MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

Madanapalle

(UGC-AUTONOMOUS)

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MASTER OF TECHNOLOGY

STRUCTURAL ENGINEERING

ACADEMIC REGULATIONS (R16)
COURSE STRUCTURE
&
DETAILED SYLLABI
For the students admitted to

Master of Technology in Structural Engineering from the academic year 2017-18 Batches onwards

M. Tech Regular Two Year P. G. Degree Course

VISION AND MISSION OF THE INSTITUTION

Vision

Become a globally recognized research and academic institution and thereby contribute to technological and socio-economic development of the nation.

Mission

To foster a culture of excellence in research, innovation, entrepreneurship, rational thinking and civility by providing necessary resources for generation, dissemination and utilization of knowledge and in the process create an ambience for practice-based learning to the youth for success in their careers.

VISION AND MISSION OF THE DEPARTMENT

Vision

Provide quality education to the students to excel in research and academics in the field of Civil Engineering and thereby to contribute to technological and socio-economic development of the nation.

Mission

- Impart quality education to create and develop research culture with deep sense of commitment and enable the industries to adopt the research outputs;
- Produce engineers with scientific temperament and moral values in the field of Civil Engineering; and
- Develop innovative solutions for problems in Civil Engineering for the welfare of all sections of the society.

ACADEMIC REGULATIONS (R16)
(2017-2018)

Applicable for students admitted to Master of Technology from 2017-18

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE
(AUTONOMOUS)

Affiliated to JNTUA, Anantapur & Approved by AICTE, New Delhi
Recognised Research Center
Accredited by NBA for CSE, ECE, EEE & ME
World Bank funded Institute
Recognised by UGC under the sections 2(f) and 12(B) of the UGC act 1956
Recognised as Scientific & Industrial Research Organization by DSIR of DST

1. Eligibility for Admissions

Admission to the M.Tech program shall be made subject to the eligibility, qualifications and specialization prescribed by the University for each Program, from time to time.

Admissions shall be made either on the basis of merit rank obtained by the qualified candidates at an Entrance Test conducted by the University or on the basis of GATE/ PGECET score, subject to reservations prescribed by the University or Government policies from time to time.

2. Program pattern

2.1 A candidate after securing admission must pursue the M.Tech program of study for four semesters.

2.2 Each semester shall be for a minimum of 90 instruction days including examinations.

2.3 A candidate admitted to a program should complete it within a period equal to twice the prescribed duration of the program from date of admission.

3. Attendance

3.1 A student shall be eligible to appear for Semester End examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the courses in a semester.

3.2 Shortage of Attendance below 65% in aggregate shall in NO case be condoned.

3.3 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

3.4 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

3.5 A student will not be promoted to the next semester unless he/she satisfies the attendance requirements of the present semester, as applicable. They may seek readmission for that semester when offered next.

3.6 A stipulated fee shall be payable towards condonation of shortage of attendance to the Institution.

4. Evaluation

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

4.1 For the theory courses 50 marks will be for the End Semester Examination.

While 30 marks will be for Internal tests, based on two Mid Term-tests held, one in the

middle of the Semester (I-II units) and another immediately after the completion of instruction (III, IV & V) units with three questions to be answered out of four in 2 hours, evaluated for 30 marks. Both tests shall carry equal weightage.

Another 20 marks will be based on submission of four assignments (5marks each).
The first and second assignments are to be submitted before I Mid-Term Examination and the third and fourth assignments are to be submitted before II Mid-Term Examination.

4.2 For practical courses, 50 marks shall be for the End Semester Examinations and 50 marks will be for internal evaluation based on the day to day performance.

4.3 For Seminar there will be an internal evaluation of 100 marks. A candidate has to secure a minimum of Grade D to be declared successful. The assessment will be made by a board consisting of HOD and two internal experts at the end of IV semester instruction.

4.4 The minimum letter grade required for pass in each theory/practical course is **"P"** (internal evaluation + End Semester Examination). However, in the end semester examination for a course (theory/practical) it is mandatory to secure a minimum of 40% of the total marks.

4.5 In case the candidate does not secure the minimum academic requirement in any of the courses (as specified in 4.4.) he has to reappear for the Semester Examination either Supplementary or regular in that course, or repeat the course when next offered or do any other specified course as may be required.

4.6 In case any student is unable to appear at any one of the two mid-term tests in any theory course for genuine reasons (for example; medical), the Principal, Head of the department and concern faculty at their discretion may permit the conduct of one additional mid-term test after the second mid-term test in that course only after satisfying himself of the genuineness of the reason given by the student supported by appropriate documentation.

5. Evaluation of Project Work

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

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

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

5.3 The work on the project shall be initiated in the penultimate semester and continued in the final semester. The duration of the project is for two semesters. The candidate can submit Project thesis with the approval of I.D.C. after 36 weeks from the date of registration at the earliest and one calendar year from the date of registration for the project work. Extension of time within the total permissible limit for completing the programme is to be obtained from the Head of the Institution.

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

5.5 A candidate shall be allowed to submit the thesis / dissertation only after passing in all the prescribed courses (both theory and practical) and then take viva voce examination of the project. The viva-voce examination may be conducted once in two months for all the candidates submitted during that period.

5.6 Three copies of the Thesis / Dissertation certified in the prescribed from by the supervisor & HoD shall be presented to the HoD. One copy is to be forwarded to the Principal.

5.7 The department shall submit a panel of three experts for a maximum of 5 students at a time. However, the thesis / dissertation will be adjudicated by one external examiner nominated by the Principal.

5.8 If the report of the examiner is favorable viva-voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the thesis / dissertation. The board shall jointly report candidates work in terms of letter grade as follows:

Performance	**Letter Grade**
Outstanding	O
Excellent	A+
Very Good	A
Good	B+
Above Average	B
Average	C
Pass	P
Fail	F
Absent	Ab

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

6. Re-Registration for Improvement of Internal Evaluation Marks:

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

- The candidate should have completed the course work and obtained examinations results for I & II semesters.
- He should have passed all the courses for which the internal evaluation marks secured are more than 50%.
- In those courses in which the student has failed in the end semester examination due to Internal evaluation marks secured being less than 50%, the candidate shall be given one chance for each Theory course and for a maximum of **three** Theory courses for Improvement of Internal evaluation marks.
- The candidate has to re-register for the chosen courses and fulfill the academic requirements.
- In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered courses stand cancelled.

7. Program Pattern

7.1 The entire program of study is for two academic years. Both the two academic years shall be on semester pattern.

7.2 A student eligible to appear for the end semester examination in a course, but absent or has failed in the end examination may appear for that course at the next supplementary examination when offered.

7.3 When a student is detained due to lack of credits/shortage of attendance he may be re-admitted when the semester is offered after fulfillment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

8. Programmes of Study

With the approval from AICTE & JNTUA, the M. Tech. Degree programme is offered at present with the following specializations;

S.No	Specialization	Code
1	Electrical Power Systems	07
2	Solar Power Systems	95
3	Advanced Manufacturing Systems	87
4	Machine Design	15
5	Digital Electronics and Communication Systems	38
6	Very Large Scale Integration & Embedded Systems	68
7	Computer Science and Engineering	58
8	Micro & Nano Electronics	
9	Structural Engineering	

9. Grading System

9.1 Letter Grades

9.1.1 Based on the student's performance during a given Semester, the students are awarded a final letter grade at the end of the Semester in each course. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade points	Absolute marks
O (Outstanding)	10	90 - 100
A+ (Excellent)	9	80 - 89
A (Very Good)	8	70 - 79
B+ (Good)	7	65 - 69
B (Above Average)	6.5	60 - 64
C (Average)	6	55 - 59
P (Pass)	5.5	50 - 54
F (Fail	0	< 50
Ab (Absent)	0	

9.1.2 A student is considered to have completed a course successfully and earned the credits if he secures a letter grade other than F / Ab in that course. A letter grade F / Ab in any course implies that the candidate is yet to clear that course.

9.1.3 A course successfully completed cannot be repeated.

9.1.4 A Semester Grade Point Average (SGPA) will be computed for each semester.

The SGPA shall be calculated as follows:

$$SGPA = \frac{\sum_{i=1}^{n} c_i g_i}{\sum_{i=1}^{n} c_i}$$

Where ‘n’ is the number of courses registered and cleared for the semester, ‘ci’ is the number of Credits allotted to a particular course, and ‘gi’ is the grade points carried by the letter corresponding to the grade awarded to the student for the course. SGPA will be rounded off to the second place of decimal and recorded as such. The SGPA would indicate the performance of the student in the semester to which it refers.

Starting from the second semester at the end of each semester S, a Cumulative Grade Point Average (CGPA) will be computed for every student as follows:

$$CGPA = \frac{\sum_{i=1}^{m} c_i g_i}{\sum_{i=1}^{m} c_i}$$

Where ‘m’ is the total number of courses the student has registered and cleared from the first semester onwards up to and including the semester S, ‘ci’ is the number of Credits allotted to a particular course ‘si’ and ‘gi’ is the grade-point carried by the letter corresponding to the grade awarded to the student for the course ‘si’. CGPA will be rounded off to the second place of decimal and recorded as such.
The CGPA would indicate the cumulative performance of the student from the first semester up to the end of the semester to which it refers.
The CGPA, SGPA and the grades obtained in all the courses in a semester will be communicated to every student at the end of every semester.
When a student gets the grade ‘F’ in any subject during a semester, the SGPA and the CGPA from that semester onwards will be tentatively calculated, taking only ‘zero point’ for each such ‘F’ grade. After the ‘F’ grade(s) has/have been substituted by better grades during a subsequent semester, the SGPA and the CGPA of all the semesters, starting from the earliest semester in which the ‘F’ grade has been updated, will be recomputed and recorded to take this change of grade into account.

9.1.5 Cumulative grade point average [CGPA] averaged over all the courses is calculated for the award of class.

9.2 Award of Class

The following Class is awarded to the student on successful completion of the M.Tech Degree. Programme depending upon the CGPA obtained;

Class	CGPA	
First Class with Distinction	≥ 7.5 & 10.0	Based on the aggregate of grades secured from the total Credits.
First Class	≥ 6.5 & < 7.5	
Second Class	≥ 5.5 & < 6.5	

9.3 In case of a specific query by students/employers regarding Semester Grade Point Average (SGPA)/ Cumulative Grade Point Average (CGPA) into percentage, the following formulae will be adopted for **notional conversion of SGPA/CGPA** into percentage.

$$\text{SGPA to Percentage} = (\text{SGPA} - 0.5) \times 10$$

$$\text{CGPA to Percentage} = (\text{CGPA} - 0.5) \times 10$$

9.4 Award of Ranks

- Ranks are awarded based on the CGPA secured by the candidates for all the courses from first to final year,

Provided the candidate has:

- Completed the entire programme in the college itself (excluding MOOCs).
- Passed all the courses in first attempt only.
- Not discontinued the programme for any period during the course of study.
- Not been awarded any punishment for being involved in malpractice or indiscipline during the course of study in the Institute.
- In case, more than one student secures same CGPA, then first rank shall be awarded based on:
- Student who secured more number of letter grade "O"," A+" and so on in decrementing order of grades.
- After applying the above clause, if a tie still exists, then all such students shall be awarded the same rank.
- Certificate and medal/award shall be given to such students as an appreciation for their achievement.

10. Transitory Regulations

Candidates who have discontinued or have been detained for want of attendance or who have failed after having undergone the program in earlier regulations or have discontinued and wish to continue the program are eligible for admission into unfinished Semester from the date of commencement of class work with the same or equivalent courses as and when such courses are offered, subject to 4.5 and 2.3 sections. Whereas they continue to be in the academic regulations into which they get readmitted.

11. Withholding of Results

If the candidate has any dues not paid to the institution or if any case of indiscipline or malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed/ promoted to the next higher Semester. The issue of awarding degree is liable to be withheld in such cases.

12. Minimum Instruction Days

The minimum instruction days including exams for each Semester shall be 90 days.

13. Student transfers

Student transfer shall be as per the guidelines issued by the Government of Andhra Pradesh from time to time.

14. Supplementary Examinations

At the end of each Semester there will be regular examinations for the current Semester. Those students who could not clear their courses in their previous attempt can appear for the examinations under supplementary category along with the regular students after registering themselves at the examination branch. Supplementary examinations for the all the other Semesters other than the current one will also be conducted at the same time.

15. General

15.1 The academic regulations should be read as a whole for purpose of any interpretation.

15.2 Malpractice rules nature and punishments are appended.

15.3 Where the words "he", "him", "his" occur in the regulations, they also include "she", "her", "hers", respectively.

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

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

Rules for Disciplinary Action for Malpractices / Improper Conduct in Examinations

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

		subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that Semester/year. The candidate is also debarred for four consecutive Semesters from class work and all Semester end examinations if his involvement is established. Otherwise the candidate is debarred for two consecutive semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he/she will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all Semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6.	Refuses to obey the orders of the any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a 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	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that Semester. If candidate physically assaults the

	person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	invigilator or/ officer in charge of the examination, then the candidate is also barred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the examination hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all Semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year. The candidate is also debarred and forfeits the seat.

		Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that Semester examinations depending on the recommendation of the committee.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Principal for further action to award suitable punishment.	

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

I Year – I Semester

S. No.	Course Code	Name of the Course	Credits
1	16SE101	Higher Engineering Mathematics	4
2	16SE102	Advanced Structural Analysis	4
3	16SE103	Theory of Elasticity and Plasticity	4
4	16SE104	Structural Dynamics	4
5	16SE105	Advanced Steel Structures	4
6	**Electives - I**		
	16SE401	Experimental Stress Analysis	4
	16SE402	Advanced Concrete Technology	
	16SE403	Design of Prestressed Concrete	
	16SE404	Theory of Plates	
7	16SE201	Advanced Concrete Technology Laboratory	2
		Total	26

I Year – II Semester

S. No.	Course Code	Name of the Course	Credits
1	16SE106	Finite Element Methods	4
2	16SE107	Repair and Rehabilitation of Structures	4
3	16SE108	Stability of Structures	4
4	16SE109	Advanced Structural Design	4
5	16SE110	Earthquake Resistant Structures	4
6	**Electives - II**		
	16SE405	Ground Improvement Techniques	4
	16SE406	Design Of Tall Buildings	
	16SE407	Analysis Of Shells And Folded Plates	
	16SE408	Advanced Bridge Engineering	
7	16SE202	Computer Aided Design and Drawing Lab	2
		Total	26

II Year – III & IV Semesters

S. No.	Course Code	Name of the Course	Credits
1	16SE501	Seminar	2
2	16SE602	Project Work	16

Marks Allocation

S. No.	Description	Internal Marks			External Marks
1	Theory	Mid Test	Assignment		50
		30	20		
2	Practical	Experiment	Record Work	Viva-Voce	50
		30	10	10	
3	Seminar	50			50

M. Tech I Year I Semester

16SE101 HIGHER ENGINEERING MATHEMATICS

L	T	P	C
4	0	0	4

Course Objectives:

The main objectives of this course are to

1. Assimilate the concepts of maxima and minima of the functions and Lagrange's equation.
2. Know the Elliptical equation and its solutions.
3. Conceptualise parabolic equations, Schmidt method and to know Eigen values and vectors trough different methods.
4. To understand eigen values and eigen vectors, Galerkin method etc.,

UNIT-I

CALCULUS OF VARIATION: Concepts of maxima and minima of functions – constraints and Lagrange's multipliers – Extreme value of functional – Euler's equations – Solutions of Euler's equation.

HAMILTON PRINCIPLE: Lagrange's equations generalized dynamic excitations- constraints in dynamical systems.

UNIT-II

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS: Taylor series method, Picard's method, Euler's method modified Euler's method & R.K. method.

UNIT-III

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS: Elliptical equations standard five point formula, diagonal five point formula – solution of Laplace equation by Leibmann's iteration method, Poisson's equation.

UNIT-IV

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS: Parabolic equations Bender – Schmidt method – Bender – Schmidt recurrence equation, crank – Nicholson difference method.

UNIT-V

EIGEN VALUES AND EIGEN VECTORS: General method – Power method, Spectral method.

FINITE ELEMENT METHOD: Weighted Residual methods, least square method, Galerkin's method – Finite elements – Interpolating over the whole domain – one dimensional case, two dimensional case – application to boundary value problems.

Course Outcomes:

After completion of the course the student will be able to

1. understand the maxima and minima of the functions and Euler'sequations.
2. comprehend modified Euler's method and elliptical equations with diagonal five point formula.
3. analyse parabolic equations by Nicholson difference method and apply different methods for Eigen values and Eigen vectors.
4. analyse problems by Weighted Residual methods, least square method, Galerkin's method

Text Books:

1. B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publishers.
2. S.S.Sastry, *I*ntroductory Methods of Numerical Methods", Prentice Hall of India Pvt. Ltd.

Reference Books

1. Steven C.Chapra and Raymond P.Canale, *Numerical methods for Engineers*, McGraw Hill Book company.
2. Curtis.F.Gerald, *Applied Numerical Analysis*, Pearson India Publishers.
3. C-Xavier, *C – Language and numerical methods*, New Age International publishers.
4. M.K.Jain, SKR Iyengar, R.K.Jain, *Computational methods for partial differential equations*, New Age International publishers

M. Tech I Year I Semester

16SE102 ADVANCED STRUCTURAL ANALYSIS

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the static and kinematic indeterminacy of the structures
2. To understand the concepts of matrix methods of analysis of structures
3. To understand the analysis of continuous beams.
4. To understand the analysis of rigid and pin jointed frames

UNIT-I

INTRODUCTION TO MATRIX METHODS OF ANALYSIS: Determination of static and kinematic indeterminacies of two-dimensional and three-dimensional portal frames, pin jointed trusses and hybrid frames-coordinate systems –structural idealization-Flexibility and stiffness matrices-Force displacement relationships for axial force, couple, torsional moments – stiffness method of analysis and flexibility method of analysis.

UNIT-II

ANALYSIS OF CONTINUOUS BEAMS: Stiffness method and flexibility method of analysis –continuous beams of two and three spans with different end conditions-internal hinges.

UNIT-III

ANALYSIS OF TWO DIMENSIONAL PORTAL FRAMES: Stiffness and flexibility method of analysis of 2D portal frames with different end conditions-plotting of bending moment diagrams

UNIT-IV

ANALYSIS OF TWO-DIMENSIONAL PIN-JOINTED TRUSSES: Stiffness and flexibility methods-computation of joint displacement and member forces.

UNIT-V

TRANSFORMATION OF COORDINATES: Local and Global co-ordinate systems-transformation of matrices from local to global coordinates of element stiffness matrix-direct stiffness method of analysis-assembly of global stiffness matrix from element stiffness matrices –static condensation-sub-structuring.

Course Outcomes:

After completion of the course the students will be able to

1. Distinguish determinate and indeterminate structures.
2. Identify the method of analysis for indeterminate structures.
3. Apply matrix methods of analysis for continuous beams.
4. Apply matrix methods of analysis for rigid and pin jointed frames.

Text Books:

1. Pundit & Gupta, *Structural Analysis,* Tata McGraw Hill Publications
2. C.S.Reddy, *Structural Analysis,* Tata McGraw Hill Publications

Reference Books:

1. Cotes, R.C., Couties, M.G., and Kong, F.K., *Structural Analysis*, Chapman & Hall India, Madras

2. John L.Meek., *Matrix Structural Analysis*, MC Graw Hill Book Company.

3. R.C.Hibbeler, *Structural Analysis,* Pearson Education

4. C.K.Wang, *Indeterminate Structural Analysis,* McGraw Hill Publishers

M. Tech I Year I Semester

16SE103 THEORY OF ELASTICITY AND PLASTICITY

L	T	P	C
4	0	0	4

Course Objectives:

1. To make the students understand the concepts of elasticity and equip them with the knowledge to independently handle the problems of elasticity.
2. To enhance the competency level and develop the self confidence through quality assignments in theory of Elasticity.
3. To inculcate the habit of researching and practicing in the field of elasticity.
4. To understand the concepts of plasticity, yield criteria, plastic flow etc.,

UNIT-I

INTRODUCTION: Elasticity –Notation for forces and stresses-Components of stresses – components of strain –Hooke's law.

PLANE STRESS AND PLANE STRAIN ANALYSIS: Plane stress-plane strain-Differential equations of equilibrium- Boundary conditions- Compatibility equations-stress function-Boundary conditions.

UNIT-II

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 : General Equation in polar co-ordinates - 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 the general solution of two dimensional problem in polar coordinates-Application of the general solution in polar coordinates.

UNIT-III

ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS: Principle stress - ellipsoid and stress-director surface-Determination of principle stresses- Maximum shear stresses-Homogeneous deformation-principle axis of strain rotation.

GENERAL THEOREMS: Balance laws - Differential equations of equilibrium- conditions of compatibility - Determination of displacement-Equations of equilibrium in terms of displacements-principle of superposition-Uniqueness of solution –the Reciprocal theorem.

UNIT-IV

TORSION OF PRISMATIC BARS: General solution of problems by displacement (St. Venant's warping function) & force (Prandtl's stress function) approaches - Membrane analogy -

Torsion of circular and non-circular (elliptic and rectangular) sections - Torsion of thin rectangular section and hollow thin walled section - Single and multi-celled sections.

UNIT-V

THEORY OF PLASTICITY: Stress-strain curve - Theories of strength and failure –Yield Criteria - Yield Surface – Plastic Flow – Plastic Work – Plastic Potential – Strain hardening

Course Outcomes:

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

1. able to solve the problems of 3-D elasticity with confidence.
2. can independently work with the problems of 2-D elasticity in Cartesian/Polar Coordinates.
3. familiarized with the use of airy's stress function in 2-D problems of elasticity in Cartesian/Polar Coordinates.
4. equipped with the knowledge of various theories of torsion of prismatic bars of various cross sections and can solve the problems of torsion.

Text Books:

1. Timoshenko, S., *Theory of Elasticity and Plasticity*, MC Graw Hill Book company.
2. Sadhu Singh, *Theory of Elasticity and Plasticity,* Khanna Publishers.

Reference Books:

1. Papov, *Advanced Strength of materials*, MC Graw Hill Book Company.
2. Chen, W.F. and Han, D.J, *Plasticity for structural Engineers*, Springer-Verlag, New York.
3. Lubliner, J., *Plasticity Theory*, Mac Millan Publishing Co., New York.
4. Y.C.Fung., *Foundations of Solid Mechanics,* Prentice Hall India

M. Tech I Year I Semester

16SE104 STRUCTURAL DYNAMICS

L	T	P	C
4	0	0	4

Course Objectives:

1. To acquaint with basic principles relating to Dynamics of structures under both damped and undamped condition.
2. To understand Impact of degree of freedom on vibration of structures
3. To make students learn about mathematical treatment of dynamics of structural Problems both single degree and multi degree of freedom.
4. To train students in dealing with vibration and earth quake analysis.

UNIT-I

Equation of Motions, Problem Statement, Solution Methods of Single Degree of Freedom Systems (SDOF)

Basic concepts of structural dynamics: single degree of freedom system, force displacement relationship, damping force, equation of motion, mass-spring-damper system, methods of Solution of differential equation.

Free Vibration (SDOF): Undamped free vibration, viscously damped free vibration, energy in free vibration.

UNIT-II

MULTI DEGREE OF FREEDOM SYSTEM: selection of the degree of freedom –Evaluation of structural property matrices-Formulation of the MDOF equations of motion –Undamped free vibrations Solution of Eigen value problem for natural frequencies and mode shapes-Orthogonality conditions - Approximate methods of extraction of Eigen values.

UNIT-III

DYNAMIC RESPONSE OF MDOF SYSTEMS: Normal co-ordinates - Mode superposition technique - Numerical integration procedures

UNIT-IV

MACHINE FOUNDATIONS

Fundamentals of Vibration; Free and Forced Vibration with and without damping; Natural frequency of foundation; Soil system; Dynamic soil properties; Vibration Isolation; Types of machines and machine foundation; I.S. Code of practice for design and construction of block foundation for reciprocating and impact type machines and framed foundations for high speed rotary machines.

UNIT-V

CONTINUOUS SYSTEM: Introduction –Flexural vibrations of beams- Elementary case- Equation of motion –Analysis of undammed free shapes of simple beams with different end conditions-principles of application to continuous beams.

Course Outcomes:

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

1. identify different types of vibrations under SDOF and MDOF system conditions.
2. evaluate impact of degree of freedom on vibration of structures.
3. demonstrate skills in treating structures for earthquake analysis.
4. develop skills relating to continuous system of structures relating to different loading conditions

Text books:

1. A.K.Chopra, "*Structural Dynamics for Earthquake Engineering*",Prentice Hall,1994
2. Clough & Penziem, *Dynamics of structures*, Mc Graw Hill Publications
3. Mario Paz, *Structural dynamics*, CBS Publications.

Reference books:

I.S:1893(latest)" code of practice for earthquakes resistant design of structures"

M. Tech I Year I Semester

16SE105 ADVANCED STEEL STRUCTURES

L	T	P	C
4	0	0	4

Course Objectives:

1. To learn the preliminary design of industrial requirements.
2. To learn the procedures of cantilever, portal frame methods of analyses.
3. To understand about types gantry girders and its design methodologies.
4. To understand theorems of plastic analysis and principles of optimization in structural design.

UNIT-I

DESIGN OF SELF SUPPORTING STACKS/CHIMNEYS: Considerations for preliminary design (industrial requirements – thermal requirement – mechanical force requirement – wind load and dead load estimation) – Detailed estimation of wind; dead-and other accidental – loads; Analysis; Detailed design including provision of stakes /spoilers – Design of super structure only.

UNIT-II

ANALYSIS OF MULTI-STOREY FRAMES USING APPROXIMATE METHODS: Cantilever method - Portal method - Analysis of multi-storey frames using substitute frame method.

UNIT-III

INDUSTRIAL BUILDINGS: Industrial buildings-braced and unbraced - Gable frames with gantry-Rigid industrial frames-Fire resistant design-Fatigue resistant design.

UNIT-IV

TOWERS: Basic structural configurations - free standing and guyed towers -Loads on towers - wind loads - foundation design - design criteria for different configurations and transmission line towers.

UNIT-V

PRINCIPLES OF OPTIMIZATION IN STRUCTURAL DESIGN: Application to simple – rectangular portal frame – minimum weight design.

Course Outcomes:

After completion of the course the student will be able to

1. Design self-supporting stacks and chimneys for industrial buildings.
2. Analyse multi-storey frames using approximate methods and able to design gantry girder to resist all types of loads.
3. Analyse portal frames by using plastic design methodologies.
4. Apply principles of optimization in structural design.

Text books:

1. Vazarani and Ratwani, *Design of Steel Structures*, Khanna Publishers
2. Punmia, B.C., Analysis of Steel Structure,

Reference books:

1. B.G.Neal, *Plastic analysis of structures,* John Wiley & Sons, Inc.
2. Baker, Steel *Skeleton V.I and II, the Cambridge University Press*
3. Timoshenko, *Strength of materials (Vol-II), CBS Publications*
4. Pinfold, *Analysis of Steel Structure*
5. Analysis of Steel Structure by Relevant IS codes

M. Tech I Year I Semester

16SE401 EXPERIMENTAL STRESS ANALYSIS

(ELECTIVE-I)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand working principle of strain gauges.
2. To understand various strain measuring devices.
3. To know the concepts of photo elasticity and its applications.
4. To learn various Non-destructive testing methods

UNIT-I

BASIC EQUATIONS AND PLANE ELASTICITY THEORY: Introduction, Strain equations of Transformation, Compatibility, Stress-Strain Relations-Two dimensional State of Stress. The Plane-Elastic problem, The Plane-Strain Approach, Plane Stress, Airy's Stress function-Cartesian Co-ordinates-Two dimensional problems in Polar Co-ordinates, Polar Components of Stress in terms of Airy's Stress function, Forms.

PRINCIPLES OF EXPERIMENTAL APPROACH: Merits of Experimental Analysis Introduction, uses of experimental stress analysis advantages of experimental stress analysis, Different methods –Simplification of problems.

UNIT-II

STRAIN MEASUREMENT USING STRAIN GAUGES: Definition of strain and its relation of experimental Determinations Properties of Strain-Gauge Systems-Types of Strain Gauges – Mechanical, Acoustic and Optical Strain Gauges.

ELECTRICAL STRAIN GAUGES: Inductance strain gauges – LVDT – Resistance strain gauges – various types –Gauge factor – Materials of adhesion base etc…

UNIT-III

STRAIN ROSETTES:Introduction – The three element Rectangular Rosette – The Delta Rosette – Corrections for Transverse Strain Gauge.

NON – DESTRUCTIVE TESTING: Ultrasonic Pulse Velocity method –Application to Concrete. Hammer Test – Application to Concrete.

UNIT-IV

BRITTLE COATING METHODS : Introduction –Coating Stress – Failure Theories –Brittle Coating Crack Patterns – Crack Detection –Types of Brittle Coating – Test Procedures for Brittle Coating Analysis – Calibration Procedures – Analysis of Brittle Coating Data.

UNIT-V

THEORY OF PHOTO-ELASTICITY: Introduction –Temporary Double refraction – The stress Optic Law –Effects of stressed model in a polariscope for various arrangements – Fringe Sharpening. Brewster's Stress Optic law

TWO DIMENSIONAL PHOTO ELASTICITY: Introduction – Isochramic Fringe patterns-Isoclinic Fringe patterns passage of light through plane Polariscope and Circular polariscope Isoclinic Fringe patterns – Compensation techniques – Calibration methods – Separation methods – Scaling Model to prototype Stresses – Materials for photo – Elasticity Properties of Photoelastic Materials.

Course Outcomes:

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

1. To work with strain gauges.
2. Do the model analysis using different theorems.
3. Apply the concepts of photo elasticity and its applications.
4. Use the various Non-destructive testing methods

Text Books:

1. J.W.Dally and W.F.Riley, *Experimental Stress Analysis*
2. Dr.Sadhu Singh, *Experimental Stress Analysis, Khanna Publishers*

Reference Books :

1. L.S.Srinath, *Experimental Stress Analysis*, MC.Graw Hill Company Publishers.
2. Dove and Adams, *Experimental Stress Analysis*

M. Tech I Year I Semester

16SE402 ADVANCED CONCRETE TECHNLOGY

(ELECTIVE-I)

L	T	P	C
4	0	0	4

Course Objectives:

1. The main aim of this course is to explain properties of ingredients of concrete admixtures and procedures for testing concrete ingredients.
2. To make the student to understand fresh and hardened characteristics of concrete and also to enable the students to identify different mix design procedures and produce concrete mix proportions.
3. To explains the characteristics of emerging concretes.

UNIT I:

CEMENTS & ADMIXTURES: Portland cement – chemical composition – Hydration, Setting of cement – Structure of hydrate cement – Test on physical properties – Different grades of cement – Admixtures – Mineral and chemical admixtures.

AGGREGATES: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregate – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate – Maximum aggregate size.

UNIT II:

FRESH CONCRETE: Workability – Factors affecting workability – Measurement of workability by different tests – Setting times of concrete – Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete – Steps in manufacture of concrete – Quality of mixing water.

HARDENED CONCRETE: Water / Cement ratio – Abram's Law – Gel space ratio – Nature of strength of concrete – Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength - Curing.

UNIT III:

TESTING OF HARDENED CONCRETE: Compression tests – Tension tests – Factors affecting strength – Flexure tests – Chemical analysis of hardened concrete

ELASTICITY, CREEP & SHRINKAGE: Modulus of elasticity – Dynamic modulus of elasticity – Posisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage – types of shrinkage.

UNIT IV:

MIX DESIGN: Factors in the choice of mix proportions – Durability of concrete – Quality Control of concrete – Statistical methods – Acceptance criteria – Proportioning of concrete mixes by various methods – BIS method of mix design.

UNIT V:

SPECIAL CONCRETES: Light weight aggregates – Light weight aggregate concrete – Cellular concrete – No-fines concrete – High density concrete – Fibre reinforced concrete – Different types of fibers – Factors affecting properties of F.R.C – Applications – Polymer concrete – Types of Polymer concrete – Properties of polymer concrete – Applications – High performance concrete – Self consolidating concrete – SIFCON.

Course Outcomes:

1. Identify different properties of concrete ingredients and estimate the properties through various test procedures.
2. Understand the characteristics of fresh and hardened concrete
3. Identify different mix design procedures and produce concrete mix proportions
4. Understand characteristics of special concretes

Text Books:

1. Neville, A.M., Properties of Concrete, Low priced Edition, 4th edition.
2. Shetty, M.S., Concrete Technology, S.Chand& Co, 2004.

References:

1. Gambhir, M.L., Concrete Technology, Tata Mc. Graw Hill Publishers, New Delhi.
2. Santha Kumar, A.R., Concrete Technology, Oxford university Press, New Delhi.

M. Tech I Year I Semester

16SE403 DESIGN OF PRESTRESSED CONCRETE

(ELECTIVE – I)

L	T	P	C
4	0	0	4

Course Objectives:

1 To understand the concepts of prestressing
2 To understand the behaviour of prestressed members in compression and flexure.
3 To understand the design of prestressed concrete members
4 To understand the transfer of prestress and Anchorage stresses

UNIT-I

DESIGN FOR FLEXURE: Definition of Type I, II, & III structures – Basic Assumptions-Permissible stresses in steel and concrete as per IS: 1343 – Basic four requirements – Design and choice of sections of Post tensioned beams – Layout of cables – check of limit state of collapse – Location of Position of wires in Pretensioned beams.

UNIT-II

DEFLECTION: Short term deflection of Uncracked Members – Long Term Deflection – Deflection due to creep – Code requirements for Limit State of Deflection.

UNIT-III

TRANSFER OF PRE STRESS: Transmission of Prestressing force by Bond – Transmission length – factors affecting transmission length – check for Transmission length – Anchorage Zone stresses in Post tensioned members – Calculation of Bearing stress and Bursting tensile forces & reinforcement in anchorage zones based on IS 1343 & Guyon's method.

UNIT-IV

STATICALLY INDETERMINATE PRESTRESSED CONCRETE STRUCTURES: Methods of Achieving continuity – Assumptions in elastic analysis – Pressure line – Linear transformation – concordant cables – Guyon's theorem – Analysis and design of continuous beams.

UNIT-V

CIRCULAR PRESTRESSING: Circular prestressing in liquid retaining tanks – Analysis for stresses – Design of tank wall incorporating recommendations of IS: 3370 Part III Code – Types of Prestressed Concrete Pipes – Design of Pipes..

Course Outcomes:

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

1. evaluate the behaviour, analyze and design of prestressed concrete structures, layout of tendon satisfying strength and serviceability limit states.
2. analyze and design for shear in P.S.C members.
3. analyze the stresses in anchorage zones and design of end anchorage
4. analyze and design prestressed circular concrete pipes and tanks

Text books:

1. *Prestressed Concrete by* N. Krishna Raju, Tata Mc Graw- Hill Companies, 4th Edition 2007
2. *Prestressed Concrete* by S. Ramamrutham, Dhanpatrai Publishing Company (P) Ltd, 2006

Reference books:

1. T.Y.Lin, *Design of Prestressed Concrete Structures*, Asian Publishing house, Bombay, 1953.
2. Y.Guyon, *Prestressed Concrete*, Vol.I&II, Wiley and Sons, 1960.
3. F.Leohhardt, *Prestressed Concrete Design And Construction*, Wilhelm Ernst and shon, Berlin, 1964.
4. C.E.Reynolds and J.C. Steedman, *Reinforced Concrete Designers Hand Book*, A view point publication, 1989.

M. Tech I Year I Semester

16SE404 THEORY OF PLATES

(ELECTIVE – I)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the basic equations, bending effects of plates.
2. To understand the symmetrical loading and various loading conditions of circular and annular plates.
3. To understand the simultaneous bending and stretching of plates and to develop governing equation.
4. To study the concepts of orthotropic plates, numerical, approximate methods, large deflection theory of plates.

UNIT-I

DIFFERENTIAL EQUATION OF THIN PLATES :

Theory of bending of thin plates with lateral loads- Governing differential equation and various boundary conditions - in Cartesian and Polar coordination.

UNIT-II

RECTANGULAR PLATES: Classical solution for rectangular plates with different types of loads and boundary conditions - Navier's and Levy's solution methods.

UNIT-III

CIRCULAR PLATES: Symmetrically loaded, circular plates under various loading conditions, annular plates.

UNIT-IV

ORTHOTROPIC PLATES: Derivation of the governing equation, applications to grillage problems as equivalent orthotropic plates.

NUMERICAL AND APPROXIMATE METHODS: Energy solutions by variational methods, finite difference and finite element methods of analysis for plate problems.

UNIT-V

LARGE DEFLECTION THEORY OF PLATES: Study of few simple cases.

Course Outcomes: After completion of the course the student will be able to

1. Understand behaviour of plates for UDL, hydrostatic, concentrated load cases.
2. Perform cylindrical bending of long rectangular plates, pure bending of rectangular and circular plates, and deflection theories.
3. Understand bending theory for structural behaviour of plates.
4. Implement numerical and approximate methods for plate problems.

Text books:

1. Timoshenko, S., and Krieger, S.W., *Theory Of Plates and Shells*, Mc Graw Hill Book company.
2. N.K.Bairagi, *Plate Analysis*, Khanna Publishers, Delhi, 1986.

Reference books:

1 Szilard, R., *Theory and Analysis of Plates*, Prentice Hall Inc

M. Tech I Year I Semester

16SE201 ADVANCED CONCRETE TECHNOLOGY LABORATORY

L	T	P	C
0	0	3	2

Course Objectives*:*

1. To learn the principles and procedures of testing Concrete materials
2. To get hands on experience by conducting the tests and evolving inferences

Experiments

1. Test on cement
    a. Consistency
    b. Setting time
    c. Soundness
    d. Compressive strength
2. Mix Design of concrete with different industrial wastes
3. Flexural behavior of concrete beam using UTM
4. Durability tests on concrete
5. Non destructive testing of concrete
6. Accelerated curing of concrete
7. Test on self compacted concrete – L box test, J box test, U box test and Slump test
8. Influence of different chemical admixtures on concrete
9. Mix design of fly ash concrete including casting and testing of specimens

Course Outcomes

1. Understand and apply the proper testing requirements for cement
2. Can prepare gradation charts with the help of laboratory testing
3. Understand and apply the proper testing requirements and techniques of plastic and hardenedconcrete.
4. Be able to design and test concrete mix designs for a specific purpose as per various code Requirements
5. Be able to test the behavior of special concretes
6. Can understand the effect of various admixtures on the properties of fresh and hardened concrete.

M. Tech I Year II Semester

16SE106 FINITE ELEMENT METHODS

L	T	P	C
4	0	0	4

Course Objectives:

1. To provide an overview and basic fundamentals of Finite Element Analysis.
2. To introduce basic aspects of finite element theory, including domain discretization, interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.
3. To explain the underlying concepts behind variational methods and weighted residual methods in FEM.
4. Formulate simple structural problems in to finite elements.

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UNIT-I

INTRODUCTION:

Concept of Finite Element Method - Merits and demerits, applications, relevant software's. Steps involved in FEM as applicable to structural mechanics problems. Descritization interpolation model, Convergence and compatibility criteria.

UNIT-II

ONE DIMENSIONAL ANALYSIS: Stiffness Matrix for Beam and Bar elements shape functions for ID elements –static condensation of global stiffness matrix-solution –Initial strain and temperature effects.

UNIT-III

TWO DIMENSIONAL ANALYSIS: 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 –static condensation.

UNIT-IV

ISOPARAMETRIC FORMULATION: Concept, Different isoparametric elements for 2d analysis-Formulation of 4-noded and 8-noded isoparametric quadrilateral elements –Lagrangian elements serendipity elements.

AXI SYMMETRIC ANALYSIS: Bodies of revolution-axi symmetric modelling –strain displacement relationship-formulation of axi symmetric elements.

UNIT-V

THREE DIMENSIONAL FEM: Different 3-D elements, 3D strain –displacement relationship-formulation of hexahedral and isoparametric solid element.

Course Outcomes:

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

1 Analyse and build FEA models for various Engineering problems.

2 Able to identify information requirements and sources for analysis , design and evaluation

3 Use professional-level finite element software to solve engineering problems.

4 Interpret results obtained from FEA software solutions, not only in terms of conclusions but also awareness of limitations.

Text books:

1. Finite element analysis _Theory & programming by G.S.Krishna murthy
2. Introduction to finite element method –Triupathi Chandra patla &Belugunudu

Reference books:

1. O.C.Zienkiewicz, *Finite element method*
2. Introduction to finite element method –J.N.Reddy
3. Cook R.D., Concepts and Applications of Finite Element Analysis, John Wiley and Sons Inc., New York, 1989.
4. Bathe K.J.., finite Element Procedures in Engineering Analysis, Prentice Hall,1990.

M. Tech I Year II Semester

16SE107 REPAIR AND REHABILITATION OF STRUCTURES

L	T	P	C
4	0	0	4

Course Objectives*:*

1. To study the procedure for non – destructive methods.
2. To study about the repair and rehabilitation of structures.

UNIT-I

EVALUATION & MATERIALS FOR REPAIR AND REHABILITATION: Non destructive evaluation: Importance – methods, Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects – Visual investigation- Acoustical emission methods- Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull out tests.

Special concretes and mortar - concrete chemicals, elements for accelerated strength gain - Expansive cement, - ferro cement - polymer concrete, sulphur infiltrated concrete,

UNIT-II

STRENGTHENING AND STABILIZATION: Techniques - Beam shear capacity strengthening- Shear Transfer strengthening - stress reduction techniques- Column strengthening-flexural strengthening- Connection stabilization and strengthening - Crack stabilization.

UNIT-III

TECHNIQUES FOR REPAIR & RETROFIT: Rust eliminators and polymers coating for rebars, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning

UNIT-IV

BONDED INSTALLATION TECHNIQUES - Fibre reinforced polymer, Externally bonded FRP- Wet layup sheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms-intermediate crack debonding- CDC debonding- plate end debonding- strengthening of floor of structures.

UNIT-V

ADVANCED MATERIALS FOR REPAIR & REHABILITATION- Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes - Light weight concrete- properties of light weight concrete- No fines concrete- design of light weight concrete- Flyash concrete-Introduction- classification of flyash- properties and reaction mechanism of flyash- Properties of flyash concrete in fresh state and hardened state- Durability of flyash concretes.

Course Outcomes

1. Understand and apply the proper techniques for concrete structures
2. Understand the strengthening & stabilization techniques.

TEXT BOOKS

1. Dension Campbell, Allen and Harold Roper, Concrete Structures, Materials,
2. MS. Shetty, Concrete Technology – Theory and practice, S.Chand and company, New Delhi.
3. Santhakumar, A.R.Training Course notes on damage assessment and Repair in low cost housing RHDC-NBO Anna University, Madras.

REFERENCE BOOKS:

1. Concrete technology- Neville & Brooks
2. Special Structural concrete- Rafat Siddique
3. Concrete repair and maintenance illustrated- Peter H Emmons

M. Tech I Year II Semester

16SE108 STABILITY OF STRUCTURES

L	T	P	C
4	0	0	4

Course Objectives:

1. To acquaint with basic principles relating to stability of structures
2. To help the students to learn about mathematical treatment of stability Problems.
3. To train students in dealing with buckling, and torsion developed for different structures under different support and loading conditions.
4. To acquaint students with the Elastic and in-elastic Buckling behaviour of structures.

UNIT-I

FORMULATIONS RELATED TO BEAM COLUMNS: Concept of Stability, Differential equation for beam columns –Beam column with concentrated loads –continuous lateral load – couples -beam column with built in ends –continuous beams with axial load –application of Trigonometric series – Determination of allowable stresses.

UNIT-II

ELASTIC BUCKLING OF BARS: Elastic buckling of straight columns – Method of Neutral Equilibrium-Effect of shear stress on buckling-Eccentrically and laterally loaded columns – energy methods –Buckling of a bar on elastic foundation, Buckling of a bar with intermediate compressive forces and distributed axial loads – Buckling of bars with change in cross section – Effect of shear force on critical load –Built up columns

UNIT-III

INELASTIC BUCKLING: Buckling of straight bars-Double modulus theory –Tangent modulus theory

MATHEMATICAL TREATMENT OF STABILITY PROBLEMS: Linear and non Linear Eigen Value problems-Buckling problem orthogonality relation –Ritz method-Timoshenko method, Galerkin method

UNIT-IV

TORSIONAL BUCKLING: Pure torsion of thin walled bar of open cross section-Non – Uniform torsion of thin walled bars of open cross section-Torsion buckling –Buckling under Torsion and Flexure.

LATERAL BUCKLING OF SIMPLY SUPPORTED BEAMS: Beams of rectangular cross section subjected for pure bending

UNIT-V

BUCKLING OF SIMPLY SUPPORTED RECTANGULAR PLATES: Derivation of equation of plate subjected to constant compression in two directions and one direction.

Course Outcomes:

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

1. Able to distinguish different types of beam columns and developing differential equations under different loading conditions.
2. Demonstrate skills in treating both elastic and in-elastic buckling of structures.
3. Develop skills relating to torsion and lateral buckling of structures.
4. Identify the difference of Elastic and in-elastic Buckling Behaviour of Structures

Text books:

1. Bleach, *Stability Of Metallic Structure* , Mc Graw hill
2. Chen & Atsuta, *Theory of Beam Columns* Vol I, Mc.Graw Hill

Reference books:

1. Timoshenko, S., and Gere., Theory *of Elastic Stability*, Mc Graw Hill Book company, 1973.
2. Chajes, A., *Principles of Structural Stability Theory*, Prentice Hall,1974

M. Tech I Year II Semester

16SE109 ADVANCED STRUCTURAL DESIGN

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the short term and long term deflections of beams and slabs.
2. To understand the mechanism of flexural cracking and its estimation
3. To understand the design of deep beams, plain concrete walls and shear walls.
4. To understand the design of beam column joints.

UNIT-I

DEFLECTION OF REINFORCED CONCRETE BEAMS AND SLABS: Introduction - Short-term Deflection of beams and Slabs -Deflection due to -Imposed loads - Short- term deflection of beams due to applied loads- Calculation of deflection by IS 456 - Calculation of deflection by BS 8110 - Deflection calculation by Eurocode - ACI Simplified Method - Deflection of continues beams by IS 456 - Deflection of Cantilevers - Deflection of Slabs

ESTIMATION OF CRACKWIDTH IN REINFORCED CONCRETE MEMBERS: Introduction - Factors affecting Crack width in beams - Mechanism of Flexural cracking Calculation of crack widths - Simple Empirical method - Estimation of Crack width in -beams by IS 456 of BS 8110 - Shrinkage and Thermal Cracking

UNIT-II

DESIGN OF REINFORCED CONCRETE DEEP BEAMS: Introduction - Minimum Thickness - Steps of Designing deep beams - Design by IS 456 - Design according to British Practice - ACI Procedure for design of deep beams - Checking for local failures - Detailing of deep beams

UNIT-III

DESIGN OF PLAIN CONCRETE WALLS: Introduction - Braced and Unbraced walls - Slenderness of walls- Eccentricities of vertical loads at Right angles to wall - Empirical design method for plane concrete walls carrying axial load - Design of walls for Inplane Horizontal forces - Rules for detailing of steel in concrete walls

DESIGN OF SHEAR WALLS: Introduction - Classification of shear walls - Classification according to behaviour - Loads in shear walls - Design of Rectangular and flanged shear walls - Derivation of formula for moment of Resistance of Rectangular shear walls

UNIT-IV

DESIGN OF CAST IN-SITU BEAM-COLUMN JOINTS: Introduction – Types of cast in-situ joints – Joints in multi-storeyed Buildings – Forces acting on Joints – Strength Requirement of Columns – Forces directly acting on joints – Design of joints for strength – Anchorage – Confinement of core of joint – Shear strength of joint – Corner (Knee) joint – Detailing for Anchorage in exterior beam-column joint – Procedure for design of joint.

UNIT-V

DESIGN OF REINFORCED CONCRETE MEMBERS FOR FIRE RESISTANCE: Introduction - ISO 834 standard heating conditions- Grading or classifications - Effect of High temperature on steel and concrete - Effect of high temperatures on different types of structural members - Fire resistance by structural detailing from Tabulated data - Analytical determination of the ultimate bending moment capacity of reinforced concrete beams under fire - Other considerations

Course Outcomes:

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

1. Design the R.C. beams and slabs to satisfy the limit state of serviceability by determining the short term and long term deflection.
2. Estimate the crack width in beams for the given load.
3. Design deep beams, plain and shear walls
4. Design beam-column join for the given loading system.

Text books:

1. P.C.Verghese, *Advanced Reinforced Concrete Design*, PHI Learning, New Delhi
2. P.Purushothaman, *Reinforced concrete Structural Elements: Behaviour, analysis and Design*, TATA Mc Graw Hill.

Reference Books:

1. C.E. Reynolds and J.C. Steedman, *Reinforced Concrete- Desigers Hand book*, a view point publication.
2. P.Dayaratnam , *Limit State Design of Reinforced Concrete Structures*, Oxford & IBH Publishers, 2004 edition.
3. N.Krishna Raju,*Advanced Reinforced Concrete Design*, CBS Publishers & Distributors.
4. Devadas Menon, Reinforced *cement concrete Structures, Tata McGraw Hill Education*

M. Tech I Year II Semester

16SE110 EARTHQUAKE RESISTANT STRUCTURES

L	T	P	C
4	0	0	4

Course Objectives:

1. To make the students understand the fundamental concepts in the analysis of the structures subjected to seismic forces.
2. To understand the vibration of structures during earthquakes.
3. To understand the students to do a competent design & detailing of seismic resistant structures.
4. To understand the student fundamentals of Seismic Planning.

UNIT-I

ENGINEERING SEISMOLOGY : Earthquake – causes of earthquake – earthquakes and seismic waves – scale and intensity of earthquakes – seismic activity – Measurements of earth quakes – seismometer- strong motion accelerograph / field observation of ground motion – analysis of earthquakes waves – earth quake motion – amplification of characteristics of surface layers – earthquake motion on the ground surface;

UNIT-II

VIBRATION OF STRUCTURES UNDER GROUND MOTION: Elastic vibration of simple structures – modelling of structures and equations of motion – free vibrations of simple structures – steady state forced vibrations – Non steady state forced vibrations – response spectrum representations; Relation between the nature of the ground motion and structural damage.

UNIT-III

DESIGN APPROACHES: Methods of analysis – selection of analysis – equivalent lateral force procedure seismic base shear – seismic design co-efficient - vertical distribution of seismic forces and horizontal shear – twisting moment - Over turning moment – vertical seismic load and orthogonal effects lateral deflection – P- Δcharacteristics effect – soil structure Interaction Seismic – Graphs study, earthquake records for design – factors affecting accelerogram characteristics - artificial accelerogram – zoning map. Dynamic – analysis procedure: Model analysis – Inelastic – time history analysis Evaluation of the results.

UNIT-IV

INTRODUCTION TO EARTHQUAKE ANALYSIS: Introduction –Excitation by rigid base translation – Lumped mass approach -SDOF and MDOF system- I.S code methods of analysis.

UNIT-V

FUNDAMENTALS OF SEISMIC PLANNING: Selection of materials and types of construction form of superstructure – framing systems and seismic units – devices for reducing. Earthquake loads,

Course Outcomes:

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

1. Analyse the forces acting on structures due to earthquake.
2. Computation of design moments and shears for framed structure as per IS:1893 and its detailing
3. Apply the concepts in the design of structures.
4. Implementing the Selection process of materials and construction form of super structure.

Text books:

1. J.A. Blume, N.M. Newmark, L.H. Corning., *Design of Multi-storeyed Buildings for Earthquake ground motions*', Portland Cement Association, Chicago,1961
2. Pankaj Agarwal, *Earthquake Resistant Design*

Reference books:

1. Minoru Wakabayashi, Design of earthquake resistant structures
2. A.K.Chopra, Structural Dynamics for Earthquake Engineering, PrenticeHall 1995.
3. R.W.Clough, Dynamics of structures. Mc GrawHill, 2nd edition, 1992.
4. N.M Newmark and E.Rosenblueth, Fundamentals of Earthquake Engineering, PrenticeHall, 1971.
5. David Key, Earthquake design practice for buildings. Thomas Telford, London, 1988
6. R.L. Wegel, Earthquake Engg; Prentice Hall 12nd edition 1989.
7. I.S.Codes No. 1893,4326,13920.

M. Tech I Year II Semester

16SE405 GROUND IMPROVEMENT TECHNIQUES

(ELECTIVE – II)

L	T	P	C
4	0	0	4

Course Objectives:

1. Need for ground improvement Techniques
2. Concept of Mechanical modification
3. Knowledge about Hydraulic modification
4. Different types of soil stabilization
5. Principles of reinforced earth

UNIT-I

Introduction to Engineering ground modification

Need for engineered ground improvement, classification of ground modification techniques; suitability, feasibility and desirability of ground improvement technique; objectives of improving soil.

UNIT-II

Mechanical Modification

In-situ densification methods in granular soils - Introduction, Vibration at the ground surface, impact at the ground surface, vibration at depth, impact at depth

In-situ densification methods in cohesive soils- Purpose of preloading and use of vertical drains, Methods of providing vertical drains-cylindrical sand drains, geosynthetic drains, stone column.

UNIT-III

Hydraulic Modification

Objectives and techniques, traditional dewatering Methods-Interceptor ditches-single stage well points-Multi stage well points-shallow well points-Vaccum well points-Shallow well system-Deep well system-Horizontal wells-Electro osmosis-Permanent drainage after construction.

UNIT-IV

Physical and chemical modification

Terminology, construction techniques, and typical uses; Types of admixtures and their effect on soil properties-Granular admixtures, Cement stabilization and cement columns, Lime

stabilization and lime columns, Stabilization using bitumen and emulsions, Stabilization using industrial wastes. Grouting: Objectives of grouting- grouts and their properties-grouting methods

UNIT-V

Modification by inclusions

Reinforced earth- concept of soil Reinforcement-Principles, components of reinforced earth, governing design of reinforced earth walls, design principles of reinforced earth walls.

Soil nailing-Different soil nailing systems and applications, the importance of construction sequence, Analysis of nailed soil, Special considerations for slope stabilization.

Geotextiles Introduction, types of geotextiles, functions and their applications, tests for geotextiles, geogrids and its functions.

Course Outcomes:

1. Identify basic deficiencies of various soil deposits
2. Decide various methods of improving the soil stability
3. Implement various techniques of ground improvement.
4. Identify and Use various admixtures in stabilizing the soil.
5. Understand the concepts of soil reinforcement and soil nailing
6. Test the soil and apply geosynthetics to carryout separation, filtration and drainage

Text Books :

1. Hausmann M.R(1990) Engineering Principles of ground modification, McGraw-Hill Education(India) Private Limited,New Delhi.
2. Ground improvement Techniques, P.Purushothama Raju, Laxmi Publications Pvt. Ltd., New Delhi.
3. Robert M. Koerner, Designing with Geosynthatics, Prentice Hall New Jercy, USA.

Reference Books

1. Construction and Geotechnical methods in Foundation Engineering, R.M.Koerner, McGraw-Hill Book Company.
2. Current Practices in Geotechnical Engineering Vol.-I, Alam Singh and Joshi, International Book Traders, New Delhi.
3. Geotechnical Engineering by SK Gulati & Manoj Datta, Tata McGraw- Hill Publishing Company Limited.
4. Advanced Foundation Engineering by V.N.S. Murthy, CBS Publishers and Distributors.

M. Tech I Year II Semester

16SE406 DESIGN OF TALL BUILDINGS
(ELECTIVE – II)

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand the Design philosophy and essential amenities.
2. To understand the Types of loads and Materials for the tall buildings.
3. To understand the load distribution in steel and concrete and different resisting systems
4. To study the concepts of analysis for displacements and member forces for load transfer systems and dynamic analysis
5. To understand the research needs in tall building materials, systems and designs.

UNIT-I

INTRODUCTION

Design Philosophy - History - advantages and disadvantages - Vertical city-concepts - essential amenities - fire safety - water supply - drainage and garbage disposal - service systems - structural and foundation systems.Factors affecting height, growth and form - Human comfort criteria.

UNIT-II

LOADS AND MATERIALS

Gravity loading - Dead and Live load - calculation - Impact and construction loads. Wind loading - static and dynamic approach - Analytical and wind tunnel experimental method. Earthquake loading - Equivalent lateral force,Modal analysis - combination of loading in various design philosophies. Materials for tall buildings - High strength concrete - Lightweight concrete - Fiber reinforced concrete Composite Materials.

UNIT-III

STRUCTURAL SYSTEMS

Behavior of High Rise structures - Different system for load distribution in steel and concrete - Vertical and horizontal load resistant systems – Rigid frames - braced frames - infilled frames - shear walls - wall frames – tubular systems - outrigger braced systems - Mega systems.

UNIT-IV

ANALYSIS AND DESIGN

Analysis and Design principles of various horizontal load transfer systems - approximate methods - Modelling for accurate analysis - 3D analysis - Member forces - displacements. Analysis for various secondary effects -Creep, shrinkage and temperature. Stability Analysis -

Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity loading, P - effect and various methods of analysis - influence of foundation instability, out of plumb effects - Elastic Deformations. Dynamic Analysis - Principles of design of tall braced frames for earthquake and blastresistant design.

UNIT-V

ADVANCED TOPICS

Structural systems for future generation buildings - Expert systems for consultations - Economics - Research needs in tall building materials, systems and designs.

Course Outcomes:

After completion of the course the student will be able to

1. Calculate the loads on the tall buildings like live loads, dead loads, impact loads etc.
2. Know the load distribution in different resisting systems.
3. Analysis and design of the various horizontal load transfer systems.
4. Know the structural systems for future generation buildings.

Text books:

1. Schuller.W.G., *"High Rise Building Structures"*, John Wiley & sons, 1977
2. Lynn.S. Beedle, *"Advances in Tall Buildings"*, CBS Publishers andDistributors, New Delhi, 1996

Reference books

1. LinT.Y. and Burry D.Stotes, " *Structural Concepts and Systems forArchitects and Engineers "*, John Wiley, 1994.
2. Gupta.Y.P.,(Editor), *"Proceedings of National Seminar on High RiseStructures - Design and Construction Practices for Middle Level Cities*", New Age International Limited, New Delhi,1995.
3. Lecture Notes on *"Tall Buildings"* - Short Term Course organized by Civil Engineering Department, SRM Engg college, Kattankulathur. June 2002
4. Smith .B.S. and Coull .A., *"Tall Building Structure"*, 'Analysis and Design', John Wiley & Sons, Inc., 1991
5. Taranath .B.S., *"Structural Analysis and Design of Tall Buildings"*, Mc Graw Hill Co. 1988

M. Tech I Year II Semester

16SE407 ANALYSIS OF SHELLS AND FOLDED PLATES (ELECTIVE – II)

L	T	P	C
0	0	0	4

Objectives:

1. To learn the principles of membrane theory and bending theory of shells.
2. To learn the governing DKJ equation for bending, Schorer's theory.
3. To develop the geometry and analysis of shells of double curvature.
4. To study the concepts of folded plate theory and Whitney's theory.

UNIT-I

EQUATIONS OF EQUILIBRIUM: Introduction, classification, derivation of stress Resultants, Principles of membrane theory and bending theory.

UNIT-II

CYLINDRICAL SHELLS: Derivation of governing DKJ equation for bending theory, details of Schorer's theory, Applications to the analysis and design of short shells and long shells. Introduction of ASCE manual coefficients for design.

UNIT-III

INTRODUCTION TO SHELLS OF DOUBLE CURVATURE: (other than shells of revolution :) Geometry and analysis of elliptic paraboloid, rotational paraboloid and hyperbolic paraboloid shapes by membrane theory.

UNIT-IV

FOLDED PLATES: Folded plate theory, plate and slab action, Whitney's theory, Simpson's theory for the analysis of different types of folded plates (Design is not included)

UNIT-V

SHELLS OF DOUBLE CURVATURE: Surfaces of revolution .Derivation of equilibrium equations by membrane theory, Applications to spherical shell and rotational Hyperboloid

Expected Outcomes:

1. Understand the classification and stress resultants of shells.
2. Able to apply DKJ equation and schorer's theory for cylindrical shells.
3. Able to apply the geometry, analysis of shells subjected to double curvature.
4. Able to solve folded plates by using whiney's and Simpson's theories.

Text books:

1. Design and construction of concrete shell roofs by G.S. Rama Swamy – CBS Publishers & Distributors, 485, Jain Bhawan Bhola Nath Nagar, shahotra, Delhi.
2. Fundamentals of the analysis and design of shell structures by Vasant S.kelkar Robert T.Swell – Prentice hall, Inc., Englewood cliffs, new Jersy -02632.

Reference books:

1. N.k.Bairagi, Shell analysis, Khanna Publishers, Delhi, 1990.
2. Billington, Ithin shell concrete structures, Mc Graw Hill Book company, New york, St. Louis, Sand Francisco, Toronto, London.
3. ASCE Manual of Engineering practice No.31, design of cylindrical concrete shell roofs ASC, Newyork

M. Tech I Year II Semester

16SE408 ADVANCED BRIDGE ENGINEERING (ELECTIVE-II)

L	T	P	C
4	0	0	4

Objectives:

1. To acquaint with the different loads and support conditions pertaining to design of Bridges
2. To understand the IRC loads and design considerations of bridges
3. To understand the design of different types of bridges
4. To understand the design of bridge foundations, piers and abutments.

UNIT-I

INTRODUCTION: Introduction and selection of type of Bridges- Loads and forces.

BOX CULVERT: General aspects – Design loads – Design moments, shears and thrusts – Design of critical section.

UNIT-II

DESIGN OF SLAB BRIDGES: Effective width of analysis – workings stress design and detailing of slab bridges for IRC loading.

T-BEAM BRIDGES: Introduction – wheel load analysis – B.M. in slab – Pigaud's theory – analysis of longitudinal girders by Courbon's theory working stress design and detailing of reinforced concrete T-beam bridges for IRC loading.

UNIT-III

PRESTRESSED CONCRETE BRIDGES: General features – Advantages of Prestressed concrete bridges – pretensioned prestressed concrete bridges – post tensioned prestressed concrete Bridge decks. Design of post tensioned prestressed concrete slab bridge deck.

UNIT-IV

BRIDGE BEARINGS: General features – Types of bearings – forces on bearings basis for selection of bearings – Design principles of steel rocker and roller bearings and its design – Design of elastometric pad bearing detailing of elastometric pot bearings.

UNIT-V

PIERS AND ABUTMENTS: Design of Abutments, Piers and their foundations.

Expected Outcomes:

1. Identify different loads and support conditions pertaining to design of bridges.
2. Design foundations for bridges
3. Design the piers and abutments for bridges.
4. Design box culverts, t-beam bridges and prestressed concrete bridges

Text Books:

1. D.Johnson Victor, *Essentials of Bridges Engineering,* Oxford& IBH publisher's Private Ltd.
2. FR Jagadeesh, M.A. jaya Ram, *Design of Bridge Structures*, Eastern Economy edition.
3. D.Johnson Victor, *Essentials of Bridges Engineering,* Oxford& IBH publisher's Private Ltd.
4. S.Ponnuswamy, *Bridge Engineering,* Mc Graw Hill Education.

Reference Books :

1. MC Aswanin VN Vazrani, MM Ratwani, *Design of Concrete Bridges*, Khanna publishers.
2. Taylor F.W., Thomson, S.E., and Smulski E., *Reinforced Concrete Bridges,* John wiley and sons, New York, 1955.
3. Derrick Beckett, *An Introduction to Structural Design of Concrete Bridges*, Surrey University; press, Henlely – Thomes, Oxford Shire, 1973
4. S.Ponnuswamy, *Bridge Engineering,* Mc Graw Hill Education.

5. MC Aswanin VN Vazrani, MM Ratwani, *Design of Concrete Bridges*, Khanna publishers.
6. Taylor F.W., Thomson, S.E., and Smulski E., *Reinforced Concrete Bridges,* John wiley and sons, New york, 1955.
7. Derrick Beckett, *An Introduction to Structural Design of Concrete Bridges*, Surrey University; press, Henlely – Thomes, Oxford Shire, 1973
8. FR Jagadeesh, M.A. jaya Ram, *Design of Bridge Structures*, Eastern Economy edition.

M. Tech I Year II Semester

16SE202 Computer Aided Design and Drawing Lab

L	T	P	C
0	0	3	2

Course Objectives:

1. To learn the software applications in structural engineering.
2. To learn the analysis of plane, space truss and frames subjected to different types of loadings.
3. To draw the detailing of RCC members and to learn the estimations.
4. To study the design concepts of steel members like truss, beams and columns.

List of Experiments:

1. Analysis and Design of plane frame using STAAD Pro
2. Analysis and Design of truss using STAAD Pro
3. Design of continuous beam using MS Excel/STAAD Pro
4. Design of columns using MS Excel/STAAD Pro
5. Design of one way Slab using MS Excel
6. Design of two way Slab using MS Excel
7. Analysis of Bridge Deck slab
8. Design of Combined Footing using MS Excel/STAAD Pro
9. Analysis of Multistoreyed space frame using STAAD Pro
10. Analysis of Retaining wall using MS Excel/STAAD Pro

Course Outcomes:

After completion of the course the student will be able to

1. Understand the software usages for structural members.
2. Able to analyse plane, space frames and dynamic response and natural frequency for beams and frames.
3. Able to design, detailing and estimations of RC members.
4. Able to design the steel members like truss, beams and columns.