Academic Regulations,

Course Structure and Syllabus

M.TECH

Civil Engineering

(2 Years Program)

NARASARAOPETA
NEC ENGINEERING COLLEGE
(AUTONOMOUS)

Kotappakonda Road, Yellamanda (Post), Narasaraopet – 522601, Guntur District, AP

Approved by AICTE, New Delhi & Permanently affiliated to JNTUK, Kakinada, Code: 47,

Accredited by NBA&NAAC, RTA Approved Pollution test Centre, ISO 9001 : 2008 Certified Institution

Phone No. : 08647-239905 **Website:www.nrtec.ac.in**

ACADEMIC REGULATIONS - 2019 FOR M.TECH

(Effective for the students admitted into I year from the Academic Year 2019-20 and onwards)

1. QUALIFICATION FOR ADMISSION

Admission to the above program 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 GATE/PGECET or on the basis of any other order of merit as approved by the Government from time to time.

2. AWARD OF M.TECH. DEGREE

A student will be declared eligible for the award of the M. Tech. Degree, if he fulfils the following academic requirements.

(a) Pursue a course of study for not less than two academic years and not more than four academic years.

(b) The candidate registers for 80 credits and secure all 80 credits.

3. COURSES OF STUDY

The following courses of study are offered at present as specializations in the

M.Tech. courses with English as medium of instruction.

S. No.	Specialization Code	Abbreviation
01	06 - DSCE	Digital Systems and Computer Electronics
02	15 - MD	Machine Design
03	21 - TE	Thermal Engineering
04	38 - DECS	Digital Electronics and Communication Systems
05	42 - P&ID	Power and Industrial Drives
06	58 - CSE	Computer Science and Engineering
07	87 - SE	Structural Engineering

And any other course as approved by the authorities from time to time.

4. STRUCTURE OF THE PROGRAMME

Semester	Credits
I M.TECH I SEM	21
I M.TECH II SEM	21
II M.TECH III SEM	38
II M.TECH IV SEM	
TOTAL	80

Each course is normally assigned a certain number of credits as follows:

- 3 credits for 4 lecture periods.

- 3 credits for 6 laboratory periods per week.

- 1 credit for seminar.

- 2 credits for comprehensive viva

- 35 credits for project work.

The performance of the candidate in each semester shall be evaluated subject wise, with a maximum of 100 marks for theory / practical / seminar / comprehensive viva on the basis of internal evaluation and end semester examinations.

5.1 THEORY

All theory subjects consisting of 6 units in each subject, the assessment shall be for 40 marks through internal evaluation and 60 marks through external end semester examination of 3 hours duration.

5. 1.a. INTERNAL EVALUATION

The internal evaluation will be based on two cycle tests conducted in each semester. The 40 internal marks will be awarded as 75% of the best cycle and 25% of the least cycle examinations, where each cycle of examination contain

Descriptive test - 30 Marks

Assignment test - 10 Marks

Each descriptive test question paper contains3 questions one from each unit covering syllabus from 3 units (first 3 units for first cycle and the remaining 3 units for second cycle). The student has to answer all the three questions (3X10M=30M).The descriptive examination will be conducted for1½ hour duration.

In Assignment Tests 5 or 6 questions will be declared in the class room at least one week in advance. In the test, two questions (one from each unit) will be given at random to each student and the student has to answer it.

The Assignment Test-1 will be conducted for 10 marks covering the syllabus from 1st& 2nd units.The Assignment Test-2 will be conducted for 10 marks from 4th&5th units.

5.1.b. EXTERNAL EVALUATION

The question paper comprises of 8 questions, there should be one from each unit. Student has to answer 5 questions out of 8, each question carry 12marks (5X12=60). The duration of end theory examination is 3 hours.

5.2 PRACTICALS

For practical subjects evaluation is as follows during the semester

5.2.a. INTERNAL EVALUATION

There shall be continuous evaluation during the semester for 40 internal marks. The internal marks shall be awarded as follows:

Record - 10 Marks

Day-to-day work - 15 Marks

Internal Lab Test - 15Marks

5.2.b. EXTERNAL EVALUATION

For practical subjects there shall be an external examination at the end of the semester for 60 marks in the presence of external examiner.

5.3 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 end semester examination and a

minimum of 50% of the total marks in the end semester examination and internal evaluation taken together.

5.4 SEMINAR

For seminar, a student under the supervision of a faculty member shall collect the literature on an advanced topic related to his specialization and review the literature then submit it to the department in a report form during the third semester and shall make an oral presentation before the departmental review committee consisting of the supervisor and head of the department / a senior faculty member. There shall be an internal evaluation for 100 marks in the form of viva voce examination and assessment of report and its presentation. There will be NO external evaluation. A candidate shall be deemed to have secured the minimum academic requirement in seminar, if he secures a minimum of 50% of marks in the examination.

If a candidate fails to secure the minimum marks prescribed for successful completion, he has to re-register and he has to submit a fresh report and appear for the evaluation by the committee.

5.5 COMPREHENSIVE VIVA-VOCE

Comprehensive viva voce examination is conducted during the 3rd semester in all the subjects of first & second semesters of the course by a committee consisting of two senior faculty members of the department. There will be NO external evaluation.

A candidate shall be deemed to have secured the minimum academic requirement in Seminar, if he secures a minimum of 50% of marks in the examination.

If a candidate fails to secure the minimum marks prescribed for successful completion, he has to re-register and undergo viva voce examination.

5.6 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.3) he has to re-appear for the end semester examination in that subject.

A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate is less than 50% and has failed in the end examination. In such a case, the candidate must re-register for the subject(s) and secure

the required minimum attendance. The candidate's attendance in the re-register subject(s) shall be calculated separately to decide upon his eligibility for writing the end examination in those subject(s). In the event of the student taking another chance, his internal marks and end examination marks in the previous attempt stand cancelled. For re-registration the candidates have to apply to the college by paying the requisite fee and get approval from the authorities before the beginning of the semester in which re-registration is required.

5.7 In case the candidate secures less than the required attendance in any re-registered subject(s), he shall not be permitted to write the End examination in that subject. He shall again re-register the subject when next offered.

5.8 Laboratory examinations must be conducted with two examiners, one of them being the laboratory class teacher or teacher of the respective college and the second examiner shall be appointed by the Principal from the panel of examiners submitted by the respective departments.

5.9 PROJECT WORK

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

5.9.1. A Project Review Committee (PRC) shall be constituted with Head of the Department and two other senior faculty members.

5.9.2. 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.

5.9.3. After satisfying 5.9.2, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work for approval. The students can initiate the Project work, only after obtaining the approval from the Project Review Committee (PRC).

5.9.4. If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the Project Review Committee (PRC). However, the Project Review Committee (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.

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

5.9.6. The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical subjects with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. The candidate has to pass all the theory and practical subjects before submission of the Thesis.

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

5.9.8. The thesis shall be adjudicated by one examiner selected by the authorities. For this, the HOD of the concerned dept. shall submit a panel of 5 examiners, eminent in that field, with the help of the guide concerned.

5.9.9. If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is unfavourable again, the thesis shall be summarily rejected. The candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the authorities.

5.9.10. If the report of the examiner is favourable, viva-voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the thesis. The Board shall jointly report the candidate's work as one of the following: Grade O(Outstanding)/ Grade A(Excellent)/Grade B(Very Good) /Grade C(Good)/ Grade D(Pass)/ Grade F(Fail).

The Head of the Department shall coordinate and make arrangements for the conduct of viva-voce examination.

5.9.11. If the report of the viva-voce is Grade F, the candidate shall retake the viva-voce examination only after three months. If he fails to get a satisfactory report at the second viva-voce examination, the candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the authorities.

6. ATTENDANCE REQUIREMENTS:

(i) A student shall be eligible to appear for the end examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects.

(ii) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester for genuine medical reasons and shall be approved by a committee duly appointed by the college. A fee stipulated by the college shall be payable towards condonation of shortage of attendance. However the number of condonations is restricted to two for the entire course.

(iii) A student who is short of attendance in a semester may seek re-admission into that semester when offered next time, within 4 weeks from the date of commencement of class work.

(iv) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for re-admission into the same class.

7. COURSE PATTERN:

(i) The entire course of study is of two academic years and every year will have TWO Semesters.

(ii) A student is eligible to appear for the end examination in a subject, but absent for it or has failed in the end examinations may appear for that subject in supplementary examinations, when conducted next.

(iii) When a student is detained due to shortage of attendance, he may be re-admitted in to the same semester/year in which he has been detained.

8. METHOD FOR AWARDING OF GRADE POINTS FOR A SUBJECT:

Theory/ Laboratory / Seminar/ Comprehensive viva/ Project (% of marks in a subject)	Corresponding Grade Points	Letter Grade
91 - 100	10	O (Outstanding)
81 - 90	9	A (Excellent)
71 - 80	8	B (Very Good)
61 - 70	7	C (Good)
51 - 60	6	D (Pass)
< 50	0	F (Fail)

9. Criteria for award of grades/division.

9.1 Calculation of Semester Grade Point Average (SGPA)* for semester

The performance of each student at the end of each semester is indicated in terms of SGPA. The SGPA is calculated as given below:

$$\text{SGPA}= \frac{\sum(CR\,X\,GP)}{\sum CR}$$

Where CR= Credits of a subject

GP = Grade Points awarded for a subject

*SGPA is calculated for a candidate who passed all the subjects in that semester.

9.2 Calculation of Cumulative Grade Point Average (CGPA) for Entire Program:

The CGPA is calculated as given below:

$$\text{CGPA}= \frac{\sum(CR\,X\,GP)}{\sum CR}$$

Where CR = Credits of a subject

GP = Grade Points awarded for a subject

- The SGPA and CGPA shall be rounded off to 2 decimal point and reported in the transcripts.
- Equivalent percentage = (CGPA – 0.75) x 10

9.3 Award of Division:

After satisfying the requirements prescribed for the completion of the program, the student shall be eligible for the award of M.Tech Degree and shall be placed in one of the following classes:

CGPA	Class
≥ 7.75	First Class with Distinction (Provided all the subjects should pass in the first attempt)
≥ 6.75	First Class (with subject failures)
≥ 5.75 &< 6.75	Second Class

10. REVALUATION:

1. Student can submit the application for revaluation, along with the prescribed fee for revaluation of his answer script(s) of theory subject(s) as per the notification issued by the Controller of Examinations.
2. The Controller of Examinations shall arrange for revaluation of such answer script(s).
3. An External examiner, other than the first examiner shall revaluate the answer script(s).

11. MINIMUM INSTRUCTION DAYS:

The minimum instruction days for each semester shall be 90 working days.

12. There shall be no branch transfer after the completion of admission process.

13. WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, to the college or if any case of indiscipline is pending against him, the result of such student will be kept withheld. His degree will be withheld in such cases.

14. TRANSITORY REGULATIONS

Discontinued or detained candidates are eligible for readmission as and when next offered.

A candidate, who is detained or discontinued in a semester, on readmission shall be required to do all the subjects in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such subjects in the earlier semester(s) he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

14.1 A student who is following JNTUK curriculum and detained due to shortage of attendance at the end of the first semester of first year shall join the autonomous batch of first year first semester. Such students shall study all the subjects prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

14.2 A student who is following JNTUK curriculum, detained due to shortage of attendance at the end of the second semester of first year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the subjects in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the subjects of the semester(s) of the batch which he had passed earlier and substitute subjects will be offered in place of them as decided by the Board of Studies. The student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree will be sum of the credits up to previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

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MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT INEXAMINATIONS

- The Principal shall refer the cases of Malpractices in Internal Assessment Test and Semester end examinations to a malpractice prevention committee constituted by him for the purpose. Such committee shall follow the approved levels of punishment. The Principal shall take necessary action against the students based on the recommendations of the committee.
- Any action by the candidate trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder:

	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 subject of the examination).	Expulsion from the examination hall and cancellation of the performance in that subject only.
1(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.

2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination(theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the college.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from classwork and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles 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 subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from classwork and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent /any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-incharge 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	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s)has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	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.	
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from classwork and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.

9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6to 8.	Student of the college expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the college for further action	

	to award suitable punishment.	

OTHER MATTERS:

1. Physically challenged candidates who have availed additional examination time and a scribe during their UG / PGECET examinations will be given similar concessions on production of relevant proof / documents.

2. The Principal shall deal in an appropriate manner with any academic problem which is not covered under these rules and regulations, in consultation with the Heads of the departments and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of regulation, approved in the meetings of the Heads of the departments shall be reported to the Academic Council for ratification.

GENERAL:

1. The academic council may, from time to time, revise, amend or change the regulations, schemes of examinations and / or syllabi.
2. Wherever the words ''he'' ''him'' ''his'', occur in the regulations, they include ''she'', ''her'', ''hers''.
3. The academic regulation should be read as a whole for the purpose of any interpretation.
4. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the principal is final.

NARASARAOPETA ENGINEERING COLLEGE::NARASARAOPET
(Autonomous)

M.TECH (STRUCTURAL ENGINEERING)

COURSE STRUCTURE

COURSE: M.TECH I SEMSTER

S.No	SubjectName	Subject Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Advanced engineering mathematics	19MSE1TH01	3	-	-	40	60	100	3
2	Theory of elasticity	19MSE1TH02	3	-	-	40	60	100	3
3	Matrix analysis of structural	19MSE1TH03	3	-	-	40	60	100	3
4	Advanced structural engineering	19MSE1TH04	3	-	-	40	60	100	3
5	**Elective–I**								
	Design of tall structures	19MSE1PE11	3	-	-	40	60	100	3
	Adavaced masonry structures	19MSE1PE12							
	Repair and rehabilitation of structures	19MSE1PE13							
	Advanced pre-stressed concrete	19MSE1PE14							
6	**Elective–II**		3	-	-	40	60	100	3
	Building information modeling	19MSE1PE21							
	Advanced concrete technology	19MSE1PE22							

	Soil dynamics and foundation engineering	19MSE1PE23							
	Plastic structural analysis	19MSE1PE24							
7	Advanced structural engineering laboratory	119MSE1LB01	-	-	6	40	60	100	3
	TOTAL		**18**	**-**	**6**	**280**	**420**	**700**	**21**

COURSE: M.TECH II SEMSTER

S.No	SubjectName	Subject Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Research methodology	19MSE2TH01	3	-	-	40	60	100	3
2	Finite element method	19MSE2TH02	3	-	-	40	60	100	3
3	Seismic resistant design	19MSE2TH03	3	-	-	40	60	100	3
4	Stability of structures	19MSE2TH04	3	-	-	40	60	100	3
5	**Elective–III**								
6	Design of industrial structures	19MSE2PE31	3	-	-	40	60	100	3
	Theory of plates and shells	19MSE2PE32							
	Advanced reinforced concrete design	19MSE2PE33							
	Experimental stress analysis	19MSE2PE34							
7	**Elective–IV**		3	-	-	40	60	100	3

	Design of offshore structure	19MSE2PE41							
	Advanced steel structures	19MSE2PE42							
	Mechanics of composite materials	19MSE2PE43							
	Alternative building materials	19MSE2PE44							
	Advanced computer application in structural engineering-acase	19MSE2LB01	-	-	6	40	60	100	3
	TOTAL		**18**	**-**	**6**	**280**	**420**	**700**	**21**

IIYear - III& IVSEMESTERS

S.NO	NAME OFTHE SUBJECT	L	P	C
1	**Seminar (19MSE3SM)**	**-**	**-**	**1**
2	**Comprehensive Viva-Voce (19MSE3CV)**	**-**	**-**	**2**
3	**Project (19MSE4PW)**	**-**	**-**	**35**
	TOTAL	**-**	**-**	**38**

M.TECH-I SEMESTER (CIVIL-SE)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE1TH01	**ADVANCED ENGINEERING MATHEMATICS**						

Course Objectives: ·

1. To know how to solve system of equations, ordinary differential equations and partial differential equations numerically.
2. To understand correlation and regression
3. To know optimization techniques in solving linear, integer and fractional programming problems

Course Outcomes:

Students will be able to ·

1. Find the solutions of system of linear and nonlinear equations. ·
2. Solve ordinary and partial differential equations numerically.
3. Find correlation coefficient and regression.
4. Optimize linear, integer and fractional programming problems.

UNIT-I

Statistic: Elements of statistic, frequency distribution; Concept of mean, median, mode and different types of distribution; Standard deviation and variance; Curve fitting by least square method; Correlation and Regression, Testing of Hypothesis; Basic type of factorial design and Analysis of Variance.

UNIT-II

Partial differential equations: Finite differences, wave equation- one and two dimensions, heat equation- one dimension and two dimension.

UNIT-III

Numerical Solutions of Elliptic (5-point formula, diagonal formula), Parabolic equations (Bender Smith, Crank Nickalson's formula)

UNIT-IV

Numerical method: Interpolation by Polynomial, Error analysis, Solution of system of linear equation by Gauss Seidal iterative method, Newton Rapson method Numerical Integration by Gauss quadrature, Solution of ordinary differential equation by Rayligh-Ritz method.

UNIT-V

Ordinary Differential Equation: i) 2nd order homogeneous equation ii) Euler Cauchys equation iii) non homogeneous linear equation.

UNIT-VI

Calculations of variations: Introduction, Functional, Euler's equation, Solutions of Euler's equations, Geodesics, Isoperimetric Problems, Several Dependent Variables, Functional

involving higher order derivatives, weighted residual method, Galerkin's method, Hamilton's principle, Lagrange's equations.

TEXT BOOK :

1. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar, R. K. Jain (New Age)
2. Dr. B.S. Grewal "*Higher Engineering Mathematics*", 42nd Edition, Khanna Publishers, 2012.
3. Introductory Methods of Numerical Analysis by S. S. Sastry (PHI).

REFERENCE BOOKS:

1. An Outline of Statistical Theory, Vol. I, II by A. M. Goon, M. K. Gupta, B. Dasgupta (The World Press Pvt. Ltd.)

3. The Design of Experiments to Find Optimal Conditions by Yu. P. Adler, E. V. Markova, Ylu V. Granovsky (MIR, 1975, Moscow)

4. Advanced Engineering Mathematics by Stanley Grossman & William R. Derrick (Harper & Row Publisher**.**

I M.TECH-I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE1TH02	**THEORY OF ELASTICITY**						

Course Objectives:

- To understand the basic concepts of deformation and strains.
- To know about the 3D stress and strain transformation.
- To know about equations and solution methods in Cartesian and polar problems in theory of elasticity.
- To know the theory of torsion of non-circular sections.

Course Outcomes:

Upon completion of this course, the student will be able to

- Formulate the equilibrium and compatibility conditions.
- Solve 2D stress and strain transformations.
- Analyse the stresses for three dimensional elements.
- Analyse problems in 2D Cartesian and polar elasticity problems.
- Solve the problems on Torsion for different shaped bars.

UNIT-I

DEFINITION AND NOTATION: Stress, Stress at a Point, Equilibrium Equations, Principal Stresses, Maximum Shear Stress, Boundary Conditions.

STRAIN AT A POINT: Compatibility Equations, Principal Strains, Generalised Hooke's law, Methods of Solution of Elasticity Problems – Plane Stress-Plane Strain Problems.

UNIT-II

TWO DIMENSIONAL PROBLEMS: Cartesian co-ordinates – Airy's stress functions – Investigation of Airy's Stress function for simple beam problems – Bending of a narrow cantilever beam of rectangular cross section under edge load – method of Fourier analysis – pin ended beam under uniform pressure.

UNIT-III

THREE DIMENSIONAL PROBLEMS: Principal stresses in three dimensions, stress invariants, equilibrium equations, octahedral stresses.

UNIT-IV

GENERAL EQUATIONS IN CYLINDRICAL CO-ORDINATES: Thick cylinder under uniform internal and / or external pressure, stress concentration.

UNIT-V

STRESSES IN AN INFINITE PLATE (with a circular hole) subjected to uniaxial and biaxial loads, stress concentration, stresses in rotating discs and cylinders.

UNIT-VI

TORSION OF CIRCULAR, ELLIPTICAL AND TRIANGULAR BARS: Membrane analogy, torsion of thin open sections and thin tubes.

TEXT BOOKS:

1. **Theory of Elasticity:** S. P. Timoshenko and J. N Gordier, Mc. Graw Hill International, 3rd edition, 2017
2. **Advanced Mechanics of solids**, L. S. Srinath, Tata Mc. Graw Hill, 2003

Reference Books

1. **Theory of Elasticity:** Dr. Sadhu Singh, Khanna Publications, 1988
2. **Elasticity, Theory, Applications &Numericals:** Martin H Sadd, Elsevier. 2005
3. **Applied Elasticity,** Seetharamu&Govindaraju, Interline Publishing
4. **Applied Elasticity,** C.T. WANG Sc. D. Mc. Graw Hill Book Co.

I M.TECH-I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE1TH03	**MATRIX ANALYSIS OF STRUCTURAL**						

Course Objectives:

- To know the static and kinematic indeterminacy of structures.
- To explain the flexibility matrix concept
- To explain the stiffness matrix concept
- To solve the beams by flexibility and stiffness matrix
- To solve the frames by flexibility and stiffness matrix
- To solve the trusses by flexibility and stiffness matrix

Course out comes:

At end of this course the student will able to

- Identifies the static and kinematic indeterminacy of structures.
- Analyze the beams by using flexibility and stiffness methods
- 3 -Analyze the trusses by using flexibility and stiffness methods
- Analyze the space structures and grids stiffness methods
- 5-Evaluating new model by using computer programming

UNIT-I

Introduction to Concept of static and kinematic indeterminacy

Flexibility method: Introduction to flexibility method, Element flexibility matrix

Analysis of axially rigid continuous beams and trusses by flexibility method using Force Transformation Matrix

UNIT-II

The Matrix Displacement Approach; Introduction; Stiffness Matrix of a Bar Element subjected to Axial Force; Co-ordinate Transformations. Global Stiffness matrix Application to Pin-Jointed Frames; Stiffness Matrix of a Beam Element; Application to Continuous Beams

UNIT-III

Matrix Displacement Analysis of Planar Rigid-Jointed Frames; Neglect of Axial Strain in the Analysis of Planar Rigid-Jointed Frames Inclined Supports Other Kinds of Loading & Other Kinds of Frames.

UNIT-IV

Matrix Displacement Analysis of Grillage or Grid,Co-ordinate transformations. Element Stiffness Matrix & its Application.

UNIT-V

Matrix Displacement Analysis of Three-Dimensional Structures, Co-ordinate Transformations Application to Space Trusses & Space Frames.

UNIT-VI

Computer programming

Programming of solution techniques for simultaneous equation solution - Matrix operation - Simple program development for element stiffness matrix - assemblage - Complete structure of a stiffness analysis program with subroutines - Use of GTSTRUDL / STAAD / SAP to solve problems in trusses, beams and frames.

TEXT BOOKS:

1. Matrix& Finite Element Displacement Analysis of Structures: D.J.Dawe.
2. Computer Analysis of Structural Systems: John F. Fleming.
3. Matrix Methods of Structural Analysis: C.K.Wang.
4. Matrix Analysis of Framed Structures: Gere & Weaver.
5. Introduction to Matrix Methods of Structural Analysis: Martin,H.C.

REFERENCES

1. *Jack. C, McCormac, " Structural Analysis: Using Classical and Matrix Methods", John Wiley, Fourth Edition, 2007.*
2. *Rajasekaran.S, Sankarasubramanian.G, "Computational Structural Mechanics", Prentice Hall of India Pvt Ltd, New Delhi - 110 001, First Edition, 2001.*
3. *William McGuire, Richard. H, Gallagher and Ronald. D, Ziemian"Matrix Structural Analysis, With MASTAN2", John Wiley, Second Edition, 2000 .*
4. *Beaufit F.W et al. "Computer Methods of Structural Analysis", Prentice Hall, 1970.*
5. *John L.Meek, "Matrix Structural Analysis", McGraw Hill Book Company, 1971.*
6. *Bathe K.J, and Wilson. E.L, "Numerical Methods in Finite Element Analysis", Prentice Hall, Engle Wood Cliffs, New Jersey, USA, 1976.*
7. *Rubinstien. M.F, "Matrix Computer Analysis of Structures", Prentice Hall, 1966.*

I M.TECH-ISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE1TH04	**ADVANCED STRUCTURAL ENGINEERING**						

Course Objectives:
The objectives of this course are

- To make students to learn principles of Structural Dynamics,
- To implement these principles through different methods and to apply the same for free and forced vibration of structures.
- To evaluate the dynamic characteristics of the structures.
- To study earthquake response of MDOF systems.
- To evaluate the methods of vibration control.

Course Outcomes:
On completion of this course, students are able to

- Achieve Knowledge of design and development of problem solving skills.
- Understand the principles of Structural Dynamics
- Design and develop analytical skills.
- Summarize the Solution techniques for dynamics of Multi-degree freedom systems
- Understand the concepts of damping in structures.

UNIT-I
Introduction: Introduction to Dynamic problems in Civil Engineering, Differential Equations in Civil Engineering,Concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement and energy principles Dynamics of Single-degree-of-freedom systems: Mathematical models of Single-degree-of-freedom systems system, Free vibration response of damped and undamped systems.Logarithmic decrement equation, Methods of evaluation of damping.

UNIT-II
Response of Single-degree-of-freedom systems to harmonic loading (rotation unbalance, reciprocating unbalance) including support motion, vibration isolation, transmissibility, Numerical methods applied to Single-degree-of-freedom systems - Duhamel integral, principle of vibration-measuring instruments – seismometer and accelerometer.

UNIT-III
Dynamics of Multi-degree freedom systems: Time History Analysis,Response Spectrum Analysis,3D Dynamic Analysis, Mathematical models of multi-degree-of-freedom systems, Shear building concept, free vibration of undamped multi-degree-of-freedom systems - Natural frequencies and mode shapes – orthogonality property of modes.

UNIT-IV

Response of Shear buildings for harmonic loading without damping using normal mode approach. Response of Shear buildings for forced vibration for harmonic loading with damping using normal mode approach, condition of damping uncoupling.

UNIT-V

Approximate methods: Rayleigh's method, Stodola's method. Dynamics of Continuous systems: Free longitudinal vibration of bars, flexural vibration of beams with different end conditions,

UNIT-VI

Stiffness matrix, mass matrix (lumped and consistent); equations of motion for the discretised beam in matrix form.

REFERENCE BOOKS:

1. Dynamics of Structures – Theory and Application to Earthquake Engineering"- 2nd ed., Anil K. Chopra, Pearson Education.
2. Earthquake Resistant Design of Building Structures, VinodHosur, WILEY (india)
3. Vibrations, structural dynamics- M. Mukhopadhaya : Oxford IBH
4. Structural Dynamics- Mario Paz : CBS publishers.
5. Structural Dynamics- Clough &Penzien : TMH 6. Vibration Problems in Engineering Timoshenko, S, Van-Nostrand Co.

I M.TECH-ISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE1PE11	**DESIGN OF TALL STRUCTURES**						

Course Objectives:
The objectives of this course is

- To make students to learn principles of stability of tall buildings,
- To design the tall buildings for earthquake and wind resistance.
- To evaluate the performance of tall structures for strength and stability.

Course Outcomes:
On completion of this course, students are able to

- Classify the different loading conditions
- Evaluate the structures by different design methods
- Design framed structures.
- Summarize the behaviour of various structural systems.
- Design the structures at different failure effects.

UNIT-I

Design Criteria: Design philosophy, loading, sequential loading, and materials – high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes. Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Gravity loading, Construction loads

UNIT-II

Wind loading: static and dynamic approach, Analytical and wind tunnel experimentation method. Earthquake loading: Equivalent lateral force, modal analysis, combinations of loading, working stress design, Limit state design, Plastic design.

UNIT-III

Behavior of Various Structural Systems: Factors affecting growth, Height and structural form; High rise behavior, Rigid frames, braced frames, in-filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, Futigger – braced and hybrid mega system.

UNIT-IV

Analysis and Design: Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of building as total structural system considering overall integrity and major subsystem interaction, analysis for member forces; drift and twist, computerized general three dimensional analyses.

UNIT-V

P-Delta analysis, simultaneous first order and P-Delta analysis, Transnational, Torsional instability, out of plum effects, stiffness of member in stability, effect of foundation rotation.

UNIT-VI

Structural elements: sectional shapes, properties and resisting capacities, design, deflection, cracking, pre-stressing, shear flow. Design for differential movement, creep and shrinkage effects, temperature effects and fire

REFERENCE BOOKS:

1. Taranath B.S, "Structural Analysis and Design of Tall Buildings"- McGraw Hill
2. Wilf gang Schuller, "High rise building structures"- John Wiley
3. Bryan Stafford Smith &Alexcoull, "Tall building structures Analysis and Design"- John Wiley
4. T.Y Lin &D.Stotes Burry, "Structural concepts and system for Architects and Engineers"- John Wiley
5. Lynn S.Beedle, "Advances in Tall Buildings"- CBS Publishers and Distributors.
6. Dr. Y.P. Gupta – Editor, "Proceedings National Seminar on High Rise Structures- Design and Construction practices for middle level cities"- New Age International Limited.

I M.TECH-ISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE1PE12	**ADAVACED MASONRY STRUCTURES**						

Learning Objectives

- The primary objective of this course is to familiarize the student with the complete design of a masonry structure.
- This includes not only the study of masonry as a building material but the design of an actual structure for all code prescribed loads including wind and seismic analysis.
- The course includes a design with axially loaded and eccentrically loaded masonry structures and deals with the structural considerations.
- And design of laterally and transversely loaded walls by using code provisions**.**

Course outcomes

Upon successful completion of the course, the student will be able to

- Identify the properties of materials for masonry structures
- Analyses the strength and stability of masonry structures by using empirical methods
- Analysis and design behaviour of the structural member under bending and shear.
- Design of masonry structures under axial load and eccentrically loads

UNIT-I

Masonry Units, Materials, types and masonry construction: Bricks, Stone and Block masonry units- strength, modulus of elasticity and water absorption of masonry materials – classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.

UNIT-II

Strength and Stability: Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

UNIT-III

Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.
Design Considerations: Effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars

UNIT-IV

Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

UNIT-V

Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.

UNIT-VI

Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads, problems on eccentrically loaded solid walls, cavity walls, walls with piers.

TEXT BOOKS:

1. Brick and Reinforced Brick Structures by Dayaratnam, P, Oxford & IBH Publishing House, 1997
2. Advanced Masonry Skills by Richard TSr. Kreh
3. Masonry Structures by Frederick Putnam Spalding
4. Design of masonry Structures by A.W. Hendry, B.P. Sinha, S.R. Davies

REFERENCES

1. NarendraTaly, Design of Reinforced Masonry Structures, ICC, 2nd Edition
2. Robert G. Drysdal, Masonry Structures behavior and Design.
3. 'Masonry Designers' Guide: Based on Building Code Requirements for Masonry Structures (ACI 530-99)

I M.TECH-I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE1PE13	**REPAIR AND REHABILITATION OF STRUCTURES**						

Course Objectives:
The objectives of this course is

- To investigate the cause of deterioration of concrete structures.
- To strategise different repair and rehabilitation of structures.
- To evaluate the performance of the materials for repair.

Course Outcomes: students are able to

- Evaluate the cause of deterioration of concrete structures.
- Analyze the concept of Serviceability and Durability.
- Examine how the Concrete repair industry equipped with variety of repair materials and techniques
- Analyzing the repairing of structures and demolition procedures.

UNIT-I

Introduction: Cause of deterioration of concrete structures, Scenario of distressed structures world over, preliminary investigations, Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking.
Damage Assessment allied Tests (Destructive, Semi-destructive, Nondestructive): Field & laboratory testing procedures for evaluating the structure for strength, corrosion activity, performance & integrity, durability. Interpretation of the findings of the tests.

UNIT-II

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT-III

Protection & maintenance of structures - Importance of protection & maintenance, Categories of maintenance, Building maintenance.Corrosion mitigation techniques to protect the structure from corrosion.
Long term health monitoring / Structural health monitoring (SHM)– Definition and motivation for SHM, Basic components of SHM and its working mechanism, SHM as a tool for proactive maintenance of structures.

UNIT-IV

Materials for Repair: Criteria for durable concrete repair, selection of repair materials, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete, FRP sheets.

UNIT-V

Seismic retrofit of concrete structures: Deficiencies in structure requiring seismic retrofit, Design philosophy, Techniques to enhance the seismic resistance of structures, advanced techniques for making seismic resistant structures

UNIT-VI

Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

TEXT BOOKS:

1. Repair and protection of concrete structures by Noel P.Mailvaganam, CRC Press,1991.
2. Concrete repair and maintenance Illustrated by Peter.H.Emmons, Galgotia publications Pvt. Ltd., 2001.
3. "Earthquake resistant design of structures" by Pankajagarwal, Manish shrikande, PHI, 2006.

REFERENCE BOOKS:

1. Sidney, M. Johnson "Deterioration, Maintenance and Repair of Structures".
2. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific and Technical
3. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons 4. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL)
4. Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India.
5. Handbook on seismic retrofit of buildings, A. Chakrabartiet.al.,Narosa Publishing House, 2010.

I M.TECH-ISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE1PE14	**ADVANCED PRE-STRESSED CONCRETE**						

Course Objectives:

- Familiarize the students with the concepts and principles of prestressed concrete.
- Equip the students with the concepts of design of flexural members.
- Understand the concept of member's deflections of prestressed concrete.

Course Outcomes:

Upon completion of this course, the student will be able to

- Determine the concepts, methods and materials of pre stressing systems.
- Design the pre stressed concrete members.
- Calculate the deflections in pre stressed concrete members.
- Design anchorage zones and composite pre stressed concrete members.
- Analyse the Prestressing techniques; design the various structural elements using Prestressing techniques.

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

MEMBERS DEFLECTIONS OF PRESTRESSED CONCRETE: Importance of Control of Deflections–FactorsInfluencingDeflection– Short term deflections of uncracked members– Prediction of long-time deflections – load – deflection curve for a PSC beam – IS code requirements for max. Deflections.

UNIT-V

PRESTRESSED CONCRETE SLABS:

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

UNIT-VI

Anchorage Zone Stresses in Beams: Introduction, Stress distribution in End Block – Anchorage zone stresses –Magnel's method- Guyon's Method - Anchorage zone Reinforcement.

References:

1. PrestressedConcretebyKrishnaRaju–FifthEdition-TataMcGrawHillBook–Co., NewDelhi.
2. DesignofPrestressConcreteStructuresbyT.Y.LinandBurn,JohnWiley,NewYork.
3. Prestressed Concrete by N. Rajagopalan, Narosa PublishingHouse
4. IS1343-2012,PrestressedConcrete–CodeofPractice,BureauofIndianStandards.
5. PrestressedConcrete:AnalysisandDesignPracticebyKarunaMoyGhosh,Prentice Hall ofIndia

I M.TECH-ISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	1	1	2	40	60	100	3
19MSE1PE21	**BUILDING INFORMATION MODELING**						

Student Learning Outcomes:

Upon completion of the course, the student will have:

1. an ability to apply knowledge of mathematics, science, and engineering gained to understand the fundamentals and basics of BIM
2. an ability to design a system, component, or process to meet desired needs within realistic constraints
3. an ability to identify, formulate, and solve engineering problems
4. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
5. an understanding of professional and ethical responsibility

Description of Course Content:

UNIT I:

Introduction- Introduction to Building Information Modeling (BIM), Understand BIM fundamentals and their relationship to structural engineering practice; Roles and Impacts of BIM- Discussions in the Structural Engineering Design, Construction Engineering and Management (might include: Infrastructure Engineering, and Facility Management);

UNIT II

Introducing Revit: Revit Architecture, Structure, and MEP (Mechanical, Electrical & Plumbing); **Use of Revit** - Creating Sets, Building Elements, Structural Systems, and MEP Systems.

UNIT III

BIM Model integration and Clash Detection – Use of BIM 360 and Navy's works

UNIT IV

Applications of BIM: (i) Concrete reinforcement and Design-to-steel workflows (ii) Construction Project Planning - How the Revit Building Information Model (BIM) 4D can be linked with project planning systems (iii) Construction Cost Estimating and Scheduling - using Revit software product in conjunction with various cost estimating solutions to benefit architects, quantity surveyors and cost estimators and builders.

UNIT V

Future & Ethics of Building Information Modelling – Better Managing and trying to achieve optimization; Information confidentiality, Honesty and integrity, responsibilities to employers and clients; obligations to the profession; legal and technical compliance.

UNIT VI

MoDel based cost estimating -3D modelling by using Revit architecture, model based cost estimating, case studies, site layout planning, BIM challenges.

References:

1) Course Text: Duell, R., Hathorn, T, and Hathorn, T.R. , Autodesk Revit Architecture 2016 Essentials, Wiley and Sons, Inc.
2) Instructors' Lecture Materials, Notes and Handouts.
3) Blackboard (course management)
4) Eastman, C., Teicholz, P., Sacks, R., & Liston, C. (2011). BIM handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors. John Wiley & Sons.
5) Hardin, B., & McCool, D. (2015). BIM and construction management: proven tools, methods, and workflows. John Wiley & Sons
6) Issa, R. R., &Olbina, S. (Eds.). (2015, May). Building Information Modeling: Applications and Practices. American Society of Civil Engineers
7) Teicholz, P. (Ed.). (2013). BIM for facility managers. John Wiley & Sons.
8) Kymmell, W. (2007). Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations (McGraw-Hill Construction Series). McGraw Hill Professional.
9) Eynon, J. (2016). Construction Manager's BIM Handbook. John Wiley & Sons.
10) Pittard, S., & Sell, P. (Eds.). (2016). BIM and Quantity Surveying. Routledge.

I M.TECH-I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE1PE22	**ADVANCED CONCRETE TECHNOLOGY**						

Course objectives:

- To evaluate the behavior of fresh and hardened concrete.
- To make aware the recent developments in concrete technology.
- To inspect the factors affecting the strength, workability and durability of concrete.
- To impart the methods of proportioning of concrete mixtures.
- To elaborate about different special concretes.

Course Outcomes: The students will be able to:

i. Analyze the testing of concrete materials as per IS code and Know the procedure to determine the properties of fresh and hardened of concrete
ii. Design the concrete mix using ACI and IS code methods
iii. Design special concretes depending on their specific applications
iv. Gain ideas on non-destructive testing of concrete
v. Evaluating the solutions for field problems

Unit-I

Cements: Review of types of cements, chemical composition; properties and tests, chemical and physical process of hydration, Blended cements.
Chemical Admixtures: Types and classification; actions and interactions; usage; effects on properties of concrete.

Unit-II

Properties of Fresh Concrete - basics regarding fresh concrete – mixing, workability, placement, consolidation, and curing, segregation and bleeding.
Properties of hardened concrete: Strength- compressive tensile and flexure - Elastic properties - Modulus of elasticity - Creep-factors affecting creep, effect of creep - shrinkage- factors affecting shrinkage, plastic shrinkage, drying shrinkage, autogenous shrinkage, carbonation shrinkage

Unit-III

Mineral Admixtures: Flyash, ground granulated blast furnace slag, metakaolin, rice-husk ash and silica fume; chemical composition; physical characteristics; effects on properties of concrete; advantages and disadvantages. **Proportioning of concrete mixtures:** Factors considered in the design of mix. BIS Method, ACI method.

Unit-IV

Durability of concrete: Durability concept; factors affecting, reinforcement corrosion; fire resistance; frost damage; sulfate attack; alkali silica reaction; concrete in sea water, statistical quality control, acceptance criteria as per BIS code.

Non-destructive testing of concrete: Surface Hardness, Ultrasonic, Penetration resistance, Pull-out test, chemical testing for chloride and carbonation- core cutting - measuring reinforcement cover.

Unit-V

Special concretes - Lightweight concrete- description of various types -High strength concrete - Self compacting concrete -Roller compacted concrete – Ready mixed concrete – Fiber reinforced concrete - polymer concrete .

Unit-VI

Special processes and technology for particular types of structure - Sprayed concrete; underwater concrete, mass concrete; slip form construction, Prefabrication technology.

Text books:

1. Neville A.M.,"Properties of Concrete", Trans-Atlantic Publications, Inc.; 5e, 2012
2. Job Thomas., " Concrete Technology", Cenage learning,
3. R. Santhakumar „ Concrete Technology", Oxford Universities Press, 2006
4. Shetty M. S., Concrete Technology", S. Chand & Co., 2006

References:

1. Mehta and Monteiro, „Concrete-Micro structure, Properties and Materials", McGraw Hill Professional
2. Neville A. M. and Brooks J. J., Concrete Technology, Pearson Education, 2010
3. Lea, Chemistry of Cement and Concrete", Butterworth-Heinemann Ltd, 5e, 2017
4. Bungey, Millard, Grantham – Testing of Concrete in Structures- Taylor and Francis, 2006

IS CODES:

1. IS:10262-2009-Recommended guidelines for concrete Mix Design
2. IS:456-2000- Plain and reinforced concrete code of practice
3. SP: 23-1982- Hand book on Concrete

I M.TECH-I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	6	40	60	100	3
19MSE1PE23	**SOIL DYNAMICS AND FOUNDATION ENGINEERING**						

Course objectives: This course will enable students:

- Theory of vibration.
- Stress, strain and elastic constants.
- Evaluation of design parameters
- Types of machine foundations.
- Active and passive types of isolation
- Construction details of machine foundations

Course outcomes:

On Successful Completion of the course, the student will be able to**:**

- Knowledge ofFree and Forced vibrations
- Stress-strain behavior of soils under cyclic loading
- Dynamic Soil Properties
- Methods of analysis of Machine Foundations
- Have knowledge toVibration of Isolation
- Details of consolidation machine foundations

UNIT - I

THEORY OF VIBRATIONS

Harmonic motion – undamped and damped free vibrations – Forced vibrations – Transient vibrations – Systems with one, two and multidegree freedom.

UNIT - II

WAVE PROPAGATION

Stress, strain and elastic constants – Elastic wave propagation in rods of finite and infinite length – Wave propagations in elastic half space.

UNIT - III

DYNAMIC SOIL PROPERTIES

Evaluation of design parameters – Laboratory and field tests – Stress – Strain characteristic of soil under dynamic loads – Dynamic Bracing Capacity of soils – Pseudo static analysis and dynamic analysis.

UNIT – IV

ANALYSIS AND DESIGN OF MACHINE FOUNDATIONS

Types of machine foundations – Modes of vibrations – Requirements of machine foundations – Empirical methods of analysis – Elastic half space theory – lumped parameter model – Design of block foundations – Design of framed foundations - Soil mass participating in vibrations.

UNIT – V

VIBRATION ISOLATION

Active and passive types of isolation – Screening of vibrations – Isolation in existing machine Foundations.Construction details of machine foundations – Permissible vibrations.

UNIT – VI

CONSTRUCTION

Construction details of machine foundations – Permissible vibrations.

Reference Books:

1. Barkan : Dynamics of bases and foundations.
2. Major: Vibration analysis and design of foundations for machines and turbines.
3. P.Sreenivasulu and C.V. Vaidyanathan (1976), Hand Book of Machine Foundations by , Tata McGraw Hill Co. Ltd., New Delhi.
4. C.Venkatramaiah (1995), Geotechnical Engineering, Wiley Eastern Ltd. (New Age International Ltd.), New Delhi,
5. A.V. NarasimhaRao&C.Venkatramaiah (2000), (Numerical Problems, Examples & Objective Questions in Geotechnical Engg. Universities Press (India) Ltd., Hyd.
6. Swamy Saran, Soil Dynamics and Machine Foundations, Galgotia Publications, New Delhi.

I M.TECH-I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	6	40	60	100	3
19MSE1PE24	**PLASTIC STRUCTURAL ANALYSIS**						

Course objectives:

The objectives of this course are

- To examine fully plastic moment condition and to develop shape factors for the various practical sections.
- To analyze Method of Limit Analysis for various end conditions of beams and frames.
- To evaluate Limit design Principles for simple frames using various methods.
- To estimate the deflections for different end conditions of beams and portal frames.
- To design moment resisting connections for various load considerations.

Course outcomes:

By the end of this course students will be able to

- Inspect basic difference between elastic and plastic analysis and construct shape factors for the various practical sections.
- Analyze the basic theorems of Limit Analysis, and apply the same to grids and portal frames.
- Prove limit design theorems and design beams and frames using the theorem.
- Assess loads & deflections for various beams and portal frames.
- Design beam to column Moment resisting connections for various load considerations.

UNIT-I

Introduction and basic hypothesis: Concepts of stress and strain, relation of steel Moment curvature relation, basic difference between elastic and plastic analysis with examples, Yield condition, idealizations, collapse criteria, Virtual work in the elastic-plastic state, Evaluation of fully plastic moment and shape factors for the various practical sections.

UNIT-II

Method of Limit Analysis: Introduction to limit analysis of simply supported fixed beams and continuous beams, Effect of partial fixity at an end, invariance of collapse loads, basic theorems of limit analysis, rectangular portal frames, gable frames, grids, superposition of mechanisms, drawing statistical bending moment diagrams for checks.

UNIT-III

Limit design Principles: Basic principles, limit design theorems, application of limit design theorems, trial and error method, method of combining mechanisms, plastic moment distribution method, load replacement method, continuous beams and simple frames designs using above principles.

UNIT-IV

Deflection in Plastic beams and frames: Load deflection relations for simply supported beams, deflection of simple pin based and fixed based portal frames, method of computing deflections.

UNIT-V

Design of beam to column Moment resisting connections: End plate: Flush & extended, T-Stub connections. Combined tension & shear considerations in welded & bolted connection.

UNIT-VI

Minimum weight Design: Introduction to minimum Weight and linear Weight functions- Foulkes theorems and its geometrical analogue and absolute minimum weight design.

TEXTBOOKS:

- "Limit State Design of Steel Structures", Dr. M R Shiyekar, PHI Publication, 3rd Print.
- Plastic Methods of Structural analysis- B G Neal, Chapman and Rall publications
- "Limit state Design of Steel Structures", S K Duggal , McGraw Hill education, 2010.

REFERENCES:

- A.S. Arya and J.L. Ajmani – Design of Steel Structures, Nemchand& Bros., Roorkee
- Ramchandra – Design of Steel Structures Vol – II, Standard Book House, Delhi.
- B.G. Neal – Plastic Method of Structural Analysis, Chapman & Hall.
- Plastic analysis and Design – C E Messennet, M ASeve.

I M.TECH-I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	6	40	60	100	3
19MSE1LB01	**ADVANCED STRUCTURAL ENGINEERING LABORATORY**						

Course Objectives:
The objectives of this course are to

- Make the students know the concepts of Self Compacting Concrete.
- Make the students to understand the effect of dynamic forces like earthquake, wind and cyclone in the structures and the method of designing of the structures against these forces.
- Enrich students with sound knowledge on the behaviour of materials both in the elastic as well as in the plastic stages.
- Understand the test procedure and behaviour of the concrete and RC beams.

Course Outcomes:
On completion of this course, students are able to

- Cast and test RC beams for strength and deformation behaviour.
- Test dynamic testing on steel beams, static cyclic load testing of RC frames and non-destruction testing on concrete.
- Analyse knowledge and skill in the analysis and design of structural components and systems using appropriate standards and codes.
- Analyse modern engineering techniques, skills, and tools necessary for structural engineering practice.
- Construct real time research projects in the field of StructuralEngineering.

LIST OF EXPERIMENTS

1. Design and Testing of self-compacting concrete of standard grade (M30 or M40)
   a) V- Funnel
   b) L -Box
   c) U -Box
   d) J -Ring
2. Tensile and Flexural strength of concrete of different grades.
3. Tensile strength of different types of steel rebars, rolled steel sections.
4. Testing of simply supported RCC beams for flexural failure
5. Testing of simply supported RCC beams for shear failure
6. Testing of RCC column
7. Non-destructive testing of concrete including rebound hammer and ultrasonic pulse method.
8. Permeability of concrete
9. Vibration analysis of beams and plates
10. Buckling load of struts.

ESSENTIAL READING:

1. A.M. Neville & J.J. Brooks, Concrete Technology, Pearson Education, Delhi, 2004.
2. A.R. Santhakumar, Concrete Technology, Oxford University Press, 2007, New Delhi

SUPPLEMENTARY READING:

1. Structural Engineering laboratory manual.
2. Relevant BIS Codes of practice for mix design, rebar testing, concrete design etc.

I M.TECH-IISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE2TH01	**RESEARCH METHODOLOGY**						

Course objectives:

- To develop understanding research objectives and types.
- To categorize, qualify and quantifying the research variables their contribution to research techniques
- To identify various sources of information for data collection and statistical data analysis
- To interpret and infer the probability distributions and testing the hypothesis with various analysis methods
- Appreciate the components of scholarly writing and evaluate its quality and to develop an understanding of the ethical dimensions of conducting applied research.
- To Develop new tools techniques for research

Course out comes

At the end of the course student will be able to:

1. Develop the design and process research objectives and types
2. Categorize, qualify and quantify the research variables their contribution to research process techniques
3. Identify various sources of information for data collection and statistical data analysis
4. Analyze and infer for the probability distributions and testing the hypothesis with various analysis methods
5. Adapt writing and evaluate its quality and to develop an understanding of the ethical dimensions of conducting applied research.
6. Improve the new tools techniques for research

UNIT – I

INTRODUCTION

Research objectives – Types – Approaches – Significance Process – Criteria of Good Research – Research Design – Concepts – Different Research Designs.

UNIT – II

DATA COLLECTION AND SAMPLING TECHNIQUES

Primary and Secondary Data – Methods of Data Collection – Editing and Presentation – Sampling – Concept – Size and Procedures – Techniques

UNIT – III

STATISTICAL ANALYSIS – I

Statistics in Research – Measures of Central Tendency, Dispersion, Asymmetry and Relationships – Simple and Multiple Correlation and Regression – Chart and Diagrams used in the Data Analysis.

UNIT – IV

STATISTICAL ANALYSIS – II

Probability Distributions – Test of Hypotheses – Parametric and Non-parametric tests – Multivariate Techniques – Factor Analysis – Simulation – Use of Excel, Statistica and MAT Lab Softwares.

UNIT – V

INTERPRETATION AND REPORT WRITING

Techniques of Interpretation, Precautions – Significance of Report Writing – Steps – Organization and Preparation of Report.

UNIT – VI

TOOLS

Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley,

REFERENCES

1. Kothari, C.R., "Research Methodology – Methods and techniques", New Age International Publishers, New Delhi, 2010.
2. PannerSelvam, R., "Research Methodology", PHI Learning Private Limited, New Delhi, 2009
3. Ramaiah, C. and Murali Krishna, P., "research Methodology – Text and Cases", Students Helpline Publishing House, Hyderabad, 2010
4. Harmitter, "Introduction to MAT LAB"

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I M.TECH-IISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE2TH02	**FINITE ELEMENT METHOD**						

Course objectives:

- To make students to learn principles of Analysis of Stress and Strain,
- To apply the Finite Element Method for the analysis of one and two dimensional problems
- To evaluate the stress and strain parameters and their inter relations of the continuum.

Course Outcomes:

On completion of this course, students are able to

- Apply different analysis methods for structural problems.
- Analyse the principles of stress-strain behaviour of continuum
- Analytical skills for developing different shape functions.
- Analysis of plane stress and plane strain problems.
- Evaluate CST elements for finite element analysis.

UNIT-I

Basic concepts of elasticity – Kinematic and Static variables for various types of structural problems – approximate method of structural analysis – Rayleigh – Ritz method – Finite difference method – Finite element method. Variation method and minimization of Energy approach of element formulation.

UNIT-II

Principles of finite element method – advantages & disadvantages – Finite element procedure. Finite elements used for one, two & three dimensional problems – Element aspect ratio – mesh refinement vs. higher order elements

UNIT-III

Nodal displacement parameters – Convergence criterion – Compatibility requirements – Geometric invariance – Shape function – Polynomial form of displacement function.

UNIT-IV

Generalized and Natural coordinates – Lagrangian interpolation function – shape functions for one, two & three dimensional elements.

UNIT-V

Isoparametric elements - Internal nodes and higher order elements– Sub parametric and super parametric elements– Jacobean transformation Matrix. Development of strain – displacement matrix and stiffness matrix, consistent load vector

UNIT-VI

Application of Finite Element Method for the analysis of one & two dimensional problems - Analysis of simple beams and plane trusses – Application to plane stress / strain axisymmetric problems using CST & Quadrilateral Elements.

REFERENCE BOOKS:

1. Krishnamoorthy C S, “Finite Element Analysis”- Tata McGraw Hill
2. Desai C and Abel J F, “Introduction to the Finite Element Method”- East West Press Pvt. Ltd., 1972 3. Bathe K J, “Finite Element Procedures in Engineering Analysis”- Prentice Hall
4. Rajasekaran. S, “Finite Element Analysis in Engineering Design”-Wheeler Publishing
5. Cook R D, Malkan D S &Plesta M.E, “Concepts and Application of Finite Element Analysis” - 3 rd Edition, John Wiley and Sons Inc., 1989
6. Shames I H and Dym C J, “Energy and Finite Element Methods in Structural Mechanics”- McGraw Hill, New York, 1985

I M.TECH-IISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE2TH03	**SEISMIC RESISTANT DESIGN**						

Course objectives:

- To make students to learn principles of engineering seismology,
- To design the reinforced concrete buildings for earthquake resistance.
- To evaluate the seismic response of the structures.

Course Outcomes:

On completion of this course, students are able to

- Achieve Knowledge of design and development of problem solving skills.
- Understand the principles of engineering seismology
- Design and develop analytical skills.
- Summarize the Seismic evaluation and retrofitting of structures.
- Understand the concepts of earthquake resistance of reinforced concrete buildings.

UNIT-I

Introduction to engineering seismology, Geological and tectonic features of India, Origin and propagation of seismic waves, Types of Faults ,characteristics of earthquake and its quantification –Magnitude and Intensity scales, seismic instruments.

UNIT-II

Earthquake Hazards in India, Structural behavior under gravity and seismic loads, Lateral load resisting structural systems, Requirements of efficient earthquake resistant structural system, damping devises, base isolation systems.

UNIT-III

The Response history and strong motion characteristics. Response Spectrum – elastic and inelastic response spectra, Computation of seismic forces in multi-storeyed buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS-1893.

UNIT-IV

Structural Configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS-1893. Effect of infill masonry walls on frames, modelling concepts of infill masonry walls. Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings – codal provisions.

UNIT-V

Design of Reinforced concrete buildings for earthquake resistance-Load combinations, design of columns and beams for ductility, ductile detailing provisions as per IS-1893. Structural behaviour, design and ductile detailing of shear walls.

UNIT-VI

Seismic response control concepts – Seismic demand, seismic capacity, Overview of linear and nonlinear procedures of seismic analysis. Performance Based Seismic Engineering methodology, Seismic evaluation and retrofitting of structures.

REFERENCE BOOKS:

1. Dynamics of Structures – Theory and Application to Earthquake Engineering- 2nd ed. – Anil K. Chopra, Pearson Education.
2. Earthquake Resistant Design of Building Structures, VinodHosur, WILEY (India)
3. Earthquake Resistant Design of Structures, Duggal, Oxford University Press
4. Earthquake resistant design of structures - PankajAgarwal, Manish Shrikande - PHI India
5. IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993
6. Design of Earthquake Resistant Buildings, Minoru Wakabayashi, McGraw Hill Pub.
7. Seismic Design of Reinforced Concrete and Masonry Buildings, T Paulay and M J N Priestley, John Wiley and Sons

I M.TECH-IISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE2TH04	**STABILITY OF STRUCTURES**						

Course objectives:

- To make students to learn principles of stability of structures,
- To analyse the structural elements for stability.
- To evaluate the use of strain energy in plate bending and stability.

Course Outcomes:

On completion of this course, students are able to

- Achieve Knowledge of design and development of problem solving skills.
- Determine the principles of strength and stability
- Design and develop analytical skills.
- Appraise the Stability analysis by finite element approach.
- Analyse the concepts of lateral buckling of beams.

UNIT-I

Beam – column – Differential equation. Beam column subjected to (i) lateral concentrated load, (ii) several concentrated loads, (iii) continuous lateral load. Application of trigonometric series, Euler's formulation using fourth order differential equation for pined – pined, fixed – fixed, fixed – free and fixed – pinned column.

UNIT-II

Buckling of frames and continuous beams.Elastic Energy method – Approximate calculation of critical loads for a cantilever. Exact critical load for hinged – hinged column using energy approach.Buckling of bar on elastic foundation. Buckling of cantilever column under distributed loads.

UNIT-III

Stability analysis by finite element approach – deviation of shape function for a two nodded Bernoulli – Euler beam element (lateral and translation of) – element stiffness and element geometric stiffness matrices – assembled stiffness and geometric stiffness matrices for a discretised column with different boundary condition

UNIT-IV

Lateral buckling of beams – differential equation – pure bending – cantilever beam with tip load – simply supported beam of I section subjected to central concentrated load.

UNIT-V

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

UNIT-VI

Expression for strain energy in plate bending with in plate forces (linear and non – linear). Buckling of simply supported rectangular plate – uniaxial load and biaxial load.

REFERENCE BOOKS:

1. Alexander Chaje_"Principles of Structural Stability Theory" prentice-hall inc.,Englewood cliffs (1974)

2. Stephen P.Timoshenko, James M Gere, "Theory of Elastic Stability"-2nd Edition, McGraw – Hill, New Delhi.

3. Robert D Cook et.al, "Concepts and Applications of Finite Element Analysis"-3rd Edition, John Wiley and Sons, New York.

4. S.Rajashekar, "Computations and Structural Mechanics"-Prentice – Hall, India.

5. Ray W Clough and J Penzien, "Dynamics of Structures" - 2nd Edition, McGraw Hill, New Delhi.

6. H.Zeiglar, "Principles of Structural Stability"-Blaisdall Publication

I M.TECH-IISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE2PE31	**DESIGN OF INDUSTRIAL STRUCTURES**						

Course Objectives:
The objectives of this course is

- To make students to learn principles of Design of industrial building ,
- To design different components of industrial structures and to detail the structures.
- To evaluate the performance of the Pre- engineered buildings.

Course Outcomes:
On completion of this course, students are able to

- Achieve Knowledge of design and development of problem solving skills.
- Understand the industrial building and the components.
- Design and develop analytical skills.
- Summarize the principles of Structural Design and detailing
- Understands the concept of Pre- engineered buildings.

UNIT-I

Analysis of industrial building for Gravity and Wind load. Analysis and design of framing components namely, girders,

UNIT-II

Analysis of industrial building for Gravity and Wind load. Analysis and design of framing components namely trusses, gable frames.

UNIT-III

Analysis and design of gantry column (stepped column / column with bracket), purlins, girts, bracings including all connections.
Analysis of transmission line towers for wind load and design of towers including all connections.

UNIT-IV

Forms of light guage sections, Effective width computation of unstiffened, stiffened, multiple stiffened compression elements of cold formed light guage sections.

UNIT-V

Concept of local buckling of thin elements.Limiting width to thickness ratio. Post buckling strength.

UNIT-VI

Concept of Pre- engineered buildings, Design of compression and tension members of cold formed light guage sections, Design of flexural members (Laterally restrained / laterally unrestrained).

REFERENCE BOOKS:

1. Bureau of Indian Standards, IS800-2007, IS875-1987, IS-801-1975. Steel Tables, SP 6 (1) – 1984
2. N Subramanian- "Design of Steel Structure" oxford University Press
3. B.C. Punmia, A.K. Jain "Design of Steel Structures", Laxmi Publications, New Delhi.
4. .Ramchandra and VirendraGehlot" Design of Steel Structures " Vol 1 and Vol.2, Scientific Publishers, Jodhpur 5. Duggal "Limit State Design of Steel Structures" TMH

I M.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE2PE32	**THEORY OF PLATES AND SHELLS**						

Course objectives:

- The objectives of this course is to make students to learn different methods of analysis of plates and shells,
- To critically detail the plates and shells.
- To evaluate the performance of spatial structures.

Course Outcomes:

On completion of this course, students are able to

- To assess the strength of thin plates.
- Understand the concepts of energy principle
- To analyze thin plates using Navier's method and Levy's method.
- Understand the principles of Analysis of circular plates.
- Summarize the performance of shells

UNIT-I

Introduction: Assumptions in the theory of thin plates – Pure bending of Plates – Relations between bending moments and curvature - Particular cases of pure bending of rectangular plates.

UNIT-II

Cylindrical bending: - Immovable simply supported edges – Strain energy in pure bending of plates in Cartesian and polar co-ordinates.

UNIT-III

Rectangular Plates: - Differential equation of plates – Boundary conditions.Navier solution for simply supported plates subjected to uniformly distributed load and point load – Levy's method of solution for plates having two opposite edges simply supported with various symmetrical boundary conditions along the other two edges loaded with u. d. l. – Simply supported plates with moments distributed along the edges - Approximate Methods. Anisotropic plates, orthotropic plates.

UNIT-IV

Circular Plates: - Differential equation of equilibrium – Uniformly loaded circular plates with simply supported and fixed boundary conditions – Annular plate with uniform moment and shear force along the boundaries.

UNIT-V

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

UNIT-VI

General Theory of Cylindrical Shells: - Assumptions, Classification, different shell surfaces, Gaussian curvature, membrane theory of circular cylindrical shell element, FBD, equilibrium equations. A circular cylindrical shell loaded symmetrically with respect to its axis, pressure vessels, cylindrical tanks. Membrane analysis of conical shell, FBD, equilibrium equation.

Text Books:

1. S.P Timoshenko and S.W Krieger, Theory of Plates and Shells, Tata McGraw Hill, 2nd edition, 2017.

Reference Books:

1. R. Szilard, Theory and Analysis of Plates – Classical Numerical Methods', Prentice Hall inc, 1974.
2. P.L Gould, Analysis of Shells and Plates, Springer-Verlag, New York, 1988.

I M.TECH-IISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE2PE33	**ADVANCED REINFORCED CONCRETE DESIGN**						

Course Objectives:
The objectives of this course is

- To make students to learn principles of Structural Design,
- To design different types of structures and to detail the structures.
- To evaluate performance of the structures.

Course Outcomes:
On completion of this course, students are able to

- Achieve Knowledge of design and development of problem solving skills.
- Understand the principles of Structural Design
- Design and develop analytical skills.
- Summarize the principles of Structural Design and detailing
- Understands the structural performance.

UNIT-I
Yield line method of design of slabs. Design of flat slabs.

UNIT-II
Design of grid floors.

UNIT-III
Design of continuous beams with redistribution of moments.

UNIT-IV
Design of Chimneys,

UNIT-V
Design of silos and bunkers.

UNIT-VI
Art of detailing earthquake resistant structures. Expansion and contraction joints

REFERENCE BOOKS:

1. A Park and Paulay, “Reinforced Reinforced and Prestressed Concrete”
2. Lin TY and Burns N H, “Reinforced Concrete Design".
3. Kong KF and Evans T H “Design of Prestressed Concrete Structures
4. P.C.Varghese, "Advanced Reinforced Concrete Design”, Prentice-Hall of India, New Delhi, 2005.
5. Dr.B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, “Comprehensive RCC Design”

I M.TECH-IISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE2PE34	**EXPERIMENTAL STRESS ANALYSIS**						

Course Objectives:

- This subject is taught to impart knowledge about the instruments and its applications.

Course Outcomes:

Upon completion of this course, the student will be able to

- Examine the working principle of strain gauges.
- Do the model analysis using different theorems.
- Assess the concepts of photo elasticity and its applications.
- Test the 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

UNIT-II

Two dimensional problems in Polar Co-ordinates, Polar Components of Stress in terms of Airy's Stress function, Forms. Principles of Experimental Approach: Merit of Experimental Analysis introduction, uses of experimental stress analysis-Advantages of experimental stress analysis, Different methods, Simplification of problems.

UNIT-III

Strain Measurement using Strain Gauges: Definition of strain and its relation to Experimental Determinations, properties of strain-gauge systems, Types of strain gauges, Mechanical and Optical strain gauges.

UNIT-IV

Electrical Strain Gauges - Introduction, LVDT - resistance strain gauge - various types - gauge factor, Materials for adhesion base, etc. Strain Rosettes: Introduction, The three element rectangular Rosette - The delta rosette - Corrections for Transverse strain effects.

UNIT-V

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

UNIT – VI

Introduction, Coating stresses and strains, coating sensitivity, coating materials, application of coatings, effects of coating thickness, Fringe-order determinations in coatings, stress separation methods.

TEXT BOOKS

1. Theory of Elasticity by Timoshenko and Goodier Jr.
2. Experimental stress analysis by Dally and Riley, McGraw-Hill.

REFERENCE BOOKS :

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

I M.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE2PE41	**DESIGN OF OFFSHORE STRUCTURE**						

Course objective:

Student will able learn the following concept

1. Types of offshore structure and modeling properties
2. the concept of wave theories
3. the concept of Solve the forces and
4. Design of jacket towers
5. Design of gravity platforms
6. Understand the repairing techniques

Course out comes: On completion of this course students will be able to

1. Determine the forces due to ocean waves
2. Design offshore structures elements by approximate methods
3. Design different type of connections
4. Analyze the corrosion by Sacrificial anode method and impressed current method
5. Identify the different types of repairing techniques

Unit -I

Introduction for offshore structures Physical and Environmental aspects of Marine and offshore construction Materials and offshore construction equipment; Marine operations; Sea floor modification and improvements.

Unit -II

Operational loads - Environmental loads due to wind, wave, current and buoyancy - Morison's Equation - Maximum wave force on offshore structure - Concept of Return waves - Principles of Static and dynamic analyses of fixed platforms - Use of approximate methods - Design of structural elements.

Unit-III

Design of Concrete Gravity Platforms - Ingredient materials and Protective Measures - Design of Side walls, Design of Decking - Design of Raft Foundation

Unit -IV

Corrosion - Corrosion mechanism - Types of corrosion - Offshore structure corrosion zones – Biological corrosion - Preventive measures of Corrosion - Principles of cathode protection systems - Sacrificial anode method and impressed current method – Online corrosion monitoring - Corrosion fatigue.

Unit-V

Repairing techniques: Underwater repairs & Strengthening Existing structures Repairs to steel Jacket- type structures- Repairs to steel piling- Repairs to concrete offshore structures- repairs to foundations- Fire damage- Pipeline repairs,

Unit-VI

Strengthening of offshore platforms and terminals, members or assembles Increasing capacity of piles for axial loads- Increasing lateral capacity of piles and structures in interaction- seismic retrofitting.

Text books:

1. Construction of Marine and offshore Structures- 2e- Ben-C. Gerwick, Jr CRC press
2. Basic Coastal Engineering by R. M. Sorensen, published by Chapman & Hall.

References Books:

1.Chakrabarti, S.K., "Hydrodynamics of Offshore Structures", Computational mechanics,
2. Thamas H Dawson, "Offshore Structural Engineering", Prentice Hall Inc. Englewood, Cliffs, N.J.
3. API Recommended Practice for Planning, "Designing and Constructing Fixed Offshore Platform", American Petroleum Institute Publication, RP2A, Dallas, Texas.

References

1. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.
2. API RP 2A. Planning, Designing and Constructing Fixed Offshore Platforms, API.
3. McClelland, B &Reifel, M. D., Planning & Design of fixed Offshore Platforms, Van Nostrand, 1986.
4. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
5. Reddy, D. V &Arockiasamy, M., Offshore Structures Vol.1 & 2, Kreiger Publ. Co.1991.
6. Morgan, N., Marine Technology Reference Book, Butterworths, 1990.
7. B.C Gerwick, Jr. Construction of Marine and Offshore Structures, CRC Press, Florida, 2000.

I M.TECH-IISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE2PE42	**ADVANCED STEEL STRUCTURES**						

Course Objectives:

To understand the

- Design of moment resisting connections used in steel frames.
- Calculation of wind forces on various types of structures.
- Design of industrial buildings.

Course outcomes:

- Familiarize various types of connections.
- Design of welded connections.
- Design of eccentrically loaded members.
- Analysis and design of industrial structures.
- Analysis and design of truss girder bridges, bunkers & silos.

UNIT-I

SIMPLE CONNECTIONS –Riveted, Bolted Pinned And Welded Connections: Riveted connections-Bolted Connections- Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip – Critical Connections – Praying Action – Combined Shear and Tension for Slip- Critical Connections.

UNIT-II

DESIGN OF WELDS - Groove welds - Design of Fillet Welds- Design of Intermittent fillet welds- Failure of Welds.

UNIT-III

ECCENTRIC AND MOMENT CONNECTIONS: Introduction – Beams – Column Connections- Connections Subjected to Eccentric Shear – Bolted Framed Connections- Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections – Welded Bracket Connections - Moment Resistant Connections.

UNIT-IV

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

UNIT-V

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

UNIT-VI

DESIGN OF STEEL BUNKERS AND SILOS - Introduction – Janseen's Theory – Airy's Theory – Design of Parameters – Design Criteria – Analysis of Bins – Hopper Bottom –Design of Bins.

REFERENCES BOOKS:

1. Design of Steel Structures. P. Dayaratnam, Publisher : S. Chand, Edition 2011 – 12.
2. Design Steel Structures Volume – II, Dr.Ramachandra&VivendraGehlotScientitic Publishes Journals Department.
3. Limit State Design of Steel Structures S.K. DuggalMcGraw Hill Education Private Ltd. New Delhi.
4. Design of Steel Structures Galyord& Gaylord, Publisher ; Tata McGraw Hill, Education. Edition 2012.
5. Indian Standard Code – IS – 800-2007, IS-875(Part-3) – 1987, Steel tables.

I M.TECH-IISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE2PE43	**MECHANICS OF COMPOSITE MATERIALS**						

COURSE OBJECTIVES:

- Explain the behavior of constituents in the composite materials
- Enlighten the students in different types of reinforcement
- Develop the student's skills in understanding the different manufacturing methods available for composite material.
- Illuminate the knowledge and analysis skills in applying basic laws in mechanics to the composite materials.

COURSE OUTCOMES:

Upon completion of this course the student will be able to:

1. Explain the mechanical behavior of layered composites compared to isotropic materials.
2. Apply constitutive equations of composite materials and understand mechanical behavior at micro and macro levels.
3. Determine stresses and strains relation in composites materials.

Pre-Requisites: Mechanics of solids & material science

UNIT I

INTRODUCTION TO COMPOSITE MATERIALS:

Introduction, Classification: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, nature-made composites, and applications. Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

UNIT II

ELASTIC BEHAVIOR OF COMPOSITE LAMINA USING MICROMECHANICS:

Introduction, Strength of Materials Approach, Semi- Empirical Models, Elasticity Approach, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, , Ultimate Strengths of a Unidirectional Lamina

UNIT III

ELASTIC BEHAVIOR OF COMPOSITE LAMINA USING MACROMECHANICS:

Introduction, Definitions: Stress, Strain, Elastic Moduli, Strain Energy, stress strain relations for general anisotropic materials, specially orthotropic materials, transversally isotropic materials, orthotropic material under plane stress and isotropic materials, relations between

mathematical and engineering constants.

UNIT IV

ELASTIC BEHAVIOR OF MULTIDIRECTIONAL LAMINATES

Basic assumptions, laminate code, strain-displacement relations, stress-strain relations of a layer within a laminate, force and moment resultants, Laminate stiffness and laminate compliance, symmetric laminates, balance laminates

UNIT V

FAILURE, DESIGN OF LAMINA:

Lamina Strength Failure Theories of an Angle Lamina: Maximum Stress Failure Theory Strength Ratio, Failure Envelopes, Maximum Strain Failure Theory, Tsai-Hill Failure Theory, Tsai-Wu

UNIT VI

FAILURE, DESIGN OF LAMINATES:

Laminate: Introduction, Special Cases of Laminates, and Failure Criterion for a Laminate, and Design of a Laminated Composite

Learning Resources

Text Books:

1. Engineering Mechanics of Composite Materials, (2nd edition), by Isaac and M Daniel, Oxford University Press, 2006 .
2. Analysis and performance of fibre Composites, (Second Edition), by B. D. Agarwaland L. J. Broutman, John Wiley & sons, NewYork , New York, 1990.

Reference Books:

1. Mechanics of Composite Materials, (3ed edition), by R. M. Jones, McGraw Hill Company, New York, 2006.
2.Analysis of Laminated Composite Structures, by L. R. Calcote, Van NostrandRainfold, New York, 1969.
3.Mechanics of Composite Materials,(Second Edition), by Autar K. Kaw, CRC, 2010.

I M.TECH-IISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE2PE44	**ALTERNATIVE BUILDING MATERIALS**						

Course Objectives:

The objective of the course is to make the students to learn:

- Introduction to the concept of low-energy and low-cost building,

locally available materials and technologies

- Get the knowledge on alternative masonary units.
- Fiber reinforced concrete materials and ferro cement materials
- Alternative building technologies for walls, and roofing systems
- Cost effective building design methods.

Course outcomes:

After a successful completion of the course, the student will be able to:

- To categorize the use of different materials for walls, roofs and other building materials
- To distinguish different fiber reinforced matrix materials
- To predict the structural masonry units for alternative materials.
- Improve the knowledge on pozzolana materials.
- Design cost effective buildings from IS code provisions.

UNIT-I

Introduction:, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Environmental friendly and cost effective building technologies, Requirements for building of different climatic regions, Traditional building methods and vernacular architecture.

Lime-Pozzolana Cements :

Raw materials, Manufacturing process, Properties and uses.

UNIT-III

Fibre Reinforced Concrete Matrix materials: Fibers: metal and synthetic, Properties and applications, Fibre reinforced plastics, Matrix materials, **Fibers:** organic and synthetic, Properties and applications building materials from Agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications, Field quality control test methods.

UNIT-IV

Alternative Building Technologies: Alternative for wall construction,Types, Construction methods ,Ferrocement And Ferroconcrete Properties, Ferrocement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications

Alternative Roofing :Systems Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes.

UNIT-V

Structural Masonry: Compressive strength of masonry elements, Factors affecting compressive strength, Strength of units, prisms / wallettes and walls, Effect of brick work bond on strength, Bond strength of masonry : Flexure and shear, Elastic properties of masonry materials and masonry,

IS Code provisions: Design of masonry compression elements, Concepts in lateral load resistance.

UNIT-VI

Cost effective building design:

Cost Effective Building Design Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.

Equipment For Production Of Alternative Materials: Machines for manufacture of concrete, Equipment for production of stabilized blocks, Moulds and methods of production of precast elements

TEXT BOOKS:

"Alternative Building Materials and Technologies", KS Jagadish, BV Venkatarama Reddy and KS NanjundaRao, New Age International pub.

REFERENCE BOOKS:

1. "Structural Masonry", Arnold W. Hendry
2. "Building materials in Developing Countries", RJS Spence and DJ Cook, Wiley pub. 1983
3. LEED India, Green Building Rating System, IGBC pub.
4. IGBC Green Homes Rating System, CII pub.

I M.TECH-IISEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	3
19MSE2LB01	**ADVANCED COMPUTER APPLICATION IN STRUCTURAL ENGINEERING-ACASE**						

OBJECTIVES

- Student excels themselves in Seismic analysis, Wind analysis, linear elastic analysis and design of simple structures.
- Analysis design of concrete and steel structures by software
- The nonlinear inelastic analysis of structures is becoming popular within the context of seismic assessment of existing structures and code based design of new structures

OUTCOMES

At the this course is to equip the students with the knowledge

- Mathematical Modeling of Structures (considering both the geometric nonlinearity and material inelasticity),
- Earthquake resistant design of structures using advanced FE based Software
- Seismic and wind Analysis and design of building by STAAD.PRO
- Design and nonlinear Pushover Analysis by ETABS
- Hands-on-practice and Case Studies for modeling& calibration; design and assessment of structures (Buildings) by STAAD.pro and ETABS

PART-A

STAAD.PRO:

1. Analysis and design of G+5 storey building.
2. Analysis and design of G+5 Storey building with wind load.
3. Seismic Analysis and design of multistory building with vertical irregularities.
4. Seismic Analysis and design of multistory building with lateral irregularities.
5. Analysis and design of shear wall of multistory building.

PART-B

ETABS: (Extended Three Dimensional Analyses of Building Systems)

1. Analysis of simply supported beam with UDL over the span.
2. Linear static Analysis and design of G+8 storey building.
3. Linear static Analysis and design of G+10 Storey building with wind load.
4. Dynamic linear seismic Analysis of a multi-storey building
5. Non-Linear pushover Analysis of multistory building

Text Books and Manuals

1.STAAD.Pro Tutorials
2. ETABS Tutorials
Code practices & its provisions: IS 456-2000, IS 800-2000, Steel tables, IS 875-part 1, 2, 3 and IS 1893 -part-1

IIYear - III& IVSEMESTERS

II M.TECH-III&IV SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	6	40	60	100	35
19MSE4PW	**PROJECT WORK**						