	ECE	Embedded Systems
2	EEE	Power Electronics
3	Civil	Structural Engineering
4	CSE	Computer Science & Engineering

4.0 Course Registration

4.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him about the PG Programme, its Course Structure and Curriculum, Choice/Option for Courses, based on his competence, progress, pre-requisites and interest.

4.2 Academic Section of the College invites 'Registration Forms' from students within 15 days from the commencement of class work through 'ON-LINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ON-LINE Registration Requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.

4.3 A Student can apply for ON-LINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his Faculty Advisor, which should

be submitted to the College Academic Section through the Head of Department (a copy of the same being retained with Head of Department, Faculty Advisor and the Student).

4.4 If the Student submits ambiguous choices or multiple options or erroneous entries - during ON-LINE Registration for the Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, thereby causing discrepancy, the decision of Head of the Department shall be final.

4.5 Course Options exercised through ON-LINE Registration are final and cannot be changed /inter-changed; further, alternate choices will also not be considered. However, if the Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Course (subject to offering of such a Course), or for another existing Course (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the first week from the commencement of Class-work for that Semester.

5.0. Attendance

The programs are offered on a unit basis with each course t being considered a unit.

5.1 The minimum instruction period for each semester shall be 90 clear instruction days.

5.2 A student shall be eligible to write semester end examinations of a course if he acquires a minimum of 75% of attendance in that course.

5.3 Condonation of shortage of attendance in each Course up to 10% (65% and above and below 75%) in each semester may be granted by the Institute Academic Committee on valid medical reasons.

5.4 Shortage of attendance below 65% shall not be condoned.

5.5 Students whose shortage of attendance is not condoned in any semester for a course(s) are not eligible to write their end semester examination of those courses and their registration for these courses shall stand cancelled. They have to register for these courses later when offered.

5.6 A fee as prescribed by the Institute Academic Committee shall be payable towards condonation of shortage of attendance.

5.7 A candidate shall put in a minimum required attendance, in at least 3 theory Courses in I semester for promoting to II semester.

5.8 In order to qualify for the award of the M. Tech. Degree, the candidate shall complete all the academic requirements of the courses, as per the course structure.

5.9 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester as applicable. They may re-register for the semester when offered next. If a candidate fulfils the attendance requirement in the present semester, he shall not be eligible for re- registration into the same class.

6.0 Evaluation

6.1 The performance of the candidate in each semester shall be evaluated Course-wise, with a maximum of 100 marks for theory and 100 marks for practicals, on the basis of Internal Evaluation and Semester End Examination.

6.2 For the theory courses 70 marks shall be awarded based on the performance in the Semester End Examination and 30 marks shall be awarded based on the Internal Evaluation. For internal evaluation there shall be the two internal examinations conducted-one in the middle of the semester and the other immediately after the completion of instruction period. Each internal examination shall be conducted for a total duration of 120 minutes. The final marks secured by the student in 'internal

evaluation' for the semester are arrived at by giving a weightage of 70% to the best secured 'internal examination' and 30% weightage to the least secured 'internal examination'. A student who is absent for any internal examination for any reason what so ever shall be deemed to have secured 'zero' marks in the test/ examination and no make-up test/ examination shall be conducted.

6.3 Question paper pattern for evaluation

I. Internal Examination

Part A (10 Marks)

5 questions of 2 marks each (All questions are compulsory).

Part B (20 Marks)

4 Questions to be answered out of 6 questions, each question carries 5 marks.

II. External Examination

Part A (20 Marks)

5 questions (1 question from each unit) of 4 marks each (Compulsory questions)

Part B (50 Marks)

5 questions (1 question from each unit with internal choice) each question carries 10 marks.

6.4 For practical courses, 70 marks shall be awarded based on the performance in the End Semester Examinations. 30 marks shall be awarded for day to day performance in the practicals as internal marks. Laboratory end examination for M. Tech. courses for 70 marks must be conducted with two Examiners, one of them being the Laboratory Course Teacher and the second examiner shall be External Examiner. External Examiner shall be appointed by the Controller of Examinations from other institutions or industry.

6.5 There shall be Mini project with seminar presentation during II semester. For Mini project with seminar, a student under the supervision of a faculty member, shall do a mini project and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Head of the Department, Supervisor

and two other senior faculty members of the department. For each Seminar there will only be internal evaluation for 50 marks. A candidate has to secure for each seminar a minimum of 50% of maximum marks to be declared successful. If he fails to secure minimum marks, he has to re-appear during the supplementary examinations.

6.6 Each student shall start the Project Work during the IV Semester as per the instructions of the Project Guide/ Project Supervisor assigned by the Head of the Department.

a) The Project Work shall be divided and carried out in 2 phases : Phase – I (Project-I) during III Semester, and Phase – II (Project-II) during IV Semester, and the student has to prepare two independent Project Work Reports – one each during each phase. First Report shall include the Project Work carried out under Phase – I, and the Second Report (Final Report) shall include the Project Work carried out under Phase – I and Phase – II put together. Phase – I and Phase – II of the Project Work shall be evaluated for 100 marks each.

b) Out of the total 100 marks allotted for each Phase of the Project Work, 40 marks shall be for the Continuous Internal Evaluation(CIE), and 60 marks shall be for the End Semester Viva-voce Examination (SEE). The marks earned under CIE for both Phases of the Project shall be awarded by the Project Guide/Supervisor (based on the continuous evaluation of student's performance during the two Project Work Phases/periods); and the marks earned under SEE shall be awarded by the Project Viva-voce Committee/ Board (based on the work carried out, report prepared and the presentation made by the student at the time of Viva-voce Examination).

c) For the Project Phase - I, the Viva-voce shall be conducted at the end of the III Semester, before the commencement of the semester End Examinations, at the Department Level by a Committee comprising of the HoD or One Professor and Supervisor (no external examiner), and the Project Phase – II Viva-voce (or Final Project

Viva-voce) shall be conducted by a Committee comprising of an External Examiner, the Head of the Department and the Project Supervisor at the end of the IV Semester, before the commencement of the semester End Examinations. The External Examiner shall be nominated by the CoE from the panel of 3 names of external faculty members (Professors or Associate Professors outside the College) submitted by the HoD.

d) If a student does not appear for any of the two Viva-Voce examinations at the scheduled times as specified above, he may be permitted to reappear for Project Phase-I and/or Project Phase-II Viva-voce examinations, as and when they are scheduled in that semester; if he fails in such 'one reappearance' evaluation

also, he has to reappear for the same in the next subsequent semester(s), as and when they are scheduled, as supplementary candidate. For the registration of Project Phase-II the student must have passed Project Phase-I.

A candidate shall be deemed to have secured the minimum academic requirement in a course if he secures a minimum of 40% marks in the End semester Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

6.7 In case the candidate does not secure the minimum academic requirement in any course (as specified in 5.9) he has to reappear for the Semester End Examination in that course.

6.8 A candidate shall be given one chance to re-register for the Courses if the internal marks secured by a candidate are less than 50% and has failed in the end examination. In such a case, the candidate must re-register for the Course(s) and secure the required minimum attendance. The candidate's attendance in the re-registered Course(s) shall be calculated separately to decide upon his eligibility for writing the end examination in those Courses(s). In the event of the student taking another chance, his internal marks and end examination marks obtained in the previous attempt stand cancelled.

6.9 In case the candidate secures less than the required attendance in any course, he shall not be permitted to write the End Examination in that course. He shall re-register the course when next offered.

7.0 Examinations and Assessment – The Grading System

7.1 Marks will be awarded to indicate the performance of each student in each Theory Course or Lab/Practical, or Project, etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in item 6 above, and a corresponding Letter Grade shall be given.

7.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades

(UGC Guidelines) and corresponding range of percentage of marks shall be followed:

% of Marks Secured (class intervals)	Letter Grade (UGC Guidelines)	Grade Points
80% and above (≥ 80%, ≤ 100%)	**O (Outstanding)**	**10**
Below 80% but not less than 70% (≥ 70%, <80%)	**A^+ (Excellent)**	**9**
Below 70% but not less than 60% (≥ 60%, <70%)	**A (Very Good)**	**8**
Below 60% but not less than 55% (≥ 55%, <60%)	**B^+ (Good)**	**7**
Below 55% but not less than 50% (≥ 50%, < 55%)	**B (above Average)**	**6**
Below 50% (< 50%)	**F (FAIL)**	**0**
Absent	**AB**	**0**

7.3 A student obtaining 'F' Grade in any Course shall be considered ' failed ' and is required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when offered. In such cases, his Internal Marks (CIE Marks) in those Courses will remain the same as those he obtained earlier.

7.4 A student not appeared for examination the 'AB' Grade will be allocated in any Course shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when offered.

7.5 A Letter Grade does not imply any specific Marks percentage and it will be the range of marks percentage.

7.6 In general, a student shall not be permitted to repeat any Course (s) only for the sake of 'Grade Improvement' or 'SGPA/CGPA Improvement'

7.7 A student earns Grade Point (GP) in each Course, on the basis of the Letter Grade obtained by him in that Course. The corresponding 'Credit Points '(CP) are computed by multiplying, the Grade Point with Credits for that particular Courses.

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

7.8 The Student passes the Course only when he **gets GP ≥ 6 (B Grade or above)**

7.9 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (∑CP) secured from All Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places, SGPA is thus computed as.

SGPA = { ∑Ni=1 Ci Gj } / { ∑Ni =1 Ci} ….For each Semester.

Where 'i' is the Course indicator index (takes into account all Courses in a Semester), 'N' is the no. of Courses 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), Ci is the no. of Credits allotted to the ith Course, and Gi

represent the Grade Points (GP) corresponding to the Letter Grade awarded for that ith Course.

7.10 The Cumulative Grade Point Average (CGPA) is measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in All registered Courses in All Semesters, and the Total Number of Credits registered in All the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, as the end of each Semester, as per the formula.

CGPA = {∑M j=1 C j G j } / {∑M j=1 C j} } …. For all S Semester registered

{ it., upto and inclusive of S Semester, S ≥2).

Where 'M' is the TOTAL no. of Subject (as specifically required and listed under the Course Structured of the parent Department) the Student has 'REGISTERED' from the 1st Semester onwards upto and inclusive of the Semester S (Obviously M > N), 'j ' is the Subject indicator index (takes into account all Courses from 1 to S Semesters),C j is the no. of Credits allotted to the jth Courses from Gj represent the Grade Points (GP) corresponding to the Letter Grade awarded for the jth Course. After registration and completion of II Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

7.11. For Calculations listed in item 7.6 – 7.10, performance in failed Courses (securing F Grade) will also be take into account, and the credits of such Courses will also be included in the multiplications and summations.

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8.0 Evaluation of Project/Dissertation Work

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

8.1 A Project Review Committee (PRC) shall be constituted with Head of the Department as Chairperson, Project Supervisor and one senior faculty

member of the Department offering the M.Tech programme as members.

8.2 Registration of Project Work: A Candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses, both theory and practical of I year.

8.3 After satisfying 8.2, a candidate has to submit, in consultation with his project Supervisor, the title, objective and plan of action of his project work to the PRC for approval. Only after obtaining the approval of the PRC the student can initiate the Project work.

8.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the changes of topic/supervisor leads to a major changes of his initial plans of project proposal. If yes his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

8.5 A candidate shall submit his project status report in two stages at least with a gap of 3 months between them.

8.6 The work on the project shall be initiated at the beginning of the III semester and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.

8.7 After approval from the PRC, the soft copy of the thesis should be submitted to the College for ANTI-PLAGIARISM check and the plagiarism report should be included in the final thesis. If the result of above check is less than 24%, then only thesis will be accepted for submission.

8.8 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College.

8.9 For Project Work,
Review-I will be conducted in III Semester and carries a maximum internal marks of 40. The evaluation should be done by the PRC for 20 marks and Project Supervisor for 20 marks. The Supervisor and PRC will examine the Literature Survey in the same domain, Problem Definition, Objective, Scope of Work. A candidate has to secure a minimum of 50% of marks to be declared successful in Project Work Review I. If he fails to secure minimum required marks he has to reappear during the supplementary examination.

8.10 Project Work Review II in IV Semester carries 40 internal marks. The evaluation should be done by the PRC for 20 marks and the Project Supervisor for 20 marks. The PRC will examine the overall progress of the Project Work and decide the eligibility of the Project for final submission. A candidate has to secure a minimum of 50% of marks to be declared successful in Project Work Review II. If he fails to fulfill minimum marks, he has to reappear for Review-II during the supplementary examination.

8.11 The thesis shall be adjudicated by the committee consisting of one senior faculty selected by the Head of the Department, the guide concerned, Head of the Department and external examiner.

8.12 If the report of the committee is not favourable, the candidate shall revise and resubmit the Thesis. If the report of the committee is unfavourable again, the thesis shall be summarily rejected.

8.13 For Project Work Evaluation (Viva Voice) will be conducted on acceptance of the Thesis in IV Semester. This is an external evaluation for 60 marks and will be evaluated by the committee. The External Examiner for the committee shall be appointed by the Controller of Examinations. The candidate has to secure minimum of 50% marks in Project Evaluation (Viva Voice) examination for its successful completion.

8.14 If he fails to secure minimum marks as specified in 8.13, he will reappear for the Viva Voice examination only after three months. In the reappeared

examination also if the candidate fails to secure minimum prescribed marks the registration for the programme stands cancelled and he will not be eligible for the award of the degree.

8.15 The Head of the Department shall coordinate and make arrangements for the conduct of Project Viva Voice examination.

9.0 Award of Degree and Class

9.1 A Student who registers for all the specified Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secured the required number of 88 Credits (with CGPA ≥ 6.0), shall be declared to have 'QUALIFIED' for the award of the M.Tech. Degree in the chosen Branch of Engineering and Technology, with the specialization for which he took admission.

9.2 Award of Class

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

Class Awarded	CGPA
First Class and Distinction	≥ 7.75
First Class	6.75 ≤ CGPA > 7.75
Second Class	6.00 ≤ CGPA < 6.75

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

10. Withholding of Results

If the student has not paid the dues, if any, to the institution or if any case of indiscipline is pending against him, the result of the student will be withheld and

he will not be allowed into the next semester.

11. General

11.1 Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

11.2 The academic regulation should be read as a whole for the purpose of any interpretation.

11.3 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.

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

MALPRACTICES RULES
DISCIPLINARY ACTION FOR
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 or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
1. (b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he 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 subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other Courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the Courses of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance

		of the original candidate who has been impersonated, shall be cancelled in all the Courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the Remaining Courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all end semester 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 will be handed over to the police and a case is registered against him.
4.	Smuggles 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 subject 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 end semester 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 subject
6.	Refuses to obey the orders of the Chief Superintendent/ Assistant–Superintendent / any officer on duty or misbehaves or creates disturbance of anykind in and around the college	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other Courses the

	or organizes a walk out or instigates others to examination hall walkout, 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.	candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the Courses of that semester/year. The candidates are also debarred 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 exam 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 subject 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 University 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 subject 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.	If the student belongs to the college, expulsion from the examination hall an cancellation of performance in that subject and all other Courses hall and all other Courses that 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 subject and all other Courses the candidate has already appeared including practical examinations and project work and shall not be permitted for other 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 subject and all other Courses the candidate has appeared including practical examinations and project work of that semester/year.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the College Academic Committee for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

Punishments to the candidates as per the above guidelines.

Malpractice identified at Spot center during valuation

The following procedure is to be followed in case of malpractice cases detected during valuation, scrutiny etc. at spot center.

1 Malpractice is detected at the spot valuation. The case is to be referred to the malpractice committee. Malpractice committee will meet and discuss/question the candidate and based on the evidences, the committee will recommend suitable action on the candidate.

2 A notice is to be served to the candidate(s) involved through the Principal to his address and to the candidate(s) permanent address regarding the malpractice and seek explanations.

3 The involvement of staff who are in charge of conducting examinations, invigilators valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examinations shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

4 Based on the explanation and recommendation of the committee, action may be initiated.

5 Malpractice committee:

i.	Controller of Examinations	Chairman
ii.	Assistant controller of Evaluation	Member
iii.	Chief Examiner of the subject/ subject expert	Member
iv.	Concerned Head of the Department	Member
v.	Concerned Invigilator	Member

DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE FOR CBCS BASED M.TECH (STRUCTURAL ENGINEERING) R-03
EFFECTIVE FROM AC YEAR 2018-19

I SEMESTER

S.No	CODE	Group	COURSE TITLE	L	T	P	C
1	B30401	PC	Advanced Structural Analysis	3	0	0	3
2	B30402	PC	Theory of Elasticity	3	0	0	3
3		PE	Professional Elective –I	3	0	0	3
4		PE	Professional Elective –II	3	0	0	3
5	B30409	PC	Numerical Methods Lab	0	0	4	2
6	B30410	PC	Advanced Concrete Laboratory-I	0	0	4	2
7	B30212	MC	Research Methodology and IPR	2	0	0	2
8	C30001	Audit-I	English for Research paper writing	2	0	0	0
			Total	**16**	**0**	**8**	**18**

II SEMESTER

S.No	CODE	Group	COURSE TITLE	L	T	P	C
1	B30411	PC	Finite Element Methods in Structural Engineering	3	0	0	3
2	B30412	PC	Structural Dynamics	3	0	0	3
3		PE	Professional Elective –III	3	0	0	3
4		PE	Professional Elective –IV	3	0	0	3
5	B30419	PC	Advanced CADD Lab	0	0	4	2
6	B30420	PC	Advanced Concrete Laboratory-II	0	0	4	2
7	B30421	PW	Mini Project with seminar	0	0	4	2
8	C30002	Audit-II	Value education	2	0	0	0
			TOTAL	**14**	**0**	**12**	**18**

III SEMESTER

S.No	CODE	Group	Title	L	T	P	C
1		PE	Professional Elective –V	3	0	0	3
2		OE	Open Elective	3	0	0	3
3	B30425	PW	Project/ Dissertation Phase -I	0	0	20	10
			TOTAL	6	0	20	**16**

IV SEMESTER

S. No	CODE	Group	Course Title	L	T	P	C
1	B30426	PW	Project/Dissertation Phase-II	0	0	32	16
			Total Credits	**0**	**0**	**32**	**16**

S.No	Group	Code	Course Title
1	PC	B30401	Advanced structural analysis
2		B30402	Theory of elasticity
3		B30411	Finite element methods in structural engineering
4		B30412	Structural dynamics
5	PE-1	B30403	Theory of thin plates and shells
6		B30404	Advanced reinforced concrete design
7		B30405	Theory of structural stability
8	PE-2	B30406	Numerical methods in structural Engineering
9		B30407	Soil dynamics & machine foundations
10		B30408	Structural health monitoring
11	PE-3	B30413	Advanced steel design
12		B30414	Design of prestressed concrete structures
13		B30415	Design of masonry structures
14	PE-4	B30416	Soil structure interaction
15		B30417	Advanced design of foundations
16		B30418	Design of industrial structures
17	PE-5	B30422	Earthquake resistance design of buildings
18		B30423	Experimental stress analysis
19		B30424	Bridge engineering
20	Laboratory 1	B30409	Numerical methods lab
23	Laboratory 2	B30410	Advanced concrete laboratory-i
24	Laboratory 3	B30419	Advanced CADD Lab
27	Laboratory 4	B30420	Advanced concrete laboratory-ii
28	PW	B30212	Research methodology and IPR
29		B30421	Mini project with seminar
30		B30425	Project/ Dissertation Phase –I

31		B30426	Project/Dissertation Phase-II

S.No	Group	Code	Course Title
1	Audit course -1	C30001	English for Research Paper Writing
2	Audit course -2	C30002	Value Education
3	Open Elective-1	B30532	Big Data and Analytics
4	Open Elective-2	B30533	Programming in Python
5	Open Elective-3	B30230	Application Specific Integrated Circuits Design
6	Open Elective-4	B30231	Embedded Systems
7	Open Elective-5	B30331	Renewable Energy Sources
8	Open Elective-6	B30332	Industrial Safety
9	Open Elective-7	B30431	Green Buildings
10	Open Elective-8	B30432	Construction Project Management

S.No	Category
PC	Professional Course
PE	Professional Elective
OE	Open Elective
PW	Project Work, Seminar

(B30401) ADVANCED STRUCTURAL ANALYSIS

M.Tech (SE)-I Semester	L	T	P	C
	3	0	0	3

UNIT I

Introduction to matrix methods of analysis - static indeterminacy and kinematic indeterminacy - degree of freedom - coordinate system - structural idealization stiffness and flexibility matrices - suitability element stiffness equations - element flexibility equations - mixed force - displacement equations - for truss element, beam element and tensional element.

Transformation of coordinates - element stiffness matrix - load vector - local and global coordinates.

UNIT II

Assembly of stiffness matrix from element stiffness matrix - direct stiffness method - general procedure - band matrix - semi bandwidth - computer algorithm for assembly by direct stiffness matrix method.

UNIT III

Analysis of plane truss - continuous beam - plane frame and grids by flexibility methods.

UNIT IV

Analysis of plane truss - continuous beam - plane frame and grids by stiffness methods.

UNIT V Special analysis procedures - static condensation and sub structuring - initial and thermal stresses.

Shear walls- Necessity - structural behaviour of large frames with and without shear walls - approximate methods of analysis of shear walls.

References Books

1. Matrix Analysis of Frames structures by William Weaver J.R and James M.Geve, CBS publications.
2. Advanced Structural Analysis by Ashok.K.Jain, New Channel Brothers.
3. Structural Analysis by C.S.Reddy.

4. Matrix Structural Analysis by Kanchi. Matrix Methods of Structural Analysis by J.Meek
5. Structural Analysis by Ghali and Neyveli.

Course Outcomes:

Upon completion of the course, students shall have ability to

1. Recall the basic concepts of degree of freedom and stiffness matrices with coordinates
2. Solve the determinate and indeterminate plane and space truss / frame system
3. Analyze substructure by stiffness method
4. Design the necessary structural behaviour of shear walls.

(B30402) THEORY OF ELASTICITY

M.Tech (SE)-I Semester	L	T	P	C
	3	0	0	3

UNIT-I

Introduction: Elasticity - notation for forces and stress - components of stresses -components of strain - Hooks law. Plane stress and plane strain analysis – differential equations of equilibrium - boundary conditions – Strain displacement relations -compatibility equations - stress function.

UNIT II

Two dimensional problems in rectangular coordinates - solution by polynomials - Saint-Venants principle - determination of displacements - bending of simple beams – simply supported and cantilever beam.

UNIT III

Two dimensional problems in polar coordinates - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates – displacements for symmetrical stress distributions edge dislocation - general solution of two-dimensional problem in polar coordinates - application to plates with circular holes – rotating disk, Bending of Prismatic Bars: stress function - bending of cantilever - circular cross section - elliptical cross section - rectangular cross section.

UNIT IV

Analysis of stress and strain in three dimensions - principal stress - stress ellipsoid – director surface - determination of principal stresses Stress Invariants - maximum shear stresses, stress tensor – strain tensor-Homogeneous deformation - principal axes of strain-rotation. General Theorems: Differential equations of equilibrium - conditions of compatibility - determination of displacement - equations of equilibrium in terms of displacements – principle of super position - uniqueness of solution - the reciprocal theorem of Strain Energy

UNIT V

Torsion of Circular Shafts - torsion of straight prismatic bars – Saint Venants method - torsion of prismatic bars - bars with elliptical cross sections - membrane analogy - torsion of narrow rectangular bars - solution of torsional problems by energy method – torsion of shafts, tubes, bars etc., Torsion of rolled profile sections.

References Books

1. Theory of Elasticity by Timeshenko, Mc Graw-Hill Publications.
2. Theory of Plasticity by J.Chakarbarthy, Mc Graw Hill Publications.
3. Theory of Elasticity by Y.C.Fung.
4. Theory of Elasticity by Gurucharan Singh.

Course outcomes:

Upon completion of the course, students shall have ability to

1. State the basic principles of elasticity, stress and strain tensors, equations of equilibrium, compatibility equations.
2. Use St. Venant's principle to simple bending of simply supported and cantilever beams
3. Compute 2D problems using polar coordinates, bending of curved bars and 3D stress and strain analysis
4. Apply the Torsion in various cross sections

(B30403) THEORY OF THIN PLATES AND SHELLS

(Professional Elective- I)

M.Tech (SE)-I Semester	L	T	P	C
	3	0	0	3

UNIT-I:

Bending of Long Rectangular Plates to a Cylindrical Surface: Differential equation for cylindrical bending of plates – Uniformly loaded rectangular plates with simple supported edges and with built in edges.

UNIT-II:

Pure Bending of Plates: Slopes and Curvatures of bent plates – Relations between bending moments and curvature – Particular cases of pure bending– Strain energy in pure bending – Limitations. Symmetrical bending of circular plates: Differential equation – Boundary conditions.

UNIT-III:

Simply supported rectangular plates under sinusoidal loading, Naviers solution and its application to concentrated load – Levy's solution for various boundary conditions subjected to different loadings like uniform and hydrostatic pressure.

UNIT-IV

Introduction to Shell Parametric Representation of a Surface: The first quadratic form; Equation to the normal of a surface; The second quadratic form; Principal curvatures, Gauss curvature, and lines of curvature; Some definitions; Classification of shell surfaces.

UNIT-V

Cylindrical shells: Membrane theory of cylindrical shells; Bending theory of cylindrical shells loaded Symmetrically –Approximate solution by Schorer's method, Beam method for analysis

Text Books:

1. Theory of plates and shells by S.P.Timoshenko and S.Woinowsky-Krieger, McGraw-Hill, 1959.

2. Stresses in plates and shells by A.C.Ugural, McGraw-Hill, 1999.

Reference Books

1. Analysis of plates by T.K.Varadan and K.Bhaskar , Narosa Publishing House, 1999.
2. "Stresses in Shells" by Flugge. Blaisdell Publishing Co, 1966
3. Design and construction of concrete shell roofs by G.S.Ramaswamy, CBS Publishers & Distributors,1986.

Course Outcomes:

Upon completion of the course, students shall have ability to

1. Outline the principle of simple bending of Plates and different Boundary conditions for plates
2. Interpret the Bending theory of rectangular and circular plates..
3. Design the cylindrical shells by using different Methods.
4. Develop the concepts of shell parameters

(B30404) ADVANCED REINFORCED CONCRETE DESIGN
(Professional Elective – 1)

M.Tech (SE)-I Semester	L	T	P	C
	3	0	0	3

UNIT I

Basic Design Concepts: Behaviour in flexure, Design of singly Reinforced rectangular sections, Design of Doubly Reinforced rectangular sections, Design of flanged beam sections, Design for shear – Design for Torsion**,** Limit state of Serviceability**:** Deflections of Reinforced concrete beams and slabs, short term deflections and long term deflection, estimation of crack width in RCC members, calculation of crack widths.

UNIT II

Limit Analysis of R.C. Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, applications for fixed and continuous beam. Yield line analysis for slabs:– yield line criterion – Virtual work and equilibrium methods of analysis – For square and circular slabs with simple and continuous end conditions. Moment Curvature diagram.

UNIT III

Ribbed slabs : Analysis of the Slabs for Moment and Shears, Ultimate Moment of Resistance, Design for shear, Deflection, Arrangement of Reinforcements.

Flat slabs: Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two way shears-Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip sketch showing reinforcement details.

UNIT IV

Design of Reinforced Concrete Deep Beams & Corbels: Steps of designing deep beams, design by IS: 456. Checking for local failures, detailing of deep beams, analysis of forces in a corbels, design procedure of corbels, design of nibs.

UNIT V

Design of Compression Members - Estimation of Effective Length of a Column – Code Requirements on Slenderness Limits,– Design of Short Columns Under Axial Compression – Design of Short Columns Under Compression With Uniaxial Bending – Design of Short Columns Under Axial Compression With Biaxial Bending – Design of Slender Columns sketch showing reinforcement details.

Design of Combined Footings - Distribution of Soil Pressure - Geometry of Two-column Combined Footing – Design Considerations in Two-Column Footings sketch showing reinforcement details.

Text Books

1. "Reinforced Concrete Design" S. Unnikrishna Pillai & Devdas Menon; Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi 2010.
2. "Advanced Reinforced Concrete" P.C. Varghese Prentice Hall of INDIA Private Ltd. 2008.

Reference Books

1. "Limit State Theory and Design of Reinforced Concrete" Dr. S. R. Karve and V.L Shah. Standard Publishers, PUNE 2004.
2. "Design of Reinforced Concrete Structures" by N.Subramanian, Oxford University Press.
3. Reinforced concrete structural elements – behaviour, Analysis and design by P. Purushotham, Tata Mc Graw-Hill, 1994.
4. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc Graw-Hill, 3rd Edition, 2005.
5. Reinforced Concrete design by Kennath Leet, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.
6. "Design Reinforced Concrete Foundations" P.C. Varghese Prentice Hall of INDIA Private Ltd.
7. IS 456-2000
8. SP 16
9. SP 34

Course Outcomes

Upon completion of the course, students shall have ability to

1. Summarize the methods of reinforced concrete design
2. List various types of RC structures
3. Design of special structural elements.
4. Design the compression members and combined footing

(B30405) THEORY OF STRUCTURAL STABILITY
(Professional Elective- I)

M.Tech (SE)-I Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

UNIT – I
Beam Columns: Differential equations for beam columns- beam columns with concentrated loads – continuous lateral loads-couples- beam columns with built in ends – continuous beams with axial load – application of trigonometrically series – Effects of initial curvature on deflections – Determination of allowable stresses.

UNIT - II
Elastic Buckling of bars and frames: Elastic Buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns- Buckling of frames-large deflections of buckled bars-Energy methods- Buckling of bars on elastic foundations- Buckle line of bar with intermediate compressive forces - Buckling of bars with change in cross-section – Effect of shear force on critical load- built up columns.

UNIT - III
In Elastic Buckling: Buckle line of straight bar- Double modulus theory – Tangent modulus theory, Inelastic lateral Buckling. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae for design – various end conditions

UNIT - IV
Torsion Buckling: Pure torsion of thin walled bars of open cross section – Non-uniform torsion of thin walled bars of open cross section- Torsional buckling – Buckling by torsion and flexure.

UNIT – V
Lateral buckling of simply supported Beams: Beams of Rectangular cross-section subjected to pure bending. Buckling of simply supported

Rectangular plates: Derivation of equation of plate subjected to constant compression in one and two directions.

Reference Books

1. Theory of elastic Stability by Timshenko & Gere-Mc Graw Hill
2. Stability of metallic structures by Blunch- Mc Graw Hill
3. Theory of Beam- Columns Vol I by Chem. & Atste Mc Graw Hill

Course outcomes:

Upon completion of the course, students shall have ability to

1. Explain the principles of strength and stability
2. Compute the problems of structural members
3. Identify the Elastic and Inelastic buckling
4. Analyze the Lateral buckling and torsional buckling of beams

(B30406) NUMERICAL METHODS IN STRUCTURAL ENGINEERING

(Professional Elective-II)

M.Tech (SE)-I Semester	L	T	P	C
	3	0	0	3

Unit I:

Solutions of linear equations: Direct method – Cramer's rule, Guass – Elimination method- Gauss – Jordan elimination – Triangulation (LU Decomposition) method – Iterative methods Jacobi – Iteration method – Gauss – Siedel iteration, Successive over –relaxation method.

Eigen values and eigen vectors: Jacobi method for symmetric matrices-Given's method for symmetric matrices-Householder's method for symmetric matrices-Rutishauser method of arbitrary matrices – Power method.

UNIT II:

Interpolation: Linear Interpolation - Higher order Interpolation - Lagrange Interpolation– Interpolating polynomials using finites differences- Hermite Interpolation -piece-wise and spline Interpolation.

Unit III

Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas – Backward and forward and central differences- Derivation of Differentiation formulas using Taylor series-Boundary conditions- Beam deflection – Solution of characteristic value problems- Richardson's extrapolation- Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations

UNIT IV.

Numerical Differentiation: Difference methods based on undetermined coefficients- optimum choice of step length– Partial differentiation.

Numerical Integration: Method based on interpolation-method based on undetermined coefficient – Gauss – Lagrange interpolation method-Radaua integration method- composite integration method – Double integration using Trapezoidal and Simpson's method.

UNIT V

Ordinary Differential Equation: Euler's method – Backward Euler method – Midpoint method – single step method, Taylor's series method- Boundary value problems.

Reference Books

1. Numerical methods for scientific and engineering computations. M.K .Jain-S. R.K. Iyengar – R.K.Jain Willey Eastern Limited
2. Numerical methods by S.S.Shastry.1995
3. Applied numerical analysis by – Curtis I.Gerala- Addission Wasley
4. Numerical methods for Engineers Stevan C. Chopra, Raymond P.Canal Mc. Graw Hill book company
5. C Language and Numerical methods by C. Xavier – New age international publisher.
6. Computer based numerical analysis by Dr. M.Shanta Kumar, Khanna Book publishers, New Delhi.

Course outcomes:

Upon completion of the course, students shall have ability to

1. Define the concepts of finite difference and finite strip method
2. Illustrate the iterative and transformation methods in structural engineering
3. Compute the ordinary and partial differential equations in structural mechanics using numerical methods.
4. Apply the numerical techniques to structural elements.

(B30407) SOIL DYNAMICS AND MACHINE FOUNDATIONS
(Professional Elective -II)

M.Tech (SE)-I Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

UNIT I
Types of machine foundations – general requirements design – criteria for machine foundations, permissible amplitudes and bearing pressure. Resonance and its effect – free and forced Vibrations with and without damping – constant force and rotating mass type excitation – magnification steady state vibrations – logarithmic decrement.

UNIT II
Natural frequency of foundation – soil system – Barkan's and I.S. methods of determining natural frequency.

UNIT III
Elastic properties of soil for dynamical purpose and their experimental determination – Elastic waves and their characteristics – Experimental determination of shear modulus from wave theory.

UNIT IV
Apparent soil mass – bulb of pressure concept – Pauw's analogy of foundation – soil systems (Concept only) - Theory of elastic half space – lamb and the dynamic Boussinesq's problem – Relsner's solution and its limitations – Quinlan and Sung's modifications – Hsiegh's equations for vertical vibration.

UNIT V
Principles of design of foundations for reciprocating and impact type of machine – as per I.S. Codes. Vibration isolation – types and methods of isolation – isolating materials and their properties.

Reference Books
1. Hand Book of Machine Foundations by S. Srinivasulu and Vaidganathan
2. Soil Mechanics & Foundation Engineering by B.C. Punmia.
3. Analysis and Design of Foundation and retaining structures-Sham Sher Prakets, Etal
4. Vibration of Soils & Foundations – Richant Hall & Woods.

Course outcomes:

Upon completion of the course, students shall have ability to

1. Define the dynamics properties of soil.
2. Apply the theory of vibrations for the dynamic behaviour of soil.
3. Design the machine foundations for different loading conditions.
4. Apply vibration isolation techniques to different types of soil.

(B30408) STRUCTURAL HEALTH MONITORING

(Professional Elective -II)

M.Tech (SE)-I Semester	L	T	P	C
	3	0	0	3

UNIT – I

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.

UNIT – II

Structural Health Monitoring: Concepts, Various Measures, Structural Safety in Alteration.

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT – III

Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

UNIT – IV

Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT – V

Introduction to Repairs and Rehabilitations of Structures : Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

Text book

1. Structural Health Monitoring, Daniel Balageas, Claus_Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006

Reference Books

1. Health Monitoring of Structural Materials and Components_Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.

2. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.

3. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc,2007.

Course outcomes:

Upon completion of the course, students shall have ability to

1. Identify the causes of distress in structures
2. Outline the Structural Heath Monitoring and audit
3. Perform the various static and dynamic field tests on structures
4. Report the Repairs and Rehabilitations of structures

(B30409) NUMERICAL METHODS LAB

M.Tech (SE)-I Semester	L	T	P	C
	0	0	4	2

Syllabus Contents:

1. Find the Roots of Non-Linear Equation Using Bisection Method.
2. Find the Roots of Non-Linear Equation Using Newton's Method.
3. Curve Fitting by Least Square Approximations.
4. Solve the System of Linear Equations Using Gauss - Elimination Method.
5. Solve the System of Linear Equations Using Gauss - Seidal Iteration Method.
6. Solve the System of Linear Equations Using Gauss - Jorden Method.
7. Integrate numerically using Trapezoidal Rule.
8. Integrate numerically using Simpson's Rules.
9. Numerical Solution of Ordinary Differential Equations By Euler's Method.
10. Numerical Solution of Ordinary Differential Equations ByRunge-Kutta Method.

Practice with MAT lab

(B30410) ADVANCED CONCRETE LABORATORY-I

M.Tech (SE)-I Semester	L	T	P	C
	0	0	4	2

1. Fineness modulus of aggregate
2. Impact strength test on coarse aggregate
3. Specific gravity and water absorption test on aggregate
4. Shape test on coarse aggregate
5. Bulking of sand
6. Fineness Test on cement
7. Consistency test on cement
8. Setting time test on cement
9. Soundness test on cement
10. Specific Gravity of cement
11. Compressive strength test on cement motor
12. Workability of normal concrete by slump cone, Vee bee consist_ meter and Compaction factor
13. Compressive strength test on concrete
14. Rebound hammer test (NDT)

(B30212) RESEARCH METHODOLOGY AND IPR

M. Tech (ES) – I Semester

L	T	P	C
2	0	0	2

UNIT-I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT-II

Effective literature studies approach, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT-III

Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-IV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT-V

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Suggested Reading:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”

4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
5. Mayall, “Industrial Design”, McGraw Hill, 1992.
6. Niebel, “Product Design”, McGraw Hill, 1974.
7. Asimov, “Introduction to Design”, Prentice Hall, 1962.
8. Robert P. Merges Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
9. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

Course Outcomes:

Upon completion of the course, students shall have ability to

1. Analyze research related information & formulate research problem.
2. Outline the research ethics.
3. Explain the importance of IPR and the need of information about Intellectual Property Right to be promoted among students in general & engineering.
4. Illustrate benefits of IPR protection

(C30001) ENGLISH FOR RESEARCH PAPER WRITING
(Audit course – I)

M.Tech (SE)-I Semester **L T P C**
2 0 0 0

Unit I

1. Planning and Preparation, Word Order, Breaking up long sentences.
2. Structuring Paragraphs and Sentences, Being Concise and Removing, Redundancy.
3. Avoiding Ambiguity and Vagueness

Unit II

4. Clarifying Who Did What. Highlighting Your Findings.
5. Hedging and Introduction

Unit III

6. Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit IV

7. Key skills are needed when writing a Title
8. Key skills are needed when writing an Abstract
9. Key skills are needed when writing an Introduction
10. Skills needed when writing a Review of the Literature

Unit V

11. Skills are needed when writing the Methods
12. Skills needed when writing the Results
13. Skills are needed when writing the Discussion
14. Skills are needed when writing the Conclusions useful phrases
15. How to ensure paper is as good as it could possibly be the first-time submission

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
Model Curriculum of Engineering & Technology PG Courses [Volume-I][41]
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht
Heidelberg London, 2011

Course Outcomes:

Upon completion of the course, students shall have ability to

1. Identify the required word order in sentences.
2. Illustrate meaningful sentence structures.
3. Clarify the findings of his research.
4. Defend his research methods.
5. Predict the outcome of his research and will write meaningful conclusions.

SEMESTER - II

(B30411) FEM IN STRUCTURAL ENGINEERING

M.Tech (SE)-II Semester	L	T	P	C
	3	0	0	3

UNIT I

Introduction: Concepts of FEM - steps involved - merits and demerits - energy principles – discrimination Raleigh - Ritz method of functional approximation. Principles of Elasticity: Stress equations - strain displacement relationships in matrix form plane stress, plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

UNIT II

One dimensional FEM: Stiffness matrix for beam and bar elements - shape functions for ID elements. Two dimensional FEM: Different types of elements for plane stress and plane strain analysis - displacement models - generalized coordinates - shape functions - convergent and compatibility requirements - geometric invariance - natural coordinate system - area and volume coordinates - generation of element stiffness and nodal load matrices

UNIT III

Isoparametric formulation: Concept - different isoparametric elements for 2D analysis -formulation of 4-noded and 8-noded isoparametric quadrilateral elements - Lagrange elements - serendipity elements.

Axi Symmetric Analysis: bodies of revolution - axi symmetric modeling - strain displacement relationship - formulation of axi symmetric elements. Three dimensional FEM: Different 3-D elements-strain-displacement relationship – formulation of hexahedral and isoparametric solid element.

UNIT IV

Introduction to Finite Element Analysis of Plates: basic theory of plate plate bending - thin plate theory - stress resultants - Mindlin's approximations - formulation of 4-noded isoperimetric quadrilateral plate element – Shell Element.

UNIT V

Introduction to non – linear analysis – basic methods – application to Special structures

Reference Books

1. Concepts and Applications of Finite Element Analysis by Robert D.Cook, David S. Malkus and Michael E. Plesha, John Wiley & Sons.
2. Finite element Methods by OC Zienkiewicz
3. Finite element analysis, theory and progarmming by GS Krishna Murthy.
4. Introduction to Finite element Method by Tirupathi Chandra Patila and Belugunudu
5. Introduction to Finite element Method by JN Reddy

Course outcomes:

Upon completion of the course, students shall have ability to

1. State the stress-strain behaviour of continuum
2. Identify the problem solving skills for 1D,2D and 3D elements
3. Formulate the 2-D and 3-D element
4. Outline concepts of elasticity and plasticity.

(B30412) STRUCTURAL DYNAMICS

M.Tech (SE)-II Semester	L	T	P	C
	3	0	0	3

UNIT I:

Theory of vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Vectorial representation of S.H.M. - Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems - Harmonic excitation -Dynamic magnification factor – Phase angle – Bandwidth

UNIT II

Introduction to Structural Dynamics : Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton's law of motion / D'Alembert's principle, Principle of virtual work and Hamilton principle.

Single Degree of Freedom Systems: Formulation and solution of the equation of motion - Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral.

UNIT III

Multi Degree of Freedom Systems : Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion -Undamped free vibrations - Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition procedure.

UNIT IV

Practical Vibration Analysis: Introduction - Stodola method - Fundamental mode analysis - Analysis of second and higher modes - Holzer method - Basic procedure.

Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural

frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams.

UNIT V

Introduction to Earthquake Analysis: Introduction - Excitation by rigid base translation - Lumped mass approach - SDOF and MDOF systems - IS. Code methods of analysis for obtaining response of multi storeyed buildings.

Reference Books

1. Dynamics of Structures by Clough & Penzien, McGraw Hill, New York
2. Structural Dynamics by Mario Paz, C.B.S Publishers, New Delhi.
3. Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore), Delhi
4. I.S: 1893 – 2016 (part-I), "Code of practice for Earthquake resistant design of Structures"

Course outcomes:

Upon completion of the course, students shall have ability to

1. Explain the vibrations and their effects in the structures
2. Calculate the dynamic motion using different methods in the structures
3. Find the vibrational effects and its responses in SDOF, MDOF and continuous system
4. Analyze the Vibration responses of structures

(B30413) ADVANCED STEEL DESIGN
(Professional Elective – III)

M.Tech (SE)-II Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

UNIT I:
Simple Connections – Riveted, Bolted Pinned And Welded Connections **:** Riveted Connections – Bolted Connections –Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip-Critical connections – Prying Action – Combined Shear and Tension for Slip-Critical Connections. Design of Groove Welds - Design of Fillet Welds – Design of Intermittent Fillet Welds – Failure of Welds.

UNIT II:
Eccentric And Moment Connections**:** Introduction – Beams – Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed Connections – Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections- Welded Bracket Connections – Moment Resistant Connections.

UNIT III:
Analysis And Design Of Industrial Buildings: Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform. Design of purlins for roofs, design of built up purlins, design of knee braced trusses and stanchions. Design of bracings.

UNIT IV:
Design Of Steel Truss Girder Bridges: Types of truss bridges, component parts of a truss bridge, economic Proportions of trusses, self weight of truss girders, design of bridge Compression members, tension members; wind load on truss girder Bridges; wind effect on top lateral bracing; bottom lateral bracing; portal ,Bracing; sway bracing.

UNIT V:
Design of Steel Bunkers And Silos :Introduction – Janssen's Theory – Airy's Theory – Design of Parameters – Design Criteria –Analysis of Bins – Hopper Bottom – Design of Bins.

Reference Books

1. Design of Steel Structures. P. Dayaratnam, Publisher : S. Chand, Edition 2011-12.
2. Design Steel Structures Volume – II, Dr. Ramachandra & Vivendra Gehlot Scientific Publishes Journals Department.
3. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. New Delhi.
4. Design of Steel Structures Galyord & Gaylord, Publisher: Tata Mc Graw Hill, Education. Edition 2012.
5. Indian Standard Code – IS – 800-2007.

Course Outcomes:

Upon completion of the course, students shall have ability to

1. Identify the various connections in the steel structures
2. Design the various steel structures
3. Analyse the concepts of special structures

(B30414) DESIGN OF PRE-STRESSED CONCRETE STRUCTURES
(Professional Elective -III)

M.Tech (SE)-II Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

UNIT I

General Principles of Prestressed Concrete **:** Pre–tensioning and post – tensioning – Prestressing by straight, concentric, eccentric, bent and parabolic tendons – Different methods and systems of prestressing like Hoyer system, Freyssinet system, Magnel Blaton system – Lee-Mc call system.

Losses of Prestress: Loss of prestress in pre-tensioned and post-tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, relaxation of steel, slip in anchorage, bending of member and frictional loss – Analysis of sections for flexure.

UNIT II

Design of Section for Flexure: Allowable stresses – Elastic design of simple beams having rectangular and I-section for flexure – kern lines – cable profile and cable layout. **Design of Sections for Shear:** Shear and Principal stresses – Improving shear resistance by different prestressing techniques – horizontal, sloping and vertical prestressing – Analysis of rectangular and I–beam – Design of shear reinforcement – Indian code provisions.

UNIT III

Deflections of Prestressed Concrete Beams: Short term deflections of uncracked members– Prediction of long-time deflections – load – deflection curve for a PSC beam – IS code requirements for max. deflections.

UNIT IV

Transfer of Prestress in Pretensioned Members**:** Transmission of prestressing force by bond – Transmission length – Flexural bond stresses – IS code provisions – Anchorage zone stresses in post tensioned members – stress distribution in End block – Analysis by approximate, Guyon and Magnel methods – Anchorage zone reinforcement.

UNIT V

Statically Indeterminate Structures : Advantages & disadvantages of continuous PSC beams – Primary and secondary moments – P and C lines – Linear transformation concordant and non-concordant cable profiles – Analysis of continuous beams and simple portal frames (single bay and single story)

Reference Books

1. Prestressed concrete by Krishna Raju Tata Mc Graw Hill Book – Co ., New Delhi.
2. Design of prestress concrete structures by T.Y. Lin and Burn, John Wiley, New York.
3. Prestressed concrete by S. Ramamrutham Dhanpat Rai & Sons, Delhi.

Course outcomes:

Upon completion of the course, students shall have ability to

1. Define the principles of prestressed concrete elements
2. Analyze and detailing the prestressed concrete elements
3. Evaluate the deflections in PSC members
4. Analyze the stress distribution in end block

(B30415) DESIGN OF MASONRY STRUCTURES

(Professional Elective -III)

M.Tech (SE)-II Semester	L	T	P	C
	3	0	0	3

UNIT- I

Introduction: Historical Perspective, Masonry Materials, Masonry Design Approaches, Overview of Load Conditions, Compression Behaviour of Masonry, Masonry Wall Configurations, Distribution of Lateral Forces.

UNIT- II

Flexural Strength of Reinforced Masonry Members: In plane and Out-of-plane loading**.**

UNIT- III

Interactions: Structural Wall, Columns and Pilasters, Retaining Wall, Pier and Foundation.

UNIT- IV

Shear Strength and Ductility of Reinforced Masonry Members.

UNIT- V

Prestressed Masonry - Stability of Walls, Coupling of Masonry Walls, Openings, Columns, Beams.

Elastic and Inelastic Analysis**,** Modeling Techniques, Static Push Over Analysis and use of Capacity Design Spectra**.**

Text book

1. Masonry Structures: Behavior and Design, Hamid Ahmad A. and Drysdale Robert G., 1994.

Reference Books

1. Design of Reinforced Masonry Structures, Narendra Taly, ICC, 2nd Edn,
2. Mechanics of Masonry Structures, Editor: Maurizio Angelillo, 2014.
3. Earthquake-resistant Design of Masonry Buildings, Toma_evi_Miha, Imperial College Press, 1999.

Course outcomes:

Upon completion of the course, students shall have ability to

1. Recall the principles of design and construction of masonry structures
2. Design and develop the analytical skills of masonry structures
3. Evaluate the strength and stability of the masonry structures
4. Analyse the pre-stressed masonry structures

(B30416) SOIL STRUCTURE INTERACTION
(Professional Elective –IV)

M.Tech (SE)-II Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

UNIT- I
Critical Study of Conventional Methods of Foundation Design, Nature and Complexities of Soil Structure Interaction.

UNIT- II
Application of Advanced Techniques of Analysis such as FEM and Finite Difference Method.

UNIT- III
Relaxation and Interaction for the Evaluation of Soil Structure Interaction for Different Types of Structure under various Conditions of Loading and Subsoil Characteristics.

UNIT- IV
Preparation of Comprehensive Design Oriented Computer Programs for Specific Problems, Interaction Problems based on Theory of Sub Grade Reaction Such as Beams, Footings, Rafts Etc.

UNIT-V
Analysis of Different Types of Frame Structures Founded on Stratified Natural Deposits with Linear and Non-Linear Stress-Strain Characteristics.

Determination of Pile Capacities and Negative Skin Friction, Action of Group of Piles Considering Stress-Strain Characteristics of Real Soils, Anchor Piles and Determination of Pullout Resistance.

Text Book
1.Analytical and Computer Methods in Foundation, Bowels J.E.,McGraw Hill Book Co., New York, 1974.

Reference Books
1.Numerical Methods in Geotechnical Engineering, Desai C.S. and Christian J.T., McGraw Hill Book Co., New York.
2. Soil Structure Interaction - The real behaviour of structures, Institution of Structural Engineers.
3. Elastic Analysis of Soil Foundation Interaction, Developments in

Geotechnical Engg. Vol-17, Elsevier Scientific Publishing Company.
4. Elastic Analysis of Soil-Foundation Interaction, Selvadurai A.P.S., Elsevier Scientific Publishing Company.
5. Analysis & Design of substructures, Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd.
6.Design of Foundation System- Principles & Practices, Kurian N. P., Narosa Publishing

Course Outcomes:

Upon completion of the course, students shall have ability to

1. Outline the basic concepts of soil structure interaction.
2. Evaluate the need for SSI in the different design works
3. Analyse Soil-structure interaction in design problems.
4. Apply Finite element techniques in seismic soil structure interaction of buildings, bridges, nuclear power plants etc.,

(B30417) ADVANCED DESIGN OF FOUNDATIONS

(Professional Elective -IV)

M.Tech (SE)-II Semester	L	T	P	C
	3	0	0	3

UNIT – I

Bearing capacity of Footings subjected to Eccentric and Inclined Loading – Meyrhoff's and Hanse's theories – elastic settlement of Footings embedded in sands and clays of Infinite thickness – Footings on soils of Finite thickness-Schmertamaunn's method, Jaubu and Morgenstern method.

UNIT - II

Pile Foundations – settlement of Pile groups resting in sands and clays – Negative skin friction – in single piles and groups of piles – under – reamed piles – specifications – load – carrying capacity in sands and clays.

UNIT – III

Caissons and well foundations : Types of caissons – well foundation Different shapes of wells – Components of wells – functions and Design – Design Criteria – Sinking of wells – lateral stability by Terzaghi's analysis.

UNIT – IV

Cantilever sheet piles and anchored bulkheads Earth pressure diagram – Determination of Depth of embedment in sands and clays – Timbering of trenches- Earth pressure diagrams – Forces in struts.

UNIT - V

Foundations in Expansive soils – Problems in Expansive soils – Mechanism of swelling – Swell Pressure and Swelling potential – Heave foundation practices – Sand cushion – CNS cushion – under –reamed pile Foundations – Granular pile – anchor technique, stabilization of expansive soils

Text Book

1. Design of foundation system, N.P. Kurian, Narosa Publishing House

Reference Books

1. Analysis and Design of Substractenes – Swami Saran
2. Basic and Applied Soil Mechanics – Gopal Ranjan and A.S.R.Rao
3. Soil Mechanics & Foundation Engineering, Foundation Engineering – II - V.N.S. Murthy.
4. Foundation Analysis and Design, J. E. Bowles, Tata McGraw Hill New York

Course Outcomes

Upon completion of the course, students shall have ability to

1. Recall subsurface exploration to evaluate soil/structure behaviour
2. Perform the laboratory and field tests for various foundations.
3. Design shallow and deep foundations under different loading conditions.
4. Analyse the foundations in expansive soils.

(B30418) DESIGN OF INDUSTRIAL STRUCTURES

(Professional Elective -IV)

M.Tech (SE)-II Semester	L	T	P	C
	3	0	0	3

Unit I

Planning of Industrial Structures – types of industrial structures – different components of industrial structures – Bracings of Industrial Buildings – Design of Steel Industrial Buildings.

Unit II

Thin Walled / Cold Formed Steel Members : Definitions – Local Bucking of Thin-Elements-Post Buckling of Thin-Elements – Light Guage Steel Columns and Compression Members – Form-Factor for Columns and Compression Members – Behaviour of Stiffened Elements Under Uniform Compression – Multiple Stiffened Compression Elements –Effective Length of Light Gauge Steel Compression Members – Light Gauge Steel Tension Members.

Unit III

RC Bunkers & Silos : Introduction – Janssen's Theory – Airy's Theory – Design of Square, Rectangular and Circular Bunkers ; Design of Silos.

Unit IV

RC Chimneys : Introduction – Wind Pressure – Stresses in Chimney Shaft Due to Self-Weight and Wind – Stresses in Horizontal Reinforcement Due to Wind Shear – Stresses Due to Temperature Difference – Combined Effect of Self Load, Wind and Temperature – Temperature Stresses in Horizontal Reinforcement Problems.

Unit V

Design Principles of Cylindrical Shells & Design Problems.

Text Book

1. Advanced Reinforced Concrete Design, By N. Krishna Raju (CBS Publishers &Distributors) 2005

References

1. Design of Steel Structures, By Ram Chandra and Virendra Gehlot vol-II, 2007.

2. Design of Steel Structures, By Duggal - Tata McGraw-Hill publishers – 2010

Course Outcomes:

Upon completion of the course, students shall have ability to

1. Outline the basic components of industrial structures.
2. Solve the problems in compression and tension members
3. Explain the various theories and concepts used to design the industrial structures.
4. Design the special RC structures

(B30419) ADVANCED CADD LAB

M.Tech (SE)-II Semester	L	T	P	C
	0	0	4	2

1. Program for design of slabs. Using Excel
2. Program for design of beams. Using Excel
3. Program for design of column using Excel
4. Program for design of a combined footing using Excel
5. Analysis and Design of truss using STAAD Pro
5. Analysis and Design of Multi-storeyed space frame, using STAAD Pro.
7. Analysis of Plane frames using STAADPro.
8. Analysis of Bridge deck slab

(B30420) ADVANCED CONCRETE LABORATORY-II

M.Tech (SE)-II Semester	L	T	P	C
	0	0	4	2

1. Aggregate Gradation charts
2. Flexural test on concrete
3. Split-tension test on concrete
4. Workability of SCC
5. Permeability test on concrete
6. Durability test on concrete
7. Creep test on concrete
8. Shrinkage of concrete
9. Air entrainment test
10. Accelerated curing tank
11. Rebar locater
12. NDT method by – Ultra-sonic plus velocity (UPV)

(B30421) MINI PROJECT WITH SEMINAR

M.Tech (SE)-II Semester	L	T	P	C
	0	0	4	2

(C30002) VALUE EDUCATION
(Audit course- II)

M.Tech (SE)-II Semester	**L**	**T**	**P**	**C**
	2	**0**	**0**	**0**

Unit-1:

1. Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.
2. Moral and non- moral valuation. Standards and principles
3. Value judgements

Unit II

4. Importance of cultivation of values.
5. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.
6. Honesty, Humanity. Power of faith, National Unity
7. Patriotism. Love for nature ,Discipline

Unit III

8. Personality and Behaviour Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.
9. Punctuality, Love and Kindness.
10. Avoid fault Thinking.
11. Free from anger, Dignity of labour.

Unit IV

12. Universal brotherhood and religious tolerance.
13. True friendship.
14. Happiness Vs suffering, love for truth.
15. Aware of self-destructive habits.
16. Association and Cooperation.
17. Doing best for saving nature

Unit V

18. Character and Competence –Holy books vs Blind faith.
19. Self-management and Good health.
20. Science of reincarnation.
21. Equality, Nonviolence, Humility, Role of Women.
22. All religions and same message.

23. Mind your Mind, Self-control.
24. Honesty, Studying effectively

Course Outcomes

On completion of the course students will be able to

1. Identify the social values and work ethics.
2. Classify the moral and non moral values.
3. Demonstrate love and kindness to fellow human beings.
4. Draw inference from the Holy books about the characters and their competence.
5. Judge the fellow beings character through their behaviour.

Suggested reading

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

III SEMESTER

(B30422) EARTHQUAKE RESISTANT DESIGN OF BUILDINGS

(Professional Elective - V)

M.Tech (SE)- III Semester	L	T	P	C
	3	0	0	3

UNIT - I

Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics- Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales-Energy released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph-Characteristics of strong ground motions- Seismic zones of India.

UNIT - II

Conceptual design: Introduction-Functional planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength-Horizontal and Vertical members-Twisting of buildings-Ductility-definition-ductility relationships-flexible buildings-framing systems-choice of construction materials-unconfined concrete-confined concrete-masonry-reinforcing steel. Introduction to earthquake resistant design: Seismic design requirements-regular and irregular configurations-basic assumptions-design earthquake loads-basic load combinations-permissible stresses-seismic methods of analysis-factors in seismic analysis-equivalent lateral force method-dynamic analysis-response spectrum method-Time history method.

UNIT - III

Reinforced Concrete Buildings: Principles of earthquake resistant deign of RC members- Structural models for frame buildings- Seismic methods of analysis- Seismic deign methods- IS code based methods for seismic design- Seismic evaluation and retrofitting- Vertical irregularities- Plan configuration problems- Lateral load resisting systems- Determination of design lateral forces- Equivalent lateral force procedure- Lateral distribution of base shear. Masonry Buildings: Introduction- Elastic properties of masonry assemblage- Categories of masonry buildings-Behaviour of unreinforced and reinforced masonry walls- Behaviour of walls- Box action and bands- Behaviour of infill walls- Improving seismic behaviour of masonry buildings- Load combinations and permissible

stresses- Seismic design requirements- Lateral load analysis of masonry buildings.

UNIT - IV

Structural Walls and Non-Structural Elements: Strategies in the location of structural walls- sectional shapes- variations in elevation- cantilever walls without openings – Failure mechanism of non-structures- Effects of non-structural elements on structural system- Analysis of non-structural elements- Prevention of non-structural damage- Isolation of non-structures.

UNIT - V

Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction- Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920. Behaviour of beams, columns and joints in RC buildings during earthquakes-Vulnerability of open ground storey and short columns during earthquakes. Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns-Case studies.

Reference Books

1. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.
3. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons
4. Masory and Timber structures including earthquake Resistant Design –Anand S.Arya, Nem chand & Brosop
5. Earthquake –Resistant Design of Masonry Building –Miha Tomazevic, Imperial college Press.
6. Earthquake Tips – Learning Earthquake Design and Construction C.V.R. Murty

Reference Codes:

1. IS: 1893 (Part-1) -2002. “Criteria for Earthquake Resistant – Design of structures.” B.I.S., New Delhi.
2. IS:4326-1993, “ Earthquake Resistant Design and Construction of Building”, Code of Practice B.I.S., New Delhi.
3. IS:13920-1993, “ Ductile detailing of concrete structures subjected to seismic force” – Guidelines, B.I.S., New Delhi.

Course Outcomes

Upon completion of the course, students shall have ability to

1. Recall the different phenomenon and causes of earthquake.
2. List the conceptual design to understand the structural behaviour of buildings under Earthquake
3. Analyze the principles of Earthquake resistant structures for RC buildings.
4. Design of structural walls and effect of non-structural elements in an earthquake resistant structure.
5. Utilize the IS code provisions for ductility considerations.

(B30423) EXPERIMENTAL STRESS ANALYSIS
(Professional Elective - V)

M.Tech (SE)- III Semester	L	T	P	C
	3	0	0	3

UNIT I

Basic equations and Plane Elasticity Theory: Introduction, Strain equations of Transformation, Compatibility, Stress-Strain Relations-Two dimensional State of Stress. The Plane-Elastic problem, The Plane-Strain Approach, Plane Stress, Airy's Stress function-Cartesian Co-ordinates-Two dimensional problems in Polar Co-ordinates, Polar Components of Stress in terms of Airy's Stress function, Forms.

Principles of Experimental Approach: Merit of Experimental Analysis introduction, uses of experimental stress analysis-Advantages of experimental stress analysis, Different methods, Simplification of problems.

UNIT II

Strain Measurement using Strain Gauges: Definition of strain and its relation to Experimental Determinations, properties of strain-gauge systems, Types of strain gauges, Mechanical and Optical strain gauges. Electrical Strain Gauges- Introduction, LVDT - resistance strain gauge - various types - gauge factor, Materials for adhesion base, etc.

Strain Rosettes: Introduction, The three elements rectangular Rosette - The delta rosette - Corrections for Transverse strain effects.

UNIT III

Brittle Coating Method: Introduction, Coating stresses - Failure theories - Brittle coating Crack pattern - Crack detection - Types of Brittle coating - Test procedures for brittle coating analysis - Calibration procedures - Analysis of brittle coating data.

UNIT IV

Theory of Photo Elasticity: Introduction, Temporary double refraction - The stress optic law - Effects of stressed model in a Polaris cope for various arrangements - Fringe sharpening, Brewster stress optic law.

UNIT V

Two Dimensional Photo Elasticity: Introduction, Isochromatic Fringe patterns - Isoclinic fringe patterns, passage of light through plane Polaris cope and circular Polaris cope, Isoclinic fringe pattern - Compensation techniques - calibration methods, separation methods, scaling Model to Proto type stress- Materials for photo - elasticity, properties of photo elastic materials.

Text Books:

1. Experimental Stress Analysis by Dr. Sadhu Singh
2. Experimental Stress Analysis by Dove and Adams

Reference Book

1. Experimental Stress Analysis by J.W.Dally and W.F.Riley

Course Outcomes

Upon completion of the course, students shall have ability to

1. Describe the equations and plane elastic theory and principles of Experimental approach
2. Evaluate the different strain measurement techniques and concept of strain rosette
3. Analyse the various brittle coating method.
4. Compute photo-elasticity.

(B30424) BRIDGE ENGINEERING
(Professional Elective -V)

M.Tech (SE)-III Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

UNIT I

Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Seismic loads- Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.

UNIT II

Solid slab Bridges: Introduction-Method of Analysis and Design.

UNIT III

Girder Bridges: Introduction-Method of Analysis and Design-Courbon's Theory, Grillage analogy

UNIT IV

Pre-Stressed Concrete Bridges: Basic principles-General Design requirements-Mild steel reinforcement in pre-stressed concrete member-Concrete cover and spacing of pre-stressing steel-Slender beams-Composite Section-Propped-Design of Propped Composite Section-Unproped composite section-Two-stage Prestressing-Shrinking stresses-General Design requirements for Road Bridges.

UNIT V

Analysis of Bridge Decks: Harmonic analysis and folded plate theory-Grillage analogy- Finite strip method and FEM. Sub-srtucture of bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers-Abutments- Design loads for Abutments.

Text Books

1. Concrete Bridge Design and Practice by V.K. Raina.
2. Design of Concrete Bridges by M.G. Aswani, V.N. Vazirani and M.M. Ratwani.

Reference Book

1. Bridge Deck Behaviour by E.C.Hambly

Course Outcomes:

Upon completion of the course, students shall have ability to

1. Recall the types of bridges, types of loading.
2. Design the solid slab bridges and girder bridges
3. Analyze and design the prestressed concrete bridges and bridge decks.

(B30230) APPLICATION SPECIFIC INTEGRATED CIRCUITS DESIGN
(Open Elective)

M. Tech (ES) – III Semester

L	T	P	C
3	0	0	3

UNIT-I: Types of ASICs
Design flow – Economics of ASICs – ASIC cell libraries – CMOS logic cell data path logic cells – I/O cells – cell compilers.

UNIT-II : ASIC Library design:
Transistors as resistors – parasitic capacitance – logical effort programmable ASIC design software: Design system – logic synthesis – half gate ASIC.

UNIT-III: Low level design entry
Schematic entry – low level design languages – PLA tools – EDIF – An overview of VHDL and verilog.

UNIT-IV: Logic synthesis
Logic synthesis in Verilog & VHDL simulation.

UNIT-V: ASIC Construction
Floor Planning & Placement Algorithms -Routing

Text Books:
1. Application specific Integrated Circuits", J.S. Smith, Addison Wesley.
2. Principles of CMOS VLSI Design: A System Perspective, N. Westle & K. Eshraghian, Addison – Wesley Pub.Co.1985. Technological Age", 2016.

Reference Books:
1. Basic VLSI Design :Systems and Circuits, Douglas A. Pucknell & Kamran Eshraghian, Prentice Hall of India Private Ltd. , New Delhi , 1989.
2. Introduction to VLSI System,C. Mead & L. Canway, Addison Wesley Publication.

3. Introduction to NMOS & VLSI System Design, A. Mukharjee, Prentice Hall,
4. Digital Integrated Circuits: A Design Perspective, Jan A. Rabey, Prentice Hall of India Pvt Ltd

Course Outcomes:

Upon completion of the course, students shall have ability to

- Analyze different types of ASICs and their libraries.
- Design programmable ASICs, Low level design ASICs using Verilog & VHDL.
- Get complete knowledge regarding different methods of software ASIC design their simulation, testing and construction of ASICs.

(B30231) EMBEDDED SYSTEMS
(Open Elective)

M. Tech (ES) – III Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

UNIT-I: Embedded Computing & CPU fundamentals
Embedded Computing: Microprocessors, embedded design process, system description formalisms. Instruction sets- CISC and RISC;
CPU fundamentals: programming I/Os, co-processors, supervisor mode, exceptions, memory management units and address translation, pipelining, super scalar execution, caching, CPU power consumption.

UNIT-II: Embedded computing platform & Program design and analysis
Embedded Computing platform: CPU bus, memory devices, I/O devices, interfacing, designing with microprocessors, debugging techniques.
Program design and analysis: models of program, assembly and linking, compilation techniques, analysis and optimization of execution time, energy, power and size.

UNIT-III: Processes and operating systems
Multiple tasks and multiple processes, context switching, scheduling policies, inter-process communication mechanisms.

UNIT-IV: Hardware accelerators & Networks
Hardware accelerators: CPUs and accelerators, accelerator system design.
Networks: Distributed embedded architectures, networks for embedded systems, network-based design and Internet-enabled systems.

UNIT-V: System design techniques
Design methodologies, requirements analysis, system analysis and architecture design, quality assurance.

Text Books:
1. Wolf, W. Computers as components- Principles of embedded computing system design. Academic Press (Indian edition available from Harcourt India Pvt. Ltd., 27M Block market, Greater Kailash II, New Delhi-110 048.)

Reference Books

1. Manuel Jiménez Rogelio,PalomeraIsidoroCouvertier "Introduction to Embedded SystemsUsing Microcontrollers and the MSP430" Springer Publications, 2014.
2. Frank Vahid, Tony D. Givargis, "Embedded system Design: A Unified Hardware/Software Introduction", John Wily & Sons Inc.2002.
3. Peter Marwedel, "Embedded System Design", Science Publishers, 2007.

Course Outcomes:

Upon completion of the course, students shall have ability to

1. Expect to understand the selection procedure of Processors in the embedded domain.
2. Design the Procedure for Embedded System.
3. Visualize the role of Real time Operating Systems in Embedded Systems
4. Evaluate the architectures & networks for embedded system.

(B30331) RENEWABLE ENERGY SOURCES
(Open Elective)

L T P C
3 0 0 3

M.Tech III Sem

Unit – I: Solar Energy
Principles of solar radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.
Solar energy collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. **Storage and applications**: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications-solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

Unit-II: Wind energy:
Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

Unit-III: Bio-mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

Unit-IV: Geothermal energy: Resources, types of wells, methods of harnessing the energy, potential in India.
Ocean energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

Unit-V: Direct energy conversion: Need for DEC, Carnot cycle, limitations, principles of DEC.

Text Books
1. Non-Conventional Energy Sources /G.D. Rai
2. Renewable Energy Technologies /Ramesh & Kumar /Narosa

Reference Books

1. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
2. Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
3. Non-Conventional Energy Systems / K Mittal /Wheeler
4. Solar Energy /Sukhame

Course Outcomes

Upon completion of the course, students shall have ability to

1. Interpret the principles of solar radiation, collection and application.
2. Explain the concepts of Wind energy generation
3. Demonstrate the concepts of Bio-mass energy and operation of IC engines
4. Illustrate the perception of Geo-thermal energy and production in India
5. Elucidate the ideology of direct energy conversion

(B30332) INDUSTRIAL SAFETY
(Open Elective)

L T P C
3 0 0 3

Course: M.Tech III Sem

Unit-I:
Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety colour codes. Fire prevention and fire fighting, equipment and methods.

Unit-II:
Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III:
Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV:
Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-V:
Periodic and preventive maintenance: Periodic inspection-concept and

need, degreasing, cleaning and repairing schemes, overhauling of

mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference Books:

- Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
- Maintenance Engineering, H. P. Garg, S. Chand and Company.
- Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
- Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London

Course outcomes:

Upon completion of the course, students shall have ability to

1. Demonstrate the concepts of industrial safety, accidents and preventive measures.
2. Explain the Fundamentals of maintenance engineering.
3. Explain Wear and Corrosion and their prevention
4. Interpret the Fault tracing and draw decision tree for problems in machine tools.
5. Explain the concepts of Periodic and preventive maintenance.

(B30431) GREEN BUILDINGS
(Open Elective)

M.Tech (SE)-III Semester

L	T	P	C
3	0	0	3

Unit-I

Overview of the significance of energy use and energy processes in building - Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

Unit-II

Indoor environmental requirement and management - Thermal comfort - Ventilation and air quality - Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.

Unit-III

Climate, solar radiation and their influences - Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

Unit-IV

End-use, energy utilization and requirements - Lighting and day lighting - End -use energy requirements - Status of energy use in buildings Estimation of energy use in a building. Heat gain and thermal performance of building envelope - Steady and non steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope -Evaluation of the overall thermal transfer.

Unit-V

Energy management options - Energy audit and energy targeting - Technological options for energy management.

Reference Books

1. J. Krieder and A. Rabl, Heating and Cooling of Buildings - Design for Efficiency, McGraw Hill, 1994.
2. S.M. Guinnes and Reynolds, Mechanical and Electrical Equipment for Buildings, Wiley, 1989.

3. Shaw, Energy Design for Architects, AEE Energy Books, 1991.
4. ASHRAE, Handbook of Fundamentals, Atlanta, 1997.
5. Donald W. Abrams, Low Energy Cooling – A Guide to the Practical Application of Passive Cooling and Cooling Energy Conservation Measures, Van Nostrand Reinhold Co., New York, 1986

Course Outcomes

Upon completion of the course, students shall have ability to

1. Describe and use the basic terms and concepts used in green buildings.
2. Recognize and analyze green buildings.
3. Identify and define green building systems and materials.
4. Analyze and solve design problems utilizing principles of green building.
5. Evaluate green buildings.

(B30432) CONSTRUCTION PROJECT MANAGEMENT
(Open Elective)

M.Tech (SE)-III Semester	L	T	P	C
	3	0	0	3

Unit-I

Management process- Roles, management theories, Social responsibilities, planning and strategic management, strategic implementation, Decision making tools and techniques-Organizational structure, Human resource management- motivation performance- leadership.

Unit-II

Classification of construction projects, Construction Stages, Resources-Functions of Construction Management and its Applications, Preliminary planning –Collection of Data-Contract planning –Scientific Methods of Management; Network Techniques in construction management- Bar Chart-Grant Chart, CPM- PERT-Cost & Time optimization.

Unit-III

Resource planning – planning for manpower, materials, Cost, equipment, Labour, Scheduling, Forms of, Scheduling-Resource allocation, budget and budgetary control methods.

Unit-IV

Contract-types of contract, contract document, specification, important conditions of contract- tender and tender document- Deposits by contractor –Arbitration, negotiation – M- Book –Muster rolls- stores.

Unit-V

Management information systems- Labour Regulations: Social security-welfare Legislation-laws relating to wages , Bonus and industrial disputes, Labour administration – insurance and safety Regulations- Workmen‘s compensation Act – other labour laws- safety in construction : legal and financial aspects of accidents in construction , occupational and safety hazard assessment , human factors in safety , legal and financial aspects of accidents , occupational and safety hazard assessment.

Text Books

1. Ghalot, P.S., Dhir, D.M., Construction planning and Management, Wiley Eastern limited, 1992
2. Chikara, K.K., Construction Project Management, Tata McGraw Hill

publishing Co, Ltd New Delhi,1998
3. Punima, B.C., Project planning and Control with PERT and CPM, Laxmi Publications New Delhi 1987

Reference Books:

1. Construction Management and Planning by Sengupta, B. Guha, H., Tata McGraw Hill Publications

Course Outcomes:

Upon completion of the course, students shall have ability to

1. Explain the importance of construction planning and functioning of various earths moving equipment.
2. Evaluate the Resource allocation and methods
3. Outline the contracts and tenders for construction works
4. Take up project management in construction.

(B30532) BIG DATA AND ANALYTICS

(Open Elective)

M.Tech(CSE) III Semester	L	T	P	C
	3	0	0	3

UNIT-I

Types of Digita Data-Classification of Digital Data; Introduction to Big Data- Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, What is Big Data?, Why Big Data?, Traditional Business Intelligence (BI) versus Big Data, A Typical Data Warehouse Environment, A Typical Hadoop Environment.

UNIT-II

Big Data Analytics-What is Big Data Analytics?, What Big Data Analytics Isn't?. Classification of Analytics; Data Science, Terminologies Used in Big Data Environments, Top Analytics Tools; The Big Data Technology Landscape-NoSQL (Not Only SQL), Hadoop.

UNIT-III

Introducing Hadoop, Why Hadoop?, RDBMS versus Hadoop, Distributed Computing Challenges, History of Hadoop, Hadoop Overview-Use Case of Hadoop, Hadoop Distributors-HDFS (Hadoop Distributed File System)-Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator)- Interacting with Hadoop Ecosystem.

UNIT-IV

Introduction to MongoDB-What is MongoDB?, Why MongoDB?, Terms Used in RDBMS and MongoDB-Data Types in MongoDB, MongoDB Query Language Introduction to MAPREDUCE Programming-Introduction-Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression. Introduction to Hive-What is Hive? Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL).

UNIT-V

Introduction to Pig-What is Pig?, The Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use Case for Pig: ETL Processing, Pig Latin Overview, Data Types in Pig, Running Pig, Execution Modes

of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User-Defined Functions (UDF), Parameter Substitution, Diagnostic Operator, Word Count Example using Pig. Introduction to Machine Learning-Introduction to Machine Learning, Machine Learning Algorithms.

Textbooks

1. Big Data and Analytics by by Seema Acharya (Author), Subhashini Chellappan, Wiley Publisher.

References:

1. Big Data, Black Book, by DT Editorial Services, Dreamtech Press (2016).

Course Outcomes:

Upon completion of the course, students shall have ability to

1. Define the Big Data.
2. Classify the Analytics.
3. Create the Big Data Applications using Hadoop frame work.
4. Analyze Machine Learning Algorithms.
5. Write the Pig Scripts.

(B30533) PROGRAMMING IN PYTHON
(Open Elective)

M.Tech (CSE) III Semester

L	T	P	C
3	0	0	3

Unit-I

Introduction to Python Programming: How a Program Works, Using Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations (Operators. Type conversions, Expressions), More about Data Output. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops

Unit-II

Functions: Introduction, Defining and Calling a Void Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions Generating Random Numbers, Writing Our Own Value-Returning Functions, The math Module, Storing Functions in Modules. File and Exceptions: Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions

Unit-III

Lists and Tuples: Sequences, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples. Strings: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings. Dictionaries and Sets: Dictionaries, Sets, Serializing Objects. Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms

Unit-IV

Object-Oriented Programming: Procedural and Object-Oriented Programming, Classes, Working with Instances, Techniques for Designing Classes, Inheritance, Polymorphism.

Unit-V

GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

Textbooks:

1. Starting Out with Python by Tony Gaddis, Pearson, 3 edition;

Reference Books:

1.Python Programming: Using Problem Solving Approach by Reema Thareja, Oxford University Press, First edition.
2. Fundamentals of Python, Kenneth A. Lambert, Cengage Learning, I edition .
3. Foundations for Analytics with Python by Clinton W. Brownley, O'Reilly Media; 1 edition.

Course Outcomes:

Upon completion of the course, students shall have ability to

1. Develop the simple applications using Python.
2. Write the modular programs in python.
3. Work with python instances.
4. Develop the GUI applications using python.