ACADEMIC REGULATIONS, COURSE STRUCTURE AND DETAILED SYLLABUS

Effective from the Academic Year 2017-18 onwards

M. Tech. Two Year Degree Programme

(MR17 Regulations)

in

Structural Engineering (SE)

Department of Civil Engineering

MALLA REDDY ENGINEERING COLLEGE (Autonomous)

(An UGC Autonomous Institution, Approved by AICTE and Affiliated to JNTUH Hyderabad, Recognized under Section 2(f) &12 (B) of UGC Act 1956, Accredited by NAAC with 'A' Grade (II Cycle) and NBA, Maisammaguda, Dhulapally (Post Via Kompally), Secunderabad-500 100
Website: www.mrec.ac.inE-mail: principal@mrec.ac.in

MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)
MR17 ACADEMIC REGULATIONS (CBCS)
For M. Tech. (REGULAR) DEGREE PROGRAMME

Applicable for the students of M. Tech. (Regular) programmeadmitted from the Academic Year ***2017-18*** onwards.

The M. Tech. Degree of Jawaharlal Nehru Technological University Hyderabad, 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 expose the post graduate students to advanced structural analysis, structural dynamics, allied theory in elasticity and plasticity, FEM etc.

PEO2: To impart training to graduate students to work in team for analysis and design of various structures as per the codal provisions.

PEO3: To orient the post graduate students to high value research related to Structural Engineering so that they get impetus to pursue research and lifelong learning.

PROGRAMME OUTCOMES (POs)

PO1: Graduates of the program will be able to independently carry out research /investigation and development work to solve practical problems.

PO2: Graduates of the program will be able to write and present a substantial technical report/document.

PO3: Graduates of the program will be able to demonstrate in depth knowledge of structural engineering discipline.

PO4: Graduates of the program will be able to function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

PO5: Graduates will develop enthusiasm and confidence to pursue lifelong learning for professional advancement.

PO6: Graduates of the program will be able to identify and analyze the impact of structural engineering in development projects and find a suitable solution from number of alternatives using software.

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 M.Techis of 2 academic years (4 Semesters), with the academic year being divided into two semesters of 22 weeks ($\geq$ 90 teaching days, out of which number of contact days for teaching / practical $\geq$ 75 and conducting examinations and preparation days = 15) each.

3.0 Courses of Study:

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

Dept.	Specialization Code	Specialization	Intake
CE	11	Structural Engineering (SE)	24
EEE	24	Electrical Power Systems (EPS)	24
ME	31	Thermal Engineering (TE)	18
	33	Machine Design (MD)	24
CSE	51	Computer Science and Engineering (CSE) – Shift-I	18
		Computer Science and Engineering (CSE) – Shift-II	24

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

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 Requirements:

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 Semester End Examination of that subject and their registration shall stand cancelled.

5.5 A stipulated 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 at least 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 both theory and 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: For each question there will be an 'eitheror choice', which means that there will be two questions from each module and the student should answer either of the two questions	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 15 marks for design/procedure/schematic diagram of the given experiment, 20 marks for conduction of experiment, 15 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/BoS Chairman

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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 Department PG Coordinator, 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.

6.4Comprehensive 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 (SEE) and Continuous Internal Evaluation (CIE) 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 Comprehensive Viva Voce 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)
≥ 90%,	10	O (Outstanding)
(≥ 80%, <90%)	9	A+ (Excellent)
(≥ 70%, < 80%)	8	A (Very Good)
(≥ 60%, < 70%)	7	B+ (Good)
(≥ 55%, < 60%)	6	B (Average)
(≥ 50%, < 55%)	5	C (Pass)
(< 50%)	0	F(Fail)
Absent	0	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 ≥ 5(C Grade or above).

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

$\text{SGPA} = \{\sum_{i=1}^{N} C_i G_i\} / \{\sum_{i=1}^{N} C_i\}$… 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

$\text{CGPA} = \{\sum_{j=1}^{M} C_j G_j\} / \{\sum_{j=1}^{M} C_j\}$ … 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 1stSemester 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/Department PG Coordinator,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 2 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 similarity 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 shall be submitted to the Chief Controller of Examinations / Principal for project evaluation (Viva Voce).

8.9 For Project work part-I in III Semester there is an internal marks of 100, the evaluation should be done by the PRC for 60 marks and Supervisor will evaluate for 40 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work and 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 reappearafter one month with modifications suggested by PRC.

8.10 For Project work part-II in IV Semester there is an internal marks of 100, the evaluation should be done by the PRC for 60 marks and Supervisor will evaluate for 40 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 after one month with modifications suggested by PRC.

8.11 For Project Evaluation (Viva Voce) in IV Semester there is an external marks of 100 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 distribution of 100 marks followed by Quality of the work (Plagiarism), Paper publication, nature of the work (Tools & software used and Innovative ideas), presentation and viva-Voce - each for 20 marks. 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 on 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 ≥ 5.0), 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	≥ 8.00
First Class	≥ 6.50 and < 8.00
Second Class	≥ 5.00 and < 6.50

9.3 A student with final CGPA (at the end of the PGP) < 5.00 will not be eligible for the Award of Degree.

10. Withholding of Results:

If the student has not paid the dues, if any, to the 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. Transitory Regulations:

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 MR17 Academic Regulations.

12. Student Transfers:

12.1 There shall be no Branch/Specialization transfers after the completion of Admission Process.

12.2 The students seeking transfer to MALLA REDDY ENGINEERING COLLEGE (Autonomous) - MREC(A) from various other Universities/institutions have to pass the failed subjects which are equivalent to the subjects of MREC(A), and also pass the subjects of MREC(A) which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of MREC(A), the students have to study those subjects in MREC(A) inspite of the fact that those subjects are repeated.

12.3 The transfer students from other Universities / Institutions to MREC (A) who are on rolls will be provided one chance to write internal examinations in the failed subjects and/or subjects not studied as per the clearance letter issued by the JNTUH.

13.General:

13.1 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.

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

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

13.4 The academic regulation should be read asa whole for the purpose of any interpretation.

13.5 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the College Academic Committee headed by the Principal is final.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

S.No.	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 practical's 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 out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester. 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.

	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	
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.***

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the aboveguidelines.

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	PC	71101	Theory of Elasticity	2	2	-	3	40	60	100
2	PC	71102	Structural Dynamics	2	2	-	3	40	60	100
3	PC	71103	Matrix Methods Of Structural Analysis	2	2	-	3	40	60	100
4	**Professional Elective - I**									
	PE	71104	Advanced R. C. Design	2	2	-	3	40	60	100
		71105	Bridge Engineering							
		71106	Plastic Analysis & Design							
5	**Professional Elective - II**									
	PE	71107	Advanced Concrete Technology	3	-	-	3	40	60	100
		71108	Tall Buildings							
		71109	Design of Shells and folded Plates							
6	**Open Elective - I**									
	OE	70B12	Computer Oriented Numerical Methods	3	-	-	3	40	60	100
		71110	Reliability Engineering							
		71111	Ground Improvement Techniques							
7	PC	71112	Advanced Concrete Laboratory	-	-	4	2	40	60	100
8	PR	71113	Seminar – I	-	-	4	2	100	--	100
			Total	14	8	8	**22**	**Contact Periods – 30**		

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	PC	71114	Finite Element Method	2	2	-	3	40	60	100
2	PC	71115	Theory of Plates	2	2	-	3	40	60	100
3	PC	71116	Prestressed Concrete Structures	2	2	-	3	40	60	100
4	**Professional Elective - III**									
	PE	71117	Repair and Rehabilitation of Buildings	3	-	-	3	40	60	100
		71118	Composite Materials							
		71119	Stability of Structures							
5	**Professional Elective - IV**									
	PE	71120	Advanced Steel Design	2	2	-	3	40	60	100
		71121	Design of Sub Structures							
		71122	Earthquake Resistant Design of Buildings							
6	Open Elective - II									
	OE	70B13	Mathematical Programming	2	2	-	3	40	60	100
		71123	Advanced Foundation Engineering							
		71124	Retaining Structures							
7	PC	71125	CAD Laboratory	-	-	4	2	40	60	100
8	PR	71126	Seminar – II	-	-	4	2	100	--	100
	Total			13	10	8	**22**	**Contact Periods – 31**		

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	PR	71127	Comprehensive Viva Voce	-	-	-	6	-	100	100
2	PR	71128	Project work Part – I	-	-	-	16	100	-	100
			Total	-	-	-	**22**			

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	71129	Project work Part – II	-	-	-	6	100	-	100
2	PR	71130	Project Viva Voce	-	-	-	16	-	100	100
			Total	-	-	-	**22**			

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. I Semester		
Code: 71101	THEORY OF ELASTICITY	L	T	P
Credits: 3		2	2	-

Course Objectives:

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

MODULE I: [10 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 –stresss function – boundary condition.

MODULE II: [10 Periods]

Two dimensional problems in rectangular coordinates – solution by polynomials – Saint-Venant's principle – determination of displacements – bending of simple beams – application of fourier 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: [10 Periods]

A. 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.

B. 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: [09 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 and 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: [09 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.

TEXT BOOKS

1. S. P. Timoshenko and J. N. Goodier, "**Theory of Elasticity**", Tata McGraw-Hill Piblication, 3rd Edition.
2. Dr. Sadhu Singh,"**Theory of Elasticity**",Khanna Publications.

REFERENCES

1. Y. C. Fung, "**An Introduction to the Theory of Aeroelasticity**", Dover Publication.
2. L. D. Landau, L. P. Pitaevskii, A. M. Kosevich& E. M. Lifshitz, "**Theory of Elasticity**", Butterworth-Heinemann, 3rd Edition.

E – RESOURCES

1. http://www.iue.tuwien.ac.at/phd/dhar/node17.html
2. https://en.wikiversity.org/wiki/Introduction_to_Elasticity
3. http://web.mit.edu/16.20/homepage/6_Torsion/Torsion_files/module_6_no_solutions.pdf
4. https://engineering.purdue.edu/~ce597m/Handouts/Theory%20of%20elasticity%20by%20Timoshenko%20and%20Goodier.pdf
5. http://www.me.ust.hk/~meqpsun/Notes/Theory%20Of%20Elasticity(Landau-1959)
6. http://www2.mae.ufl.edu/haftka/adv-elast/lectures/Sections6.1-2.pdf
7. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-20-structural-mechanics-fall-2002/lecture-notes/unit10.pdf
8. http://nptel.ac.in/courses/105108070/
9. https://www.youtube.com/watch?v=uO_bW2zzrNU

Course Outcomes:

After the completion of the course students will be able to:

1. Understand the principles of elasticity and plane stress and plane strain problems with boundary conditions.
2. Evaluate the symmetric and asymmetric stress distribution with rectangular and polar coordinates in 2dimensional analysis by Saint-Venant's principles using boundary conditions and solving their relative problems.
3. Recognize the analysis of stress and strain in reciprocal 3 dimensions with ellipsoid principles and theorems.
4. Understand the torsion and bending of prismatic bars for elliptical circular cross sections, hydrodynamicalanalogies with their solutions by soapfilm method.
5. Understand the uses of experimental stress analysis and their methods with application.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**2**	**2**	
CO2	**3**		**3**	**2**	**2**	
CO3	**3**		**3**	**2**	**2**	
CO4	**3**		**3**	**2**	**2**	
CO5	**3**		**3**	**2**	**2**	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. I Semester		
Code: 71102	STRUCTURAL DYNAMICS	L	T	P
Credits: 3		2	2	-

Course Objectives:

To impart knowledge on the structural dynamics of single degree of freedom system and multi degree of freedom system.

MODULE I:Theory of vibrations [10 Periods]

Introduction – Elements of vibratory system – Degrees of Freedom – ContinuousSystem – 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

MODULEII: [10 Periods]

A. Introduction to Structural Dynamics : Fundamental objectives of dynamic analysis –Types ofprescribed 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.

B. SingleDegree of Freedom Systems: Formulation and solution of the equation of motion – Freevibration response – Response to Harmonic, Periodic, Impulsive and general dynamic loadings – Duhamel integral.

MODULEIII:Multi Degree of Freedom Systems [10 Periods]

A. Selection of the degrees of Freedom – Evaluation of structuralproperty matrices – Formulation of the MDOF equations of motion – Undamped free vibrations – Solutions of Eigen value problem for natural frequencies and mode shapes.

B. Analysis of Dynamic response – Normal co-ordinates – Uncoupled equations of motion – Orthogonal properties of normal modes – Mode superposition procedure.

MODULEIV: [09 Periods]

A. Practical Vibration Analysis: Introduction –Stodola method – Fundamental mode analysis – Analysisof second and higher modes –Holzer method – Basic procedure.

B. Continuous Systems: Introduction – Flexural vibrations of beams – Elementary case – Derivation ofgoverning 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.

MODULEV: [09 Periods]

Introduction – Excitation by rigid base translation – Lumpedmass approach – SDOF and MDOF systems – I.S. Code methods of analysis for obtaining response of multi storied buildings.

TEXT BOOKS

1. Mario Paz, "**Structural Dynamics**", C.B.S Publishers, New Delhi.
2. Anil K. Chopra, "**Dynamics of Structures**", Pearson Education (Singapore),3rd Edition.

REFERENCES

1. Clough &Penzien, "**Dynamics of Structures**", McGraw Hill, New York.
2. IS:1893-1984, "**Code of practice for Earthquake resistant design of Structures**" and latest IS:1893-2002 (version) Part-1

E – RESOURCES

1. http://www.learnengineering.org/2012/12/theory-of-vibration.html
2. http://personal.cityu.edu.hk/~bsapplec/theoryof.htm
3. http://www.tech.plym.ac.uk/soe/james/my_papers/STRC201_SDOF_JMWB.pdf
4. http://www.brown.edu/Departments/Engineering/Courses/En4/Notes/vibrations_mdof/vibrations_mdof.htm
5. http://www.iitg.ernet.in/scifac/qip/public_html/cd_cell/chapters/r_tiwari_dyn_of_mach/Chapter_13-Vibration%20of%20Multi%20degree-of-freedom%20system.pdf
6. http://www.springer.com/in/book/9780387945248
7. http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1096-9845
8. http://trove.nla.gov.au/work/7612381?selectedversion=NBD969606
9. http://nptel.ac.in/courses/105101006/
10. http://freevideolectures.com/Course/3129/Structural-Dynamics

Course Outcomes:

After the completion of the course students will be able to:

1. Understand various vibratory systems like SHM, damped and undamped vibrations, free and forced vibrations.
2. Understand formulation of equation of motion by D'Alembert's principle, Principle of virtual work and Hamilton Principle.
3. Formulate and solve equations of motion for SDOF systems, Eigen value problem for natural frequency and mode shapes.
4. Evaluate the vibration analysis using Stodola Method, Analysis of second and higher modes using Holzer method and flexural vibration of simple beams.
5. Recognize earthquake analysis with Lumped mass approach and IS Code methods for the analysis of multistoried buildings.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**		**3**	**2**	**1**	**1**
CO2	**1**		**3**	**2**	**1**	**1**
CO3	**1**		**3**	**2**	**1**	**1**
CO4	**1**		**3**	**2**	**1**	**1**
CO5	**2**		**3**	**2**	**3**	**1**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. I Semester		
Code: 71103	MATRIX METHODS OF STRUCTURAL ANALYSIS	L	T	P
Credits: 3		2	2	-

Course Objectives:

To impart knowledge on matrix methods of structural analysis of indeterminate structures like continuous beams, trusses and portal frames.

MODULE I: **[10 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: **[10 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: **[10 Periods]**

A. Assumptions in flexibility matrix method – Analysis of plane truss and continuous beam using flexibility matrix methods.

B. Analysis of plane frame and grids by flexibility matrix methods.

MODULE IV: **[09 Periods]**

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

MODULE V: **[09 Periods]**

Special analysis procedures – static condensation and sub structuring –Initial and thermalstresses.

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

TEXT BOOKS

1. William Weaver and James M. Gere, "**Matrix Analysis of Frame structures**", CBS publishers & Distributors Pvt. Ltd., New Delhi.
2. AshokK.Jain, "**Advanced Structural Analysis**" by, Nem Chand & Bros., 3rd Edition.

REFERENCES

1. C.S.Reddy, "**Basic Structural Analysis**", Tata McGraw Hill Education Private Limited, 3rd Edition.
2. Madhu B. Kanchi, "**Matrix Methods of Structural Analysis**", John Wiley & Sons, 2nd Edition
3. K.U.Muthu, Azmi Ibrahim, Vijayanand M and MagantiJanardhana, "**Basic Structural Analysis**", I.K.InternationalPublishing House Pvt. Ltd., 3rd Edition.
4. John L. Meek, "**Matrix Structural Analysis**", McGraw-Hill Inc., 1st Edition.
5. Amin Ghali, Adam Neville and Tom G. Brown, "**Structural Analysis: A Unified Classical**

and Matrix Approach", CRC Press (Taylor & Francis Group), 6th Edition.

E – RESOURCES

1. http://web.iitd.ac.in/~sbhalla/flexibility.pdf
2. https://engineering.purdue.edu/~aprakas/CE474/CE474-Ch3-ForceMethod.pdf
3. http://www.colincaprani.com/files/notes/SAIV/4%20-%20Matrix%20Stiffness%20Method.pdf
4. https://www.elsevier.com/books/matrix-methods-of-structural-analysis/livesley/978-0-08-018888-1
5. http://www.sefindia.org/forum/files/c_structural_forum_powell_dec08_196.pdf
6. http://nptel.ac.in/courses/105106050/20#
7. http://freevideolectures.com/Course/3015/Advanced-Structural-Analysis
8. http://www.nptelvideos.in/2012/11/advanced-structural-analysis.html

Course Outcomes:

After the completion of the course students will be able to:

1. Solve statically indeterminate structures using matrix method and apply the coordinate transformation method for stiffness and flexibility method.
2. Understand formulation of various stiffness matrices and concept of direct stiffness by computer algorithm.
3. Understand and perform analysis of trusses, continuous beams and rigid frames using flexibility method.
4. Understand and perform analysis of trusses, continuous beams and rigid frames using stiffness method.
5. Analyse a structure under static condensation due to initial and thermal stresses and to understand the structural behaviour of shear wall.

CO – PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		3	1	1	
CO2	3	1	3	1	2	3
CO3	3		3	1	1	
CO4	3		3	1	1	
CO5	3		3	1	1	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. PE – I		
Code: 71104	ADVANCED R. C. DESIGN	L	T	P
Credits: 3		2	2	-

Course Objectives:
To impart knowledge on the behavior and design on various reinforced concrete structural elements like flat slabs, corbels, deep beams and combined footings.

MODULE I: Basic Design Concepts [10 Periods]
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: Limit Analysis of R. C. Structures [10 Periods]
Rotation of a plastic hinge, Redistribution of moments, momentrotation characteristics ofRC 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: Design of Ribbed slabs, Flat slabs [10 Periods]
A. Ribbed Slab: Analysis of Slabs for Moment and Shears, UltimateMoment of Resistance, Design for shear, Deflection, Arrangement of Reinforcements.
B. Flat slab: Direct design method–Distribution of moments in column strips and middle strip – momentand 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: Design of Reinforced Concrete Deep Beams & Corbels [09 Periods]
Steps of Designing Deep Beams, Designby 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: Design of Compression members [09 Periods]
Estimation of effective length of a column – Code requirementson 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 CombinedFooting – Design Considerations in Combined Footing for Two Columns.

TEXT BOOKS

1. S. UnnikrishnaPillai&Menon, "**Reinforced concrete design**", Tata McGraw Hill, 2nd Edition.
2. P.C. Varghese, "**Advanced Reinforced Concrete Design**", Prentice Hall of India.
3. Dr. V. L. Shah & Dr. S. R. Karve, "**Limit state theory and design of reinforced concrete**", Structures Publications, 7th Edition.
4. Mete A. Sozen, Toshikatsu Ichinose& Santiago Pujol, "**Principles of Reinforced Concrete Design**", CRC Press,

REFERENCES

1. KennathLeet, "**Reinforced concrete design**", Tata McGraw-Hill International, editions, 2ndEdition.

2. P.Purushotham, "**Reinforced concrete structural elements – Behaviour, Analysis and design**", Tata McGraw-Hill.
3. Arthus H. Nilson, David Darwin, and Chorles W. Dolar, "**Design of concrete structures**", Tata McGraw-Hill, 3rd Edition.
4. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, "**Reinforced concrete structures**", Laxmi Publications.
5. I.C. Syal& A. K. Goel, "**Reinforced Concrete Structures**", S. Chand.

E – RESOURCES

1. https://civildigital.com/ribbed-waffle-slab-system-advantages-disadvantages/
2. https://www.filepicker.io/api/file/SZv8TraTUq0WL5BLuirL
3. http://web.iiit.ac.in/~rahman/is456.pdf
4. http://www.frilo.eu/tl_files/frilo/pdf/en/pdf_doku/B9_eng.pdf
5. https://enjiner.wordpress.com/2013/06/15/corbel-design/
6. https://theconstructor.org/geotechnical/foundations/combined-footing-design-with-example/8/
7. http://www.springer.com/engineering/civil+engineering/journal/40091
8. http://www.springer.com/engineering/civil+engineering/journal/40069
9. http://journals.sagepub.com/home/ase
10. http://nptel.ac.in/courses/105105105/

Course Outcomes:

After the completion of the course students will be able to:

1. Understand basic design concepts of reinforced concrete members.
2. Develop an idea about design of fixed and continuous beams and yield line analysis of slabs.
3. Familiarize with design and detailing of flat and ribbed slabs.
4. Designconcrete deep beams and corbels.
5. Understand the basic design concepts of compression members and combined footings as per IS codal provisions.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**1**		
CO2	**3**		**3**	**1**	**1**	**1**
CO3	**3**		**3**	**2**	**1**	**1**
CO4	**3**	**1**	**3**	**2**	**1**	**1**
CO5	**3**	**1**	**3**	**3**	**1**	**1**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. PE – I		
Code: 71105	BRIDGE ENGINEERING	L	T	P
Credits: 3		2	2	-

Course Objectives:

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

MODULE I: **[10 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 – Seismic loads – Frictional resistance of expansion bearings – Secondary Stresses – Temperature Effect – Erection Forces and effects – Width of roadway and footway – General Design Requirements.

MODULE II: **[10 Periods]**

Solid slab Bridges: Introduction – Method of Analysis and Design –Design of RC slab, skewslab and box culverts. Design of T-beam bridges.

MODULE III: **[10 Periods]**

A. Girder Bridges: Introduction – Method of Analysis and Design – bow string girder bridges – Design of plate girder bridges – steel trussed bridges – Courbon's Theory, Grillage analogy.

B. Introduction to long span bridges: Cable stayed bridges and suspension bridges, Forces on piers and abutments – Design of piers and abutments.

MODULE IV: **[09 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: **[09 Periods]**

Analysis of Bridge Decks: Harmonic analysis and folded plate theory – Grillage analogy – Finite strip method and FEM. Sub– Structure of bridges: Substructure – Beds block – Piers – Pier Dimensions–Abutments.

TEXT BOOKS

1. M.G.Aswani, V.N.Vazirani and M.M.Ratwani, "**Design of Concrete Bridges**", Khanna Publishers.
2. Johnson Victor, "**Essentials of Bridge Engineering**", Oxford & IBH., 6th Edition.

REFERENCES

1. E.C.Hambly**, "Bridge Deck Behaviour**", CRC Press, 2nd Edition.
2. N.KrishnaRaju**, "Design of Bridges",** Oxford &IBH Publishing Co. Pvt. Ltd., 4th Edition.
3. S. Ponnuswamy, "**Bridge Engineering**", Tata McGraw Hill, 2nd Edition.
4. V. K. Raina**, "Concrete Bridge Practice Analysis, Design &Economics**", Shroff Publication &Distribution Pvt. Ltd., 4th Edition.

E – RESOURCES

1. http://www.in.gov/dot/div/contracts/training/2010/StructConf/1015aReinfConcrete.pdf
2. http://www.virginiadot.org/business/resources/bridge/rc_slab_cont.pdf
3. https://www.fhwa.dot.gov/bridge/lrfd/fhwanhi04041_steel.pdf
4. https://www.fhwa.dot.gov/bridge/lrfd/fhwanhi04043.pdf
5. http://ascelibrary.org/journal/jbenf2
6. http://home.iitk.ac.in/~vinaykg/Iset453.pdf
7. http://content.iospress.com/journals/bridge-structures/12/1-2
8. http://www.iospress.nl/journal/bridge-structures/
9. http://nptel.ac.in/syllabus/105999906/

Course Outcomes:

After the completion of the course students will be able to:

1. Demonstrate different types of bridges with diagrams as per IRC loading standards.
2. Analyze and design solid slab bridges.
3. Analyze and design girder bridges and to familiarize with the design principles of long span bridges like cable stayed and suspension bridges.
4. Analyze and design prestressed concrete bridges.
5. Analyze the bridge deck using finite element methods and analysis of substructure of bridge.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1			**3**	**3**	**2**	**1**
CO2	**2**		**3**	**2**	**2**	**2**
CO3	**2**		**3**	**2**	**2**	**2**
CO4	**2**		**3**	**2**	**2**	**2**
CO5	**2**		**3**	**2**	**2**	**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. PE – I		
Code: 71106	PLASTIC ANALYSIS & DESIGN	L	T	P
Credits: 3		2	2	-

Course Objectives:

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

MODULE I: **[10 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: **[10 Periods]**

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

MODULE III: **[10 Periods]**

A. Secondary Design Problems: Introduction – Influence of Axial force on the plastic moment – influence of shear force on the plastic moment.

B. Local buckling of flanges and webs – Lateral buckling – Column stability.

MODULE IV: **[09 Periods]**

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

MODULE V: **[09 Periods]**

Design of Steel Frames: Introduction – Single bay, single storey frames – simplified procedures for Single span frames – Design of Gable frames with Haunched Connection. Ultimate Deflections:Introduction – Deflection at ultimate load – Deflection at working load – Deflections of Beams and Single span frames.

TEXT BOOKS

1. L.S.Beedle, "**Plastic Design of Steel Frames**", John Wiley & Sons Inc.
2. B. G. Neal, "**The Plastic Methods of Structural Analysis**", Springer US, 1st Edition.

REFERENCES

1. Philip G Hodge, "**Plastic Analysis of Structures**", R. E. Krieger Publishing Co.
2. C. E. Massonner and M. A. Save, "**Plastic Analysis and Design: Beams and frames**", Blaisdell Publishing Company.

E – RESOURCES

1. http://www.steel-insdag.org/TeachingMaterial/chapter35.pdf
2. http://www.aboutcivil.org/plastic-analysis-definition-principles.html
3. http://people.fsv.cvut.cz/~wald/CESTRUCO/Texts_of_lessons/06-GB_Moment_Connections.pdf
4. https://www.whirlwindsteel.com/blog/bid/407703/an-introduction-to-continuous-steel-beam-construction
5. http://people.uwplatt.edu/~robermat/CEE3150/example/full.pdf

6. https://www.elsevier.com/books/plastic-analysis-and-design-of-steel-structures/wong/978-0-7506-8298-5
7. https://www.istructe.org/journal/volumes/volume-33-(published-in-1955)/issues/issue-7/articles/plastic-analysis-and-design-of-mild-steel-vierende
8. http://nptel.ac.in/courses/105106113/7
9. http://nptel.ac.in/courses/114105031/34

Course Outcomes:

After the completion of the course students will be able to:

1. Identify the locations of plastic hinges and understands the beam, sway and combined mechanism.
2. Design the continuous beamsfor uniform c/s and varying c/s using plastic method of analysis.
3. Understand the plastic analysis and design of columns.
4. Design the straight corner and haunched connections, interior beam column connections.
5. Find out the deflections of beams and frames and design of frames and gable frames.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**2**	**2**	
CO2	**3**		**3**	**2**	**2**	
CO3	**3**		**3**	**2**	**2**	
CO4	**3**		**3**	**2**	**2**	
CO5	**3**		**3**	**2**	**2**	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. PE – II		
Code: 71107	ADVANCED CONCRETE TECHNOLOGY	L	T	P
Credits: 3		2	2	-

Course Objectives:

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

MODULE I: **[10 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: **[10 Periods]**

Fresh 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: **[10 Periods]**

A. High Strength Concrete – Micro structure – Manufacturing and Properties – Design of HSC Using ErintroyShaklok Method – Ultra High Strength Concrete.

B. High Performance Concrete– Requirements and properties of High Performance Concrete – Design Considerations.

MODULE IV **[09 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: **[09 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. A.M.Neville, "**Properties of Concrete**", Prentice Hall, 5th Edition.
2. A. R. Santhakumar, "**Concrete Technology**", Oxford University Press.
3. M.S.Shetty, "**Concrete Technology (Theory and Practice)**", S.ChandPublishing.

REFERENCES

1. P.K.Mehta, "**Concrete: Micro Structure, Properties and Materials**", Tata McGraw Hill Publishing House Pvt. Ltd.
2. RafatSiddique, "**Special Structural concretes**", Galgotia Publications.
3. N. Krishna Raju, "**Design of Concrete Mixes**", CBS Publications.

E – RESOURCES

1. https://en.wikipedia.org/wiki/Properties_of_concrete
2. http://civil-resources.blogspot.in/2010/06/high-performance-concrete.html

3. www.cee.mtu.edu/~llsutter/classes/cet1141/present/hvalue.ppt
4. http://www.nbmcw.com/concrete/26923-high-performance-concrete.html
5. http://www.j-act.org/
6. http://icjonline.com/
7. http://nptel.ac.in/courses/105102012/
8. https://www.youtube.com/watch?v=cx5gPKp9QEc&list=PLbMVogVj5nJQU7M0LdA77p_XaaWBJniNc

Course Outcomes:

After the completion of the course students will be able to:

1. Acquire good knowledge in concrete making materials.
2. Determine the properties of fresh and hardened concrete.
3. Understand the properties and performance of high strength concrete and high performance concrete.
4. Identify the application of special concrete and able to do the mix design as per codes
5. Acquire deep knowledge in form work and structural requirements.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**3**	**3**	**2**	**1**
CO2	**3**	**2**	**3**	**1**	**3**	**1**
CO3	**2**		**2**	**2**	**2**	**2**
CO4	**3**	**2**	**3**	**2**	**3**	**2**
CO5			**1**	**1**	**1**	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. PE - II		
Code: 71108	TALL BUILDINGS	L	T	P
Credits: 3		2	2	-

Course Objectives:

To introduce the students to conceptualizing contemporary and emerging trends in the growth of tall buildings and urban habitat, including the use of green principles in modern structures and urban developments. To impart knowledge on hybrid structural systems, high performance construction materials, structural analysis methods and design tools involved in the design of tall buildings.

MODULE I: Introduction [10 Periods]

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: Lateral load resisting elements [10 Periods]

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: Choice of System for a Building [10 Periods]

A. 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.

B. Load distribution in a tall building – Load resisted by different shear walls & frames – Determinate & Indeterminate problems – Equivalent Stiffness method.

MODULE IV: Methods of Analysis [09 Periods]

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: Modern Methods [09 Periods]

Analysis of Tall buildings by Stiffness method– Available software's for analysis of tall buildings.

TEXT BOOKS

1. Bungale S. Taranath, "**Steel, Concrete& Composite Design of Tall Buildings**" McGraw-Hill Education; 2nd edition.
2. Bungale S. Taranath, "**Structural Analysis and Design of Tall Buildings: Steel and Composite Construction**" CRC Press.
3. Mark Sarkisian, "**Designing Tall Buildings: Structure as Architecture**", Routledge Publication.

REFERENCES

1. Bungale S. Taranath, "**Reinforced Concrete Design of Tall Buildings**", by CRC Press, 1st Edition.
2. Analysis of Shear Walled Buildings by S. M. A. Kazimi& R. Chandra, Tor-steel Research Foundation, Calcutta, India.
3. William Weaver and James M. Gere "**Matrix Analysis of Framed Structures**", Springer US, 3rd Edition.
4. Wolfgang Schueller, "**The Design of Building Structures**" Prentice Hall.

E – RESOURCES

1. www.iitk.ac.in/nicee/wcee/article/1752.pdf
2. www.iitk.ac.in/nicee/wcee/article/8_vol5_1237.pdf
3. www.iitgn.ac.in/seismic-design/files/GAM_LateralLoadResistingSystems.pdf
4. http://sydney.edu.au/architecture/documents/publications/ASR/Structural%20Developments%20in%20Tall%20Buildings.pdf
5. https://link.springer.com/chapter/10.1007%2F978-1-4684-6581-5_79#page-1
6. http://publications.lib.chalmers.se/records/fulltext/245349/245349.pdf
7. https://www.youtube.com/watch?v=XCun_ewg-I8
8. https://www.youtube.com/watch?v=ujh4CFhitho

Course Outcomes:

After the completion of the course students will be able to:

1. Differentiate between different structural systems for buildings and associated height limits.
2. Calculate the design loads for all buildings.
3. Differentiate between different floor systems and their suitability for use in tall buildings.
4. Perform structural modeling and analysis of tall buildings.
5. Perform the analysis of tall buildings using modern method.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**2**	**2**	**1**
CO2	**3**		**3**	**2**	**2**	**1**
CO3	**3**		**3**	**2**	**2**	**1**
CO4	**3**		**3**	**2**	**2**	**1**
CO5	**3**		**3**	**2**	**2**	**1**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. PE – II		
Code: 71109	DESIGN OF SHELLS AND FOLDED PLATES	L	T	P
Credits: 3		2	2	-

Course Objectives:

To impart knowledge on the fundamentals of shells with single and double curvature, design of short and long shells and analysis and design of folded plates.

MODULE I: **[10 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: **[10 Periods]**

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

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

MODULE III: **[10 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: **[09 Periods]**

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

MODULE V: **[09 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. G.S.Ramaswamy, "**Design and Construction of Concrete Shell Roofs**", CBS Publishers and Distributors, 1st Edition.
2. Binoy K. Chaterjee, "**Theory andDesign of Concrete Shells**", Chapman and Hall, 3rd Edition.

REFERENCES

1. Billington D. P., "**Thin Shell Concrete Structures**",Tata McGraw Hill, 2nd Edition.
2. N.K.Bairagi, "**Shell Analysis**", Khanna Publishers
3. N.KrishnaRaju, "**Advanced Reinforced Concrete Design**", CBS Publishers and Distributors, 3rd Edition.

E – RESOURCES

1. http://encyclopedia2.thefreedictionary.com/Folded+Plate+Structure
2. http://www.ketchum.org/ShellTandF/

3. https://ocw.mit.edu/courses/mechanical-engineering/2-081j-plates-and-shells-spring-2007/readings/lecturenote.pdf
4. https://fenix.tecnico.ulisboa.pt/downloadFile/395139427473/resumo.pdf
5. http://www.ansys.stuba.sk/html/elem_55/chapter4/ES4-51.htm
6. http://www.ijsrd.com/articles/IJSRDV3I90258.pdf
7. http://www.ijser.org/researchpaper/Study-of-Fold-and-Folded-Plates-in-Structural-Engineering.pdf
8. https://www.youtube.com/watch?v=N4KrZ_DczrE
9. https://www.youtube.com/watch?v=Ndv1rWr4ke4

Course Outcomes:

After the completion of the course students will be able to:

1. Understand the functional and structural behavior of shells and method of analysis with the equation of equilibrium by deriving the stress resultants and Flugges simulation equation.
2. Gain knowledge about DKJ equation of bending theory of analyzing and designing short and long walls and beam theory of cylindrical shells.
3. Understand the concepts of geometry, analysis and design of inverted umbrella type, elliptic, paraboloid, conoid and hyperbolic parabolic shapes.
4. Analyze the axisymmetrical by membrane theory and application of spherical shells and hyperboloid of revolution cooling towers.
5. Understand the structural behavior of folded plates with whitney method and Simpsons method and analysis of continuous and prestressed folded plates.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**2**	**2**	
CO2	**3**		**3**	**2**	**2**	**1**
CO3	**3**		**3**	**2**	**2**	
CO4	**3**		**3**	**2**	**2**	**1**
CO5	**3**		**3**	**2**	**2**	**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. OE– I		
Code: 70B12	COMPUTER ORIENTED NUMERICAL METHODS	L	T	P
Credits: 3		2	2	-

Course Objectives:

The objective of this course is to introduce various numerical techniques which are indispensible tools to solve system of equations. Various methods are used to reduce the global error involved in approximations. This course fills into this perceived need. The treatment should be informed by the fact that not only conceptual but also (and in some cases) more importantly numerical or computational methods are of essence.

MODULE I: [10 Periods]

Solutions of linear equations: Direct method – Cramer's rule, Gauss-Elimination method – Gauss-Jordan elimination – Triangulation (L-U Decomposition) method – Iterative methods Jacobi-Iteration method – Gauss-Seidel 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: [10 Periods]

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

MODULE III:Finite Difference and their Applications [10 Periods]

A. Introduction – Differentiation formulas by Interpolating parabolas – Backward and forward and central differences – Derivation of Differentiation formulae using Taylor series– Boundary conditions–Beam deflection.

B. 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: [09 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: [09 Periods]

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

TEXT BOOKS

1. M.K.Jain,S.R.K.Iyengarand R.K.Jain,"**Numerical methods for scientific and engineering computations**", New age international limited,2nd edition.
2. S.S. Sastry,"**Introductory Methods of Numerical Analysis**", Prentice-Hall of India Private Limited, 4th edition.

REFERENCES

1. Curtis I.Gerala"**Applied numerical analysis**",AddissionWasley – published campus.

2. Stevan C.Chopra and Raymond P.Canal "**Numerical methods for Engineers"**, McGraw Hill book company.
3. Dr. M.Shanta Kumar "**Computer based numerical analysis**", Khanna Book publishers, New Delhi.
4. William T.Vetterling"**Numerical recipes in example book (C)"**, Camebridge university press.

E – RESOURCES

1. http://textofvideo.nptel.iitm.ac.in/122102009/lec22.pdf (Eigen Value problems by Prof.T.K.V.Iyengar)
2. http://www.math.vt.edu/people/adjerids/homepage/teaching/SUM08/Math4445/eigenvalues.pdf (Eigen Value problems by S. Adjerid)
3. https://www.math.uh.edu/~jingqiu/math4364/spline.pdf (Spline Interpolation)
4. http://mathworld.wolfram.com/NumericalIntegration.html (Numerical Integration)
5. http://mathworld.wolfram.com/topics/ODESolving.html (Numerical solution of ODE)
6. http://www.sciencedirect.com/science/article/pii/0771050X75900182(Numerical Integration)
7. https://www.hindawi.com/journals/ijde/2016/8150497/ (Numerical solution of ODE)
8. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0054660 (Interpolation)
9. http://nptel.ac.in/courses/122107036/27 (Eigen value problems)
10. http://nptel.ac.in/courses/111101003/11 (Numerical Integration)
11. http://nptel.ac.in/courses/111101003/8 (Cubic spline Interpolation)
12. http://nptel.ac.in/courses/111101003/32 (multi step methods)
13. http://nptel.ac.in/courses/111101003/37 (power method)

Course Outcomes:

After the completion of the course students will be able to:

1. Demonstrate the representation of different numeric equation used to obtain approximate solutions for linear equations.
2. Apply linear interpolation and interpolating polynomials by different interpolation methods.
3. Apply the knowledge on finite difference and their applications.
4. Identify the solution for numerical differentiation and integration.
5. Evaluate the ordinary differential equation using Eulers and Taylors series method.

CO – PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1			3		2	
CO2	2		2			
CO3	2		2			
CO4	2					
CO5	3	1				

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. OE – I		
Code: 71110	RELIABILITY ENGINEERING	L	T	P
Credits: 3		2	2	-

Course Objectives:

To impart knowledge on concepts of reliability, discrete distributions and hierarchicalsystems.

MODULE I: **[10 Periods]**

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

MODULE II: **[10 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: **[10 Periods]**

A. Discrete Distributions: Density and distributions, Continuous Distributions – Normal distribution, Weibull distribution, Rayleigh distribution, Exponential distribution , uniform distribution and Dirichlet Continuous Distribution.

B. Numerical Characteristics of Random Variables – Mathematical expectation and variance, Laplace Transform.

MODULE IV: **[09 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: **[09 Periods]**

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

TEXT BOOKS

1. Balagurusamy E., "**Reliability Engineering**", McGraw Hill Education(India) Pvt. Ltd.
2. Roy Billinton& Ronald N. Allan"**Reliability Evaluation of Engineering Systems**", Springer.
3. Andrzej S. Nowak, Kevin R. Collins, "**Reliability of Structures**", CRC Press (Taylor & Francis Group), 2nd Edition.

E – RESOURCES

1. https://en.wikipedia.org/wiki/Reliability_engineering
2. http://www1.iitb.ac.in/~re/
3. http://sebokwiki.org/wiki/Reliability,_Availability,_and_Maintainability
4. http://web.utk.edu/~kkirby/IE591/ReliabEg_1.pdf
5. http://www.sciencedirect.com/science/article/pii/004579067390027X
6. https://link.springer.com/chapter/10.1007/978-3-642-35743-5_4
7. http://nptel.ac.in/courses/112107143/39

Course Outcomes:

After the completion of the course students will be able to:

1. Demonstrate the representation of different numeric equation used to obtain approximate solutions for linear equations.
2. Apply linear interpolation and interpolating polynomials by different interpolation methods.
3. Apply the knowledge on finite difference and their applications.
4. Identify the solution for numerical differentiation and integration.
5. Evaluate the ordinary differential equation using Eulers and Taylors series method.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1			**3**		**2**	
CO2	**2**		**2**	**1**		
CO3	**2**		**2**	**1**		
CO4	**2**					
CO5	**3**	**1**				

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. OE – I		
Code: 71111	GROUND IMPROVEMENT TECHNIQUES	L	T	P
Credits: 3		2	2	-

Course Objectives:

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

MODULE I:Introduction to Engineering Ground Modification [10 Periods]

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.

MODULEII:Mechanical Modification [10 Periods]

Principles Compaction control of soil densification – Properties of Compacted soil tests, Specification Dynamiccompaction requirements, Blasting,Tamping and Compaction piles of Vibrocompaction.

MODULE III:Hydraulic Modification [10 Periods]

A. Objectives and techniques, traditional dewatering methods and theirchoice, Design of dewatering system, Electro-osmosis and Filtration.

B. Drainage and seepage control with Geosynthetics, sand drains, Preloading and vertical drains, Electro-kinetic dewatering.

MODULE IV:Physical and Chemical Modification [09 Periods]

Modification by admixtures, Shotcreting and GMODULEingTechnology, Modification at depth by grouting, Crack Grouting and compaction grouting, Jet grouting, Thermal Modification, Ground freezing.

MODULE V:Modification by Inclusions and Confinement [09 Periods]

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., "**Engineering Principles of Ground Modification**", McGraw Hill publications, New York.
2. P.Purushothama Raj, "**Ground Improvement Techniques**", Laxmi Publications, India.

REFERENCES

1. M.P.Moseley and K.Krisch, "**Ground Improvement**", Taylor and Francis,2nd Edition.
2. Jones C. J. F. P., "**Earth Reinforcement and soil structures**",Butterworths, London.
3. K. Krisch&F.Krisch, "**Ground Control and Improvement**", John Wiley & Sons, 1994.
4. Peter G. Nicholson, "**Soil Improvement and Ground Modification Methods**", Elsevier Publishers

E – RESOURCES

1. https://theconstructor.org/geotechnical/ground-improvement-techniques-soil-stabilization/1836/
2. http://civil.emu.edu.tr/old_website/data/civl454/CH1-%20Int%20to%20gr%20modf.pdf

3. https://www.eqc.govt.nz/sites/public_files/documents/EQC-landtrials-infographic.pdf
4. gndec.ac.in/~igs/ldh/conf/SDP/Presentations/presentations/22-12.../GIT-SDP.pptx
5. http://www.sciencedirect.com/science/book/9780124080768
6. http://nptel.ac.in/courses/105104034/
7. http://nptel.ac.in/downloads/105108075/#
8. http://nptel.ac.in/courses/105108075/module1/Lecture02.pdf

Course Outcomes:

After the completion of the course students will be able to:

1. Understand the soil types and their insitu and laboratory tests
2. Gain knowledge about the principles of compaction control of soil densification and its tests.
3. Understand the soil dewatering techniques with respect to field conditions.
4. Gain knowledge about the grouting techniques for different field conditions.
5. Identify the soil reinforcements using different techniques and insitu methods.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**	**2**	**1**	**1**	**1**	
CO2	**2**	**1**	**1**	**1**		
CO3	**2**	**1**	**1**	**1**	**1**	**1**
CO4	**1**		**1**	**1**		
CO5	**2**		**3**	**1**	**2**	**1**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. I Semester		
Code: 71112	ADVANCED CONCRETE LABORATORY	L	T	P
Credits: 2		-	-	4

Course Objectives:

To impart knowledge on testing of fresh/hardened concrete and non destructive testing on concrete.

SYLLABUS:

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.

Course Outcomes:

After the completion of the course students will be able to:

1. Identify the properties of various materials used for making concrete.
2. Test the properties of fresh/ self compacting concrete.
3. Understand the properties of hardened concrete.
4. Perform nondestructive testing of hardened concrete.
5. Find the influence of W/c ratio and the usage of chemical admixtures.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	2	2	3
CO2	3	2	3	2	2	3
CO3	3	2	3	2	2	3
CO4	3	2	3	2	2	3
CO5	3	2	3	2	2	3

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. I Semester		
Code: 71113	SEMINAR - I	L	T	P
Credits: 2		-	-	4

Course Objectives:

To work on a specific technical topic in Structural Engineering and acquire the skills of written, oral presentation and acquire writing abilities for seminars and conferences.

SYLLABUS:

The students will work for four hours per week. They will be asked to give a presentation on any topic of their choice related to Structural Engineering and to engage in discussion with the audience. A brief copy of their presentation also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will defend their presentation. Evaluation will be based on the technical presentation and the report and also on the interaction shown during the seminar.

Course Outcome:

At the end of the course, students should be able to

1. Write technical documents to the standards
2. Give oral presentation on technical and general topics
3. Express ideas clearly with examples
4. Identify the research opportunities related to their area.
5. Communicate effectively.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1		3	2	2	2	
CO2		1	3	2	3	
CO3	2	3	2	3	1	
CO4	3	1	3	1	1	
CO5		3		2	2	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. II Semester		
Code: 71114	FINITE ELEMENT METHOD	L	T	P
Credits: 3		2	2	-

Course Objectives:

To impart knowledge on the basic principles of finite element analysis procedure and to perform 1D, 2D and 3D structural analysis using finite element methods.

MODULE I: **[10 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: **[10 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: **[10 Periods]**

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

B. 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: **[09 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.

MODULEV: **[09 Periods]**

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

TEXT BOOKS

1. Robert D.Cook, David S.Malkus, Michael E. Plesha& Robert J. Witt, "**Concepts and Applications of Finite Element Analysis**", John Wiley & Sons, 4th Edition.

REFERENCES

1. ZienkiewiczO.C. and Taylor R. L.,"**Finite element Method – Volume 1**", McGraw-Hill Publishing Co., 4th Edition.
2. KrishnamoorthyC. S., "**Finite element analysis: Theory and Programming**",McGraw Hill Education, 2nd Edition.
3. TirupathiR. Chandrupatla and Ashok D. Belegundu, "**Introduction to Finite Elements in**

Engineering",Pearson, 3rd Edition.

E – RESOURCES

1. https://www.comsol.co.in/multiphysics/finite-element-method
2. http://www.iitg.ernet.in/engfac/rtiwari/resume/usdixit.pdf
3. https://www.iitk.ac.in/tkic/workshop/FEM/ppt/TK_2.pdf
4. http://www.cs.rpi.edu/~flaherje/pdf/fea2.pdf
5. http://www4.ncsu.edu/~zhilin/TEACHING/MA587/chap9.pdf
6. http://what-when-how.com/the-finite-element-method/fem-for-two-dimensional-solids-finite-element-method-part-1/
7. https://en.wikipedia.org/wiki/Mindlin%E2%80%93Reissner_plate_theory
8. http://www.mat.unimi.it/users/lovadina/download/LMR-pp09-01.pdf
9. https://www.journals.elsevier.com/finite-elements-in-analysis-and-design/
10. https://www.hindawi.com/journals/mpe/finite.element/
11. http://nptel.ac.in/courses/112106135/
12. http://nptel.ac.in/courses/112104115/
13. http://nptel.ac.in/courses/105105041/

Course Outcomes:

After the completion of the course students will be able to:

1. Understand the basic concept of FEM with energy principles and understand fundamental theory of elasticity including plane stress, plane strain &axi symmetric problems.
2. Know the generation of stiffness matrix for 1D and 2D elements for plane stress, plane strain, generalized coordinates and shape function.
3. Understand isoperimetric elements, axi symmetric and 3D elements and their formulation.
4. Formulation of 4 noded isoperimetric for thin plates and shell elements.
5. Understand the non-linear analysis and application of FEM to special structures.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**2**	**2**	**1**
CO2	**3**		**3**	**2**	**2**	**1**
CO3	**3**		**3**	**2**	**2**	**1**
CO4	**3**		**3**	**2**	**2**	**1**
CO5	**3**		**3**	**2**	**2**	**1**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. II Semester		
Code: 71115	THEORY OF PLATES	L	T	P
Credits: 3		2	2	-

Course Objectives:

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

MODULE I: [10 Periods]

A. 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.

B. 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: Small Deflection Theory of Thin Rectangular Plates [10 Periods]

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: Circular and Orthotropic Plates [10 Periods]

A. 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.

B. 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: Plates on Elastic Foundations [09 Periods]

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: [09 Periods]

A. 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

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

TEXT BOOKS

1. S. Timoshenko& S. W. Krieger, "**Theory of Plates and Shells**", McGraw Hill Book Co., New York.
2. P. Szilard, "**Theory and Analysis of Plates–Classical and Numerical Methods**", Prentice Hall.

REFERENCES

1. K. Chandrashekhara, "**Theory of Plates**", University Press.
2. N. K. Bairagi, "**Shell Analysis**", Khanna Publishers.

E – RESOURCES

1. https://web.stanford.edu/~chasst/Course%20Notes/Introduction%20to%20the%20Theory%20of%20Plates.pdf
2. https://en.wikipedia.org/wiki/Bending_of_plates
3. http://imechanica.org/files/theory%20of%20plates.pdf
4. http://www.me.ust.hk/~meqpsun/Notes/Chapter3.pdf
5. http://dspace.library.iitb.ac.in/xmlui/bitstream/handle/10054/805/6102.pdf?sequence=1
6. https://www.elsevier.com/books/advances-in-the-theory-of-plates-and-shells/voyiadjis/978-0-444-88366-7
7. https://www.hindawi.com/journals/isrn/2014/291478/
8. https://arc.aiaa.org/doi/abs/10.2514/3.9477
9. https://ocw.mit.edu/courses/mechanical-engineering/2-081j-plates-and-shells-spring-2007/readings/lecturenote.pdf
10. http://www.nptel.ac.in/courses/105105041/module%206.pdf

Course Outcomes:

After the completion of the course students will be able to:

1. Analyze the cylindrical bending of uniformly loaded rectangular plates, with different end conditions the strain energy in pure bending by energy methods.
2. Understand small deflection theory of thin rectangular plates with uniform sinusoidal loading, hydrostatic by Navier and levy's solutions using various boundary conditions.
3. Establish relationship between slope, deflection, moments and curvature in circular plates for symmetric loading and bending of unisotropic plates and the determination of rigidities in various case and application to the theory of grid works.
4. Calculate the deflection of uniformly loaded simply supported rectangular plates resting on elastic foundation using Navier and levy's type solutions.
5. Understand the bending of plates under the combined action of in plane and lateral types of loads and application rectangular plates subjected to simple loading using finite difference methods.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**2**	**2**	
CO2	**3**		**3**	**2**	**2**	**1**
CO3	**3**		**3**	**2**	**2**	
CO4	**3**		**3**	**2**	**2**	**1**
CO5	**3**		**3**	**2**	**2**	**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. II Semester		
Code: 71116	PRESTRESSED CONCRETE STRUCTURES	L	T	P
Credits: 3		2	2	-

Course Objectives:

To impart knowledge on the principles of prestressed concrete structures, design of section for Flexure and Shear.

MODULE I: [10 Periods]

A. General Principles of Prestressed Concrete : Pre-tensioning and post-tensioning – Prestressingby straight, concentric, eccentric, bent and parabolic tendons – Different methods and systems ofprestressing like Hoyer system, Freyssinet system, MagnelBlaton system – Lee-Mccall system.

B. Losses of Prestress : Loss of prestress in pre-tensioned and post-tensioned members due tovarious 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 ofsections for flexure.

MODULE II: [10 Periods]

A. Design of Section for Flexure: Allowable stresses – Elastic design of simple beams havingrectangular and I-section for flexure – kern lines – cable profile and cable layout.

B. 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: [10 Periods]

A. Limit State design of partially prestressed concrete beams – Analysis and design of prestressed concrete pipes, tanks, slabs – one way and two way (numerical problems restricted to pipes and tanks only).

B. Short term deflections of uncracked members–Prediction of long-time deflections – load-deflection curve for a PSC beam – IS code requirements for maximum deflections.

MODULE IV:Transfer of Prestress in Pretensioned Members [09 Periods]

Transmission of prestressing force by bond –Transmission length – Flexural bond stresses – IS code provisions –Anchorage zone stresses inpost tensioned members – stress distribution in End block – Analysisbyapproximate,Guyon and Magnel methods – Anchorage zone reinforcement.

MODULE V:Statically Indeterminate Structures [09 Periods]

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)

TEXT BOOKS

1. N. Krishna Raju, "**PrestressedConcrete**", Tata McGraw Hill Education, 5th Edition.
2. S. Ramamrutham, "**Prestressed Concrete**", DhanpatRai Publishing Company Pvt. Ltd.

REFERENCES

1. N. Krishna Raju, "**Prestressed Concrete Problems and Solutions**", CBS Publishers and Distributors, 3rd Edition.
2. T.Y. Lin and Ned H. Burns, "**Design of prestressed Concrete Structures**", Wiley India Pvt.

Ltd., 3rd Edition.

E – RESOURCES

1. https://www.quora.com/What-is-the-basic-principle-of-pre-stressed-concrete
2. https://theconstructor.org/concrete/prestressed/lossess-in-prestress-of-prestressed-concrete/3287/
3. http://nptel.ac.in/courses/IIT-MADRAS/PreStressed_Concrete_Structures/pdf/2_Losses_in_Prestress/Section2.1.pdf
4. http://www.gf.uns.ac.rs/~zbornik/doc/ZR25.11.pdf
5. http://www.nptel.ac.in/courses/105106117/pdf/6_Deflection_Crack_Width/Section6.1.pdf
6. http://www.arpnjournals.com/jeas/research_papers/rp_2011/jeas_1211_604.pdf
7. http://ascelibrary.org/doi/abs/10.1061/(ASCE)0733-9445(1985)111%3A11(2464)
8. https://www.concrete.org/topicsinconcrete/topicdetail/prestressed
9. http://www.nptel.ac.in/courses/105106117/

Course Outcomes:

After the completion of the course students will be able to:

1. Realize the importance of prestressingin construction, methods and systems of prestressed concrete members.
2. Design the sections for flexure and shear by different prestressing techniques.
3. Acquire the knowledge of deflection of short and long term deflection using IS code provisions.
4. Analyze and design for the transmission of prestress in post tensioned members.
5. Design the statically indeterminate structures.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**		**3**	**2**	**2**	**1**
CO2	**2**		**3**		**1**	**1**
CO3			**3**		**2**	**1**
CO4	**3**	**2**	**3**		**1**	**1**
CO5			**3**		**1**	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. PE – III		
Code: 71117	REPAIR AND REHABILITATION OF BUILDINGS	L	T	P
Credits: 3		2	2	-

Course 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 practicing and budding engineers of the latest in repair materials and technologies, in order to maintain the serviceability of the structures.

MODULE I: **[10 Periods]**

Introduction – Deterioration of Structures – Distress in Structures – Causes and Prevention – Mechanism of Damage – Types of Damage.

MODULE II: **[10 Periods]**

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

MODULE III: **[10 Periods]**

A. Diagnosis and Assessment of Distress: Visual inspection – non destructive tests – ultrasonic pulse velocity method – rebound hammer technique – ASTM classifications – pullout tests – Bremor test – Windsor probe test.

B. Crack detection techniques – case studies – single and multistorey buildings – Fibreoptic method for prediction of structural weakness – Damage Assessment.

MODULE IV: **[09 Periods]**

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

MODULE V: **[09 Periods]**

A. Strengthening of Structures–Strengthening Methods–Retrofitting–Jacketing – strengthening by pre-stressing – case studies – bridges – water tanks – cooling towers – heritage buildings – high rise buildings.

B. Health Monitoring of Structures–Useof Sensors – Building Instrumentation.

TEXT BOOKS

1. Peter H. Emmons, "**Concrete Repair and Maintenance Illustrated**", RS Means Company Inc,
2. W. H. Ransom, "**Building Failures: Diagnosis and Avoidance**", Routledge, 2nd Edition.

REFERENCES

1. A.R. Santhakumar, "**Concrete Technology**", Oxford University Press.
2. Maierhofer Christiane, "**Non-Destructive Evaluation of Reinforced Concrete Structures Volume 1**", Woodhead Publishing Limited.
3. B.L. Gupta and Amit Gupta, "**Maintenance and Repair of Civil Structures**", Standard Publications.

E – RESOURCES

1. https://theconstructor.org/concrete/repair-rehabilitation-concrete-structure-failure-damage/13870/
2. https://theconstructor.org/concrete/distress-of-concrete-and-remedial-measures/7361/
3. https://theconstructor.org/concrete/inspection-of-concrete-structures-i/863/
4. http://criteriumhomeinspection.com/sites/default/files/content/bulletins/structural_inspection.pdf
5. https://civilconstructionresourcez.wordpress.com/2012/07/14/shotcrete-and-gunite/
6. https://theconstructor.org/structural-engg/strengthening-structures/1576/
7. https://www.elsevier.com/books/repair-and-rehabilitation-of-structures/madhavi/978-0-12-811184-0
8. http://icjonline.com/journals/201202feb/files/2012_02_icj%20e%20journal.pdf
9. https://www.academia.edu/9171834/Repair_and_Rehabilitation_of_Structures
10. http://cpwd.gov.in/Units/handbook.pdf
11. http://nptel.ac.in/courses/114106035/1

Course Outcomes:

After the completion of the course students will be able to:

1. Understand the distress and deterioration in structures their causes, prevention, types and mechanism of damages.
2. Understand the causes, mechanism and prevention of corrosion of steel reinforcement and fire rating of structures.
3. Understand the symptoms and diagnosis of distress, damage assessment using NDT.
4. Understand repair of concrete structures and under water structures using guniting, shotcrete and underpinning.
5. Understand various methods of strengthening like retrofitting, jacketing and health monitoring of structures using sensors and building instrumentation.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**	**1**	**3**	**2**	**1**	**2**
CO2	**2**		**3**	**2**	**2**	**1**
CO3	**3**		**3**	**3**	**2**	**1**
CO4	**2**		**3**	**2**	**1**	**1**
CO5			**3**	**3**	**2**	**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. PE – III		
Code: 71118	COMPOSITE MATERIALS	L	T	P
Credits: 3		2	2	-

Course Objectives:

To get the knowledge on requirements of structural materials and behaviour of glass fibre-reinforced laminates and basic fracture mechanics.

MODULE I: **[10 Periods]**

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

MODULE II: **[10 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: **[10 Periods]**

A. 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.

B. Glass Reinforced Composites: Introduction, Continuously reinforced laminates –uni-directionally and multi directionally continuously reinforced laminates, discontinuously reinforced laminates – Stiffness and Strength properties.

MODULE IV: **[09 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: **[09 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.

TEXT BOOKS

1. M.Holmes and D.J.Just, "**Glass Fibre Reinforced Plastics in Structural Engineering**", Elsevier Science Ltd.
2. MadhujitMukhopadhyay, "**Mechanics of Composite materials and Structures**" University Press.

REFERENCES

1. George C. Sih and Alberto Carpinteri, "**Advanced Technology for Design and Fabrication of Composite Materials and Structures**", Springer.

2. Jack R. Vinson and Robert L. Sierakowski, "The Behaviour of Structures Composed of Composite Materials", Springer, 2nd Edition.

E – RESOURCES:

1. https://en.wikipedia.org/wiki/Composite_material
2. http://compositebuild.com/wp-content/uploads/2013/07/Composite-Materials-in-Building-and-Construction-Applications.pdf
3. http://www.tifac.org.in/index.php?option=com_content&id=544:composites-in-civil-engineering&catid=85:publications&Itemid=952
4. http://www.compositesone.com/product/industries/construction/
5. http://www.claisse.info/2010%20papers/l16.pdf
6. http://ksm.fsv.cvut.cz/~sejnom/download/pm10_tisk.pdf
7. https://en.wikipedia.org/wiki/Fracture_mechanics
8. http://journals.sagepub.com/home/jcm
9. https://www.journals.elsevier.com/engineering-fracture-mechanics/
10. http://nptel.ac.in/courses/114106035/1

Course Outcomes:

After the completion of the course students will be able to:

1. Understand requirements of structural materials and nature of homogeneous and composite materials.
2. Understand stress-strain relationships and strength, stiffness characteristics of composite laminate and glass reinforced laminate.
3. Understand the characteristics of glass fiber reinforced laminate and glass reinforced composites.
4. Understand GRP properties relevant to structural design.
5. Understand different types and mechanism of fractures in structures.

CO – PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1			2		3	
CO2	2		2			
CO3	2		2			
CO4			2		2	
CO5	2		2			

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. PE – III		
Code: 71119	STABILITY OF STRUCTURES	L	T	P
Credits: 3		2	2	-

Course Objectives:

To impart knowledge on behaviour of beam columns, elastic buckling of bars and frames and torsion buckling.

MODULE I: **[10 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: **[10 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: **[10 Periods]**

A. Inelastic Buckling: Buckle line of straight bar – Double modulus theory – Tangent modulus theory, Inelastic lateral Buckling.

B. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae for design – various end conditions

MODULE IV: **[09 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: **[09 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.

TEXT BOOKS

1. Stephen P. Timshenko&James M. Gere, "**Theory of Elastic Stability**", Dover Publications Inc. 2nd Edition.

REFERENCES

1. Blunch, "**Stability of metallic structures**", Tata McGraw Hill.
2. Wai-Fah Chen & Toshio Atsuta, "**Theory of Beam-Columns Vol. I**", J. Ross Publishing Classics.

E – RESOURCES

1. http://www.colorado.edu/engineering/CAS/courses.d/Structures.d/IAST.Lect23.d/IAST.Lect23.pdf
2. https://theconstructor.org/structural-engg/stability-of-structure/1887/
3. http://www.brad.ac.uk/staff/vtoropov/burgeon/thesis_sameh/chap3.pdf

4. https://rules.dnvgl.com/docs/pdf/DNV/cn/2004-04/Cn30-1.pdf
5. http://civildigital.com/lateral-torsional-buckling-beams-lateral-deflection-torsion/
6. http://www.worldscientific.com/worldscinet/ijssd
7. http://civil.northwestern.edu/people/bazant/PDFs/Papers/S36.pdf
8. http://nptel.ac.in/syllabus/105999912/

Course Outcomes:

After the completion of the course students will be able to:

1. Solve the differential equation for beam column along with various boundary conditions and end conditions.
2. Learn the buckling of members and frames with various boundary conditions and forces acting up on them using energy methods.
3. Understand the in elastic buckling using modulus theories and develop empirical formulas for design.
4. Find out the torsion buckling for uniform and non uniform thin walled bars of open cross section.
5. Learns the behavior of buckling and bending of simply supported rectangular plates and derive the plates subjected to compression in one and two direction.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**		**3**	**2**	**1**	**1**
CO2	**1**		**3**	**2**	**1**	**1**
CO3	**1**		**3**	**2**	**1**	**1**
CO4	**1**		**3**	**2**	**1**	**1**
CO5	**2**		**3**	**2**	**3**	**1**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. PE – IV		
Code: 71120	ADVANCED STEEL DESIGN	L	T	P
Credits: 3		2	2	-

Course Objectives:

To design the simple, eccentric connections and design of industrial buildings and steel bunkers.

MODULE I: Simple Connections –Riveted, Bolted Pinned and Welded Connections: **[10 Periods]**

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: Eccentric and Moment Connections [10 Periods]

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

MODULE III: Analysis and Design of Industrial Buildings [10 Periods]

A. 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.

B. Design of purlins for roofs, design of built up purlins, Design of knee braced trusses and stanchions. Design of bracings.

MODULE IV: Design of Steel Truss Girder Bridges [09 Periods]

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: Design of Steel Bunkers and Soils [09 Periods]

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

TEXT BOOKS

1. Subramaniam N., "**Design of Steel Structures**", Oxford University Press.
2. Dayaratnam P., "**Design of Steel Structures**", S. Chand& Company.

REFERENCES

1. S. S. Bhavikatti, "**Design of Steel Structures – by Limit State Method as per IS:800-2007**", I K International Publishing House Pvt. Ltd., 4th Edition.
2. Dr. Ramachandra&VirendraGehlot, "**Design Steel Structures Volume – II**", Scientific Publishers.
3. S.K. Duggal, "**Limit State Design of Steel Structures**", Tata McGraw Hill Education Private Ltd., 2nd Edition.

4. Indian Standard Code IS:800-2007.

E – RESOURCES

1. http://steel.fsv.cvut.cz/suscos/PP/1C03-12-Footbridges.pdf
2. http://www.bridgetochina.org.hk/download/it_transport_manual_part2.pdf
3. https://theconstructor.org/structural-engg/structural-design-of-bunkers-with-procedure-and-design-considerations/14630/
4. http://gala.gre.ac.uk/6974/1/WCA091230.pdf
5. http://nptel.ac.in/courses/105106113/2_industrial_building/1_introduction.pdf
6. http://www.springer.com/engineering/civil+engineering/journal/13296
7. http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1867-0539
8. http://nptel.ac.in/courses/105106112/
9. http://www.nptelvideos.in/2012/11/design-of-steel-structures.html
10. http://nptel.ac.in/courses/105106113/

Course Outcomes:

After the completion of the course students will be able to:

1. Analyze the behavior of simple connections like bolted, riveted, pinned welded and design them for axial forces.
2. Analyze the behavior of bolted, welded connections and design them for eccentric and moment connections.
3. Analyze and design of industrial buildings for various loads and load combinations.
4. Design of steel truss bridges and other components.
5. Carry out wind load calculations for tall structures and design of steel chimneys.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**1**		
CO2	**3**		**3**	**1**	**1**	**1**
CO3	**3**		**3**	**2**	**1**	**1**
CO4	**3**	**1**	**3**	**2**	**1**	**1**
CO5	**3**	**1**	**3**	**3**	**1**	**1**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. PE – IV		
Code: 71121	DESIGN OF SUB STRUCTURES	L	T	P
Credits: 3		2	2	-

Course Objectives:

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

MODULE I: Shallow Foundations [10 Periods]

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

MODULE II: Raft Foundations [10 Periods]

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

MODULE III: Pile Foundations [10 Periods]

A. Introduction – Types of pile foundations – load carrying capacity – structural design of straight piles – Structural design of pile

B. Reinforcement details of pile and pile caps different shapes of piles cap – structural design of pile cap.

MODULE IV: Design of Retaining Walls [09 Periods]

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

MODULE V: Machine Foundations [09 Periods]

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 I.S. Codes. Vibration isolation – types and methods of isolation –Isolating materials and their properties.

TEXT BOOKS

1. Swami Saran, "**Analysis and Design of Substructures**", CRC Press, 2nd Edition.
2. P. C. Varghese, "**Design of Reinforced Concrete Foundations**", PHI Learning Pvt. Ltd., 1st Edition.
3. Nainan P. Kurain, "**Design of foundation systems-Principles and Practice**", Alpha Science International Ltd., 3rd Edition.
4. Srinivasulu, P and Vaidyanathan, C. V., "**Handbook of Machine Foundations**" Structural Engineering Research Centre.

REFERENCES

1. Bowles J.E., "**Foundation Analysis and Design**", McGraw Hill Education, 5th Edition.
2. Tomlinson.M.J, "**Foundation Design and Construction**", Pitman Publishing, 2nd Edition.
3. Braja M. Das, "**Principles of Foundation Engineering**", Cengage, 7th Edition.
4. Narayan V. Nayak"**Foundation design manual**",DhanpatRai Publications Pvt. Ltd., 6th Edition.
5. ShamsherPrakashand Vijay K Puri, "**Foundations for Machines : Analysis and Design**" John Wiley and Sons.

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

E – RESOURCES

1. http://nptel.ac.in/courses/105101083/download/lec16.pdf
2. http://nptel.ac.in/courses/105101083/download/lec20.pdf
3. https://theconstructor.org/structural-engg/design-of-raft-foundation/3212/
4. http://nptel.ac.in/courses/105108075/module8/Lecture31.pdf
5. https://theconstructor.org/geotechnical/types-of-machine-foundations/8258/
6. http://nptel.ac.in/courses/105101083/download/lec32.pdf
7. http://ascelibrary.org/doi/abs/10.1061/(ASCE)GM.1943-5622.0000237
8. http://www.enganalytics.com/publications-category/49-deep-and-shallow-foundations.html
9. http://nptel.ac.in/courses/105106144/
10. http://nptel.ac.in/courses/105107120/

Course Outcomes:

After the completion of the course students will be able to:

1. Acquire the knowledge about the soil investigation and design of different footings.
2. Design the raft foundation and its requirements.
3. Design the pile foundation and its reinforcement details.
4. Analyze and design for various types of retaining walls for its stability.
5. Analyze and design for reciprocating and impact machines as per IS codes and isolation methods.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**1**		
CO2	**3**		**3**	**1**	**1**	**1**
CO3	**3**		**3**	**2**	**1**	**1**
CO4	**3**	**1**	**3**	**2**	**1**	**1**
CO5	**3**	**1**	**3**	**3**	**1**	**1**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. PE – IV		
Code: 71122	EARTHQUAKE RESISTANT DESIGN OF BUILDINGS	L	T	P
Credits: 3		2	2	-

Course Objectives:

To impart knowledge on earthquake resistant design of RC members – structural models for frame buildings.

MODULE I: **[10 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: **[10 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: **[10 Periods]**

A. 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.

B. 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: **[09 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: **[09 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.

TEXT BOOKS

1. S. K. Duggal, "**Earthquake Resistant Design of structures**", Oxford University Press, 2nd Edition.
2. PankajAgarwal and Manish Shrikhande, "**Earthquake Resistant Design of structures**", Prentice Hall of India Pvt. Ltd.

REFERENCES

1. T. Paulay and M. J. N. Priestley, "**Seismic Design of Reinforced Concrete and Masonry Building**", John Wiley & Sons.
2. AnandS.Arya, "**Masonry and Timber structures including Earthquake Resistant Design**", Nemchand& Sons, 6th Edition.
3. MihaTomazevic, "**Earthquake Resistant Design of Masonry Building**", Imperial College Press.
4. C.V.R. Murty, "**Earthquake Tips – Learning Earthquake Design and Construction**".National Information Centre of Earthquake Engineering (NICEE), IIT Kanpur.

E – RESOURCES

1. https://www.nicee.org/EQTips.php
2. https://www.nicee.org/iaee/E_Chapter3.pdf
3. http://www.iitk.ac.in/nicee/wcee/article/10_vol7_3659.pdf
4. http://www.nzsee.org.nz/db/Bulletin/Archive/04(2)0222.pdf
5. https://c.ymcdn.com/sites/www.nibs.org/resource/resmgr/BSSC/P-749_Chapter4.pdf
6. http://www.iitk.ac.in/nicee/IITK-GSDMA/NSE_002_31May2013.pdf
7. http://www.iitk.ac.in/nicee/wcee/article/11_1460.PDF
8. https://link.springer.com/chapter/10.1007%2F978-1-4471-2055-1_6#page-1
9. http://ieeexplore.ieee.org/document/1145407/?reload=true
10. http://nptel.ac.in/courses/105101004/
11. http://nptel.ac.in/courses/105105104/pdf/m16l39.pdf

REFERENCE CODES

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

Course Outcomes:

After the completion of the course students will be able to:

1. Understand earthquake phenomenon cause of earthquakes, faults, plate tectonics, seismic waves and terms associated with earthquake and measuring instruments.
2. Study the functional planning, continuous load path, simplicity and symmetry and learn design earthquake loads, basic load combinations, seismic methods of analysis.
3. Understand the principles of earthquake resistant design of RC members, structural seismic design and the behavior of masonry building, unreinforced and reinforced masonry walls, box action and bands, analysis and lateral load on masonry buildings.
4. Understands the strategies of structural walls, sectional shapes, variation in elevation, cantilever walls without openings, prevention and isolation of non structural damage.

5. Understand the ductility considerations in earthquake design of RC buildings and the design capacities for beams and columns.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**		**3**	**2**	**1**	**1**
CO2	**1**		**3**	**2**	**1**	**1**
CO3	**1**		**3**	**2**	**1**	**1**
CO4	**1**		**3**	**2**	**1**	**1**
CO5	**2**		**3**	**2**	**3**	**1**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. OE – II		
Code: 70B13	MATHEMATICAL PROGRAMMING	L	T	P
Credits: 3		2	2	-

Course Objectives:

This course deals with the extremely important topics under the broad umbrella of optimization. This is synonymous with efficiency which is the underlying prime rationale for all scientific and technological advances and progress.

MODULE I: Linear Programming [10 Periods]

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

MODULE II: Integer Linear Programming [10 Periods]

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

MODULE III: Dynamic Programming [10 Periods]

A. Belman's Principle of optimality; recursive relations

B. Solution of L.P. Problem; simple examples.

MODULE IV: Non-Linear Programming [09 Periods]

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

MODULE V: Search Methods [09 Periods]

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

TEXT BOOKS

1. J.C.Pant, "**Introduction to Optimization**", Jain brothers; New Delhi.
2. S.S.Rao, "**Optimisation theory and applications**", Wiley Eastern Ltd., New Delhi.

REFERENCES

1. K.V.Mital, "**Optimization method**", Wiley Eastern Ltd., New Delhi.
2. J.K. Sharma, "**Introduction to OR**"
3. S.D.Sharma, "**Introduction to OR**"

E – RESOURCES

1. https://www.math.ucla.edu/~tom/LP.pdf (Linear Programming by Thomas S. Ferguson)
2. https://web.stanford.edu/class/msande310/310trialtext.pdf (Non-Linear Programming).
3. https://www.cs.cmu.edu/~avrim/451f09/lectures/lect1001.pdf (Dynamic programming).
4. http://www.doc.ic.ac.uk/~br/berc/integerprog.pdf (Integer Linear programming).
5. http://esatjournals.net/ijret/2013v02/i07/IJRET20130207012.pdf(Integer Linear programming).

6. http://www.sciencedirect.com/science/article/pii/S0888613X10000897(Linear programming).
7. https://ucilnica1213.fmf.unilj.si/pluginfile.php/11706/mod_resource/content/0/HELDKarpAlgoritemZaPTP_clanek.pdf (Dynamic programming).
8. http://nptel.ac.in/courses/111102012/ (Linear programming).
9. http://nptel.ac.in/courses/111105039/32 (Non-Linear Programming).
10. http://nptel.ac.in/courses/111102012/ (Integer Linear programming).
11. http://nptel.ac.in/courses/106101060/18 (Dynamic programming).
12. http://nptel.ac.in/courses/111105039/27 (Fibonacci search).

Course Outcomes:

After the completion of the course students will be able to:

1. Find feasible solution to LPP by various methods.
2. Minimize the cost and time by using Travelling salesmen Problem.
3. Understand various methods Dynamic programming.
4. Understand the various concepts on Non-Linear programming.
5. Understand the various concepts of Search methods.

CO – PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3				3	1
CO2	3		2		3	1
CO3	3			2	3	1
CO4	3		1		3	2
CO5	3			1	3	2

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. OE – II		
Code: 71123	ADVANCED FOUNDATION ENGINEERING	L	T	P
Credits: 3		2	2	-

CourseObjectives:

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: Soil Exploration [10 Periods]

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: Shallow Foundations andBearing Capacity [10 Periods]

Shear Failure; Effect of Water Table; Footings withEccentric 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: Settlement [10 Periods]

A. Components–Immediate, Primary and Secondary Settlements, Consolidation, Stressesand Displacements in Homogeneous, Layered and Anisotropic Soils; Bearing Pressure using SPT, CPT, Dilatometer and Pressure meter.

B. Settlement of foundations on Sands – Schmertmann and Burland&Burbridge methods; Structure Tolerance to Settlement and Differential Settlements, Rotation, codal Provisions.

MODULE IV: Deep Foundations [09 Periods]

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: Special Topics of Foundation Engineering [09 Periods]

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 andevaluating expansive soils, typical structural distress patterns and Preventive design & construction measures.

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

TEXT BOOKS

1. Das B. M., "**Principles of Foundation Engineering**", Wadsworth Publishing Co Inc; 7th Edition.
2. Donald P. Coduto, "**Foundation Design: Principles and Practices**", Prentice Hall; 2nd Edition.

REFERENCES

1. Joseph E. Bowles, "**Foundation Analysis and Design**", McGraw-Hill Companies Inc., 5th Edition.
2. Poulos, H. G. & Davis, E. H., "**Pile Foundation Analysis and Design**", john wiley& sons inc.
3. Tomlinson, M. J., "**Foundation Design and Construction**", Prentice Hall, 7th Edition.
4. Baecher, G.B. & Christian, J.T., "**Reliability and Statistics in Geotechnical Engineering**", Wiley Publications.

E – RESOURCES

1. http://civilblog.org/2015/09/05/6-different-methods-of-boring-used-for-soil-exploration/
2. https://en.wikipedia.org/wiki/Shallow_foundation
3. https://theconstructor.org/geotechnical/types-of-shallow-foundations/5308/
4. https://foundationtechnology.com/causes-foundation-settlement/
5. https://en.wikipedia.org/wiki/Deep_foundation
6. http://www.aegweb.org/?page=ExpansiveSoil
7. http://www.foundation-repair-guide.com/expansive-soil.html
8. http://www5.unitn.it/Biblioteca/it/Web/EngibankFile/703982.pdf
9. http://www.icevirtuallibrary.com/doi/abs/10.1680/feng.12.00016
10. http://nptel.ac.in/courses/105105039/
11. http://nptel.ac.in/courses/105108069/
12. http://www.nptelvideos.in/2012/11/foundation-engineering.html

Course Outcomes:

After the completion of the course students will be able to:

1. Get an insight of problems faced during sight investigations to handling soil exploration in foundation problems and understand behaviour of soil.
2. Design/ handle slope stability and evaluation of bearing for shallow foundations.
3. Understand the behaviour of soil to settlement and calculation of bearing pressure using various methods.
4. Identify and analyse the need for different types of piles and pile groups.
5. Evaluate the properties of foundations on collapsible and expansive soil and to have knowledge in reliability based design.

CO – PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		2	2	2	
CO2	3		2		2	1
CO3	3		2	1	2	1
CO4	3		2		2	1
CO5	3		2	1	2	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. OE – II		
Code: 71124	RETAINING STRUCTURES	L	T	P
Credits: 3		2	2	-

Course Objectives:

To design the earth retaining structures used in construction of road/railways/pipe lines/open excavations.

MODULE I: Earth Pressure Theories [10 Periods]

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

MODULE II: Conventional Retaining Wall [10 Periods]

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: Flexible Walls [10 Periods]

A. Sheet pile walls, Construction methods – Design of sheet pile walls – various methods of construction of sheet pile walls.

B. Cantilever and Anchored sheet pile wall – Design of cantilever and anchored sheet pile wall – construction methods.

MODULE IV: Reinforced Soil Walls/Mechanically Stabilised Earth [09 Periods]

Failure mechanisms – bond and rupturefailures, Analysis methods, Limit equilibrium method – Internal and external stability, Static and seismic analyses.

MODULE V: Braced Cuts [11 Periods]

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

TEXT BOOKS

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

REFERENCES

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

E – RESOURCES

1. http://www.aboutcivil.org/theories-of-earth-pressure.html
2. https://gradeup.co/retaining-wall-earth-pressure-theories-i-ef811008-982a-11e6-91c4-20dd018ef821
3. http://www.deepexcavation.com/en/sheet-pile-walls
4. https://theconstructor.org/geotechnical/sheet-pile-walls/7131/
5. https://en.wikipedia.org/wiki/Mechanically_stabilized_earth
6. http://civilengineersforum.com/braced-cut-types-uses/

7. http://www.sciencedirect.com/science/article/pii/S1110016813000744
8. http://ascelibrary.org/doi/abs/10.1061/(ASCE)GT.1943-5606.0001356
9. http://www.gf.uns.ac.rs/~zbornik/doc/NS2015.051.pdf
10. http://nptel.ac.in/courses/105106052/9
11. http://nptel.ac.in/courses/105101083/download/lec26.pdf

Course Outcomes:

After the completion of the course students will be able to:

1. Study the earth pressure theories for cohesion and non cohesion soils and also understands the stresses due to compaction and surcharge loads.
2. Study the types and proportioning of retaining walls, stability factors of gravity and cantilever walls and also learns about backfill material and drainage.
3. Study and understand the sheet pile walls and construction methods of cantilever and anchored sheet pile wall.
4. Learn the failure methods and analysis methods of reinforced earth walls.
5. Learn the earth pressure in braced cuts for stability, yielding and settlement of ground surrounding excavation.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	**Programme Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**	**2**	**1**	**1**	**1**	
CO2	**2**	**1**	**1**	**1**		
CO3	**2**	**1**	**1**	**1**	**1**	**1**
CO4	**1**		**1**	**1**		
CO5	**2**		**3**	**1**	**2**	**1**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. II Semester		
Code: 71125	CAD LABORATORY	L	T	P
Credits: 2		-	-	4

Course Objectives:

The objective of the course is to make the students familiar with design of structural components like retaining walls and water tanks and to draw detailing diagram using AutoCAD.

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 multistoried space frame using STAAD Pro.
8. Analysis of Bridge deck slab.

Course Outcomes:

After the completion of the course students will be able to

1. Solve a matrix problem using arrays and functions.
2. Bending moment and shear force diagrams using "C".
3. Design beams, columns, slabs and footings using Excel.
4. Analyse a truss and a multistoried frame using STAAD Pro.
5. Analyse a bridge deck slab using STAAD Pro.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	2	2	3
CO2	3	2	3	2	2	3
CO3	3	2	3	2	2	3
CO4	3	2	3	2	2	3
CO5	3	2	3	2	2	3

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. II Semester		
Code: 71126	SEMINAR – II	L	T	P
Credits: 2		-	-	4

Course Objectives: To promote deeper understanding the basic concepts, physical mechanism behind the processes, participate in scientific analysis and comprehensive of scientific writing of verbal presentation. This course is to introduce post graduate student to ideas, methods and techniques that can improve the content and presentation of scientific seminars.

Course Outcomes:

At the end of the course, students should be able to

1. Write technical documents to the standards
2. Give oral presentation on technical and general topics
3. Express ideas clearly with examples
4. Identify the research opportunities related to their area.
5. Communicate effectively.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1		3	2	2	2	
CO2		1	3	2	3	
CO3	2	3	2	3	1	
CO4	3	1	3	1	1	
CO5		3		2	2	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. III Semester		
Code: 71127	COMPREHENSIVE VIVA VOCE	L	T	P
Credits: 6		-	-	-

Course Objective: The objective of the course is to make the students familiar on the courses in previous semesters.

Course Outcomes:

After the completion of this course the student will be able to

1. comprehensively to answer questions from all the courses of two semesters.
2. Attain Oral Presentation skills by answering questions in precise and concise manner.
3. Gain confidence
4. Develop inter-personal skills.
5. Cognitive thinking on applications of the courses of two semesters

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	3	1	3	
CO2		1	3	2	2	
CO3		2	3	2	2	
CO4		1	1	3	2	1
CO5	3	2	3	2	2	1

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. III Semester		
Code: 71128	PROJECT WORK PART – I	L	T	P
Credits: 16		-	-	-

Course Objectives: To utilize basic knowledge and advance techniques to make product/process using experimentation and/or simulation and expose to others as document and oral presentation.

Course Outcomes:

At the end of the course, students should be able to

1. Summarize the work completed in the form of technical documents
2. Specify the techniques implemented or to be implemented
3. Explain the results obtained in Project Phase I
4. Summarize the ultimate finding of the project
5. Detailed presentation of work carried out.

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	3	1	2	1
CO2	3		3	2	2	3
CO3	1	3	2	1	3	2
CO4	3	2	2		2	2
CO5		3	3	2	1	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. IV Semester		
Code: 71129	PROJECT WORK PART – II	L	T	P
Credits: 6		-	-	-

Course Objectives: To utilize science and engineering to make product/process using innovative techniques, predict the results and prepare technical documents.

Course Outcomes:

At the end of the course, students should be able to

1. Identify project goals, constraints, deliverables, performance criteria, control needs and requirements.
2. Implement concepts, tools and techniques to do quality projects.
3. Adapt projects in response to issues that arise internally and externally.
4. Interact with team and stakeholders in a professional manner, respecting differences, to ensure a collaborative project environment.
5. Utilize technology tools for communication, collaboration, information management, and decision support.

CO – PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	3	2		2
CO2	3		3	2	2	2
CO3	2		2	1	3	1
CO4	1		2	3	3	1
CO5		3	2	3	2	3

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M. Tech. IV Semester		
Code: 71130	PROJECT VIVAVOCE	L	T	P
Credits: 16		-	-	-

Course Objectives: To utilize science and engineering to make product/process using innovative techniques, predict the results and prepare technical documents.

Course Outcomes:

After the completion of this course the student will be able to

1. Prepare comprehensive report based on literature survey.
2. Select a suitable problem relevant to Structural Engineering with an attention to real life problems faced by the society
3. Find solution either through simulation or through practical work.
4. Present the results from the work comprehensively through presentation.
5 Present his/her work in a conference or publish the work in a peer reviewed journal

CO – PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COS	Programme Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	1	2	2
CO2	3		3	2	3	2
CO3	3		3	2	3	2
CO4	2	3	2	2	1	1
CO5	3	3	3	2	2	2