CMR COLLEGE OF ENGINEERING &TECHNOLOGY

(UGC Autonomous)

Kandlakoya, Medchal Road, Hyderabad – 501 401

ACADEMIC REGULATIONS - R 22

Academic Regulations of M. Tech (Regular/Full Time) Programmes, 2022-23 (R22) CBCS)

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

1.0 Post-Graduate Degree Programmes in Engineering & Technology (PGP in E & T)

CMR College of Engineering & Technology (CMRCET) offers **Two** Years (**Four** Semesters) full-time Master of Technology (M.Tech.) Degree Programmes, under Choice Based Credit System (CBCS) in different branches of Engineering and Technology with different specializations.

2.0 Eligibility for Admissions

2.1 Admission to the PGPs shall be made subject to eligibility, qualification and specializations prescribed by the University from time to time, for each specialization under each M.Tech programme.

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

2.3 The medium of instructions for all PG Programmes will be **ENGLISH** only.

3.0 M. Tech. Programme (PGP in E & T) Structure

3.1 The M. Tech. Programs in E & T of CMRCET are of Semester pattern, with **Four** Semesters consisting of **Two** academic years, each academic year having **Two** Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 22 weeks duration (inclusive of Examinations), with a minimum of 90 instructional days per Semester.

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

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

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

3.4.1 Semester Scheme

Each Semester shall have 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) are taken as 'references' for the present set of Regulations. The terms 'SUBJECT' and 'COURSE' imply the same meaning here and refer to 'Theory Subject', or 'Lab Course', or 'Design/Drawing Subject', or 'Mini Project with Seminar', or 'Dissertation', as the case may be.

3.4.2 Credit Courses

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

- One credit for one hour/week/semester for theory/lecture (L) courses
- One credit for two hours/ week/semester for laboratory/ practical (P) courses or tutorials (T)

Other student activities like study tour, guest lecture, conference/workshop participations, technical paper presentations and mandatory courses (Non-credit Audit Courses) will not carry any credits.

3.4.3 Subject Course Classification

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

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

4.0 Course Registration

4.1 A 'Faculty Advisor or Counselor' shall be assigned to each specialization, who will advise on the Post Graduate Programme (PGP), its Course Structure and Curriculum, Choice/Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.

4.2 The Academic Section of the College invites 'Registration Forms' from students within 15 days from the commencement of class work. The 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 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 it being retained with Head of Department, Faculty Advisor and the Student).

4.4 Subject/ Course Options through Registration are final and CANNOT be changed, nor can they be inter-changed; further, alternate choices also will not be considered. However, if the Subject/ Course that has already been listed for Registration by the College in a Semester could not be offered due to unforeseen or unexpected reasons, then the Student will be allowed to have alternate choice either for a new Subject, if it is offered, or for another existing Subject (subject to availability of seats). Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

5.0 Attendance Requirements

The programmes are offered based on a unit system with each subject being considered a unit. Attendance is calculated separately for each subject.

5.1 Attendance in all classes (Lectures/Laboratories) is compulsory. The minimum required attendance ineach theory subject (***also mandatory Audit Courses***) including the attendance of mid-term examination /Laboratory etc. is 75%. Two periods of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject. ***The attendance of mandatory Audit Courses should be maintained separately by the College.*** A student shall not be permitted to appear for the Semester End Examinations (SEE), if his attendance is less than 75%.

5.2 A student's Seminar report and presentation on Mini Project shall be eligible for evaluation, only if he ensures a minimum of 75% of his attendance in Seminar presentation classes on Mini Project duringthat Semester.

5.3 Condoning of shortage of attendance (between 65% and 75%) up to a maximum of 10% (considering the days of attendance in sports, games, NCC, NSS activities and Medical grounds) in each subject (Theory/Lab/Mini Project with Seminar) of a semester shall be granted by the College Academic Committee on genuine reasons.

5.4 A prescribed fee per subject shall be payable for condoning shortage of attendance after getting the approval of College Academic Committee for the same. The College Academic Committee shall maintain relevant documents along with the request from the student.

5.5 Shortage of Attendance below 65% in any subject shall in **no case be condoned.**

5.6 A Student, whose shortage of attendance is not condoned in any Subject(s) (Theory/Lab/Mini Project with Seminar) in any Semester, is considered as 'Detained in that Subject(s), and is not eligible to write Semester End Examination(s) of such Subject(s), (in case of Mini Project with Seminar, his/her Mini Project with Seminar Report or Presentation are not eligible for evaluation) in that Semester; and he/she has to seek re-registration for those Subject(s) in subsequent Semesters, and attend the same as and when offered.

5.7 A student fulfills the attendance requirement in the present semester, shall not be eligible for readmission into the same class.

5.8 a) A student shall put in a minimum required attendance in at least **three theory subjects (excluding *mandatory (non-credit audit)* course)** in first Year I semester for promotion to first Year II Semester.

b) A student shall put in a minimum required attendance in at least **three theory subjects (excluding *mandatory (non-credit audit)* course)** in first Year II semester for promotion to second Year I Semester.

6.0 Academic Requirements

The following academic requirements must be satisfied, in addition to the attendance requirements mentioned in item no. 5. The performance of the candidate in each semester shall be evaluated subject- wise, with a maximum of 100 marks per subject / course (theory / practical), based on Internal Evaluation and Semester End Examination.

6.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course, if he secures not less than:

- 40% of Marks (24 out of 60 marks) in the Semester End Examination;
- 40% of Marks in the internal examinations (16 out of 40 marks allotted for CIE); and
- A minimum of 50% of marks in the sum total of CIE (Continuous Internal Evaluation) and SEE(Semester End Examination) taken together; in terms of Letter Grades this implies securing **'B'** Grade or above in a subject.

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

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

Note: (1) The SGPA will be computed and printed on the marks memo only if the candidate passes in all the subjects offered and gets minimum B grade in all the subjects.

(2) CGPA is calculated only when the candidate passes in all the subjects offered in all these semesters

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

6.5 If a student registers for extra subject(s) (in the parent department or other departments/ branches of Engineering) other than those listed subjects totaling to **68** credits as specified in the course structure, the performance in extra subject(s) (although evaluated and graded using the same procedure as that of the required **68** credits) will not be considered while calculating the SGPA and CGPA. For suchextra subject(s) registered, percentage of marks and Letter Grade alone will be indicated in the Grade Card/Marks Memo, as a performance measure, subject to completion of the attendance and academic requirements as stated in items 5 and 6.1 - 6.3.

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

6.7 A student eligible to appear for the Semester End Examination in any subject, but absent from it or failed (failing to secure 'B' Grade or above), may reappear for that subject at the supplementary examination as and when conducted. In such cases, his Internal Marks assessed earlier for that subject will be carried over, and added to the marks secured in the supplementary examination, for the purpose of evaluating his performance in that subject.

6.8 A Student who fails to earn 68 credits as per the specified course structure, and as indicated above, within four academic years from the date of commencement of his first year first semester, shall forfeit his seat in M. Tech. programme and his admission shall stand cancelled.

7.0 Evaluation - Distribution and Weightage of Marks

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

7.1 The performance of a student in every subject/course (including practicals and Project) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination). The Continuous Internal Evaluation shall be made based on the average of the marks secured in the two Mid-Term Examinations conducted, first Mid-Term examinations in the middle of the Semester and second Mid-Term examinations during the last weekof instruction.

7.2 In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Each Mid- Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 20 marks with a totalduration of 2 hours as follows:

1. Mid-Term Examination for 30 marks:

a. Part - A: Objective/quiz paper for 10 marks.

b. Part – B: Descriptive paper for 20 marks.

The objective/quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks. The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks. The average of the two Mid Term Examinations shall be taken as the final marks for Mid Term Examination (for 30 marks).

The remaining 10 marks of Continuous Internal Assessment (out of 40) are distributed as:

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

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

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

Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject for 5 marks before II Mid-Term Examination.

- The Student, in each subject, shall have to earn 40% of marks (i.e. 16 marks out of 40 marks) in CIE, 40% of marks (i.e. 24 marks out of 60) in SEE and Overall 50% of marks (i.e. 50 marks out of 100 marks) both CIE and SEE marks taking together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 40% (16 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 40% of CIE marks (16 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.

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

7.3 The Semester End Examinations (SEE), for theory subjects, will be conducted for 60 marks consisting of two parts viz. i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.

- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the studentshould answer either of the two questions.
- The duration of Semester End Examination is 3 hours.

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

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

The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the cluster / other colleges which will be decided by the examination branch of the University.

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

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

- The Student, in each subject, shall have to earn 40% of marks (i.e. 16 marks out of 40 marks) inCIE, 40% of marks (i.e. 24 marks out of 60) in SEE and Overall 50% of marks (i.e. 50 marks out of 100 marks) both CIE and SEE marks taking together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 40% (16 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 40% of CIE marks (16 marks out of 40 internal marks),

his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.

7.5 For conducting laboratory end examinations of all PG Programmes, one internal examiner and one external examiner are to be appointed by the Principal/Controller of Examinations. The external examiner should be selected from outside the College concerned but within the cluster.

7.6 There shall be Mini Project with Seminar during I year II semester for internal evaluation of 100 marks. The Departmental Academic Committee (DAC) will review the progress of the mini project during theseminar presentations and evaluate the same for 50 marks. Mini Project Viva Voce will be evaluatedby the DAC for another 50 marks before the semester end examinations. Student shall carryout themini project in consultation with the mini project supervisor which may include critically reviewing theliterature, project implementation and submit it to the department in the form of a report and shall make an oral presentation before the DAC consisting of Head of the Department, Mini Project supervisor and two other senior faculty members of the department. The student has to secure a minimum of 50% of marks in i) seminar presentation and ii) mini project viva voce, to be declared successful. If he fails toobtain the minimum marks, he has to reappear for the same as and when scheduled.

7.7 Every candidate shall be required to submit a dissertation on a topic approved by the Dissertation Review Committee.

7.8 A Dissertation Review Committee (DRC) shall be constituted with the Head of the Department as Chairperson, Dissertation Supervisor and one senior faculty member of the Department offering theM.Tech. programme.

7.9 Registration of Dissertation Work: A candidate is permitted to register for the Dissertation Work after satisfying the attendance requirement in all the subjects, both theory and laboratory.

7.10 After satisfying 7.9, a candidate must present in ***Dissertation Work Review - I***, in consultation with his Dissertation Supervisor, the title, objective and plan of action of his Dissertation work to the Dissertation Review Committee (DRC) for approval ***within four weeks*** from the commencement of **Second year First Semester**. Only after obtaining the approval of the DRC can the student initiate the Dissertation work.

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

7.12 A candidate shall submit his Dissertation progress report in two stages at least with a gap of **three** months between them.

7.13 The work on the Dissertation shall be initiated at the beginning of the II year and the duration of the Dissertation is two semesters. A candidate is permitted to submit

Dissertation Thesis only after successful completion of all theory and practical courses with the approval of DRC ***not earlier than 40 weeks*** from the date of approval of the Dissertation work. For the approval of DRC, the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the DRC.

7.14 The Dissertation Work Review - II in II Year I Semester carries 100 internal marks. Evaluation should be done by the DRC for 50 marks and the Supervisor will evaluate the work for the other 50 marks. The Supervisor and DRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain and progress of the Dissertation Work. A candidate has to secure a minimum of 50% of marks to be declared successful in Dissertation Work Review - II. If he fails to obtain the minimum required marks, he has to reappear for Dissertation Work Review - II as and when conducted.

7.15 The Dissertation Work Review - III in II Year II Sem. carries 100 internal marks. Evaluation should be done by the DRC for 50 marks and the Supervisor will evaluate it for the other 50 marks. The DRC will examine the overall progress of the Dissertation Work and decide whether or not the Dissertation is eligible for final submission. A candidate has to secure a minimum of 50% of marks to be declared successful in Dissertation Work Review - III. If he fails to obtain the required minimum marks, he has to reappear for Dissertation Work Review - III as and when conducted. For Dissertation Evaluation (Viva Voce) in II Year II Semester there are external marks of 100 and it is evaluated by the external examiner. The candidate has to secure a minimum of 50% marks in Dissertation Evaluation (Viva- Voce) examination.

7.16 Dissertation Work Reviews - II and III shall be conducted in phase I (Regular) and Phase II (Supplementary). Phase II will be conducted only for unsuccessful students in Phase I. The unsuccessful students in Dissertation Work Review - II (Phase II) shall reappear for it at the time of Dissertation Work Review - III (Phase I). These students shall reappear for Dissertation Work Review
- III in the next academic year at the time of Dissertation Work Review - II only after completion of Dissertation Work Review - II, and then Dissertation Work Review - III follows. The unsuccessful students in Dissertation Work Review - III (Phase II) shall reappear for Dissertation Work Review - III in the next academic year only at the time of Dissertation Work Review - II (Phase I).

7.17 After approval from the DRC, a soft copy of the thesis should be submitted for ANTI-PLAGIARISM check and the plagiarism report should be submitted to the Examination branch and be included in the final thesis. The Thesis will be accepted for submission, if the similarity index is less than **30%**. If the similarity index has more than the required percentage, the student is advised to modify accordingly and re- submit the soft copy of the thesis after one month. The maximum number of re-submissions of thesis after plagiarism check is limited to ***TWO***. The candidate has to register for the Dissertation work and work for two semesters. After three attempts, the admission is liable to be cancelled. The college authorities are advised to make plagiarism check of every soft copy of theses before submissions.

7.18 Three copies of the Dissertation Thesis certified by the supervisor shall be submitted to the College, after submission of a research paper related to the Dissertation work in a UGC approved journal. A copy of the submitted research paper shall be attached to thesis.

7.19 The thesis shall be adjudicated by an external examiner selected by the Principal/Controller of Examinations. For this, the Head of the department shall submit a panel of **three** examiners from among the list of experts in the relevant specialization as submitted by the supervisor concerned.

7.20 If the report of the external examiner is unsatisfactory, the candidate shall revise and resubmit the Thesis. If the report of the examiner is unsatisfactory again, the thesis shall be summarily rejected. Subsequent actions for such dissertations may be considered, only on the specific recommendationsof the external examiner and /or Dissertation Review Committee. No further correspondence in this matter will be entertained, if there is no specific recommendation for resubmission.

7.21 If the report of the examiner is satisfactory, the Head of the Department shall coordinate and decide for the conduct of Dissertation Viva-Voce examination. The Dissertation Viva-Voce examination shall beconducted by a board consisting of the Supervisor, Head of the Department and the external examiner who adjudicated the Thesis. The candidate has to secure a minimum of 50% of marks in Dissertation Evaluation (Viva-Voce) examination.

7.22 If he fails to fulfill the requirements as specified in 7.21, he will reappear for the Dissertation Viva-Voce examination ***only after three months***. In the reappeared examination also, if he fails to fulfill the requirements, he will not be eligible for the award of the degree, unless he is asked to revise and resubmit his Dissertation Work by the board within a specified time period (within ***four*** years from the date of commencement of his first year first semester).

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

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

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

8.0 Re-Admission/Re-Registration

8.1 Re-Admission for Discontinued Student

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

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

8.3 A candidate shall be given only one-time chance to re-register and attend the classes for a maximum of two subjects in a semester, if the internal marks secured by a candidate are less than 40% and failed in those subjects but fulfilled the attendance requirement. A candidate must re-register for failed subjects within four weeks of commencement of the class work, in the next academic year and secure the required minimum attendance. In the event of the student taking this chance, his Continuous Internal Evaluation (internal) marks and Semester End Examination marks obtained in the previous attempt stand cancelled.

9.0 Examinations and Assessment - The Grading System

9.1 Grades will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Mini Project with Seminar, Dissertation, etc., based on the percentage of marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 7 above, and a corresponding Letter Grade shall be given.

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

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

9.3 A student obtaining **'F'** Grade in any Subject is deemed to have 'failed' and is required to reappear as 'Supplementary Candidate' for the Semester End Examination (SEE), as and when conducted. In such cases, his Internal Marks (CIE Marks) in those subjects will remain as obtained earlier.

9.4 If a student has not appeared for the examinations, '**Ab**' Grade will be allocated to him for any subject and shall be considered 'failed' and will be required to reappear as

'Supplementary Candidate' for the Semester End Examination (SEE), as and when conducted.

9.5 A Letter Grade does not imply any specific marks percentage; it is only the range of percentage of marks.

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

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

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

9.8 The student passes the Subject/ Course only when he **gets GP ≥ 6 (B Grade or above).**

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

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

where 'i' is the Subject indicator index (taking into account all Subjects in a Semester), 'N' is the no. of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), C_i is the no. of Credits allotted to the ith Subject, and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that ith Subject.

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

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

(ie., up to and inclusive of S Semesters, S ≥ 2),

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' for from the 1st Semester onwards upto and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (taking into account all Subjects from 1 to S Semesters), C_j is the no. of Credits allotted to the jth Subject, and G_j represents the Grade Points

(GP) corresponding to the Letter Grade awarded for that jth Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA

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

SGPA = 159/21 = 7.57

Illustration of calculation of CGPA

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

CGPA = 612/96 = 6.37

10.0 Award of Degree and Class

10.1 If a student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of **68** 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 that he was admitted into.

10.2 Award of Class

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

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

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

11.0 Withholding of Results

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

12.0 General

12.1 Credit: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours ofpractical work/field work per week.

12.2 Credit Point: It is the product of grade point and number of credits for a course.

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

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

12.5 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the University is final.

12.6 The CMRCET 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 University.

MALPRACTICE RULES

Disciplinary Action for Malpractices/Improper Conduct in Examinations

	Nature of Malpractices/ Improper conduct	Punishment
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers, smart watches, electronic gadgets 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. Confiscation of Cell phones, pager, palm computers, smart watches, electronic gadgets etc. and the same would be handed over only after punishment finalized by Malpractice Committee.
(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, pager, palm computers, smart watches, electronic gadgets 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. Confiscation of Cell phones, pager, palm computers, smart watches, electronic gadgets etc. and the same would be handed over only after punishment finalized by Malpractice Committee.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers, cell phones, smart watches, electronic gadgets 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 subjects the candidate has already appeared including practical examinations excluding Project work/ Mandatory Courses /Technical Seminar and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled. Confiscation of Cell phones, pager, palm computers, smart watches, electronic gadgets etc. and the same would be handed over only after punishment finalized by Malpractice Committee.
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 subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the Remaining subjects 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 subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. 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 any kind in and around the or organizes a walk out or instigates others **to** examination hall-walk out, or threatens the officer- in-charge or any person on duty in or outside the examination hall of any injury**,** to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer- in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to	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 subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects 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.

	use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
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 subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Semester End Examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of That semester/year. 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 performance in that subject and all other subjects shall and cancellation of the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a state of inebriated/drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for other remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations excluding Project work/ Mandatory Courses /Technical

		Seminar 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

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

Malpractice committee:

(a) Chief Superintendent	Chairman
(b) Controller of Examinations	Member
(c) Dean Academics	Member
(d) Chief Examiner of the Course/ Subject Expert	Member
(e) Concerned Head of the Department	Member
(f) Observer	Member

******

CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)
DEPARTMENT OF CIVIL ENGINEERING
M. Tech- Structural Engineering
CBCS & OUTCOME BASED COURSE STRUCTURE

M. Tech I Year I Semester							
Course Code	**Course Title**	**Hours per Week**			**Credits**	**Maximum Marks**	
		L	**T**	**P**		**CIE**	**SEE**
B420301	Advanced Structural Mechanics	3	0	0	3	40	60
B420302	Theory of Elasticity and Plasticity	3	0	0	3	40	60
B4204XX	Professional Elective - I	3	0	0	3	40	60
B4204XX	Professional Elective -II	3	0	0	3	40	60
B420501	Computer Aided Design Laboratory	0	1	2	2	40	60
B420502	Structural Engineering Laboratory	0	1	2	2	40	60
B420303	Research Methodology & IPR	2	0	0	2	40	60
B400705	Audit Course - I	2	0	0	0	--	
Total		**16**	**02**	**04**	**18**		
Number of hours per Week		**22**					

M. Tech I Year II Semester							
Course Code	**Course Title**	**Hours per Week**			**Credits**	**Maximum Marks**	
		L	**T**	**P**		**CIE**	**SEE**
B420304	Finite Element Analysis	3	0	0	3	40	60
B420305	Structural Dynamics	3	0	0	3	40	60
B4204XX	Professional Elective - III	3	0	0	3	40	60
B4204XX	Professional Elective - IV	3	0	0	3	40	60
B420503	Numerical Analysis Laboratory	0	1	2	2	40	60
B420504	Advanced Structural Analysis and Design Laboratory	0	1	2	2	40	60
B420801	Mini Project with Seminar	0	0	4	2	100	-
B400706	Audit Course- II	2	0	0	0		
Total		**14**	**02**	**08**	**18**		
Total hours per Week		**24**					

M. Tech II Year I Semester							
Course Code	Course Title	Hours per Week			Credits	Maximum Marks	
		L	T	P		CIE	SEE
B4204XX	Professional Elective - V	3	0	0	3	40	60
B4206XX	Open Elective	3	0	0	3	40	60
B420802	Dissertation Work Review - II	0	0	12	6	100	-
Total		**06**	**00**	**12**	**12**		
Total hours per Week		**18**					

M. Tech II Year II Semester							
Course Code	Course Title	Hours per Week			Credits	Maximum Marks	
		L	T	P		CIE	SEE
B420803	Dissertation Work Review - III	0	0	12	6	100	-
B420804	Dissertation Viva-Voce	0	0	28	14	-	100
Total		**0**	**0**	**40**	**20**		
Total hours per Week		**40**					
Total Credits					**68**		

List of Professional Electives:

	Code	Subject Name
PE - I	B420401	Theory of Plates and Shells
	B420402	Computer Oriented Numerical Methods
	B420403	Structural Stability
PE - II	B420404	Advanced Reinforced Concrete Design
	B420405	Structural Health Monitoring
	B420406	Structural Optimization
PE - III	B420407	Advanced Structural Steel Design
	B420408	Structural Reliability
	B420409	Design of High-Rise Buildings
PE - IV	B420410	Advanced Pre-stressed Concrete Design
	B420411	Special Concretes
	B420412	Design of Bridges
PE - V	B420413	Earthquake Resistant Design of Structures
	B420414	Pre-Engineered Buildings
	B420415	Rehabilitation and Retrofitting of Structures

List of Open Electives offered by the CE and Other Department

	Code	Subject Name	Offered by
OE	B420601	Disaster Management	CE-SE
	B458601	Optimization Techniques	CSE-CSE
	B455601	Embedded Systems	ECE-ES
	B443601	Photovoltaic System	EEE-PE

List of Audit Courses

S.No.	Code	Subject Name
1	B400701	English for Research Paper Writing
2	B400702	Sanskrit for Technical Knowledge
3	B400703	Value Education
4	B400704	Constitution of India
5	B400705	Pedagogy Studies
6	B400706	Stress Management by yoga
7	B400707	Personality Development Through Life Enlightenment Skills

ADVANCED STRUCTURAL MECHANICS

M.Tech (SE): I-Semester **L T P C**
Subject Code: B420301 **3 0 0 3**

Pre-requisites: Structural Analysis I & II

UNIT - I

Unsymmetrical Bending: Definition of Shear Center in Bending - Symmetrical and Nonsymmetrical Bending - Bending Stresses in Beams Subjected to Nonsymmetrical Bending - Deflections of Straight Beams Subjected to Nonsymmetrical Bending

UNIT - II

Advanced Analysis of Beams: Curved Beams: Circumferential Stresses in a Curved Beam - Radial Stresses in Curved Beams - Correction of Circumferential Stresses in Curved Beams Having I-, T-, or Similar Cross Sections - Deflections of Curved Beams

Beams on Elastic Foundations - Infinite Beam Subjected to a Concentrated Load: Boundary Conditions - Infinite Beam Subjected to a Distributed Load Segment

UNIT - III

Column Buckling: Concept of Column Buckling - Deflection Response of Columns to Compressive Loads - Euler Buckling of Columns with General End Constraints - Local Buckling of Columns - Inelastic Buckling of Columns

UNIT - IV

Introduction to matrix methods of analysis: Static indeterminacy and kinematic indeterminacy - degree of freedom - coordinate system - structure idealization stiffness and flexibility matrices - suitability element stiffness equations - elements flexibility equations - mixed force - displacement equations-Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates - Assembly of stiffness matrix from element stiffness matrix – Analysis of trusses, beams and frames by stiffness matrix methods

UNIT - V

Direct stiffness method: General procedure - banded matrix - semi bandwidth - assembly by direct stiffness matrix method -Application of direct stiffness method to trusses, simple and continuous beams and frames

TEXTBOOKS:

1. Matrix Structural Analysis by Madhu B. Kanchi
2. Matrix Methods of Structural Analysis by J.Meek
3. Structural Analysis by Ghali and Neyveli

REFERENCEBOOKS:

1. Structural Analysis by DevdasMenon, Narosa Publishing Housing Pvt Ltd.
2. Indeterminate Structural Analysis by K U. Muttu,IK International Publishing House Pvt.ltd
3. Matrix Analysis of Frames structures by William Weaver J.R and James M.Gere, CBS publications.

Course Outcomes: After completion of the course, students should be able to

1. Formulate the stiffness for various types of structures
2. Formulate the flexibility matrices for various types of structures
3. Analyze the continuous beams, portal frames and trusses by stiffness method (structure approach)
4. Analyze the continuous beams, portal frames and trusses by flexibility method (structure approach)
5. Solve the Trusses, Continuous beams, Portal frames using element approach of stiffness method

THEORY OF ELASTICITY AND PLASTICITY

Course: M. Tech (SE): I-Year I-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420302	**3**	**0**	**0**	**3**

UNIT - I

Stress: Introduction to Elasticity – Definition of Kinetics and Kinematics - Notation for forces and stress - Components of stresses – Stress tensor - Differential equations of equilibrium in 2D & 3D in Cartesian coordinates and in polar coordinates - boundary conditions – Cauchy's postulate – Stress transformation – Direction Cosines -Principal stresses – Stress invariants – Decomposition of stresses -Hydrostatic and Deviatoric stresses – Octahedral stresses – stress concentration factors.

UNIT - II

Strain: Notation for strain - Components of strain – Strain tensor – Strain Components -Strain - displacement relations - Strain Compatibility Conditions - Strain transformation – Direction Cosines - Principal strains – Strain invariants - Octahedral strains – Strain Rosette.

UNIT - III

Stress -Strain Relationship: Navier's equation for stress-strain relationships – Relationship between Material constants – Stress - strain relations in 2D and 3D – Complementary conditions for shear - Material symmetry - Reduction of Material constants from anisotropic to orthotropic, monoclinic, isotropic and transversely isotropic – Plane stress, Plane strain and axi-symmetric idealizations - Mohr circle in 2D and 3D – Airy's stress function – Potential function

UNIT - IV

Solution of 2D and 3D Elasticity Problems: Problem solving using stress function approach: Beam bending problems – Symmetric stress distribution problems, Plane problems. Torsion problems in Elasticity – Membrane analogy approach – Application to non- circular thin walled sections

UNIT - V

Plasticity: Introduction to plasticity – Yield criteria for pressure dependent and independent materials - Tresca's criterion – Von mises criterion – Mohr-Coulomb criterion -Rankine criterion -Flow rule – Associative and Non-Associative-Hardening rules and consistency conditions -Introduction to iterative and return mapping.

TEXT BOOKS:

1. Theory of Elasticity by Timeshenko, McGraw-Hill Publications

REFERENCES:

1. Theory of Elasticity by Y.C.Fung
2. Advanced Mechanics of solids by LS Srinath,
3. Elasticity and Plasticity for structural Engineers by Wang & Chen

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Apply principles of elastic theory to estimate stresses of structural engineering problem

CO2: Apply principles of elastic theory to estimate strains of structural engineering problems

CO3: Develop the differential equations of equilibrium for 2D and 3D

CO4: Solve engineering problems related to Torsion of shafts.

CO5: Apply principles of plasticity to solve material nonlinear problems.

THEORY OF PLATES AND SHELLS

(Professional Elective - I)

Course: M. Tech (SE): I-Year I-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420401	**3**	**0**	**0**	**3**

UNIT - I

Introduction: Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations,Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions.

UNIT - II

Small Deflection Theory of Thin Rectangular Plates: Assumptions – Derivation of governing differential equation for thin plates – Boundary conditions – simply supported plate under sinusoidal load – Navier solution – Application to different cases – Levy's solution for various boundary conditions subjected to different loadings like uniform and hydrostatic pressure.

UNIT - III

Circular Plates: Differential Equation for symmetrical bending of Laterally loaded circular Plates –Uniformly loaded circular plates –circular plate concentrically loaded – circular plate loaded at center

UNIT - IV

Shells – functional behaviour – examples – structural behaviour of shells classification of shells –Definitions – various methods of analysis of shells – merits and demerits of each method – 2D.Membrane equation.
Equations of equilibrium: Derivation of stress resultants – cylindrical shells – Flugges simulations equations.

UNIT - V

Introduction to the shells of Double curvatures: Geometry, analysis and design of elliptic paraboloid, conoid and hyperbolic parabolic shapes, inverted umbrella type.
Axi- Symmetrical shells: General equation - Analysis and axi-symmetrical by membrane theory. Application to spherical shell and hyperboloid of revolution cooling towers.

TEXT BOOKS:

1. Theory of Plates & Shells –Stephen, P. Timoshenko, S. Woinowsky-Krieger – Tata MC Graw Hill Edition

REFERENCES:

1. Analysis and design of concrete shell roofs By G. S. Ramaswami, CBS publications.
2. Design of concrete shell roofs By Billington – Tata MC Graw Hill, New York
3. Design of Shells and Folded Plates by P.C. Varghese, PHI Learning Pvt. Ltd

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Apply the principle of virtual work and boundary conditions for space curves, surfaces, shell co-ordinates.

CO2: Use analytical methods for the solution of thin plates and shells

CO3: Use analytical methods for the solution of shells and folded plates

CO4: Apply the numerical techniques and tools for the complex problems in thin plates

CO5: Apply the numerical techniques and tools for the complex problems in shells

COMPUTER ORIENTED NUMERICAL METHODS

(Professional Elective - I)

Course: M. Tech (SE): I-Year I-Sem. **L T P C**
Subject Code: B420402 **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 -Applications

UNIT - II:

Eigen values and eigen vectors: Jacobi method for symmetric matrices- Given's method for symmetric matrices- Householder's method for symmetric matrices-Rutisha user method of arbitrary matrices –Power method, Fast Fourier Transform (FFT)

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 Taylorseries- 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- extrapolation method – Partial differentiation.

Numerical Integration: Method based on interpolation-method based on undetermined coefficient –Gauss – legrange 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, Runge-Kutta method Predictor-Corrector Method -Trapezoidal and Midpoint method – Implicit RungeKutta method – Boundary value problem – Difference method –Shooting method -Structural Engineering Applications.

TEXT BOOKS:

1. Numerical Methods for Scientific and Engineering Computations. M. K. Jain - S. R. K. Iyengar – R. K. Jain Willey Eastern Limited.

REFERENCES:

1. Applied numerical Analysis by – Curtis I. Gerala- AddissionWasley – published campus.
2. Numerical Methods for Engineers Stevan C. Chopra, Raymond P. Canal Mc. Graw Hill book company.
3. C Language and Numerical Methods by C. Xavier – New age international publisher.
4. Numerical methods using MATLAB by George Lindfield and John penny, Academic press

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Illustrate the different linear equations problems

CO2: Apply the concept of various methods of interpolation

CO3: Adapt the finite difference to various elements

CO4: Make use of numerical differentiation and integration

CO5: Construct the solution using ordinary differential equation

STRUCTURAL STABILITY
(Professional Elective - I)

Course: M. Tech (SE): I-Year I-Sem. **L T P C**
Subject Code: B420403 **3 0 0 3**

UNIT – I

Criteria for Design of Structures: Stability, Strength, and Stiffness, Classical Concept ofStability of Discrete and Continuous Systems, Linear and nonlinear behavior.

UNIT – II

Stability of Columns: Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling.

UNIT – III

Stability of Frames: Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.

UNIT – IV

Stability of Beams: lateral torsion buckling.

Stability of Plates: axial flexural buckling, shear flexural buckling, buckling under combined loads.

UNIT – V

Introduction to Inelastic Buckling and Dynamic Stability.

TEXT BOOKS:

1. Theory of elastic stability, Timoshenko and Gere, Tata McGraw Hill,1981.

REFERENCES:

1. Principles of Structural Stability Theory, Alexander Chajes, Prentice Hall, New Jersey.
2. Structural Stability of columns and plates, Iyengar, N. G. R., Eastern west press Pvt. Ltd.
3. Strength of Metal Structures, Bleich F. Bucking, Tata McGraw Hill, New York.

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Apply the approximate methods based on energy to determine the stability of simple systems

CO2: Analyse the beams for Flexural Buckling, Lateral Bracing of Columns and Combined Axial, Flexural & Torsion Buckling

CO3: Analyse elastic and in-elastic buckling of bars and frames

CO4: Analyse the beams for lateral torsional buckling and plates for axial & shear flexural buckling under loads.

CO5: Distinguish tangent modulus and double modulus theories of inelastic buckling led to the column

ADVANCED REINFORCED CONCRETE DESIGN

(Professional Elective - II)

Course: M. Tech (SE):I-Year I-Sem. **L T P C**

Subject Code: B420404 **3 0 0 3**

UNIT - I

Limit state Analysis of R.C. Structures: Introduction- Loads – Different types of Loads and load combinations – Different methods of Design- Working Stress Method and Limit State Method –Materials - Characteristic Values – Reliability based methods of design - Partial safety factors –Stress Block Parameters - Plastic hinge, Redistribution of moments, moment rotation characteristics of RC member

UNIT - II

Limit state of Flexure: I.S. code provisions, loading pattern, Bending Moment Envelop, Application for Fixed Beams and Continuous Beams, Deep Beams and Corbels

UNIT - III

Inelastic Analysis of Slabs: Yield line criterion – Virtual work and equilibrium methods of analysis –For square circular, Rectangular, Triangular and Hexagonal with simple and continuous end condition, Reinforcement details.
Ribbed slabs: Analysis of the Slabs for Moment and Shears, Ultimate Momentof Resistance, Design for shear, Deflection, Arrangement of Reinforcements.
Flat slabs: Direct designmethod – 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 Equivalentframe method. Limitations of Direct design method, Distribution of moments in column strips and middle strip sketch showing reinforcement details.

UNIT - IV

Limit state of Shear, Bond and Torsion: Design for Shear, Bond and Torsion - Mechanism of shear and bond failure - Design of shear using limit state concept – Design for Bond –Anchorage and Development length of bars - Design of sections for torsion - Detailing of reinforcement

UNIT - V

Limit State of Compression: Design of Short and Long columns - slenderness limits, Methods of Design of Slender Columns, Additional Moment Method, Procedure for Design of Slender Columns.

TEXT BOOKS:

1. Advanced Reinforced Concrete P.C. Varghese Prentice Hall of INDIA Private Ltd. 2008.
2. Design of Reinforced Concrete Structures by N.Subramanian, Oxford University Press.

REFERENCES:

1. Design Reinforced Concrete Foundations P.C. Varghese Prentice Hall of INDIA Private Ltd.
2. IS 456- 2000 Plain and Reinforced concrete book of Practice.
3. SP 16 - Design Aids for Reinforced Concrete to IS 456
4. SP 34 - Hand Book as Concrete Reinforcement and retaining

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Design the different RCC structural elements using various philosophies and load combinations.

CO2: Analyze the loading pattern, Bending Moment for various beam elements as per the codal provisions

CO3: Evaluate the various slabs using yield line criterion and equilibrium methods

CO4: Design shear, bond and torsion of an element using limit state concept and draw the reinforcement details.

CO5: Design of compression members for various columns

STRUCTURAL HEALTH MONITORING

(Professional Elective - II)

Course: M. Tech (SE): I-Year I-Sem. **L T P C**
Subject Code: B420405 **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.

REFERENCES:

1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006
2. Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.
3. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan,Taylor and Francis Group, London, UK, 2006.
4. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Diagnosis the distress in the structure understanding the causes and factors.

CO2: Assess the health of structure using static field methods.

CO3: Examine the various static field tests

CO4: Assess the health of structure using dynamic field tests.

CO5: Suggest repairs and rehabilitation measures of the structure

STRUCTURAL OPTIMIZATION
(Professional Elective - II)

Course: M. Tech (SE): I-Year I-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420406	**3**	**0**	**0**	**3**

UNIT – I

Introduction: Simultaneous Failure Mode and Design, Classical External Problems.

UNIT – II

Calculus of Variation: Variational Principles with Constraints,

UNIT – III

Linear Programming, Integer Programming, Nonlinear Programming, Dynamic Programming,

UNIT – IV

Geometric Programming and Stochastic Programming.

UNIT – V

Applications: Structural Steel and Concrete Members, Trusses and Frames.
Design: Frequency Constraint, Design of Layouts.

REFERENCES:

1. Elements of Structural Optimization, Haftka, Raphael T., Gürdal, Zafer, Springer
2. Variational methods for Structural optimization, Cherkaev Andrej, Springer

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Explain the simultaneous failure mode and design

CO2: Use Variational principle for optimization

CO3: Perform linear, non-linear, dynamic and geometric programing methods

CO4: Apply optimization techniques to structural steel and concrete members

CO5: Design using frequency constraint

COMPUTER AIDED DESIGN LABORATORY
(Lab - I)

Course:M. Tech (SE): I-Year I-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420501	**0**	**1**	**2**	**2**

Pre-Requisites:

1. Computer Aided Civil Engineering Drawing Principles
2. Microsoft Excel

List of Experiments:

1. Analysis and design of determinate and indeterminate beams & development of Excel template
2. Analysis and design of plane frames and development of Excel template.
3. Analysis and design of space frame and development of Excel template
4. Analysis and design of a multi-storeyed building subjected to DL, LL and WL
5. Analysis and design of multi-storeyed building subjected to DL, LL and EQ
6. Analysis and design of Roof trusses including WL calculation in Excel Spreadsheet
7. Analysis and design of Gantry girder and development of spread sheet

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Design the determinate and indeterminate beams

CO2: Develop the plane and space frames

CO3: Analyze the multi-storeyed building subjected to various loads

CO4: Apply the wind load to the roof trusses

CO5: Analyze and design the gantry girder

STRUCTURAL ENGINEERING LABORATORY
(Lab - II)

Course: M. Tech (SE): I-Year I-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420502	**0**	**1**	**2**	**2**

List of Experiments/Assignments:

A. Tests on following fresh concretes

Self- Compacting Concrete, High Strength Concrete, Normal Strength Concrete
The tests shall include

1. Mix Design
2. Workability tests
3. Material characterization of ingredients
   a) Specific gravity test
   b) Water absorption test
   c) Gradation Analysis (Sieve Analysis)
   d) Tests on setting times

B. Tests on Hardened Concrete:

1. Compression test on High strength Concrete Cubes and Cylinders
2. Flexure tests on Normal strength concrete under reinforced, Over reinforced and balanced beams
3. Flexure tests on Normal strength concrete beams with and without Shear reinforcement
4. Creep Test
5. Shrinkage Test

C. Durability Tests:

1. Water Permeability
2. Carbonation tests
3. Sulphate attack test (Na_2SO_4 / $MgSO_4$)
4. Sorptivity test

D. Non-Destructive testing (NDT): NDTof concrete using rebound hammer & ultrasonic pulse velocity

REFERENCE BOOKS:

1. Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
2. Concrete Technology, Shetty M. S., S. Chand and Co., 2006.
3. Concrete Technology by A.R. Santha kumar, Oxford University Press.

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Design normal and special concretes and evaluate the parameters affecting its performance

CO2: Identify the properties of various materials used for making concrete.

CO3: Apply engineering principles to understand mechanical characteristics of structural elements

CO4: Apply engineering principles to understand durability characteristics of structural elements

CO5: Perform nondestructive testing of hardened concrete.

RESEARCH METHODOLOGY AND IPR

Course: M. Tech (SE): I-Year I-Sem. **L T P C**
Subject Code: B420303 **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 approaches, analysis, Plagiarism, Research ethics

UNIT- III:

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- IV:

Nature of Intellectual Property: Patents, Designs, Trade 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 underPCT.

UNIT- V:

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

TEXT BOOKS:

1. Research Methodology by C.R. Kothari, New Age Publishers, 2004
2. Intellectual Property Rights Under WTO, by T. Ramappa, S. Chand, 2000

REFERENCES:

1. Research Methodology: A Step by Step Guide for beginners, Ranjit Kumar, 2nd Edition,
2. Resisting Intellectual Property, Halbert, Taylor & Francis Ltd,2007.
3. Intellectual Property in New Technological Age, Robert P. Merges, Peter S. Menell, Mark A. Lemley, 2016.

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Identify research problem formulation and analyze research related information.

CO2: Make use of literature study approaches, analysis Plagiarism and Research ethics

CO3: Develop technical skills of report writing, proposal and presentation

CO1: Design procedure of obtaining Patents, Trade Marks and Copyrights.

CO1: Apply Patent Rights on new developments in IPR

CONSTITUTION OF INDIA
(Audit Course-I)

Course: M. Tech (SE): I-Sem. **L T P C**
Subject Code: B400705 **2 0 0 0**

Prerequisite: None

UNIT-I:

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working), Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT-II:

Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to on stitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III:

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

UNIT-IV:

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT-V:

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

TEXT BOOKS/ REFERENCES:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

FINITE ELEMENT ANALYSIS

Course: M. Tech (SE): I-Year II-Sem. **L T P C**
Subject Code: B420304 **3 0 0 3**

UNIT – I

Introduction to FEM: Types of Problems – Types of Materials – Elastic / Inelastic situations – Typesof forces: Body forces / Surface Traction / Point loads – Deformable bodies – Types of Deformations –Homogeneous / Non homogeneous Problems – Equations of equilibrium for elastic 2-D / 3-D continua- Equilibrium equations for 2-D / 3-D boundary elements – Boundary conditions – Strain-displacementrelation for 2-D / 3-D – Stress-strain relation for 2-D / 3-D – Plane stress / Plane strain problems.
Virtual Work Formulation: Application to problems of plane trusses with static indeterminacy notexceeding three.

UNIT – II

Variational Formulation: Approximate methods of Analysis- Weighted residual method - Rayleigh-Ritz Method -Strong form weak form -Variational principle - Stationarity Functional or Differential equation Finite element formulation for1-D problems: Minimum Potential Energy Approach, week form approach, introduction to natural coordinates -Finite element approximations in one dimension-Lagrangian approximation-Hermitian approximations, FE formulation for Axial bar, Euler Bernoulli beam -Numerical Examples
Finite element formulation for 2-D problems: FE Approximation in 2-Dimension, Pascals triangle, Convergence criterion, Compatible and incompatible elements, FE Formulation for plane stress, plane strain and Axi-symmetrical problems, Shape functions for 2-Dimensional CST Element-4 noded quadrilateral element -Highier order triangular and rectangular elements- Consistent Nodal load vector-Numerical Examples

UNIT – III

Iso-parametric elements: Quadrilateral elements: FE Formulation for linear and quadratic isoparametric elements, Construction of shape functions using natural coordinates/Strain-displacement matrices/Load matrices, for body force and surface traction/ Expressions for stiffness matrix, load matrices for 4-noded quadrilateral elements/ Gauss Quadrature of numerical integration / Problems with rectangular, elements, kinematic indeterminacy not exceeding three- Determination of shape functions for 2nd order quadrilateral elements and for elements of with serendipity / Strain-displacement matrices / Load matrices for body force and surface traction

UNIT – IV

Finite element formulation for 3 -D elements, FE Formulation for Tetrahedral and Hexahedral elements: Volume coordinates, Strain-displacement matrix, stiffness matrix, load matrices due to body force and surface traction/ introduction to Hexahedron (brick) elementsGalerkin's Method of Weighted Residuals – Application to problems of mathematics / structuralengineering, number of trial functions not exceeding two.Weak form of Trial Function - Application to problems of mathematics / structural engineering, number of elements limited to two - Strain-displacement relationship/stress-strain relationship / determination ofstiffness matrix for 3-noded ring element and load matrices for body force and surface traction/ Problems with kinematic indeterminacy not exceeding three for 3-noded ring elements only

UNIT – V

Numerical examples: Simple 1-D model, 2-D model and a 3-D model/ analysis and post processing of the results using commercially available FEA software and available codes.

TEXT BOOKS:

1. Reddy, J. N, (1993). ―An Introduction to the Finite Element Method‖, McGraw Hill, New York.
2. Chandrupatla, T. R. And Belegundu, A. D, (2001). ―Introduction to Finite Elements in Engineering‖, Prentice Hall of India, New Delhi.

References:

1. Cook, R. D. (1981). ―Concepts and Application of Finite Element Analysis‖, John Wiley and Sons.

2. Zienkiewicz, O. C. And Taylor, R. L, (1989). ―The Finite Element Method‖, Vol.1, McGraw Hill Company Limited, London.
3. Seshu. P, (2003). ―Finite Element Analysis‖, Prentice Hall of India Private Limited, New Delhi.
4. David V. Hutton, (2005). ―Fundamentals of Finite Element Analysis‖, Tata McGraw-Hill, Publishing Company Limited, New Delhi.
5. Bathe, K. J, (2006). ―Finite Element Procedures‖, Prentice Hall of India, New Delhi

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Analyze the FEA models for various engineering problems

CO2: Formulate the finite element approximations for 1-D & 2-D problems

CO3: Make use of shape functions for Iso-parametric elements to obtain stiffness matrix

CO4: Formulate the finite element approximations for 3-D problems

CO5: Use the standard finite element software to solve the structural engineering problems.

STRUCTURAL DYNAMICS

Course: M. Tech (SE): I-Year II-Sem. **L T P C**

Subject Code: B420305 **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 – Vectorialrepresentation of S.H.M. – 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.

UNIT - II

Single Degree of Freedom Systems: Free vibrations of single degree of freedom system –undampedand damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems– Half Power (Band-Width) Method-Harmonic excitation - Vibration Isolation – Response to support motion-Force transmitted to the foundation-Transmissibility-Dynamic magnification factor – Phaseangle.Response to General Dynamic Loading – Duhamel's Integral-Constant Force, Rectangular load,Triangular load, Response to Periodic loading-Fourier series expression of periodic loading- Responseto Fourier series loading

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.

UNIT - V

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.

TEXT BOOKS:

1. Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore), Delhi.
2. Fundamentals of Structural Dynamics by Roy. R. Craig, John wiley& sons

REFERENCES:

1. Dynamics of Structures by Ray W.Clough& Joseph Penzien, Second Edition, CBS Publishers & Distributors
2. Structural Dynamics by Mario Paz and William Leigh, Fifth Edition, Springer
3. Theory of Vibrations by W.T. Thomson, Pearson

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Apply the fundamental concepts and definitions used in structural dynamics.

CO2: Calculate the natural frequency of a system using equilibrium or energy methods.

CO3: Determine the effect of viscous damping on the response of a freely vibrating system.

CO4: Determine the response of a system to a harmonic excitation.

CO5: Evaluate the vibration analysis using Stodola Method, Analysis of second and higher modes using Holzer method and flexural vibration of simple beams

ADVANCED STRUCTURAL STEEL DESIGN

(Professional Elective - III)

Course: M. Tech (SE): I-Year II-Sem. **L T P C**
Subject Code: B420407 **3 0 0 3**

UNIT - I

Simple Connections –Bolted Pinned And Welded 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

Plastic Analysis: Introduction – Plastic Theory – Plastic neutral Axis plastic moment, Elastic & Plastic Section modulii shape factors plastic Hinge – Fundamental condition conditions in plastic analysis, methods of plastic analysis – collapse load – simply supported, propped cantilever beam, fixed beams continuous beams, portal frame single bay single storey portal frame at different level subjected to vertical and horizontal loads.

UNIT - III

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 - IV

Analysis and Design of Industrial Buildings:ead 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 andstanchions, Design of bracings.

UNIT - V

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 girde Bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; sway bracing Design of Lacing.

TEXT BOOKS:

1. Limit State Design of Steel Structures by N. Subramanian
2. Limit State Design of Steel Structures S.K. DuggalMcGraw Hill Education Private Ltd. New Delhi.

REFERENCES:

1. Design of Steel Structures. P.Dayaratnam, Publisher : S. Chand, Edition 2011-12.
2. Design Steel Structures Volume – II, Dr. Ramachandra & VivendraGehlot Scientific Publishes Journals Department.
3. Design of Steel Structures Galyord& Gaylord, Publisher: Tata McGraw Hill, Education. Edition 2012.
4. Indian Standard Code – IS – 800-2007.
5. Indian Standard Code – IS – 875 – Part III – 2015

STRUCTURAL RELIABILITY

(Professional Elective - III)

Course: M. Tech (SE): I-Year II-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420408	**3**	**0**	**0**	**3**

UNIT - I

Concepts of Structural Safety: General - Design methods- Basic Statistics: Introduction -Data reduction – Histograms - Sample correlation - Probability Theory: Introduction, Random events -Random variables - Functions of random variables - Moments and expectation - common probability distribution - Extremal distribution.

UNIT - II

Resistance Distributions and Parameters: Introduction - Statistics of properties of concrete, steel, strength of bricks and mortar - dimensional variations - characterization of variables - Allowable stresses based on specified reliability.

UNIT - III

Basic Structural Reliability: Introduction - Computation of Structural reliability- Monte Carlo Study of Structural Safety: General- Monte Carlo method - Applications.

UNIT - IV

Reliability Methods: Introduction - Basic variables and failure surface - First-order second-moment methods (FOSM)

UNIT - V

Reliability Based Design: Introduction - Determination of partial safety factors - Safety checking formats - Development of reliability-based design criteria - Optimal safety factors -Summary of results of study for Indian standard – RCC Design.

TEXT BOOKS:

1. R. Ranganathan, Structural Reliability Analysis and Design, Jaico Publishing House, 2006.
2. R.E. Melchers, Structural Reliability – Analysis & Prediction, 2/e, Wiley – Blackwell, 1999.

REFERENCES:

1. Maurice Lemaire, Structural Reliability,Wiley (2009).
2. Dan M. Frangopol, MitsuoKawatani&Chul-Woo Kim, Reliability and Optimization of Structural Systems, Taylor & Francis (2006)

DESIGN OF HIGH-RISE BUILDINGS

(Professional Elective - III)

Course: M. Tech (SE): I-Year II-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420409	**3**	**0**	**0**	**3**

UNIT - I

Loading and Design Principles: Loading- sequential loading, Gravity loading, Wind loading, Earthquake loading, - Equivalent lateral force, modal analysis - combination of loading, – Static and Dynamic approach - Analytical and wind tunnel experimental methods - Design philosophy - working stress method, limit state method and plastic design.

UNIT - II

Behaviour of Various Structural Systems: Factors affecting growth, height and structural form. High rise behaviour, Rigid Frames, braced frames, In filled frames, shear walls, coupled shear walls, wallframes, tubulars, cores, outrigger - braced and hybrid mega systems.

UNIT - III

Analysis and Design: Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of buildings as total structural system considering overall integrity and major subsystem interaction, Analysis for member forces, drift and twist - Computerized three dimensional analysis –Assumptions in 3D analysis – Simplified 2D analysis.

UNIT - IV

Structural Elements: Sectional shapes, properties and resisting capacity, design, deflection, cracking, prestressing, shear flow, Design for differential movement, creep and shrinkage effects, temperature effects and fire resistance.

UNIT - V

Stability of Tall Buildings: Overall buckling analysis of frames, wall-frames, Approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first-order and P-Delta analysis, Translational, Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation.

TEXT BOOKS:

1. Taranath B.S., “Structural Analysis and Design of Tall Buildings”, McGraw Hill, 1988.
2. Beedle.L.S., “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1986.

REFERENCES:

1. Bryan Stafford Smith and Alexcoull, “Tall Building Structures - Analysis and Design”, John Wiley and Sons, Inc., 2005.
2. Gupta.Y.P.(Editor), Proceedings of National Seminar on High Rise Structures - Design and Construction Practices for Middle Level Cities, New Age International Limited, New Delhi,1995.
3. Lin T.Y and Stotes Burry D, “Structural Concepts and systems for Architects and Engineers”, John Wiley, 1988

ADVANCED PRESTRESSED CONCRETE DESIGN

(Professional Elective - IV)

Course: M. Tech (SE):I-Year II-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420410	**3**	**0**	**0**	**3**

UNIT I:

Introduction:Prestressing Systems – Pretensioning Systems – Post-tensioning Systems – High Strength Steel and Concrete - Analysis of Prestress - Resultant Stresses at a Section – Pressure Line or Thrust Line – Concept of Load Balancing.Losses of Prestress – Loss Due to Elastic Deformation of Concrete – Shrinkage of Concrete – Creep – Relaxation of Stress in Steel – Friction – Anchorage Slip.

UNIT II:

Deflections of prestressed concrete members: Importance of Control of Deflections – Factors Influencing Deflection – Short-term Deflections of Uncracked Members – Prediction of Long-time Deflections – Deflections of Cracked Members – Requirements of IS 1343-2012.
Ultimate Flexural Strength of Beams: Introduction, Flexural theory using first principles – Simplified Methods – Ultimate Moment of Resistance of untensioned Steel.

UNIT III:

Composite constructions: Introduction, Advantages, Types of Composite Construction, Analysis of Composite beams- Differential shrinkage- Ultimate Flexural and shear strength of composite sectionsDeflection of Composite Beams. Design of Composite sections.

UNIT IV:

Prestressed concrete slabs: Types Of Prestressed Concrete Floor Slabs- Design of Prestressed Concrete One Way and Two Way Slabs.
Prestressed Concrete Pipes: Circular prestressing- Types of Prestressed Concrete Pipes- Design of Prestressed Concrete Pipes.

UNIT V:

Continuous beams: Advantage of Continuous Members – Effect of Prestressing Indeterminate Structures – Methods of Achieving Continuity – Methods of Analysis of Secondary Moments –Concordant Cable Profile – Guyon's Theorem, Redistribution of moments in a continuous beam.
Anchorage Zone Stresses in Beams: Introduction, Stress distribution in End Block – Anchorage zone stresses –Magnel's method- Guyon's Method - Anchorage zone Reinforcement as per IS1343-2012.

TEXT BOOKS:

1. Prestressed concrete, krishnanraju N., Tata McGraw Hill, New Delhi.
2. Prestressed concrete by K. U. Muthu, PHI Learning Pvt. Ltd

REFERENCES:

1. Design of prestressed concrete structure, Lin T. Yand Burns, Asia Publication house, 1995.
2. Limit state design of prestressed concrete, Gutan Y, Applied science publishers, 1972.
3. IS:1343-2012-code of practice for Prestressed concrete

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Realize the importance of prestressing the long span structures and heavily loaded members.

CO2: Acquire the knowledge of various prestressingtechniques ;their merits and demerits.

CO3: Develop skills in planning, analysis and design of prestressed concrete beams, and slabs.

CO4: Develop skills to satisfy the serviceability and strength provisions of the Indian Standards (IS: 1343-2012).

CO5: Analyze and design for the transmission of prestress in post tensioned members.

SPECIAL CONCRETES
(Professional Elective - IV)

Course: M. Tech (SE): I-Year II-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420411	**3**	**0**	**0**	**3**

UNIT - I

Fresh and Hardened Concrete: Fresh concrete - Workability tests on concrete- Workability tests on Self Compacting Concretes - segregation and bleeding. Hardened Concrete - Abram's law - Gel- space ratio - Maturity concept - Stress Strain behavior, Creep and Shrinkage.

UNIT - II

High Performance and High Strength Concretes: High performance concrete - Requirements and properties of high-performance concrete - Design considerations – High strength concrete – Design considerations.

UNIT -III

Advanced Concrete Design: Light weight concrete - Self Compacting concrete - Polymer concrete -Fiber reinforced concrete – Reactive powder concrete - Bacterial concrete-Geo-polymer concrete –Requirements and guidelines- Advantages and Applications – Porous pavement – White Topping –Roller compacted concrete

UNIT -IV

Concrete Mix Design: Quality control - Quality assurance - Quality audit - Mix design by various methods - BIS method - DOE method - ACI method – Erntroy & Shacklock's method.

UNIT - V

Performance Evaluation of Reinforced Concrete Structures: Durability of concrete & Corrosion tests - Resistivity of concrete - Half Cell Potential - Rapid Chloride Penetration Test - Macro cell Corrosion - Effects of concrete exposed to acidic environment - Durability Factor - Accelerated Corrosion Cracking Test - Non-destructive evaluation of concrete structures - Ultrasonic Pulse Velocity - Evaluation of Dynamic Shear & Young's Modulus - Introduction to XRD & SEM Analysis.

TEXT BOOKS:

1. Properties of Concrete, A. M. Neville, Pearson Education
2. Concrete Microstructure, Properties and Materials, P. K. Mehta and Paulo J. M. Monteiro, McGrawHill
3. Civil Engineering Materials by Shan Somayaji, Pearson Publishers, 2000

REFERENCES:

1. Corrosion of Steel in Concrete, P. Schiessl, Chapman & Hall
2. Concrete Making Materials, SandorPopovics, Hemisphere Publishing Corporation
3. Cement Based Composites, Andrzej M. Brandt

DESIGN OF BRIDGES

(Professional Elective - IV)

Course: M. Tech (SE): I-Year I-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420412	**3**	**0**	**0**	**3**

Prerequisites: Structural Analysis I &II, Reinforced Concrete Design

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

UNIT - II

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

UNIT - III

Box Culverts: - Single Cell Box Culvert – Design Loads, Design Moments, Shears and Thrusts. Design of Critical sections.

UNIT - IV

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

UNIT - V

Sub-structure of bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers, Abutments-Design loads for Abutments.

REFERENCES:

1. Design of Concrete Bridges by M. G. Aswani, V. N. Vazirani and M. M. Ratwani.
2. Bridge Deck Behaviour by E. C. Hambly.
3. Concrete Bridge Design and Practice by V. K. Raina.
4. Essentials of Bridge Engineering by Johson Victor, Oxford & IBH
5. Design of Bridges by V. V. Sastry, DhanpatRai& Co

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Explain the various of loads in design of bridges

CO2: Analyze and design of solid slab bridges

CO3: Analyze and Design of Prestressed Concrete bridges

CO4: Develop the Design methods of girder bridges.

CO5: Design the solid slab bridges and girder bridges

NUMERICAL ANALYSIS LABORATORY

(Lab III)

Course: M. Tech (SE): I-Year II-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420503	**0**	**1**	**2**	**2**

LIST OF EXPERIMENTS:

Overview of MATLAB, Matrix operations (Addition, Subtraction, Multiplication, Transpose)

1. Solution of simultaneous equations using matrix inversion – Resolution of forces and moments and finding the reactions on a beam.
2. Solution of system of linear equations using Gauss Elimination method - Application to the analysis of indeterminate beams
3. Solution of System of linear equations using Gauss Seidal iteration Method – Application to the analysis of portal frames
4. Finding the Roots of non-linear equations using Newton – Raphson Method - Application for finding the slopes and deflections in determinate beams
5. Finding the Solution of an Eigen Value problem – Application to a multistory RC building for determining the Time periods and Mode shapes.
6. Numerical Integration using Trapezoidal & Simpson's Rule – Application for finding the Areas and Volumes of a given plot.
7. Numerical solution of ordinary differential equations by Runge- Kutta method
8. Numerical solution of second and higher order differential equations Plotting Simple Graphs, Basic 2D Plots, 3D Plots

COURSE OUTCOMES: On completion of the course students will be able to

CO1: Find Roots of non-linear equations by Bisection method and Newton's method.
CO1: Do curve fitting by least square approximations
CO3: Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/ Gauss - Jorden Method
CO4: Integrate Numerically Using Trapezoidal and Simpson's Rules
CO5: Find Numerical Solution of Ordinary Differential Equations by Euler's Method, Runge - Kutta Method.

ADVANCED STRUCTURAL ANALYSIS AND DESIGN LAB
(Lab IV)

Course: M. Tech (SE): I-Year II-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420504	**0**	**1**	**2**	**2**

Pre-requisites: RCC and Steel design

List of Experiments:

1. Analysis of a Bridge Deck by Grillage Analogy
2. Analysis and Design of a PEB Structure
3. Analysis and design of a Gantry Girder
4. Analysis and design of a High Rise Multi storied Building
5. Analysis and design of a High rise Multi storey Building with shear wall
6. Analysis and design of a High rise Multi storey Building with Flat Slab System
7. Analysis and design of Flat Slab Raft foundation
8. Analysis and design of Beam Slab Raft foundation

Mini Project with Seminar

Course: M. Tech (SE): I-Year II-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420801	**0**	**0**	**4**	**2**

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES
(Professional Elective – V)

Course: M. Tech (SE): II-Year I-Sem. **L T P C**
Subject Code: B420413 **3 0 0 3**

Pre-requisites: Structural Dynamics, Reinforced Concrete Design

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.
Introduction: Functional planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength - Seismic design requirements-regular and irregular configurations-basic assumptions.

UNIT - II

Conceptual Design: Horizontal and Vertical Load Resisting Systems - System and Members for Lateral Loads and High Rise / Tall Structures.Twisting of Buildings – Flexible Building and Rigid Building Systems. Strength and Stiffness – Ductility – Definition – Ductility Relationships – Choice of construction Materials – Unconfined Concrete & Confined Concrete - Design Earthquake Loads – Basic Load Combinations – Permissible Stresses, Seismic Methods of Analysis – Static Method – Equivalent Lateral Force Method. Dynamic Analysis –Response Spectrum Method.

UNIT - III

Introduction to Earthquake Resistant Design: Seismic Design Requirements and Methods. RC Buildings – IS Code based Method.- Vertical Irregularities – Mass Irregularity Torsional Irregularity - Plan Configuration Problem - Design Lateral Force, Base Shear Evaluation – Lateral Distribution of Base Shear – Structural Walls Strategies and the Location of Structural Walls – Sectional Shapes –Behaviour of Unreinforced and Reinforced Masonry Walls – Behaviour of Walls Box Action and Bands – Behaviour of infill Walls - Non Structural Elements – Failure Mechanism of Nonstructural Elements –Effects of Nonstructural Elements on Structural System – Analysis – Prevention of Damage to Nonstructural Elements – Isolation of Non-Structures.

UNIT - IV

Design of Shear walls: Classification according to Behavior, Loads in Shear walls, Design of Rectangular and Flanged Shear walls, Derivation of Formula for Moment of Resistance of Rectangular Shear walls – behaviour of Coupled Shear Walls.

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. Behavior of beams, columns and joints in RC buildings duringearthquakes-Vulnerability of open ground storey and short columns during earthquake.Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns, Case studies.

REFERENCES:

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 –AnandS.Arya, Nemchand& Bros
5. Earthquake –Resistant Design of Masonry Building –MihaTomazevic, Imperial college Press.
6. Design of Reinforced Concrete Structures by N. Subramanian, Oxford University Press.

REFERENCE CODES:

1. IS: 1893 (Part-1) -2016. “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:13920-2016, “Ductile detailing of concrete structures subjected to seismic force” –Guidelines, B.I.S., New Delhi.

PRE-ENGINEERED BUILDINGS
(Professional Elective – V)

Course: M. Tech (SE): II-Year I-Sem. **L T P C**
Subject Code: B420414 **3 0 0 3**

Pre-requisites: Design of Steel Structures & Structural Analysis

UNIT - I:

Introduction to Pre-Engineered Buildings: Introduction – History - Advantages of PEB – Applications of PEB – Materials used for manufacturing of PEB. Difference between Conventional Steel Buildingsand Pre-Engineered buildings.

UNIT - II:

Pre-Engineered Building Components: Primary System: Main frames, Gable End Frame – Secondary frame system: Sizes and Properties of Purlins & Girts – Bracing System: Rod, angle, Portal, Pipe bracing – Sheeting and Cladding: Roof Sheeting and Wall sheeting – Accessories: Turbo Ventilators, Ridge vents, Sky Lights, Louvers, Insulation, Stair cases, Design of PEB frame under the influence of Dead, Live, Collateral, Wind, Seismic and Other applicable Loads. Serviceability Limits as per code. Design Parameters of PEB Frames - Depth of the section, Depth to Flange width ratios, Thickness of Flange to thickness of Web ratio. d/tw, bf/tf ratios of sections as per IS code. Section Sizes as per Manufacturing Limitations, Analysis and Design of Rigid Frames.

UNIT - III:

Peb Frame Connection Design Methodology: Rigid Frame Moment Connection, Shear Connection, High strength bolts & grades, Lever arm, bolt Patten its effect on connection design, thickness of connection plate, Selection of governing forces for connection design.

UNIT - IV:

Mezzanine Floor Systems: Design of Mezzanine Beams, Columns and joists – Mezzanine decking, Different types of Mezzanine Floor systems – Grating, Chequered plate and Rigid floor System, Types of base plate Pinned , Fixed, strength bolts, different types of bolts & grades, Lever arm, bolt Patten itseffect on connection design, thickness of connection plate, base plate size, Selection of governing forces for base connection design & Anchor bolt.

UNIT - V:

Analysis and Design Of Pre-Engineered Buildings: 2D and 3D Modelling of Portal Frames, Optimization Techniques, Comparison of software output with manual calculations. Design of Cold Formed Sections i.e., Purlins and Girts, Design of Roof Sheeting, trapezoidal , Standing seam sheeting, Welding technology, Manufacturing process , Erection Procedures

REFERENCES:

1. Pre-Engineered Steel Building, K.S. Vivek and P.Vyshnavi, LAP Lamdert Academic Publishing.
2. Metal building systems: Design and Specifications, Third edition, Alexander Newman, McGraw Hill Education.
3. Pre-Engineered Metal Building Systems, Labsori

REHABILITATION AND RETROFITTING OF STRUCTURES
(Professional Elective – V)

Course: M. Tech (SE): II-Year I-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420415	**3**	**0**	**0**	**3**

Prerequisites: Reinforced Concrete Design, Steel Design, Concrete Technology

UNIT – I

Introduction – Definition of Repair, Retrofitting, Strengthening and rehabilitation, Deterioration of Structures – Distress in Structures – Causes and Prevention, Mechanism of Damage – Types ofDamage, Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake

UNIT – II

Corrosion of Steel Reinforcement – Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Phenomena of Desiccation, Damage Assessment -,Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems -Influence on Serviceability and Durability- Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

UNIT – III

Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column andbeams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building, Inspection and Testing – Symptoms and Diagnosis of Distress - Damage assessment – NDT.

UNIT – IV

Repair of Structure – Common Types of Repairs – Repair in Concrete Structures – Repairs in Under Water Structures – Guniting – Shot Create – Underpinning. Strengthening of Structures – Strengthening Methods – Retrofitting – Jacketing.

UNIT – V

Materials for Repair and Retrofitting: Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunitend Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning- Health Monitoring of Structures – Use of Sensors – Building Instrumentation.

REFERENCES:

1. Concrete Technology by A.R. Santakumar, Oxford University press
2. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey University Press
3. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.
4. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso, (1981)

DISASTER MANAGEMENT
(Open Elective)

Course: M. Tech (SE): I-Sem. **L T P C**
Subject Code: B420601 **3 0 0 3**

UNIT-I:

Introduction: Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-II:

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III:

Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-IV:

Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

UNIT-V:

Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

TEXT BOOKS/ REFERENCES:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi.

DISSERTATION PHASE – I

Course: M. Tech (SE): II-Year I-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420414	**3**	**0**	**0**	**3**

Syllabus Contents:

Dissertation-I will have mid semester presentation and end semester presentation. Mid semesterpresentation will include identification of the problem based on the literature review on the topic referring to latest literature available.End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions and must bring out individuals contribution.Continuous assessment of Dissertation – I and Dissertation – II at Mid Sem and End Sem will be monitored by the departmental committee.

DISSERTATION PHASE – II

Course: M. Tech (SE): II-Year I-Sem.	**L**	**T**	**P**	**C**
Subject Code: B420802	**6**	**0**	**12**	**6**

Syllabus Contents:

Dissertation – II will be extension of the work on the topic identified in **Dissertation – I.**Continuous assessment should be done of the work done by adopting the methodology decided involving numerical analysis/ conduct experiments, collection and analysis of data, etc. There will be pre-submission seminar at the end of academic term. After the approval the student has to submit the detail report and external examiner is called for the viva-voce to assess along

ENGLISH FOR RESEARCH PAPER WRITING
(Audit Course- II)

Course: M. Tech (SE): I-Sem. **L T P C**
Subject Code: B400706 **2 0 0 0**

Prerequisite: None

UNIT-I:

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

UNIT-II:

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-III:

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

UNIT-IV:

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT-V:

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

TEXT BOOKS/ REFERENCES:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
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's
4. book.
5. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht
6. Heidelberg London, 2011

DISASTER MANAGEMENT
(Open Elective)

Course: M. Tech (SE): I-Sem. **L T P C**
Subject Code: B420601 **3 0 0 3**

UNIT-I:

Introduction: Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-II:

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III:

Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-IV:

Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

UNIT-V:

Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

TEXT BOOKS/ REFERENCES:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi.