ACADEMIC REGULATIONS, COURSE STRUCTURE

AND DETAILED SYLLABUS
UNDER

CHOICE BASED CREDIT SYSTEM (CBCS)

Effective from the Academic Year 2015-16

M. Tech. Two Year Degree Course

(MR-15 Regulations)

in

STRUCTURAL ENGINEERING (SE)
Department of Civil Engineering

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

(An Autonomous Institution approved by UGC and affiliated to JNTUH, Approved by AICTE & Accredited by NAAC with 'A' Grade and NBA & Recipient of World Bank Assistance under TEQIP Phase – II, S.C 1.1)

Maisammaguda, Dhulapally (Post & Via Kompally), Secunderabad-500 100

www.mrec.ac.in **E-mail:** principal@mrec.ac.in

MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

MR 15– ACADEMIC REGULATIONS (CBCS) FOR M. Tech. (REGULAR) DEGREE PROGRAMME

Applicable for the students of M. Tech. (Regular) programme from the Academic Year ***2015-16*** and onwards.

The M. Tech. Degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements for the award of the Degree.

INSTITUTION VISION

A Culture of excellence , the hallmark of MREC as world class education center to impart Technical Knowledge in an ambience of humanity, wisdom, intellect, creativity with ground breaking discovery, in order to nurture the students to become Globally competent committed professionals with high discipline, compassion and ethical values.

INSTITUTION MISSION

Commitment to progress in mining new knowledge by adopting cutting edge technology to promote academic growth by offering state of art Under graduate and Post graduate programmes based on well-versed perceptions of Global areas of specialization to serve the Nation with Advanced Technical knowledge.

DEPARTMENT VISION

Striving to be the centre of excellence in civil engineering education. To provide students the latest learning techniques and complete knowledgebase for sustainable development of society.

DEPARTMENT MISSION

Provide value based technical education and empower the students to become competent professionals.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To provide students with a solid foundation in Mathematical, Scientific, software skills and Engineering fundamentals required to solve engineering problems and also to pursue higher studies.

PEO2: To train students with good scientific and engineering breadth so as to comprehend, analyze, design and create novel products and solutions for the real life problems.

PEO3: To inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach and ability to relate engineering issues to broader social context.

PROGRAMME OUTCOMES (POs)

1	Ability to Perform standard analysis and design of structural systems following codes and modern practices.
2	Apply basic technical concepts to identify, analyze and solve technical problems involving structural material behavior under forces
3	Plan and prepare design and construction documents, such as specifications, contracts, change orders, engineering drawings, and construction schedules as per the client requirements considering economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4	an ability to work effectively on multidisciplinary teams
5	Determine deformations and stresses in structural systems under the action forces: gravity, wind, fire, earth pressure and flood.
6	Engage in lifelong learning, Understand professional, ethical and social responsibilities, Will be committed to quality, timeliness, and continuous improvement
7	an ability to Communicate effectively,
8	Estimate material quantities for technical projects & Select appropriate engineering materials and practices Conduct standardized field and laboratory testing on civil engineering materials
9	Utilize modern surveying methods for land measurement and/or construction layout Employ productivity software to solve technical problems
10	Respect diversity and possess a knowledge of contemporary professional, societal and global issues; and
11	Perform economic analyses and cost estimates related to design, construction, operations and maintenance of systems in the civil technical specialties

1.0 ELIGIBILITY FOR ADMISSIONS :

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

2.0 AWARD OF M.Tech. DEGREE :

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

2.2 The student shall register for all 88 credits and secure all the 88 credits.

2.3 The minimum instruction days in each semester are 90.

3.0 COURSES OF STUDY :

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

1. Computer Science and Engineering
2. Digital Systems and Computer Electronics
3. Electrical Power Systems
4. Embedded Systems
5. Geotechnical Engineering
6. Machine Design
7. Structural Engineering
8. Thermal Engineering
9. VLSI System Design

and any other programme as approved by the University from time to time.

3.1 Departments offering M. Tech. Programmes with specializations are noted below:

CE	GTE	Geo Technical Engineering
	SE	Structural Engineering
EEE	EPS	Electrical Power Systems
ME	MD	Machine Design
	TE	Thermal Engineering
ECE	DSCE	Digital Systems and Computer Electronics
	ES	Embedded Systems
	VLSI SD	VLSI System Design
CSE	CSE	Computer Science and Engineering

4 COURSE REGISTRATION :

4.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him 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 Academic Section of the College invites 'Registration Forms' from students within 15 days from the commencement of class work for the first semester through 'ON-LINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ON-LINE Registration Requests for any 'SUBSEQUENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'CURRENT SEMESTER'.

4.3 A Student can apply for ON-LINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from the 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 If the Student submits ambiguous choices or multiple options or erroneous entries during ON-LINE Registration for the Subject(s) / Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first mentioned Subject/ Course in that Category will be taken into consideration.

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

5 ATTENDANCE :

The programmes are offered on a unit basis with each subject/course being considered as a unit.

5.1 Attendance in all classes (Lectures/Laboratories etc.) is compulsory. The minimum required attendance in each theory / Laboratory etc. is 75% including the days of attendance in sports, games, NCC and NSS activities for appearing for the Semester End examination (SEE). A student shall not be permitted to appear for the Semester End Examinations (SEE) if his attendance is less than 75%.

5.2 Condonation of shortage of attendance in each subject up to 10% (65% and above and below 75%) in each semester shall be granted by the College Academic Committee (CAC).

5.3 Shortage of Attendance below 65% in each subject shall not be condoned.

5.4 Students whose shortage of attendance is not condoned in any subject are not

eligible to write their end Semester End Examination of that subject and their registration shall stand cancelled.

5.5 A fee prescribed by the CAC, shall be payable towards Condonation of shortage of attendance.

5.6 A Candidate shall put in a minimum required attendance in atleast three (3) theory subjects in I semester for promoting to II Semester. In order to qualify for the award of the M.Tech. Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.

5.7 A student shall not be promoted to the next semester unless the student satisfies the attendance requirement of the present Semester, as applicable. The student may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, the student shall not be eligible for readmission into the same class.

6 EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS: :

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practicals, on the basis of Continuous Internal Evaluation and Semester End Examinations. For all Subjects/ Courses, the distribution shall be 40 marks for CIE, and 60 marks for the SEE

6.1 Theory Courses :

6.1.1 Continuous Internal Evaluation (CIE):

The CIE consists of two Assignments each of 05 marks and two mid-term examinations each of 35 marks. The CIE shall be finalized based on the 70% of the best performed and 30% of the other performance.The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.

First Assignment should be submitted before the conduct of the first mid-term examinations, and the Second Assignment should be submitted before the conduct of the second midterm examinations. The Assignments shall be as specified by the concerned subject teacher.. Each mid-term examination shall be conducted for a total duration of 120 minutes, for 35 marks.

The division of marks for CIE is as given below:

Mid – Term Examination				
Part	**Type of Questions**	**No. of questions**	**Marks per question**	**Total**
Part A	Multiple-choice questions	10	0.5	05
	Fill-in the blanks	10	0.5	05
	Sub-Total			10
Part B	Compulsory questions	5	2	10
Part C	Choice questions (3 out of 5)	3	5	15
			Mid-Term Exam Total	35
			Assignment	05
			Grand Total	40

6.1.2 Semester End Examination (SEE):

The division of marks for SEE is as given below:

Semester End Examination				
Part	**Type of Questions**	**No. of questions to be answered**	**Marks per question**	**Total**
Part A	Compulsory Questions (One from each module)	5	4	20
Part B	Choice Questions (5 out of 8) (Minimum one from each module)	5	8	40
			Grand Total	60

6.2 Practical Courses:

6.2.1 Continuous Internal Evaluation (CIE):

There will be CIE for 40 marks, shall be awarded with a distribution of 20 marks for day-to-day performance and timely submission of lab records, 5 marks for viva-voce, 15 marks for internal lab exam (best out of two exams).

6.2.2 Semester End Examination (SEE):

There will be SEE for 60 marks, shall be awarded with a distribution of 20 marks for write-up on the given experiment, 20 marks for proficiency in the exam, 10 marks for results and 10 marks for viva-voce. For conducting SEE, one internal examiner and one external examiner will be appointed by the Chief Controller of Examinations of the College. The external examiner should be selected from outside the College among the autonomous/reputed institutions, from a panel of three examiners submitted by the concerned Head of the Department.

6.3 Seminar:

There shall be two seminar presentations during I semester and II semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 100 marks with a distribution of 30 marks for the report, 50 marks for presentation and 20 marks for the queries. A candidate has to secure a minimum of 50% of marks to be declared successful. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examinations.

6.4 Comprehensive Viva-Voce:

There shall be a Comprehensive Viva-Voce in III Semester. The Comprehensive Viva-Voce is intended to assess the students' understanding of various subjects studied during the M. Tech. course of study. The Head of

the Department shall be associated with the conduct of the Comprehensive Viva-Voce through a Committee. The Committee consists of the Head of the Department, one senior faculty member and an external examiner. The external examiner shall be appointed by the Chief Controller of Examinations from a panel of three examiners submitted by the concerned Head of the Department. There are no internal marks for the Comprehensive Viva-Voce and evaluates for maximum of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examinations.

6.5. **General:** A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the Semester End Examination and a minimum of 50% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together. In case the candidate does not secure the minimum academic requirement in any subject he has to reappear for the Semester End Examination in that subject. A candidate shall be given one chance to re-register for the subject if the internal marks secured by the candidate are less than 50% and failed in that subject. This is allowed for a maximum of three subjects and should register within two weeks of commencement of that semester class work. In such a case, the candidate must re-register for the subjects and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon the eligibility for writing the Semester End Examination in those subjects. In the event of the student taking another chance, the student's Continuous Internal Evaluation (CIE) marks and Semester End Examination (SEE) marks obtained in the previous attempt stands cancelled.

7 EXAMINATIONS AND ASSESSMENT - THE GRADING SYSTEM :

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

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

% of Marks Secured (Class Intervals)	Grade Points	Letter Grade (UGC Guidelines)
≥ 80%	10	O (Outstanding)
≥ 70% to < 80%	9	A+ (Excellent)
≥ 60% to < 70%	8	A (Very Good)
≥ 55% to < 60%	7	B+ (Good)
≥ 50% to < 55%	6	B (Above Average)
< 50%	0	F (Fail)
Absent	Ab	Ab

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

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

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

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

7.7 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course. The corresponding 'Credit Points' (CP) is computed by multiplying the Grade Point with Credits for that particular Subject/ Course.
Credit Points (CP) = Grade Point (GP) x Credits …. For a Course

7.8 The Student passes the Subject/ Course only when he gets GP $\geq$ 6(B Grade or above).

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

$$\text{SGPA} = \left\{\sum_{i=1}^{N} C_i G_i\right\} / \left\{\sum_{i=1}^{N} C_i\right\} \ldots \text{For each Semester}$$

where 'i' is the Subject indicator index (takes 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 i^{th} Subject, and G represents the Grade Points (GP) corresponding to the Letter Grade awarded for that i^{th} Subject.

7.10 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 II Semester onwards, at the end of each Semester, as per the formula

$$\text{CGPA} = \left\{\sum_{j=1}^{M} C_j G_j\right\} / \left\{\sum_{j=1}^{M} C_j\right\} \ldots \text{for all S semesters registered}$$
(i.e., upto and inclusive of S semesters, S $\geq$ 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' from the 1st Semester onwards upto and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), C_j is the no. of Credits allotted to the j^{th} Subject, and G_j represents the Grade Points (GP)corresponding to the Letter Grade awarded for that j^{th} Subject. After registration and completion of I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

7.11 For Calculations listed in Item 7.6 – 7.10, performance in failed Subjects/ Courses (securing F Grade) will also be taken into account, and the Credits of such Subjects/Courses will also be included in the multiplications and summations.

8. EVALUATION OF PROJECT/DISSERTATION WORK :

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

8.1 A Project Review Committee (PRC) shall be constituted with Head of the Department as Chairperson, Project Supervisor and one senior faculty member of the Departments offering the M. Tech. programme.

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

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

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

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

8.6 The work on the project shall be initiated at the beginning of the III Semester and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.
Note: *The project supervisor/guide has to ensure that the student has to publish a minimum of one paper related to the thesis in a National/International Conference/Journal.*

8.7 For the final approval by the PRC, the soft copy of the thesis should be submitted for ANTI-PLAGIARISM for the quality check and the plagiarism report should be included in the final thesis. If the copied information is less

than 24%, then only thesis will be accepted for submission.

8.8 Three copies of the Project Thesis certified by the supervisor, HOD and Principal shall be submitted to the Chief Controller of Examinations for project evaluation (viva voce).

8.9 For Project work part-I in III Semester there is an internal marks of 50, the evaluation should be done by the PRC for 30 marks and Supervisor will evaluate for 20 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain. A candidate has to secure a minimum of 50% of marks to be declared successful for Project work part-I. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examination.

8.10 For Project work part-II in IV Semester there is an internal marks of 50, the evaluation should be done by the PRC for 30 marks and Supervisor will evaluate for 20 marks. The PRC will examine the overall progress of the Project Work and decide the Project is eligible for final submission or not. A candidate has to secure a minimum of 50% of marks to be declared successful for Project work part-II. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examination.

8.11 For Project Evaluation (Viva Voce) in IV Semester there is an external marks of 150 and the same evaluated by the External examiner appointed by the Chief Controller of Examinations. For this, the Head of the Department shall submit a panel of 3 examiners, eminent in that field, with the help of the supervisor/guide concerned. The candidate has to secure minimum of 50% marks in Project Evaluation (Viva-Voce) examination.

8.12 If the student fails to fulfill as specified in 8.11, based the recommendation of the external examiner, the student will reappear for the Viva-Voce examination with the revised thesis only after three months. In the reappeared examination also, fails to fulfill, the student will not be eligible for the award of the degree.

8.13 The Head of the Department shall coordinate and make arrangements for the conduct of Project Viva-Voce examination.

9. AWARD OF DEGREE AND CLASS :

9.1 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 **88** Credits (with CGPA $\geq$ 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 specialization as he admitted.

9.2 Award of Class

After a student has satisfied 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 and < 7.75
Second Class	≥ 6.00 and < 6.75

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

10. <u>WITHHOLDING OF RESULTS</u> :

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 of the student will be withheld and he will not be allowed into the next semester. His degree will be withheld in such cases.

11. <u>TRANSITORY REGULATIONS</u> :

11.1 If any candidate is detained due to shortage of attendance in one or more subjects, they are eligible for re-registration to maximum of three earlier or equivalent subjects at a time as and when offered.

11.2 The candidate who fails in any subject will be given two chances to pass the same subject; otherwise, he has to identify an equivalent subject as per MR15 Academic Regulations.

12. <u>GENERAL</u>:

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

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

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

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

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

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

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

		examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme 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 in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	Refuses to obey the orders of the Chief Controller of Examinations (CCE) / Controller of Examinations (CE) / Assistant Controller of Examinations (ACE) / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of

	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-incharge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination	the courses of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police cases registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. 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.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that SEE.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the CCE for further action toward suitable punishment.	

Note: ***The student(s) found indulging in malpractices during the CIE also will be punished based on the recommendations of the College Academic Committee.***

MALLA REDDY ENGINEERING COLLEGE

(Autonomous)

M.Tech Structural Engineering

COURSE STRUCTURE

I SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	CC-I	51101	Theory of Elasticity	4	-	-	4	40	60	100
2	CC-II	51102	Structural Dynamics	4	-	-	4	40	60	100
3	CC-III	51103	Advanced Structural Analysis	4	-	-	4	40	60	100
4	PE-I	50B14	Computer oriented Numerical Methods	4	- - -	- - -	4	40	60	100
		51104	Reliability Engineering							
		51105	Ground Improvement Techniques							
5	PE-II	51106	Advanced Concrete Technology	4	- - -	- - -	4	40	60	100
		51107	Tall Buildings							
		51108	Advanced Foundation Engineering							
6	PE-III	51109	Advanced R. C. Design	4	-	-	4	40	60	100
		51110	Bridge Engineering							
		51111	Plastic Analysis & Design							
7	Laboratory-I	51112	Advanced Concrete Lab	-	-	4	2	40	60	100
8	Seminar-I	51113	Seminar-I	-	-	4	2	100	--	100
			Total	24	-	8	**28**	**Contact Periods -32**		

II SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	CC-IV	51114	Finite Element Method	4	-	-	4	40	60	100
2	CC-V	51115	Theory of Plates	4	-	-	4	40	60	100
3	CC-VI	51116	Prestressed Concrete	4	-	-	4	40	60	100
4	PE-IV	51117	Repair and Rehabilitation of Buildings	4	- - -	- - -	4	40	60	100
		51118	Composite Materials							
		50B15	Optimisation Techniques							
5	PE-V	51119	Advanced Steel Design	4	- - -	- - -	4	40	60	100
		51120	Design of Sub Structures							
		51121	Stability of Structures							
6	PE-VI	51122	Design of Shells and folded Plates	4	-	-	4	40	60	100
		51123	Earthquake Resistant Design of Buildings							
		51124	Retaining Structures							
7	Laboratory–II	51125	CAD Lab	-	-	4	2	40	60	100
8	Seminar-II	51126	Seminar-II	-	-	4	2	100	--	100
	Total			24	-	8	**28**	**Contact Periods -32**		

III-SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	CV	51127	Comprehensive Viva Voce	-	-	-	4	-	100	100
2	PR -I	51128	Project work Part-I	-	-	16	8	50	-	50
			Total	-	-	16	**12**	**Contact Periods -16**		

IV-SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	PR -II	51129	Project work Part-II	-	-	16	8	50	-	50
2	PR -III	51130	Project Viva-Voce	-	-	-	12	-	150	150
			Total	-	-	16	**20**	**Contact Periods -16**		

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51101 **Credits: 4**

M.Tech (Structural Engineering) – I Semester

THEORY OF ELASTICITY

Objectives : To impart knowledge on the basic concepts of theory of elasticity, and solve the Structural Engineering problems.

MODULE-I **[12 Periods]**

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

MODULE- II. **[12 Periods]**

Two dimensional problems in rectangular coordinates - solution by polynomials - Saint-Venant's principle - determination of displacements - bending of simple beams - application of corier series for two dimensional problems - gravity loading. Two dimensional problems in polar coordinates - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates - displacements for symmetrical stress distributions - simple symmetric and asymmetric problems - general solution of two- dimensional problem in polar coordinates - application of general solution in polar coordinates.

MODULE- III. **[12 Periods]**

Analysis of stress and strain in three dimensions - principal stresses - stress ellipsoid -

director surface - determination of principal stresses - max shear stresses – homogeneous deformation - principal axes of strain rotation. General Theorems: Differential equations of equilibrium - conditions of compatibility - determination of displacement - equations of equilibrium in terms of displacements - principle of super position - uniqueness of solution - the reciprocal theorem.

MODULE- IV. **[12 Periods]**

Torsion of Prismatic Bars - torsion of prismatic bars - bars with elliptical cross sections - other elementary solution - membrane analogy - torsion of rectangular bars - solution of torsion problems by energy method - use of soap films in solving torsion problems - hydro dynamical analogies - torsion of shafts, tubes , bars etc. Bending of Prismatic Bars: Stress function - bending of cantilever - circular cross section - elliptical cross section - rectangular cross section - bending problems by soap film method - displacements.

MODULE- V. **[12 Periods]**

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

REFERENCES

1. Theory of Elasticity by Timeshanko, McGrawhill Publications.
2. Theory of Plasticity by J.Chakarbarthy, McGrawhill Publications.
3. Theory of Elasticity by Y.C.Fung.
4. Theory of Elasticity by Gurucharan Singh.

Outcomes: The learner will be able to solve problems of elasticity and plasticity and be able to apply numerical methods to solve continuum problems.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51102 **Credits: 4**

M.Tech (Structural Engineering) – I Semester

STRUCTURAL DYNAMICS

MODULE – I **[12 Periods]**

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

MODULE – II **[12 Periods]**

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

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

MODULE – III **[12 Periods]**

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.

MODULE – IV **[12 Periods]**

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

Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams.

MODULE – V **[12 Periods]**

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

REFERENCES:

1. Dynamics of Structures by Clough & Penzien, McGraw Hill, New york
2. Structural Dynamics by Mario Paz, C.B.S Publishers, New Delhi.
3. Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore), Delhi.
4. I.S: 1893 - 1984, "Code of practice for Earthquake resistant design of Structures" and latest I.S: 1893 - 2002 (version) Part-1

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51103 **Credits: 4**

M.Tech (Structural Engineering) – I Semester

ADVANCED STRUCTURAL ANALYSIS

Objectives : To impart knowledge on the analysis of indeterminate structures like continuous beams, trusses and portal frames.

MODULE- I **[12 Periods]**

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 - for truss element, beam element and tensional element.

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

MODULE- II **[12 Periods]**

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

MODULE- III **[12 Periods]**

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

MODULE- IV **[12 Periods]**

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

MODULE -V. **[12 Periods]**

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

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

REFERENCES

1. Matrix Analysis of Frames structures by William Weaver J.R and James M.Gere, CBS publications.
2. Advanced Structural Analysis by Ashok.K.Jain, New Channel Brothers.
3. Basic Structural Analysis by C.S.Reddy.
4. Matrix Structural Analysis by Madhu B. Kanchi.
5. Indeterminate Structural Analysis by K.U.Muthu *et al.*,I.K.International Publishng House Pvt. Ltd.
6. Matrix Methods of Structural Analysis by J.Meek.
7. Structural Analysis by Ghali and Neyveli.

Outcomes: The learner will be able to analyse different indeterminate structures using Matrix methods.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 50B14 **Credits: 4**

M.Tech (Structural Engineering) – I Semester

COMPUTER ORIENTED NUMERICAL METHODS
(Professional Elective – I)

Objectives: To impart knowledge about various methods of analysing linear equations and understand the different mathematical techniques.

Objectives: To impart knowledge about various methods of analysing linear equations and understand the different mathematical techniques.

MODULE- I: **[12 Periods]**

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

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

MODULE- II: **[12 Periods]**

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

MODULE- III **[12 Periods]**

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

MODULE- IV. **[12 Periods]**

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

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

MODULE- V **[12 Periods]**

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

REFERENCES:

1. Numerical methods for scientific and engineering computations. M.K.Jain-S.R.K.Iyengar – R.K.Jain Willey Eastern Limited.
2. Numerical methods by S.S.Shastry.
3. Applied numerical analysis by – Curtis I.Gerala- Addission Wasley – published campus.
4. Numerical methods for Engineers Stevan C.Chopra, Raymond P.Canal Mc. Graw Hill

book company.
5. C Language and Numerical methods by C.Xavier – New age international publisher.
6. Computer based numerical analysis by Dr. M.Shanta Kumar, Khanna Book publishers, New Delhi.

Outcomes : The learner will be able to apply various mathematical techniques to Structural engineering problems.

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Course Code: 51104 **Credits: 4**

M.Tech (Structural Engineering) – I Semester

RELIABILITY ENGINEERING
(Professional Elective – I)

Objectives : To impart knowledge on concepts of reliability, discrete distributions and hierarchical systems.

MODULE I **[12 Periods]**

Basic Concepts of Reliability : Introduction, Reliability and Quality, Failures and Failure Modes, Cuses of Failures and Unreliability, Maintainability and Availability, History of Reliability, Reliability Literature.

MODULE II **[12 Periods]**

Design for Reliability : Constraints and Considerations : Reliability Analysis, Mathematical Models and Numerical Evaluation, Designing for Higher Reliability, Redundancy Techniques, Equipment Hierarchy, Reliability and Cost.

MODULE –III **[12 Periods]**

Discrete Distributions : Density and distributions, Continuous Distributions, Numerical Characteristics of Random Variables, Laplace Transform.

MODULE-IV **[12 Periods]**

Maintainability and Availability Concepts : Introduction, Maintainability Function, Availability Function, Frequency of Failure, Two-MODULE parallel system with Repair, K-out-of M systems, Preventive Maintenance**.**

MODULE-V: **[12 Periods]**

Hierarchical Systems : Introduction, Logic Diagram Approach, Conditional Probability Approach, System Cost, Illustrations and Discussions, Reliability Approximations.

TEXT BOOKS :

8. Reliability Engineering by E. Balagurusamy, McGraw Hill Education(India) Pvt. Ltd.
9. Reliability Evaluation of Engineering Systems by Roy Billinton & Ronald N. Allan, Springer.
10. Reliability of Structures, Second Edition by Andrzej S. Nowak, Kevin R. Collins December 20, 2012 by CRC Press

Outcomes : The learner will be able to design a reliable systems and develop and analyse reliability and cost models for hierarchical systems.

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Course Code: 51105 **Credits: 4**

M.Tech (Structural Engineering) – I Semester

GROUND IMPROVEMENT TECHNIQUES
(Professional Elective – I)

Objective: To understand the importance of ground improvement and know various ground improvement techniques available to date, and selecting and designing suitable ground improvement technique for given soil conditions.

MODULE-I **[12 Periods]**

Introduction to Engineering Ground Modification: Need and objectives, Identification of soil types, In-situ and laboratory tests to characterize problematic soils; Mechanical, Hydraulic, Physico-chemical, Electrical, Thermal methods, etc. and their applications.

MODULE-II **[12 Periods]**

Mechanical Modification – Principles Compaction control of soil densification – Properties of Compacted soil tests, Specification Dynamic compaction requirements, Blasting, Tamping and Compaction piles of Vibro compaction.

MODULE-III **[12 Periods]**

Hydraulic Modification – Objectives and techniques, traditional dewatering methods and their choice, Design of dewatering system, Electro-osmosis, Filtration, Drainage and seepage control with Geosynthetics, sand drains, Preloading and vertical drains, Electro-kinetic dewatering.

MODULE-IV **[12 Periods]**

Physical and Chemical Modification – Modification by admixtures, Shotcreting and GMODULEing Technology, Modification at depth by grouting, Crack Grouting and compaction grouting, Jet grouting, Thermal Modification, Ground freezing.

MODULE-V **[12 Periods]**

Modification by Inclusions and Confinement - Soil reinforcement, reinforcement with strip, bar, mesh, sheet and grid reinforced soil. In-situ ground reinforcement, ground anchors, rock bolting and soil nailing, case studies.

TEXT BOOKS

1. Hausmann, M. R. (1990) –Engineering Principles of Ground Modification, McGraw Hill publications, New York.
2. P.Purushothama Raj (1995) - Ground Improvement Techniques, Laxmi Publications, India.

REFERENCES:

1. M.P.Moseley and K. Krisch (2006) – Ground Improvement, II edition, Taylor and Francis.
2. Jones C. J. F. P. (1985) – Earth Reinforcement and soil structures – Butterworths, London.

3. K. Krisch & F.Krisch (2010) –Ground Control and Improvement, John Wiley & Sons, 1994.
4. Peter G. Nicholson (2015): Soil Improvement and Ground Modification Methods, Elsevier Publishers

Outcome: Depending on the site conditions, students will be able to identify suitable ground improvement technique for specific project and its implications.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51106 **Credits: 4**

M.Tech (Structural Engineering) – I Semester

ADVANCED CONCRETE TECHNOLOGY
(Professional Elective – II)

Objectives : To impart knowledge on concrete making materials, concrete mix design for proportioning and their testing.

MODULE – I **[12 Periods]**

Concrete Making Materials: Cement- Bogue's compounds – Hydration Process– Types of cement – Aggregates – Gradation Charts – Combined aggregate-Alkali Silica Reaction - Admixtures – Chemical and Mineral admixtures.

MODULE – II **[12 Periods]**

Fresh and Hardened Concrete: Fresh Concrete - workability tests on Concrete Setting times of Fresh Concrete - Segregation and bleeding.

Hardened Concrete : Abram's law- Gel space ratios, Maturity Concept – Stress Behaviour – Creep and Shrinkage – Durability tests on concrete - Non destructive testing of concrete.

MODULE - III **[12 Periods]**

High Strength Concrete – Micro structure – Manufacturing and Properties- Design 0s HSC Using Erintroy Shaklok Method- Ultra High Strength Concrete.

High Performance Concrete- Requirements and properties of High Performance Concrete- Design Considerations.

MODULE –IV **[12 Periods]**

Special Concrete: Self Compacting concrete – Polymer concrete – Fiber reinforced concrete – Reactive Powder concrete – Requirements and Guidelines – Advantages and Applications. Light weight concrete.

Concrete mix design : Quality Control - Quality assurance - Quality audit- Mix Design method - BIS method, ACI method, DOE method.

MODULE –V **[12 Periods]**

Form work – materials – structural requirements – form work systems – connections – specifications – design of form work – shores – removal for forms – reshoring – failure of form work.

TEXT BOOKS:

1. Properties of Concrete by A.M.Neville, ELBS publications.
2. Concrete: Micro Structure, Properties and Materials by P.K.Mehta, Tata Mc Graw Hill Publishing House Pvt. Ltd
3. Concrete Technology by A.K. Santhakumar, Oxford Press.
4. Concrete Technology by M.S.Shetty, S.Chand & Co.

REFERENCES:

1. Special Structural concretes by Rajat Siddique, Galgotia Publications.
2. Design of Concrete Mixes by N.Krishna Raju, CBS Publications.

Outcomes : The learner will be able to design concrete mixes of different grades and also use the special concretes.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51107 **Credits: 4**

M.Tech (Structural Engineering) – I Semester
TALL BUILDINGS
(Professional Elective – II)

Objective : To impart knowledge on analysis of tall buildings.

MODULE-I **[12 Periods]**

Introduction : Classification of Buildings – Low-rise, medium-rise, high-rise – Evolution of tall buildings – Ordinary framed buildings & Shear-wall buildings –Behaviour of buildings under lateral loads like Wind loads, Earthquake loads & Blast loads – Basic structural & functional design requirements –Strength, Stiffness & Stability.

MODULE-II **[12 Periods]**

Lateral load resisting elements : Frames, Shear walls & Tubes – Shear, Bending & combined modes of deformation – Structural behavior of Rigid frames – Simplified methods of analysis – Substitute frame method, Portal method, Cantilever method, Equivalent frame method –Structural behaviour of Shear walls – Approaches of analysis – Elastic continuum approach & Discrete approach -- Structural behavior of Tubes –Actions.

MODULE-III **[12 Periods]**

Choice of System for a Building : Frame building, Shear wall building, Shear walls acting with frames, Single framed tubes – Other structural forms – Staggered Wall-beam system, Tube-in-tube system, Base isolation technique for earthquake resistance. Load distribution in a tall building – Load resisted by different shear walls & frames – Determinate & Indeterminate problems – Equivalent Stiffness method.

MODULE-IV **[12 Periods]**

Methods of Analysis : Shear walls without Openings – Estimation of Stiffness by simple Cantilever theory & Deep beam theory – Shear walls with Openings – Equivalent frame for large openings –

Muto's method for small openings –Elastic Continuum approach – Coull & Chowdhry's method –

Design Charts – Limitations of Continuum approach. Shear wall- Frame Interaction : Sharing of loads between wall & frame - Different methods – comparison -- Khan & Sbrounis' method – Design charts - - Mac Leod's method - Advantages & limitations -- Cooperation of Floor slabs – Equivalent width.

MODULE-V **[12 Periods]**

Modern Methods : Analysis of Tall buildings by Stiffness method – Available Softwares for analysis of tall buildings.

REFERENCES

1. Concrete & Composite Design of Tall Buildings by Taranath B., Mc Graw Hill.
2. Reinforced Concrete Design of Tall Buildings by Bungales. Taranath, CRC Press.
3. Analysis of Shear Walled Buildings by S. M. A. Kazimi & R. Chandra, Tor-steel Research Foundation, Calcutta, India.
4. Analysis of Framed Structures by Gere & Weaver
5. Design of Building Structures by Wolfgang Schuller, Prentice Hall

Outcomes : The learner will be able to analyse and chose a appropriate systems for tall buildings.

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Course Code: 51108 **Credits: 4**

M.Tech (Structural Engineering) – I Semester

ADVANCED FOUNDATION ENGINEERING
(Professional Elective – II)

Objective: To determine the bearing capacity of shallow and deep foundations and to estimate settlements of structures subjected to external loads, leading to design of foundations resting on soils.

MODULE-I **[12 Periods]**

Soil Exploration: Exploration Methods; Planning the Exploration Program; Boring and Sampling; In Situ Tests: Standard & Cone Penetration Tests, Field Vane, Dilatometer, Pressure meter; Rock Sampling, Core Recovery, RQD; Geophysical Exploration; Preparation of Soil Report, Case Studies.

MODULE-II **[12 Periods]**

Shallow Foundations: **Bearing Capacity:-** Shear Failure; Effect of Water Table; Footings with Eccentric or Inclined Loads, Footings on Layered Soils, Slopes on finite layer with a Rigid Base at Shallow Depth, effect of compressibility of soil, on soils with strength increasing with depth, Plate Load tests, Presumptive bearing capacity.

MODULE-III **[12 Periods]**

Settlement: Components – Immediate, Primary and Secondary Settlements, Consolidation, Stresses and Displacements in Homogeneous, Layered and Anisotropic Soils; Bearing Pressure using SPT, CPT, Dilatometer and Pressure meter; Settlement of foundations on Sands-Schmertmann and Burland & Burbridge methods; Structure Tolerance to Settlement and Differential Settlements, Rotation, Codal Provisions.

MODULE-IV **[12 Periods]**

Deep Foundations: **Single Pile:** Vertically loaded piles, Static capacity- α, β and λ Methods, Dynamic formulae; Wave Equation Analyses; Point Bearing Resistance with SPT and CPT Results; Bearing Resistance of Piles on Rock; Settlement; Pile Load Test; Uplift Resistance; Laterally Loaded Piles -Ultimate Lateral Resistance; Negative Skin Friction; Batter Piles; Under Reamed Piles; Ultimate Capacity of Pile Groups in Compression, Pullout & Lateral Load; Efficiency; Settlements of Pile Groups; Interaction of Axially & Laterally Loaded Pile Groups, Codal Provisions.

MODULE-V **[12 Periods]**

Special Topics of Foundation Engineering

Foundations on Collapsible Soils: Origin and occurrence, Identification, Sampling and Testing,

Preventive and Remedial measures.

Foundations on Expansive Soils: The nature, origin and occurrence, Identifying, testing and evaluating expansive soils, typical structural distress patterns and Preventive design & construction measures.

***Introduction to Reliability-Based Design**: Brief introduction of probability and statistics, LRFD for structural strength requirements, LRFD for geotechnical strength requirements, Serviceability requirements

TEXT BOOKS

1. Das, B. M. - Principles of Foundation Engineering 5th Edition Nelson Engineering (2004)
2. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012. Phi Learning (2008)

REFERENCE BOOKS

1. Bowles, J. E. - Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc. (1996)
2. Poulos, H. G. & Davis, E. H. - Pile Foundation Analysis and Design john wiley & sons inc (1980-08)
3. Tomlinson, M. J. - Foundation Design and Construction - Prentice Hall (2003).
4. Baecher, G.B. & Christian, J.T. – Reliability and Statistics in Geotechnical Engineering, Wiley Publications (2003)

Outcome: Students should be in a position to design foundations for varieties of structures resting on soil deposits, and appreciate the importance of reliability based design in geotechnical engineering.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51109 **Credits: 4**

M.Tech (Structural Engineering) – I Semester

ADVANCED R.C. DESIGN
(Professional Elective –III)

Objectives : To impart knowledge on the behavior and design on various reinforced concrete structural elements.

MODULE- I **[12 Periods]**

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

MODULE- II **[12 Periods]**

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

MODULE- III **[12 Periods]**

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

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

MODULE- IV **[12 Periods]**

Design of Reinforced Concrete Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456, Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels , Design of Procedure of Corbels, Design of Nibs.

MODULE- V **[12 Periods]**

Design of Compression members: Estimation of effective length of a column-Code requirements on Slenderness Limits, Design of Short Columns under Axial Compression, Design of Short Columns with Uniaxial Bending, Design of Short Columns under Biaxial Bending, Design of Slender Columns.

Design of Combined Footings- Distribution of soil Pressure – Geometry of Two Column Combined Footing – Design Considerations in Combined Footing for Two – Columns.

TEXT BOOKS:

1. Reinforced concrete design by S. Unnikrishna Pillai & Menon, Tata Mc. Graw Hill, 2nd Edition, 2004
2. Advanced Reinforced Concrete Design – P.C. Varghese, Prentice Hall of India, 2008
3. Limit state theory and design of reinforced concrete by Dr. S.R. Karve and Dr. V.L. Shah, Standard Publishers, Pune, 3rd Edition, 1994.

4. Principles of Reinforced Concrete Design by Mete A. Sozen, Toshikatsu Ichinose, Santiago Pujol July 14, 2014 CRC Press

REFERENCE BOOKS:

1. Reinforced concrete design by Kennath Leet, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.
2. Reinforced concrete structural elements – Behaviour, Analysis and design by P.Purushotham, Tata Mc.Graw-Hill, 1994.
3. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.
4. Reinforced concrete structures, Vol.1, by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, 2004.
5. Reinforced Concrete Structures – I.C. Syal & A.K. Goel, S. Chand, 2004.

Outcomes : The learner will be able to design the reinforced concrete elements like beams, slabs and compression members.

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51110 **Credits: 4**

M.Tech (Structural Engineering) – I Semester

BRIDGE ENGINEERING
(Professional Elective – III)

Objectives : To impart knowledge on the behavior and design aspects of various types of bridges.

MODULE I. **[12 Periods]**

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-Sesmic loads-Frictioal resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of raodway and footway-General Design Requirements.

MODULE II. **[12 Periods]**

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

MODULE III **[12 Periods]**

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

MODULE IV. **[12 Periods]**

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

MODULE V. **[12 Periods]**

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

REFERENCES

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

Outcomes: The learner will be able to analyze and design of different types of bridges.

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Course Code: 51111 **Credits: 4**

M.Tech (Structural Engineering) – I Semester
PLASTIC ANALYSIS & DESIGN
(Professional Elective – III)

Objectives : To impart knowledge on the analysis of steel structures like continuous beams, steel frames and connection, using Plastic Analysis.

MODULE – I **[12 Periods]**

Analysis of Structures for Ultimate Load: Fundamental Principles – statical method of Analysis – Mechanism method of analysis – Method of analysis, Moment check – Carry over factor – Moment Balancing Method.

MODULE - II **[12 Periods]**

Design of Continuous Beams: Continuous Beams of uniform section throughout – Continuous Beams with different cross-sections.

MODULE - III **[12 Periods]**

Secondary Design Problems: Introduction – Influence of Axial force on the plastic moment – influence of shear force – local buckling of flanges and webs – lateral buckling – column stability.

MODULE - IV **[12 Periods]**

Design of Connections: Introduction – requirement for connections – straight corner connections – Haunched connection – Interior Beam-Column connections.

MODULE - V **[12 Periods]**

Design of Steel Frames: Introduction – Single bay, single storey frames – simplified procedures for Sinole span frames – Design of Gable frames with Haunched Connection. Ultimate Deflections:

Introduction – Deflection at ultimate load – Deflection at working load – Deflections of Beams and Sinole span frames.

REFERENCES:

1. Plastic Design of Steel Frames, L.S.Beedle.
2. Plastic Analysis, B.G.Neal.
3. Plastic Analysis, Horve.

Outcomes : The learner will be able to design continuous beams and steel frames.

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Course Code: 51112 **Credits: 2**

M.Tech (Structural Engineering) – I Semester

ADVANCED CONCRETE LABORATORY

1 Tests on cement - Consistency, Setting times, Soundness, Compressive Strength.
2. Gradation Charts of Aggregates.
3. Bulking of fine Aggregate.
4. Aggregate Crushing and Impact value
5. Workability Tests on Fresh self compacting concrete
6. Air Entrainment Test on fresh concrete.
7. Marsh cone test.
8. Permeability of Concrete.
9. Non Destructive Testing of Concrete.
10. Accelerated Curing of Concrete.
11. Influence of W/C ratio on strength and Aggregate / Cement ratio on workability and Strength
12. Influence of Different Chemical Admixtures on concrete.

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Course Code: 51113 **Credits: 2**

M.Tech (Structural Engineering) – I Semester

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Course Code: 51114 **Credits: 4**

M.Tech (Structural Engineering) – II Semester

FINITE ELEMENT METHOD

MODULE – I **[12 Periods]**

Introduction: Concepts of FEM - steps involved - merits and demerits - energy principles – discrimination - Raleigh - Ritz method of functional approximation.

Principles of Elasticity: Stress equations - strain displacement relationships in matrix form plane stress, plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

MODULE – II **[12 Periods]**

One dimensional FEM: Stiffness matrix for beam and bar elements - shape functions foe ID elements.

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

MODULE – III **[12 Periods]**

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

Axi Symmetric Analysis: bodies of revolution - axi symmetric modeling - strain displacement relationship - formulation of axi symmetric elements.

Three dimensional FEM: Different 3-D elements-strain-displacement relationship – formulation of hexahedral and isoparametric solid element.

MODULE – IV **[12 Periods]**

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

MODULE – V **[12 Periods]**

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

REFERENCES:

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

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Course Code: 51115 **Credits: 4**

M.Tech (Structural Engineering) – II Semester

THEORY OF PLATES

Objectives : To impart knowledge on the behavior of plates and to analyse the problems pertaining to beams on elastic foundation.

MODULE- I **[12 Periods]**

Cylindrical Bending : Different kind of plates – Assumptions - Derivation of differential equation for cylindrical bending of long rectangular plates - Analysis of uniformly loaded rectangular plates with edges simply supported and fixed subjected to uniform load.

Pure Bending of Plates : Slope and curvature of slightly bent plates – Relations between moments and curvature - Particular cases of pure bending - Strain energy in pure bending – Energy methods like Ritz and Galerkin Methods to rectangular plates subjected to simple loadings.

MODULE- II **[12 Periods]**

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's solution – Application to different cases – Levy's solution for various boundary conditions subjected to different loadings like uniform and hydrostatic pressure.

MODULE- III **[12 Periods]**

Circular Plates : Symmetrical loading – Relations between slope, deflection, moments and curvature – Governing differential equation – Uniformly loaded plates with clamped and simply supported edges – Central hole – bending by moments and shearing forces uniformly distributed.

Orthotropic Plates : Introduction – Bending of anisotropic plates - Derivation of governing differential equation – Determination of Rigidities in various cases like R.C. slabs, corrugated sheet – Application to the theory of grid works.

MODULE- IV **[12 Periods]**

Plates on Elastic Foundations : Governing differential equation – deflection of uniformly loaded simply supported rectangular plate – Navier and Levy type solutions - Large plate loaded at equidistant points by concentrated forces P.

MODULE- V **[12 Periods]**

Buckling of Plates: Governing equation for Bending of plate under the combined action of in-plane loading and lateral loads – Buckling of rectangular plates by compressive forces acting in one and two directions in the middle plane of plate

Finite Difference Methods: Introduction - Application to rectangular plates subjected to simple loading.

REFERENCES:

1. Theory of Plates and Shells by Timoshenko, McGraw Hill Book Co., New York.

2. Theory and Analysis of Plates by P. Szilard, Prentice Hall.
3. Theory of Plates by Chandrasekhar, University Press.
4. Plate Analysis by N. K. Bairagi, Khanna Publishers. New Delhi.

Outcomes : The learner will be able to understand the behavior of plates for loadings and boundary conditions.

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Course Code: 51116 **Credits: 4**

M.Tech (Structural Engineering) – II Semester

PRESTRESSED CONCRETE

MODULE – I **[12 Periods]**

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

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

MODULE – II **[12 Periods]**

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

MODULE – III **[12 Periods]**

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

MODULE – IV **[12 Periods]**

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

MODULE – V **[12 Periods]**

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

REFERENCES :

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

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Course Code: 51117 **Credits: 4**

M.Tech (Structural Engineering) – II Semester

REPAIR AND REHABILITATION OF BUILDINGS
(Professional Elective – IV)

Objectives:

- To get the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures to abreast the practising and budding engineers of the latest in repair materials and technologies, in order to maintain the serviceability of the structures.

MODULE – I **[12 Periods]**

Introduction – Deterioration of Structures – Distress in Structures – Causes and Prevention.

Mechanism of Damage – Types of Damage.

MODULE – II **[12 Periods]**

Corrosion of Steel Reinforcement – Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Phenomena of Desication.

MODULE – I II **[12 Periods]**

Inspection and Testing – Symptoms and Diagnosis of Distress – Damage assessment – NDT.

MODULE – IV **[12 Periods]**

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

MODULE – V **[12 Periods]**

Strengthening of Structures – Strengthening Methods – Retrofitting – Jacketing. Health Monitoring of Structures – Use of Sensors – Building Instrumentation.

TEXT BOOKS:

1. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso, (1981)
2. Building Failures : Diagnosis and Avoidance, EF & N Spon, London, B. A. Richardson, (1991).

REFERENCES:

1. Concrete Technology by A.R. Shantakumar, Oxford University press
2. Defects and Deterioration in Buildingts, E F & N Spon, London
3. Non-Destructive Evaluation of Concrete Structures by Bungey
4. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.

Outcomes:

- Understand the behavior of existing constructions.

- Understand the main causes of structural failures carry out calculations on load bearing capacity of structures be able to draw, read and understand diagrams, normal force, shear force and bending moments.
- Have skill to design repair interventions of different type of civil structures.

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Course Code: 51118 **Credits: 4**

M.Tech (Structural Engineering) – II Semester

COMPOSITE MATERIALS
(Professional Elective – IV)

MODULE – I **[12 Periods]**

Introduction: Requirements of structural materials, influence of nature of materials in structural form, Nature of structural materials- Homogeneous materials, composite materials.

MODULE – II **[12 Periods]**

Macro mechanical Properties of composite Laminae: Introduction, Assumptions and Idealizations, Stress Strain relationships for composite Laminae- Isotropic, Orthotropic laminae, Strength Characteristics- Basic concepts, Strength hypothesis for isotropic and Orthotropic laminae. Macro mechanical Analysis of composite Laminae: Introduction, Assumptions and Limitations, Stiffness characteristics of glass reinforced laminae- Stress-Strain relationships in continuous, discontinuous fibre laminae, Strength characteristics of glass reinforced laminae Strengths in continuous, discontinuous fibre laminae.

MODULE – III **[12 Periods]**

Behaviour of Glass Fibre-Reinforced laminates: Introduction, Stiffness characteristics of Laminated composites-Behaviour of Laminated beams and plates, Strength characteristics of Laminated composites- Strength analysis and failure criteria, Effect of inter laminar structures. Glass Reinforced Composites: Introduction, Continuously reinforced laminates-uni-directionally and multi directionally continuously reinforced laminates, Discontinuously reinforced laminates – Stiffness and Strength properties.

MODULE – IV **[12 Periods]**

GRP properties relevant to structural Design: Introduction, Short-term strength and stiffness-Tensile, Compressive, Flexural and Shearing. Long term strength and stiffness properties, Temperature effects, Effect of fire, Structural joints- Adhesive, mechanical, Combinational, Transformed sections.

MODULE – V **[12 Periods]**

Basic Fracture Mechanics – Crack in a structure - Mechanisms of fracture and crack growth - Cleavage fracture – ductile fracture - Fatigue cracking – Environment assisted cracking - Service failure analysis.

REFERENCE:

1. GRP in Structural Engineering M.Holmes and D.J.Just.
2. Mechanics of Composite materials and Structures by Manjunath Mukhopadhyay; Universities Press

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Course Code: 50B15 **Credits: 4**

M.Tech (Structural Engineering) – II Semester

OPTIMISATION TECHNIQUES
(Professional Elective – IV)

Course Objectives:

Student will be able to

1. Define statement of optimization problem
2. Solve optimization problems using linear programming
3. Solve optimization problems using Dynamic programming

MODULE-I: **[12 Periods]**

LINEAR PROGRAMMING

Introduction and formulation of models; convexsity; graphical &simplex method; two phase method; degeneracy, non-existent and unbounded solutions; duality in L.P. Dual simplex method, Big-M Method sensitivity analysis; Revised simplex method; Transportation and Assignment problems.

MODULE- II: **[12 Periods]**

NON-LINEAR PROGRAMMING:

Classical optimization methods; equality and inequality constraints; Lagrange multipliers; &Kuhn-tucker conditions; quadratic forms; quadratic programming and Beal's methods.

MODULE- III: **[12 Periods]**

SEARCH METHODS:

One dimensional optimization; Fibonacci search; multi dimensional search methods; univariate search; gradient methods; steepest descent/ascent methods; conjugate gradient method; Fletcher- reeves method; penalty function approach.

MODULE-IV: **[12 Periods]**

DYNAMIC PROGRAMMING:

Belman's Principle of optimality; recursive relations; solution of L.P. Problem; simple examples.

MODULE-V: **[12 Periods]**

INTEGER LINEAR PROGRAMMING:

Gomory's cutting plane method; branch and bound algorithm; traveling salesman problem; knapsack problem; linear C-1 problem.

REFERENCES

1. Introduction to optimization-J.C.Paint; Jain brothers; New Delhi.
2. Optimisation theory and applications-S.S.Rao; Wiley Eastern Ltd., New Delhi.
3. Optimization method-K.V.Mital; Wiley Eastern Ltd... New Delhi.
4. Introduction to OR J.K. SHARMA Introduction to OR S.D .SHARMA.

Course Outcomes

On successful completion of this course, it is expected that students should be able to

1. Understand Engineering optimization.
2. Classify the optimization problems.
3. Understand various methods of linear programming & Dynamic programming

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Course Code: 51119 **Credits: 4**

M.Tech (Structural Engineering) – II Semester

ADVANCED STEEL DESIGN
(Professional Elective – V)

MODULE – I **[12 Periods]**

SIMPLE CONNECTIONS –RIVETED, BOLTED PINNED AND WELDED CONNECTIONS:

Riveted connections-Bolted Connections- Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip – Critical Connections – Praying 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.

MODULE – II **[12 Periods]**

ECCENTRIC AND MOMENT CONNECTIONS:

Introduction – Beams – Column Connections- Connections Subjected to Eccentric Shear – Bolted Framed Connections- Bolted Seat Connections – Bolted Brackete Connections. Bolted Moment Connections – Welded Framed Connections – Welded Brackete Connections - Moment Resistant Connections.

MODULE – III **[12 Periods]**

Analysis and Design of Industrial Buildings :

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

MODULE – IV **[12 Periods]**

DESIGN OF STEEL TRUSS GIRDER BRIDGES :

Types of truss bridges, component parts of a truss bridge, economic proportions of trusses, self weight of truss girders, design of bridge compression members, tension members; wind load on truss girder bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; sway bracing.

MODULE – V **[12 Periods]**

Design of Steel Bunkers and Soils

Introduction – Janseen's Theory – Airy's Theory – Design of Parameters – Design Criteria – Analysis of Bins – Hopper Bottom –Design of Bins.

References:

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

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Course Code: 51120 **Credits: 4**

M.Tech (Structural Engineering) – II Semester

DESIGN OF SUB STRUCTURES
(Professional Elective – V)

Objectives:

1. To impart knowledge on the types and purposes of different foundation systems and structures
2. To gain familiarity with different types of foundation
3. To explore the students to the design of shallow foundations and deep foundations
4. To understand the concept of retaining walls and machine foundations

MODULE I **[12 Periods]**

SHALLOW FOUNDATIONS

Soil investigation – Basic requirements of foundation –Types and selection of foundations. Design of reinforced concrete isolated, combined, eccentric, strip, and strap footings.

MODULE II **[12 Periods]**

RAFT FUODATIONS

Design of raft foundation. Types of rafts, Design of slab raft foundation and Design of beam and slab raft foundation.

MODULE III **[12 Periods]**

PILE FOUNDATIONS

Introduction – Types of pile foundations – load carrying capacity - structural design of straight piles – Structural design of pile-Reinforcement details of pile and pile caps different shapes of piles cap – structural design of pile cap.

MODULE IV **[12 Periods]**

DESIGN OF RETAINING WALLS

Stability Analysis and design of gravity, Cantilever, counter fort and basement retaining walls.

MODULE V **[12 Periods]**

MACHINE FOUNDATIONS

Introduction – Types of machine foundations – General criteria for design of machine foundation - Vibration analysis of machine foundation - Design of foundation for Reciprocating machines and Impact machines - as per l.S. Codes. Vibration isolation - types and methods of isolation - isolating materials and their properties.

TEXT BOOKS

1. Sawmi Saran, “Analysis and Design of Substructures”, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.1998
2. P. C. Varghese, “Design of Reinforced Concrete Foundations”, PHI Learning Pvt. Ltd., New Delhi, 2009
3. Kurain N. P, “Design of foundation systems-Principles and Practice”, Narosa Publishing house, New Delhi, 2005.

4. “Handbook of Machine Foundations” Srinivasulu, P. And Vaidyanathan, C. V., Tata McGraw
5. -Hill, New Delhi, 2001

REFERENCES:

1. Bowles .J.E., “Foundation Analysis and Design”, McGraw Hill Publishing co., New York, 1986.
2. Tomlinson.M.J, “Foundation Design and Construction”, Longman, Sixth Edition, New Delhi, 1995.
3. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
4. Narayan V. Nayak Foundation design manual,Dhanpat Rai & Sons, 2006
5. “Foundations for Machines, Analysis and Design” Prakash Shamsher and Puri Vijay K, John Wiley and Sons, USA, 1988
6. IS 2911 : Part 1 : Sec 1 : 1979 Code of practice for design and construction of pile foundations: Part 1 Concrete piles, Section 1 Driven cast in-situ concrete piles

Outcomes:

- The students will be able to understand necessary theoretical background for design of foundation systems

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Course Code: 51121 **Credits: 4**

M.Tech (Structural Engineering) – II Semester

STABILITY OF STRUCTURES
(Professional Elective – V)

MODULE – I **[12 Periods]**

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

MODULE – II **[12 Periods]**

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

MODULE – III **[12 Periods]**

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

MODULE – IV **[12 Periods]**

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

MODULE – V **[12 Periods]**

Lateral buckling of simply supported Beams: Beams of Rectangular cross-section subjected to pure bending. Buckling of simply supported Rectangular plates: Derivation of equation of plate subjected to constant compression in one and two directions.

REFERENCES

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

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Course Code: 51122 **Credits: 4**

M.Tech (Structural Engineering) – II Semester

DESIGN OF SHELLS AND FOLDED PLATES
(Professional Elective – VI)

MODULE – I **[12 Periods]**

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.

MODULE – II **[12 Periods]**

Derivation of the governing DKJ equation for bending theory, - Schorer's theory - Application to the analysis and design of short and long shells.

Beam theory of cylindrical shells: Beam and arch action, Analysis using beam theory.

MODULE – III **[12 Periods]**

Introduction to the shells of Double curvatures: Geometry, analysis and design of elliptic paraboloid, conoid and hyperbolic parabolic shapes, inverted umbrella type.

MODULE – IV **[12 Periods]**

Axi- Symmetrical shells: General equation - Analysis and axi-symmetrical by membrane theory. Application to spherical shells and hyperboloid of revolution cooling towers.

MODULE – V **[12 Periods]**

Folded plates – Introduction – Types of folded plates – structural behaviour of folded plates – advantages – Assumptions Whitney method of analysis – Edge shear equation - Analysis of folded plates of Whitney's method.

Simpsons method of Analysis of folded plates – moment and stress distribution – no rotation and rotation solutions – continuous folded plates – pre stressed continuous folded plates.

TEXT BOOKS:

1. Analysis and design of concrete shell roofs By G.S.Ramaswami.
2. Design of concrete shell roofs By Chaterjee.

REFERENCES:

1. Design of concrete shell roofs By Billington
2. Shell Analysis By N.K.Bairagi.
3. Advanced R.C Design By Dr.N.Krishna Raju.

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Course Code: 51123 **Credits: 4**

M.Tech (Structural Engineering) – II Semester

EARTHQUAKE RESISTANT DESIGN OF BUILDINGS
(Professional Elective – VI)

MODULE – I **[12 Periods]**

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.

MODULE – II **[12 Periods]**

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

MODULE – III **[12 Periods]**

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

MODULE – IV **[12 Periods]**

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

MODULE – V **[12 Periods]**

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

Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns-Case studies.

REFERENCE BOOKS:

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

REFERENCE CODES:

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

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Course Code: 51124 **Credits: 4**

M.Tech (Structural Engineering) – II Semester

RETAINING STRUCTURES
(Professional Elective – VI)

MODULE-I **[12 Periods]**

Earth Pressure Theories: Rankine's and Coulomb's Earth pressure theories for cohesive and cohesionless soils, stresses due to compaction and surcharge loads.

MODULE-II **[12 Periods]**

Conventional Retaining Wall: Types of retaining walls, Stability (sliding, overturning, bearing capacity & overall) of gravity and cantilever walls, Proportioning of retaining walls, Backfill material and drainage.

MODULE-III **[12 Periods]**

Flexible Walls: Sheet pile walls, Construction methods- Cantilever and Anchored sheet pile wall.

MODULE-IV **[12 Periods]**

Reinforced Soil Walls/Mechanically Stabilised Earth: - Failure mechanisms-bond and rupture failures, Analysis methods, Limit equilibrium method- Internal and external stability, Static and seismic analyses.

MODULE-V **[12 Periods]**

Braced Cuts: Lateral earth pressure in braced cuts, Design of various components, Stability of braced cuts, base heave and stability, yielding and settlement of ground surrounding excavation.

Text Books:

1. Das, B. M. - Principles of Foundation Engineering 5th Edition Nelson Engineering (2004)
2. Bowles, J. E. - Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc. (1996)

Reference:

1. Rowe, R. K. - Geotechnical & Geoenvironmental Engineering Hand Book -Springer (2001)
2. Hans Friedrich Winterkorn, Hsai-Yang Fang - Foundation Engineering Handbook, Van Nostrand Reinhold, 1975
3. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012.

2015 – 16

Malla Reddy Engineering College (Autonomous)

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Course Code: 51125 **Credits: 2**

M.Tech (Structural Engineering) – II Semester

CAD LABORATORY

1. Program using arrays and functions for matrix manipulation.
2. Programs to draw bending moment and shear force diagrams. Using graphic in C
3. Program for design of slabs. Using Excel
4. Program for design of beams. Using Excel
5. Program for design of column and footing using excel
6. Analysis of truss using STAAD Pro.
7. Analysis of multistoreyed space frame, using STAAD Pro.
8. Analysis of Bridge deck slab.

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Course Code: 51126 **Credits: 2**

M.Tech (Structural Engineering) – II Semester

SEMINAR-II

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Malla Reddy Engineering College (Autonomous)

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Course Code: 51127 **Credits: 4**

M.Tech (Structural Engineering) – III Semester

COMPREHENSIVE VIVA VOCE

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Course Code: 51128 **Credits: 8**

M.Tech (Structural Engineering) – III Semester

PROJECT WORK PART-I

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Course Code: 51129 **Credits: 8**

M.Tech (Structural Engineering) – IV Semester

PROJECT WORK PART-II

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Course Code: 51130 **Credits: 12**

M.Tech (Structural Engineering) – IV Semester

PROJECT VIVA- VOICE