PACE INSTITUTE OF TECHNOLOGY AND SCIENCES
ONGOLE

ACADEMIC REGULATIONS (R21)

For

MASTER OF TECHNOLOGY

Two Year Degree Programme

(Applicable for the batches admitted from the **A.Y. 2021-22**)

PACE INSTITUTE OF TECHNOLOGY AND SCIENCES

NH-16, Near Valluramma Temple, ONGOLE-523272

ANDHRA PRADESH, INDIA

ACADEMIC REGULATIONS (R21) FOR M.Tech. (REGULAR)

Applicable for students of Master of Technology (Regular)
from Academic Year 2021-22 onwards

Pace Institute of Technology and Sciences, Ongole, 2021 Regulations (R21 Regulations) applicable for all the students admitted into first year of Master of Technology programme from the academic year 2021-22.

1. ELIGIBILITY FOR ADMISSIONS:

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 conducted by the University or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt. from time to time.

2. AWARD OF M. Tech DEGREE:

A student shall be declared eligible for the award of the M. Tech Degree, if he pursues a course of study in not less than two and not more than four academic years.

The student shall register for all 68 credits and secure all the 68 credits.

The minimum instruction days in each semester are 90.

3. PROGRAMME OF STUDY:

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

Sl No	Programme
1	Structural Engineering (SE)
2	VLSI & Embedded Systems (VLSI&ES)
3	Computer Science and Engineering (CSE)

4. ATTENDANCE:

4.1 A student shall be eligible to write semester end examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects/courses, and with minimum 50% in each and every course including practicals.

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

4.3 Shortage of Attendance **below** 65% in aggregate shall not be condoned and not eligible to write their end semester examination of that class.

4.4 Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.

4.5 A prescribed fee shall be payable towards condonation of shortage of attendance.

4.6 A student shall not be promoted to the next semester unless, he satisfies the attendance requirement of the present semester, as applicable. They may seek re-admission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for re-admission into the same class.

5. EVALUATION:

		The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practical, on the basis of Internal Evaluation and Semester End Examination.
	5.1	For the theory subjects 70 marks shall be awarded based on the performance in the Semester End Examination and 30 marks shall be awarded based on the Internal Evaluation. The internal evaluation shall be made based on the **average** of the marks secured in the two Mid Term-Examinations conducted-one in the middle of the Semester and the other immediately after the completion of instruction. Each mid term examination shall be conducted for a total duration of 90 minutes with 3 questions (without choice) each question for 10 marks. Semester End Examination is conducted for 70 marks for all FIVE (5) questions (one question from one unit) to be answered (either or).
	5.2	For practical subjects, 70 marks shall be awarded based on the performance in the Semester End Examinations and 30 marks shall be awarded based on the day-to-day performance as Internal Marks. The internal evaluation based on the day to day work-5 marks, record- 5 marks and the remaining 20 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the examiners, with breakup marks of Procedure-20, Experimentation-30, Results-10, Viva-voce-10.
	5.3	For Mini Project with Seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, supervisor/mentor and two other senior faculty members of the department. For Mini Project with Seminar, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.
	5.4	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 aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.
	5.5	In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.4) 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 **are 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-registered 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 obtained in the previous attempt shall stands cancelled. For re- registration the candidates have to apply to the Chief Controller of Examinations through the department by paying the requisite fees and get approval from the Chief Controller of Examinations before the start of the semester in which re-registration is required.
	5.6	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.
	5.7	Laboratory examination for M. Tech. courses 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 Chief Controller of Examinations from the panel of examiners submitted by the respective department.
6.	**EVALUATION OF PROJECT/DISSERTATION WORK**	

		Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.	
		6.1	A Project Review Committee (PRC) shall be constituted with Head of the Department and two other senior faculty members in the department.
		6.2	Registration of Dissertation/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.
		6.3	After satisfying 6.2, 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 student can initiate the Project work, only after obtaining the approval from the Project Review Committee (PRC).
		6.4	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 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.
		6.5	Continuous assessment of Dissertation-I and Dissertation-II during the Semester(s) will be monitored by the PRC.
		6.6	A candidate shall submit his status report in two stages to the PRC, at least with a gap of 3 months between them.
		6.7	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 course 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 and shall publish his/her project work in a reputed journal before submission of the Thesis.
		6.8	Three copies of the Project Thesis certified by the supervisor shall be submitted to the College/School/Institute.
		6.9	The thesis shall be adjudicated by one examiner selected by the Chief Controller of Examinations. For this, the Principal of the College shall submit a panel of 5 examiners, eminent in that field, with the help of the guide concerned and head of the department.
		6.10	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 unfavorable again, the thesis shall be summarily rejected. The candidate has to re-register for the project and completes the project within the stipulated time after takingthe approval from the Chief Controller of Examinations.
		6.11	The Head of the Department shall coordinate and make arrangements for the conduct of Viva-Voce examination.
		6.12	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 for a maximum of 100 marks as one of the following: A. Excellent B. Good C. Satisfactory D. Unsatisfactory

6.13 If the report of the Viva-Voce is unsatisfactory (ie, < 50 marks), 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 Chief Controller of Examinations.

7. **Cumulative Grade Point Average (CGPA)**

A letter grade and grade points will be awarded to a student in each course based on his performance as per the grading system given below.

Marks Range Theory / Laboratory (Max – 100)	Marks Range Mini Project/ Project Work or Dissertation (Max – 100)	Letter Grade	Level	Grade Point
≥ 90	≥ 90	O	Outstanding	10
80 to <90	80 to <90	S	Excellent	9
70 to <80	70 to <80	A	Very Good	8
60 to <70	60 to <70	B	Good	7
50 to <60	50 to <60	C	Satisfactory	6
<50	<50	F	Fail	0
			Absent	0

A. **Computation of SGPA**

The following procedure is to be adopted to compute the Semester Grade Point Average(SGPA) and Cumulative Grade Point Average(CGPA):

The **SGPA** is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergoneby a student, i.e

SGPA (S_i) =$\sum (C_i \text{ X } G_i) / \sum C_i$

Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the ith course.

B. **Computation of CGPA**

The **CGPA** is also calculated in the same manner taking into account all the courses undergone by a student overall the semester of a Programme, i.e.

CGPA = $\sum (C_i \text{ X } S_i) / \sum C_i$

Where S_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Equivalent Percentage = (CGPA – 0.75) x 10

8. AWARD OF DEGREE AND CLASS

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M.Tech Degree he shall be placed in one of the following three classes:

Class Awarded	CGPA to be secured	
First Class with Distinction	≥ 7.75 (without Supplementary appearance)	**From the CGPA secured From 68 Credits.**
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	

The Grades secured, Grade points and Credits obtained will be shown separately in the

9. WITHHOLDING OF RESULTS

If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

10. TRANSITORY REGULATIONS (for R21)

Discontinued or detained candidates are eligible for re-admission into same or equivalent subjects at a time as and when offered.

The candidate who fails in any subject will be given two chances to pass the same subject; otherwise, he has to identify an equivalent subject as per R18 academic regulations.

12 GENERAL

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

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

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

The college may change or amend academic regulations or syllabi at any time subject to approval of the competent authority and the changes or may apply the amendments made to all students with effect from the dates notified.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

Sl. No.	Nature of Malpractices/Improper conduct If the candidate:	Punishment
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 theperformance in that subject only.
b.	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police anda 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.
3.	Impersonates any other candidate in connection withthe examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he 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 class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that 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-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	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.
7.	Leaves the exam hall taking away answer script or intentionally tears the script or any part thereof insideor outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges 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 examinationhall.	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 othersubjects the candidate has appeared including practical examinations and project work of that semester/yearexaminations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Chief Controller of Examinations for further action and impose suitable punishment.	

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India
For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student.

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing	2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India
For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

ABSOLUTELY NO TO RAGGING

1. **Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.**
2. **Ragging entails heavy fines and/or imprisonment.**
3. **Ragging invokes suspension and dismissal from the College.**
4. **Outsiders are prohibited from entering the College and Hostel without permission.**
5. **Girl students must be in their hostel rooms by 7.00 p.m.**
6. **All the students must carry their Identity Cards and show them when demanded**
7. **The Principal and the Wardens may visit the Hostels and inspect the rooms any time.**

Jawaharlal Nehru Technological University Kakinada
For Constituent Colleges and Affiliated Colleges of JNTUK

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

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DEPARTMENT OF CIVIL ENGINEERING

R21 Regulations M. Tech. (Structural Engineering) Course Structure

I YEAR I SEMESTER								
S.No.	**Code**	**Course**	**L**	**T**	**P**	**Credits**	**Internal**	**External**
1	PP21CET01	Theory of Elasticity	3	0	--	3	30	70
2	PP21CET02	Structural Dynamics	3	0	--	3	30	70
5	PP21CET03	Advanced Concrete Technology	2	0	--	2	30	70
3	**Professional Elective- I**		3	0	--	3	30	70
	PP21CEE01	Matrix Analysis of Structures						
	PP21CEE02	Analytical & Numerical Methods for Structural Engineering						
	PP21CEE03	Design of RCC Foundations						
4	**Professional Elective –II**		3	0	--	3	30	70
	PP21CEE04	Bridge Engineering						
	PP21CEE05	Repair and Rehabilitation of Structures						
	PP21CEE06	Advanced Reinforced Concrete Design						
6	PP21CEL01	Advanced Concrete Technology Laboratory	-	--	4	2	30	70
7	PP21CEL02	Advanced Structural Engineering Laboratory	-	--	4	2	30	70
8	PP21CEA01	AuditCourse–1	2	0	0	0		
		Total	**17**	**0**	**8**	**18**	**210**	**490**

I YEAR II SEMESTER								
S.No.	**Code**	**Course**	**L**	**T**	**P**	**Credits**	**Internal**	**External**
1	PP21CET04	Finite Element Methods in Structural Engineering	3	0	-	3	30	70
2	PP21CET05	Theory of Plates and Shells	3	0	-	3	30	70
3	**Professional Elective –III**		3	0	-	3	30	70
	PP21CEE07	Stability of Structures						
	PP21CEE08	Advanced Steel Design						
	PP21CEE09	Analysis of Offshore Structures						
4	**Professional Elective –IV**		3	0	- -	3	30	70
	PP21CEE10	Earthquake Resistant Design of Buildings						
	PP21CEE11	Precast and Prefabricated Structure						
	PP21CEE12	Earth Retaining Structures						
5	PP21CEL03	Computer Aided Design Laboratory	- -	- -	4	2	30	70
6	PP21CEL04	Structural Design laboratory	- -	- -	4	2	30	70
7	PP21CEM01	Mini Project With Seminar	0	0	4	2	50	
8	PP21CEA02	Audit Course -2	2	0	0	0		
Total			**14**	**0**	**12**	**18**	**230**	**420**

II Year – I Semester								
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Internal**	**External**
1	**Program Elective/ MOOCS**		3	0	--	3	30	70
	PP21CEE13	Design Of prestressed Concrete structures						
	PP21CEE14	Structural Health Monitoring						
2	**Open Elective/MOOCS****		3	0	--	3	30	70
	PP21CEO01	Artificial Intelligence Technique						
	PP21CEO02	Construction Management						
	PP21CEO03	Green Technology						
3	PP21CEP01	Dissertation Phase-I/Industrial Project	--	--	20	10	100	--
Total			**6**	0	**20**	**16**	**160**	**140**

II Year - II Semester								
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Internal**	**External**
1	PP21CEP02	Project/Dissertation Phase II (Continued from III Semester)	0	0	32	16	50	100
Total			**0**	**0**	**32**	**16**	**50**	**100**

AUDIT COURSE 1 &2

S NO	SUBJECT CODE	SUBJECT NAME
1	PP21CEA01	English for Research Paper Writing
2	PP21CEA02	Disaster Management
3	PP21CEA03	Value Education
4	PP21CEA04	Pedagogy Studies
5	PP21CEA05	Stress Management by Yoga
6	PP21CEA06	Personality Development through Life Enlightenment Skills

M. Tech I Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

THEORY OF ELASTICITY

Internal marks: 30

COURSE CODE: PP21CET01 **External marks :70**

Course Prerequisite: Advanced Structural Analysis

Course Objectives:

1. To make students to learn principles of analysis of Stress and Strain
2. To introduce the airy stress functions for 2-D plane stress and plane strain problems in Cartesian and cylindrical coordinate systems.
3. To impart the knowledge on evaluating the stress and strain parameters and their interrelations of the continuum.
4. To introduce to the student the analysis of linear elastic solids under mechanical and thermal loads.
5. To guide the students to analyze the torsion of a prismatic bar using membrane analogy

Course Outcomes:

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

1. Know the definition of stress and deformation and how to determine the components of the stress and strain tensors.
2. Apply the conditions of compatibility and equations of equilibrium.
3. Understand how to express the mechanical characteristics of materials, constitutive equations and generalized Hook law.
4. Use the equilibrium equations stated bythe displacements and compatibility conditions stated by stresses.
5. Understand index notation of equations, tensor and matrix notation and define state of plane stress, state of plane strain.
6. Be able to analyze real problem and to formulate the conditions of theory of elasticity Applications.
7. Determine the boundary restrictions in calculations. Solve the basic problems of the theory of elasticity by using Airy function expressed as bi- harmonic function.

SYLLABUS:

UNIT-I **(10 lectures)**

Elasticity – Notation for forces and stresses – components of stresses and strains – Hooke's Law- Plane Stress – Plane strain – Differential Equations of equilibrium – Boundary conditions – Compatibility equations - Stress function – Boundary Conditions.

Unit-II **(10 lectures)**

Two dimensional problems in rectangular co- ordinates – Solution by polynomials – Saint Venant's principle – Determination of displacements – Bending of simple beams – Application of Fourier series for two dimensional problems for gravity loading

UNIT-III **(08 lectures)**

Two dimensional problems in polar co- ordinates - General equations in polar co- ordinates – Stress distribution for problems having symmetrical about an axis - Strain components in polar

co- ordinates– Displacements for symmetrical stress distributions - Stresses for plates with circular holes subjected to far field tension – stress concentration factor.

UNIT IV **(09 lectures)**

Analysis of stress and strain in three dimension - Principal stresses – Stress ellipsoid and stress director surface – Determination of principal stresses - Maximum shear stress – Homogeneous Deformation – General Theorems - Differential equations of equilibrium – Conditions of compatibility– Equations of equilibrium in terms of displacements – Principle of superposition
– Uniqueness of solution –Reciprocal theorem.

UNIT-V **(09 lectures)**

Torsion of Prismatic bars – Bars with elliptical cross section – Other elementary solution – Membrane analogy – Torsion of rectangular bars – Solution of Torsional problems by energy method**.**

Text Books:

1. Theory of Elasticity, Timoshenko S. and GoodierJ. N., McGraw Hill, 1961.
2. Elasticity,Sadd M.H.,Elsevier,2005.
3. Engineering Solid Mechanics, RagabA.R., BayoumiS.E., CRC Press,1999.
4. Computational Elasticity, AmeenM., Narosa,2005.
5. Solid Mechanics, KazimiS. M. A., Tata McGraw Hill,1994.
6. Advanced Mechanics of Solids, SrinathL.S., Tata McGraw Hill,2000.

Reference Books:

1. Theory of Elasticity- Timoshenko & Goodier
2. Elasticity: Theory, Applications and Numeric- Martin H. Sadd

Web References:

1. http://sciold.ui.ac.ir/~sjalali/PhD.Students/quantum.theory.of.solids/6.pdf
2. http://solidmechanics.org

M. Tech I Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

STRUCTURAL DYNAMICS

Internal marks :30

COURSE CODE: PP21CET02 **External marks :70**

Course Prerequisite: Basics in Earthquake Resistance Design

Course Objectives:

1. To make students to learn principles of structural dynamics.
2. To impart the knowledge of SDOF through different methods and to apply the same for free and forced vibration of structures.
3. To enable the students to evaluate the dynamic characteristics of the structures.
4. To make students to study the SDOF and MDOF system response.
5. To impart the knowledge on SDOF and MDOF concepts of free and forced vibration of structures.

Course Outcomes:

After completion of the course the student will be able to

1. Understand the response of structural systems to dynamic loads
2. Realize the behavior and response of linear and nonlinear SDOF and MDOF structures with various dynamic loading.
3. Understand the behavior and response of MDOF structures with various dynamic loading.
4. Possess the ability to find out suitable solution for continuous system
5. Understand the behavior of structures subjected to dynamic loads under free vibration
6. Understand the behavior of structures subjected to dynamic loads Harmonic excitation and earthquake load.

Syllabus

UNIT I **(10 lectures)**

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

UNIT II **(10 lectures)**

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

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

loadings - Duhamel integral.

UNIT III **(10 lectures)**

Multi Degree of Freedom Systems : Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion - Undamped free vibrations - Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition procedure.

UNIT IV **(09 lectures)**

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

UNIT V **(09 lectures)**

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

UNIT V **(09 lectures)**

Introduction to Earthquake Analysis: Deterministic Earthquake Response: Systems on Rigid Foundations -Types of Earthquake Excitations – Lumped SDOF Elastic Systems, Translational Excitations -Generalized coordinate -SDOF Elastic Systems, Translational Excitations, Linear Static Method – Analysis for obtaining response of multi storied RC Building.

TEXT BOOKS

1. Structural Dynamics Anil K Chopra, 4edition, Prentice Hall Publishers
2. Structural Dynamics Theory & Computation – Mario Paz, CBS Publishes andDistributors.
3. Elementary Structural Dynamics- V.K. Manika Selvam, Dhanpat Rai Publishers

REFERENCE:

1. Dynamics of Structures by Clough & Penzien 3e, Computers & Structures Inc.
2. Theory of Vibration -William T Thomson, Springer Science.
3. Mechanical Vibrations- S. S. Rao, 5e, Pearson Publications.
4. Structural Dynamics of Earthquake Engineering - Theory and Applicationusing Mathematicaand Matlab- S. Rajasekharan

Web References:

1. www2.ce.ntu.edu.tw/~dynamics/dynamics/hw99/43-utline%20and%20content.pdf
2. www.dphu.org/uploads/attachements/books/books_2607_0.pdf

M.Tech I Year I Semester **Course Structure**

L	T	P	C
2	0	0	2

ADVANCED CONCRETE TECHNOLOGY

Internal marks :30

COURSE CODE: PP21CET03 **External marks :70**

Course Prerequisite: Concrete Technology

Course Objectives:

1. To impart knowledge on concrete making materials.
2. To study about Fresh and Hardened Concrete.
3. To learn different concepts High Strength Concrete.
4. To acquire design principles of Concrete Mix Design.
5. To impart knowledge on Form work.

Course Outcomes:

At the end of the Course, the Student will be able to:

1. gain knowledge on concrete making materials
2. Know importance and properties of fresh and hardened concrete
3. gain knowledge on high strength concrete.
4. design concrete mix.
5. implement form works

Syllabus

UNIT – I **(10 lectures)**

Concrete Making Materials : Cement – Bogus Compounds – Hydration Process – Types of Cement – Aggregates – Gradation Charts – Combined Aggregate – Alakali Silica Reaction – Admixtures – Chemical and Mineral Admixtures. Bureau of Indian Standards (BIS) Provisions.

UNIT – II **(10 lectures)**

Fresh And Hardened Concrete: Fresh Concrete – workability tests on Concrete – Setting Times of Fresh Concrete – Segregation and bleeding.

Hardened Concrete: Abrams Law, Gel space ratios, Maturity concept – Stress strain Behavior– Creep and Shrinkage – Durability Tests on Concrete – Non Destructive Testing of Concrete.BIS Provisions.

UNIT – III **(10 lectures)**

High Strength Concrete – Microstructure – Manufacturing and Properties – Design of HSC Using Erintroy Shaklok method – Ultra High Strength Concrete.

High Performance Concrete – Requirements and Properties of High Performance Concrete – Design Considerations. BIS Provisions.

UNIT – IV **(09 lectures)**

Special Concretes: Self Compacting concrete, Polymer Concrete, Fibre Reinforced Concrete – Reactive Powder Concrete – Requirements and Guidelines – Advantages and Applications.

Concrete Mix Design: Quality Control – Quality Assurance – Quality Audit - Mix Design

Method – BIS Method – IS.10262 – 2019 Concrete Mix proportion guidelines. DOE Method–Light Weight Concrete, Self Compacting Concrete.

UNIT – V **(09 lectures)**

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

TEXT BOOKS

1. Properties of Concrete by A. M. Neville, ELBS publications Oct 1996.
2. Concrete Technology by A. R. Santhakumar, 2nd Edition, Oxford University Press.
3. Concrete Technology by M.S. Shetty, S.Chand & Co 2009.

REFERENCES

1. Concrete: Micro Structure, Properties and Materials by P. K. Mehta and P. J.Monteiro,. Mc.Graw-Hill Publishing Company Ltd. New Delhi
2. Design of Concrete Mixes by N. Krishna Raju, CBS Publications, 2000.
3. Special Structural concretes by Rafat Siddique, Galgotia Publications 2000.4. IS10262-2009
4. Relevant BIS Codes

Web references

1. https://nptel.ac.in/courses/105/106/105106176/
2. https://onlinecourses.nptel.ac.in/noc20_ce45/preview
3. https://lecturenotes.in/subject/1063/advance-concrete-technology-act/all

M.Tech I Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

MATRIX ANALYSIS OF STRUCTURES

(Professional Elective-I)

Internal marks :30

COURSE CODE: PP21CEE01 **External marks :70**

Course Prerequisite: Structural Analysis -II

Course Objectives:

1. To enable the students to implement matrix analysis principles through stiffness matrix & flexibility matrix.
2. To discuss with students to know global stiffness matrix equation &structure stiffness matrix Equations.
3. To enable students to apply stiffness method for grid element, tapered and curved beams.
4. To make the students to know analysis of elastic foundation by stiffness method.
5. To impart the knowledge on space truss and frames & analysis simple truss, beams and frames.

Course Outcomes:

1. Perform the structural analysis of determinate and indeterminate structures using classical compatibility methods, such as method of consistent displacements, force and equilibrium Methods.
2. Perform structural analysis using the stiffness method.
3. Solve multiple degree of freedom two- and three-dimensional problems involving trusses, beams, frames and plane stress.
4. Understand basic finite element analysis.

Syllabus

UNIT: 1 **(09 lectures)**

Introduction of matrix methods of analysis – Static and kinematic indeterminacy –Degree of freedom– Structure idealization- stiffness and flexibility methods – Suitability: Element stiffness matrix for truss element, beam element and Torsional element- Element force - displacement equations.

UNIT: 2 **(09 lectures)**

Stiffness method – Element and global stiffness equation – coordinate transformation and global assembly – structure stiffness matrix equation – analysis of simple pin jointed trusses – continuous beams – rigid jointed plane frames

UNIT: 3 **(10 lectures)**

Stiffness method for Grid elements – development of stiffness matrix – coordinates transformation. Examples of grid problems – tapered and curved beams

UNIT: 4 **(10 lectures)**

Additional topics in stiffness methods – discussion of band width – semi band width –

static condensation – sub structuring –Loads between joints- Support displacements- inertial and thermalstresses- Beams on elastic foundation by stiffness method.

UNIT: 5 **(09lectures)**

Analysis of plane truss - continuous beams with and without settlement - plane frame including side swaysingle storey, single – bay and gable frame by flexibility method using system approach

TEXT BOOKS

1. Matrix analysis of structures, Robert E Sennet- Prentice Hall- Englewood cliffs- NewJercy.
2. Advanced structural analysis, P. Dayaratnam- Tata McGraw hill publishing companylimited.
3. Structural Analysis Matrix Approach - Pandit and Gupta, Mc Graw Hil Education

REFERENCES

1. Indeterminate Structural analysis, C K Wang, Amazon Publications
2. Analysis of Tall buildings by force – displacement – Method M. Smolira Mc. Graw Hill.
3. Foundation Analysis and design, J.E. Bowls, 5e, Amazon Publications.
4. Matrix Analysis of Framed Structures 3e-William Weaver, Jr, James M. Gere,Van NostrandReinhold, Newyork
5. Matrix Methods of Structural Analysis Madhu B. Kanchi, Wiley Publications.
6. Indeterminate Structural Analysis by K. U. Muthu, IK International Publishing house

Web References:

1. https://www.researchgate.net/publication/322721792_Matrix_Structural_Analysis_ Lec ture_Notes_Handwritten
2. https://www.scribd.com/doc/176013125/Statically-Indeterminate-Structures-Chu-Kia- Wang-Ph-D-R

M.Tech I Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

ANALYTICAL & NUMERICAL METHODS FOR STRUCTURAL ENGINEERING

(Professional Elective-I)

Internal marks :30

COURSE CODE: PP21CEE02 **External marks :70**

Course Prerequisite: Advanced Mathematics

Course Objectives:

1. To make the students to learn heat equation and Laplace equation.
2. To impart the knowledge on numerical solutions to heat and Laplace equations.
3. To impart the knowledge on Relation between differential and integral equations.
4. To illustrate the concept of Random Variables And Estimation Theory Probability.

Course Outcomes:

1. Understand the fundamentals of the theory of elasticity
2. Implement the principles and techniques of photo elastic measurement
3. Obtain the principles and techniques of strain gage measurement
4. Adopt the principles and techniques of moiré analysis
5. Apply the principles and techniques of holographic interferometer
6. Apply the principles and techniques of brittle coating analysis Understand the fundamentals of the theory of elasticity.

Syllabus

UNIT-I **(12 lectures)**

Transform Methods- Laplace transform methods for one-dimensional wave equation - Displacements in a long string - Longitudinal vibration of an elastic bar - Fourier transforms methods for one-dimensional heat conduction problems in infinite and semi-infinite rod

UNIT-II **(12 lectures)**

Elliptic Equations-Laplace equation - Properties of harmonic functions - Fourier transform methods for Laplace equation Calculus Of Variations- Variation and its properties - Euler's equation - Functionals dependent on first and higher order derivatives - Functionals dependent on functions of several independent variables - Some applications - Direct methods - Ritz and Kantorovich methods

UNIT-III **(12 lectures)**

Integral Equations- Fredholm and Volterra integral equations - Relation between differential and integral equations - Green's function -Fredholm equation with separable kernel - Iterative method for solving equations of second kind

UNIT-IV

Random Variables And Estimation Theory Probability - Probability distributions - moments, M.G.F-Two dimensional random variables correlation, regression multiple and partial

correlation and regression - Curve fitting - Principle of least squares - Fitting of straight lineand parabola. Estimation theory basic concepts (Review) - Estimation of parameters - Maximum likelihood estimates - method of moments

TEXT BOOKS

1. Introduction to Partial Differential Equations, Sankara Rao. K, , PHI, New Delhi,1995
2. Elements of Partial Differential Equations, Sneddon. I.N, Mc Graw Hill, 1986

REFERENCE

1. Differential Equations and Calculus of Variations Elsgolts. L, Mir Publishers,Moscow, 1966
2. Fundamentals of Mathematical Statistics Gupta. S.C, & Kapoor. V.K, SultanChand & Sons,Reprint 1999.
3. Higher Engineering Maths for Engg. And Sciences Venkataraman. M. K,National PublishingCompany, Chennai
4. Numerical Methods for Engineering Problems N. Krishna Raju, K.U. Muthu MacmillanPublishers

Web references

1. www.scilab.org/
2. http://nptel.ac.in/
3. http://ocw.mit.edu/

M.Tech I Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

DESIGN OF REINFORCED CONCRETE FOUNDATIONS

(Professional Elective-I)

Internal marks :30

COURSE CODE: PP21CEE03 **External marks :70**

Course Prerequisite: Concrete Technology

Course Objectives:

1. to impart knowledge on foundation structures.
2. To make students to learn about wall foundations.
3. To impart knowledge on raft foundations.
4. To illustrate the concept of Combined Piled Raft Foundations and Circular and Annular Rafts.
5. To impart knowledge on design of cantilever and Basement Retaining Walls

Course Outcomes:

1. Attain the perception of site investigation to select suitable type of foundation based on soil category.
2. Capable of ensuring design concepts of shallow foundation.
3. Can be efficient in selecting suitable type of pile for different soil stratum and in evaluation of group capacity by formulation.
4. Design different types of well foundation.

Syllabus UNIT – I **(09 lectures)**

Foundation Structures & Design of Centrally Loaded Isolated Footings and Column Pedestals – Introduction, Rigid and Flexible Foundations, Loads and their Effects, Design Requirements, Geotechnical Design, Empirical and Exact Methods of Analysis of foundations, Design Loads for Foundations, Recommended Approach to Structural Design of Foundations.

Introduction, General Procedure for Design, Design of Square Footing of Uniform Depth (Pad Footing), Design of sloped Rectangular Footings, Design Procedure, Detailing of Steel, Design of Rectangular Pad Footings, Design of Plain Concrete Footings, Design of Pedestals, Design Calculation for Pedestals.

UNIT – II **(09 lectures)**

Wall Footings – Introduction Simple Plain Concrete Wall Footings, Reinforced Concrete Continuous Strip Wall Footings, Design of continuous Strip Wall Footings, Design for Longitudinal Steel, R.C. T Beam Footings in Shrinkable Soils, Foundations of Partition Wall in Ground Floors, Summary.

Strip Footings Under Several Columns – Introduction, Design Procedure for Equallyloaded and Equally Spaced Columns, Analysis of Continuous Strip Footing for Unsymmetric Loading, Analysis of Strip Footing with Unsymmetrical Loads, Detailing of Members.

UNIT – III **(10 lectures)**

Raft Foundations – Introduction, Rigid and Flexible Foundations, common Types of Rafts, Deflection Requirements of Beams and Slabs in Rafts, General considerations in Design of Rigid Rafts, Types of Loadings and Choice of Rafts, Record of Contact Pressures Measured Under Rafts, Modern Theoretical Analysis.

Design of Flat Slab Rafts-Mat Foundations – Introduction, Components of Flat Slabs, Preliminary Planning of Flat Slab Rafts, Analysis of Flat Slab by Direct Design Method, Method of Analysis, Values for Longitudinal Distribution and Transverse, Redistribution, Shear in Flat Slabs, Bending of Columns in flat Slabs, Limitations of Direct Design Method for Mats, Detailing of Steel, Design of Edge Beam in Flat Slabs. **Beam and Slab Rafts** – Introduction, Planning of the Raft, Action of the Raft, Approximate Dimensioning of the Raft, Design of the Beam and Slab Raft under Uniform Pressure, Structural Analysis for the Main Slab, Design of Secondary and Main Beams, Analysis by Winkler Model, Detailing of Steel.

UNIT – IV **(09 lectures)**

Combined Piled Raft Foundations (CPRF) – Introduction, Types and uses of Piled Rafts, , Interaction of Pile and Raft, Ultimate Capacity and Settlement of Piles, Estimation of Settlement of Raft in Soils, Allowable Maximum and Differential Settlement in Buildings, Design of CPRF System, conceptual Method of Design, Conceptual Method of Analysis, Distribution of Piles in the Rafts, Theoretical Methodsof Analysis.

Circular and Annular Rafts – Introduction, Positioning of chimney Load on Annular Raft, Forces Acting on Annular Rafts, Pressures Under Dead Load and Moment, Methods of Analysis, Conventional Analysis of Annular Rafts, Analysis of Ring Beams Under circular Layout of Columns, Analysis of Ring Beam Transmitting Column Load to Annular Rafts, Detailing of Annular Raft Under Columns of a Circular Water Tank.

UNIT – V **(09 lectures)**

Under-reamed Pile Foundations – Introduction, Safe Loads on Under-reamed Piles, Design of Under-reamed Pile Foundation for Load Bearing Walls of Buildings, Design of Grade Beams, Design of Under-reamed Piles Under Columns of Buildings, Use of Under-reamed Piles for Expansive Soils.

Design of cantilever and Basement Retaining Walls – Introduction, Earth Pressure and Rigid Walls, Calculation of Earth Pressure on Retaining Walls, Design of Rigid Walls, Design of Ordinary R.C. cantilever Walls, Design of cantilever Walls without Toe, Design of Basement Walls, Calculation of Earth Pressures in Clays, Design of FreeStanding Basement Walls.

TEXT BOOKS

1. Design of Reinforced Concrete Foundations by P. C Varghese, PHI LearningPrivate Limited., New Delhi.
2. Swamy saran

REFERENCE

1. Design of Reinforced Concrete Structures by N. Subramaniam- OxfordUniversity.
2. Reinforced Concrete Design by Unnikrishna Pillai and Devdas Menon, Tata McGraw Hill.

Web references

1. tps://nptel.ac.in/content/storage2/courses/105105104/pdf/m11l29.pdf
2. https://www.youtube.com/watch?v=PVoS8Bnvlh4
3. https://baixardoc.com/documents/design-of-reinforced-concrete-foundations-by-p-c-varghese-deep--5cf5838b465a6

M.Tech I Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

BRIDGE ENGINEERING

(Professional Elective-II)

Internal marks :30

COURSE CODE: PP21CEE04 **External marks :70**

Course Prerequisite: Pre stressed Concrete, DDSS

Course Objectives:

1. Familiarize Students with different types of Bridges and IRC standards.
2. Equip student with concepts and design of Slab Bridges, T Beam Bridges, Box Culverts.
3. Understand concepts of design of Plate Girder Bridges
4. Familiarize with different methods of inspection of bridges and maintenance.

Course Outcomes:

1. Design theories for super structure and substructure of bridges.
2. Design Culvert, R.C.C T Beam Bridge.
3. Understand the behavior of continuous bridges, box girder bridges.
4. Possess the knowledge to design prestressed concrete bridges.
5. Design Railway bridges, Plate girder bridges, different types of bearings, abutments, piers and various types of foundations for Bridges.

Syllabus

UNIT: I **(09 lectures)**

Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces- Seismic loads- Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General DesignRequirements.

UNIT: II **(09 lectures)**

Pigeaud‟s method- design of longitudinal girders- Guyon- Messonet method- Hendry Jaegar method- Courbon‟s theory. (Ref: IRC- 21), voided slabs, Super Structure: Slab bridge- Wheel load on slab- effective width method- slabs supported ontwo edges- cantilever slabs- dispersion length- Design of interior panel of slab- T- Beam bridges.

UNIT: III **(10 lectures)**

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

UNIT-IV **(10 lectures)**

Plate girder bridges- Elements of plate girder and their design- web- flange- intermediate stiffener- vertical stiffeners- bearing stiffener- design problem

UNIT: 5 **(10 lectures)**

Sub structure- Abutments- Stability analysis of abutments- piers- loads on piers – Analysis of piers- Design problem(Ref: IRC- 13, IRC- 21, IRC- 78)- Pipe culvert- Flow pattern in pipe culvers- culvert alignment- culvert entrance structure- Hydraulic design and structural design of pipe culverts- reinforcements in pipes .(Ref: IRC: SP- 13)

TEXT BOOKS

1. Design of Bridges by N. Krishna Raju CBS Publishers and Distributors
2. Design of Concrete Bridges- M.G. Aswini, V.N. Vazirani, M.M Ratwani, Khanna Publishers
3. Essentials of Bridge Engineering- Jhonson Victor D, 7e, Oxford IBH Publications

REFERENCES:

1. Bridge Deck Behavior- E.C. Hambly 2e- CRC Press
2. Concrete Bridge Design and Practice- V.K. Raina, Tata McGraw- Hill Publishing CompanyLimited
3. Bridge Engineering by S. Ponnuswamy, Mc Grawhill Publications
4. IRC 6- 2016 Standard Specifications and Code of Practice for Road bridges
5. IRC 112-2011 Code of Practice for Concrete Road Bridges.

Web references

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2. https://onlinecourses.nptel.ac.in/noc20_ce40/preview
3. https://lecturenotes.in/subject/1711/bridge-engineering

M.Tech I Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

REPAIR AND REHABILITATION OF STRUCTURES

(Professional Elective-II)

Internal marks :30

COURSE CODE: PP21CEE05 **External marks :70**

Course Prerequisite: concrete technology, Structural Analysis, Design of Reinforced

Concrete structure

Course Objectives:

1. To familiarize the students with various types of deteriorations and preventive measures.
2. Imparting the knowledge of Non-Destructive Testing methods for concrete.
3. To create awareness in Failure of buildings.
4. Initiating the student with the knowledge of Materials for repair and rehabilitation
5. To produce Civil Engineering students to have strong foundation in Repair Techniques and Investigation of structures.

Course Outcomes:

1. Recognize the mechanisms of degradation of concrete structures and to design durable concrete structures.
2. Conduct field monitoring and non- destructive evaluation of concrete structures.
3. Design and suggest repair strategies for deteriorated concrete structures including repairing with composites.
4. Understand the methods of strengthening methods for concrete structures
5. Assessment of the serviceability and residual life span of concrete structures by Visual inspection and in situ tests.
6. Evaluation of causes and mechanism of damage.
7. Evaluation of actual capacity of the concrete structure Maintenance strategies.

Syllabus:

UNIT: 1 **(09 lectures)**

Materials for repair and rehabilitation - Admixtures- types of admixtures- purposes of using admixtures- chemical composition- Natural admixtures- Fibres- wraps- Glass and Carbon fibre wraps- Steel Plates- Non destructive evaluation: Importance-Concrete behavior under corrosion, disintegrated mechanisms-moisture effects and thermal effects–Visual investigation-Acoustical emission methods-Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull out tests

UNIT: 2 **(09 lectures)**

Strengthening and stabilization- Techniques- design considerations- Beam shear capacity strengthening- Shear Transfer strengthening- stress reduction techniques- Column strengthening- flexural strengthening- Connection stabilization and strengthening, Crack stabilization.

UNIT: 3 **(09 lectures)**

Bonded installation techniques- Externally bonded FRP- Wet layup sheet, bolted plate, nearsurface mounted FRP, fundamental debonding mechanisms- intermediate crack debonding- CDC debonding- plate end debonding- strengthening of floor of structures

UNIT: 4 **(10 lectures)**

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

UNIT: 5 **(10 lectures)**

High performance concretes-Introduction-Development of high performance concretes-Materials of high performance concretes- Properties of high performance concretes-SelfConsolidating concrete- properties- qualifications.

TEXT BOOKS

1. Maintenance Repair Rehabilitation & Minor works of Buildings- P.C. Varghese, PHIPublications
2. Repair and Rehabilitation of Concrete Structures – P.I. Modi, C.N. Patel, PHI Publications
3. Rehabilitation of Concrete Structures- B. Vidivelli, Standard Publishers Distributors
4. Concrete Bridge Practice Construction Maintenance & Rehabilitation- V.K. Raina, ShroffPublishers and Distributors.

REFERENCE:

1. Concrete Technology Theory and Practice- M.S. Shetty, S Chand and Company
2. Concrete Repair and Maintenance illustrated- Peter H Emmons
3. Concrete Chemical Theory and Applications- Santa Kumar A.R.Indian Society for Construction Engineering and Technology, Madras
4. Handbook on Repair and Rehabilitation of RC Buildings published by CPWD, Delhi

Web references

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2. https://www.indianconcreteinstitute.org/component/proceedings/?task=articles&cat_id=10
3. https://nptel.ac.in/courses/105/102/105102176/
4. https://www.youtube.com/watch?v=fikRPFpbgVo
5. https://www.youtube.com/watch?v=i11zIlOeqfU
6. https://www.youtube.com/watch?v=F1-X6qxcqOw
7. https://www.youtube.com/watch?v=0XIGC5WwW-4
8. https://www.youtube.com/playlist?list=PLQ95I61HjkU_1BhGmnkjFoRKIVxoEnfhD

M.Tech I Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

ADVANCED REINFORCED CONCRETE DESIGN

(Professional Elective-II)

Internal marks :30

COURSE CODE: PP21CEE06 **External marks :70**

Course Prerequisite: Concrete Technology

Course Objectives:

1. Course is designed to shape the concrete and use the steel bars for external loads on different building elements.
2. To understand the codal recommendations for methods of design.
3. To analyse and design of various reinforced concrete structures like water tanks.
4. Analysis and design of intz tank and its staging.
5. Raft foundation, corbels, underground and on ground circular water tanks, intz tank, bunkers and silos
6. To analyse and design of Raft Foundations.
7. To analyse and design of Pile Foundations

Course Outcomes:

1. Estimate the deflection of Concrete beams and slabs.
2. Estimate crack width and its affects.
3. Design flat slabs, bunkers, silos and chimneys.
4. Understand the thermal effect on concrete members

Syllabus:

UNIT I **(09 lectures)**

Limit Analysis of R C Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, loading pattern, Bending Moment Envelop, Application for Fixed Beams and Continuous Beams. Inelastic Analysis of Slabs, Moment Redistribution.

UNIT II **(09 lectures)**

Yield line analysis for slabs: Yield line criterion – Virtual work and equilibrium methods of analysis – For square circular, Rectangular, Triangular and Hexagonal with simple and continuous end conditions.

UNIT III **(09 lectures)**

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

Flat slabs: Direct design method – Distribution of moments in column strips and middle strip-

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

UNIT IV **(10 lectures)**

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

UNIT V **(10 lectures)**

Design of Slender Columns – Slenderness limits, Methods of Design of Slender Columns, Additional Moment Method, Procedure for Design of Slender Columns. Detailing of reinforcement.

Eccentrically Loaded columns- development of interaction Diagrams

TEXT BOOKS

1. Advanced Reinforced Concrete Design, by P.C. Varghese Prentice Hall India Limited
2. Design of Reinforced Concrete Structures by N.Subramanian, Oxford University Press.
3. Reinforced Concrete Design, by S. Unnikrishna Pillai & Devdas Menon Tata Mc. Graw-HillPublishing Company Ltd. New Delhi 2010.

REFERENCE

1. Limit State Theory and Design of Reinforced Concrete S. R. Karve and V.L Shah. StandardPublishers
2. Reinforced concrete structural elements – behavior, Analysis and design by P. Purushotham,Tata Mc.Graw-Hill, 1994.
3. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, TataMc. Graw-Hill, 3rd Edition, 2005.
4. Reinforced Concrete design by Kennath Leet, Tata Mc. Graw-Hill International, editions, 2ndedition, 1991.
5. Design Reinforced Concrete Foundations P.C. Varghese Prentice Hall of INDIA Private Ltd.
6. IS 456-2000 Plain and Reinforced concrete book of Practice.
7. SP 16- Design Aids for Reinforced Concrete to IS 456
8. SP 34 - Hand Book as Concrete Reinforcement and retaining

M.Tech I Year I Semester **Course Structure**

L	T	P	C
0	0	4	2

ADVANCED CONCRETE TECHNOLOGY LABORATORY

Internal marks :30

COURSE CODE: PP21CEL01 **External marks :70**

Course Objectives:

1. To equip the students to conduct all fundamental experiments.
2. The impart adequate knowledge on various design principles by experimenting.
3. To enable the students to investigate the performance of structural elements.
4. To make the students to investigate the materials for sustainable constructions.

Course Outcomes:

At the end of the Course, Student will be able to

1. Explain Knowledge of design and development of experimenting skills.
2. Conduct various laboratory tests on Cement, Aggregates
3. Know strain measurement
4. Non- destructive testing
5. Chemical analysis on concrete and Aggregate and Sand

Syllabus:

List of Experiments:

1. Studyon Water / Cement Ratios Vs Workability of different concretes
2. Studyon Water / Cement Ratios Vs Strength of different concretes
3. Studyof variation of Coarse Aggregate to Fine Aggregates on Workability
4. Studyof variation of Coarse Aggregate to Fine Aggregates on Strength
5. Strain measurement - Electrical resistance strain gauges
6. Non destructive testing- Impact Hammer test, UPV test
7. Qualifications tests on Self compaction concrete- L Box , J Box , U box and Slump tests

NOTE: A minimum of five experiments from the above set have to be conducted

M.Tech I Year I Semester **Course Structure**

L	T	P	C
0	0	4	2

ADVANCED STRUCTURAL ENGINEERING LABORATORY

Internal marks :30

COURSE CODE: PP21CEL02 **External marks :70**

Course Objectives:

1. To equip the students to conduct all fundamental experiments on beams
2. The impart adequate knowledge on various deflections and cracks
3. To enable the students to investigate the performance of RCC Beams designed for Bending and failing in Shear
4. The impart adequate knowledge on RCC Beams designed for Shear and failing in Bending
5. To make the students to investigate the RCC One way and two way slabs

Course Outcomes:

At the end of the Course, Student will be able to

1. Explain Knowledge of Deflection and Cracks on a Under Reinforced Over Reinforced and Balanced Sections
2. Perform tests on RCC Beams designed for Bending and failing in Shear
3. Do tests on performance of RCC One way and Two-way slabs
4. Conduct various laboratory tests on concrete to find youngs modulus of elasticity
5. Know how to extract concrete core samples from pavements

Syllabus:

List of Experiments:

1. Study on Deflection and Cracks on a Under Reinforced Over Reinforced and BalancedSections
2. Studyon Performance of RCC Beams designed for Bending and failing in Shear
3. Studyon Performance of RCC Beams designed for Shear and failing in Bending
4. Studyon Performance of RCC One-way slabs
5. Studyon Performance of RCC Two-wayslabs with simply supported edge conditions
6. Studyon Performance of RCC Two-wayslabs with fixed edge conditions
7. Calculation of Young‟s Modulus of Elasticity of Concrete
8. Extraction and Studyof Concrete Core samples from pavements

NOTE: A minimum of five experiments from the above set have to be conducted as demonstration to entire class.

M.Tech I Year II Semester **Course Structure**

L T P C

3 0 0 3

FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING

Internal marks :30

COURSE CODE: PP21CET04 **External marks :70**

Course Prerequisite: Structural Analysis-II

Course Objectives:

1. To enable the students to learn the principles and concepts related to finite element methods.
2. To make the students to model, analyze, and interpret results to realistic engineering problems.
3. To equip the students with necessary knowledge to formulate beam elements using FEM.
4. To enable the students to formulate plane stress plain strain axi symmetric problem.
5. To impart knowledge to judge the quality of the numerical solution and improve accuracy in an efficient manner by optimal selection of solution variables.

Course Outcomes:

At the end of the Course, Student will be able to

1. Summarize direct and formal methods for deriving finite element equations.
2. Solve truss elements using the finite element method.
3. Apply finite element methods for analysis of beam and frame elements.
4. Analyze plane stress, plane strain, axi symmetric problems element method.
5. Analyze iso-parametric formulations

Syllabus

UNIT: 1 **(09 lectures)**

Introduction: Review of stiffness method- Principle of Stationary potential energy- Potential energy of an elastic body- Rayleigh- Ritz method of functional approximation - variational approaches - weighted residual methods

UNIT: 2 **(09 lectures)**

Finite Element formulation of truss element: Stiffness matrix- properties of stiffness matrix – Selection of approximate displacement functions- solution of a plane truss- transformation matrix and stiffness matrix for a 3- D truss- Inclined and skewed supports- Galerkin‟s method for 1- D truss – Computation of stress in a truss element.

UNIT: 3 **(09 lectures)**

Finite element formulation of Beam elements: Beam stiffness- assemblage of beam stiffness matrix- Examples of beam analysis for concentrated and distributed loading- Galerkin‟s method - 2- D

Arbitrarily oriented beam element – inclined and skewed supports –rigid plane frame examples

UNIT: 4 **(10 lectures)**

Finite element formulation for plane stress, plane strain and axi- symmetric problems- Derivation of CST and LST stiffness matrix and equations- treatment of body and surface forces- Finite Element solution for plane stress and axi- symmetric problems-comparison of CST and LST elements – convergence of solution- interpretation of stresses.

UNIT: 5 **(10 lectures)**

Iso- parametric Formulation: Iso- parametric bar element- plane bilinear Iso- parametric element – quadratic plane element - shape functions, evaluation of stiffness matrix, consistent nodal load vector - Gauss quadrature- appropriate order of quadrature

– element and mesh instabilities – spurious zero energy modes, stress computation- patch test.

TEXT BOOKS

1. A first course in the Finite Element Method – Daryl L. Logan, Thomson Publications.
2. Concepts and applications of Finite Element Analysis – Robert D. Cook, Michael E Plesha,John Wiley & Sons Publications
3. Fundamental Finite Element Analysis and Applications: with Mathematica and MatlabComputations, Bhatti, M.A. Wiley Publications

REFERENCES:

1. Introduction to Finite Elements in Engineering- Tirupati R. Chandrupatla, Ashok D.Belgunda, PHI publications.
2. Finite Element Methods (For Structural Engineers) Wail N Rifaie, Ashok K Govil, New AgeInternational (P) Limited

Web References:

1. http://sv.20file.org/up1/658_0.pdf
2. http://www.dschool.ir/images/introduction%20to%20finite%20elements%20in%20engineering,%203rd%20ed,%20t.r.chandrupatla.pdf

M.Tech I Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

THEORY OF PLATES AND SHELLS

Internal marks :30

COURSE CODE: PP21CET05 **External marks :70**

Course Prerequisite: Theory of Elasticity.

Course Objectives:

1. To make the students to know the classical theory of elastic plates and address various boundary condition.
2. To demonstrate the students to known the analysis of circular plates under various loading conditions.
3. To impart the knowledge on analysis of shells using principles of membrane theory & bending theory.
4. To discuss the students to know the analysis& design cylindrical shells.
5. To impart the knowledge on design of cylindrical shells by geometry analysis & membrane theory.

Course Outcomes:

At the end of the Course, Student will be able to

1. Explain the behavior of rectangular plates under various loading conditions.
2. Evaluate the internal parameters in circular plates & annular plates.
3. Examine shells using principles of membrane theory & bending theory.
4. Illustrate applications of short and long shells.
5. Analyze cylindrical shells of different shapes by membrane theory.

Syllabus

UNIT: 1 **(09 lectures)**

Derivation of governing differential equation for plate– in plane bending and transverse bending effects- Rectangular plates: Plates under various loading conditions like concentrated, uniformly distributed load and hydrostatic pressure. Navier and Levy‟s type of solutions for various boundary condition.

UNIT: 2 **(09 lectures)**

Circular plates: Symmetrically loaded, circular plates under various loading conditions, Annular plates.

UNIT: 3 **(10 lectures)**

Introduction to Shells- Single and double curvature- Equations of Equilibrium of Shells: Derivation of stress resultants, Principles of membrane theory and bending theory

UNIT: 4 **(09 lectures)**

Cylindrical Shells: Derivation of the governing DKJ equation for bending theory,details of

Schorer"s theory. Application to the analysis and design of short and long shells. Use of ASCE Manual coefficients for the design.

UNIT: 5 **(10 lectures)**

Beam theory of cylindrical shells: Beam and arch action. Design of diaphragms - Geometry analysis and design of elliptic Paraboloid, Conoidal and Hyperbolic Paraboloid shapes by membrane theory.

TEXT BOOKS

1. Theory of Plates and Shells 2e –S. Timoshenko and S. Woinowsky Krieger, McGraw- Hillbook company, INC, New York.
2. Reinforced Concrete Shells and Folded Plates by P.C. Varghese, Prentice Hall IndiaPublications
3. Analysis of Thin Concrete Shells by K. Chandrasekhara, New Age International (P) Ltd

REFERENCES:

1. Theory and Analysis of Elastic Plates and Shells by J. N. Reddy, CRS Press
2. A Text Book of Shell Analysis – Bairagi, K, Khanna Publisher, New Delhi.
3. Design and Construction of Concrete Shell Roofs – Ramaswamy, G.S, Mc Graw Hill, New York

Web References:

1. http://www.cap-recifal.com/ccs_files/articles/cuveaqua1_denisio/Timoshenko_-_Theory_of_ plates_and_shells.pdf
2. http://homepage.tudelft.nl/p3r3s/MSc_projects/reportKanta.pdf

M.Tech I Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

STABILITY OF STRUCTURES

(Professional Elective-III)

Internal marks :30

COURSE CODE: PP21CEE07 **External marks :70**

Course Prerequisite: Theory of Elasticity

Course Objectives:

1. To make students to learn the behavior of beam columns for different loading conditions.
2. To discuss the basic principles of stability and buckling and to apply equilibrium and energy approaches for the buckling of different types of members.
3. To enable the students evaluate the elastic buckling behavior of bars.
4. To impart the knowledge of buckling of bars under torsion.
5. To enable the students to study lateral buckling of simply supported beams.

Course Outcomes:

At the end of the Course, Student will be able to

1. Analyze the behavior of beam columns for different loading conditions.
2. Examine the principles of strength, stability, elastic buckling behavior of bars.
3. Design in elastic buckling behavior of structural members.
4. Examine buckling behavior of thin walled bars of open cross section under torsion.
5. Analyze beams subjected to lateral buckling

Syllabus

UNIT: 1 **(09 lectures)**

Beam columns: Differential equation for beam columns – Beams column with concentrated loads– continuous lateral load – couples – Beam column with built in ends – continuous beams with axial load – application of Trigonometric series – Determination of allowable stresses

UNIT: 2 **(09 lectures)**

Elastic buckling of bars : Elastic buckling of straight columns – Effect of shear stress on buckling- Eccentrically and laterally loaded columns –Sway & Non Sway mode - Energy methods – Buckling of a bar on elastic foundation – Buckling of bar with intermediate compressive forces and distributed axial loads – Buckling of bars with change in cross section – Effect of shear forceon critical load – Built up columns – Effect of Initial curvature on bars – Buckling of frames – Sway & Non Sway mode

UNIT: 3 **(09 lectures)**

In- elastic buckling: Buckling of straight bars – Double modulus theory Tangent modulus theory.Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae of design – various end conditions – Design of

columns based on buckling. Mathematical Treatment of stability problems: Buckling problem orthogonality relation – Ritz method –Stiffness method and formulation of Geometric stiffness matrix- Applications to simple frames

UNIT: 4 **(10 lectures)**

Torsional 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 of Torsion and Flexure

UNIT: 5 **(10 lectures)**

Lateral Buckling of simply supported Beams: Beams of rectangular cross section subjected for pure bending, Buckling of I Section subjected to pure bending

TEXT BOOKS

1. Theory of Stability of Structures by Alexander ChaJes.
2. Theory of Elastic Stability by S. P. Timshenko & J.M. Gere- Mc Graw Hill Publications
3. Theory of Elastic Stability by Manikaselvam

REFERENCES:

1. Fundamentals of Structural Stability by George J Smith & Dewey H. Hodges, ElsevierPublications
2. Elastic Stability of Structural Elements, N.G.R. Iyengar Macmillan Publications

Web References:

1. www.kstr.lth.se/fileadmin/kstr/pdf_files/forsk_kurs/Intro.pdf
2. nptel.ac.in/courses/105106116/10

M.Tech I Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

ADVANCED STEEL DESIGN

(Professional Elective-III)

Internal marks: 30

COURSE CODE: PP21CEE08 **External marks :70**

Course Prerequisite: Design and drawing of Steel Structures

Course Objectives:

1. To impart knowledge on behavior on simple connections- Riveted, Bolted Pinned And Welded Connections
2. To impart knowledge on Plastic Analysis
3. To know about eccentric and moment connections
4. To impart knowledge on Analysis And Design Of Industrial Buildings
5. To impart knowledge Design of Steel Truss Girder Bridges

Course Outcomes:

At the end of the Course, Student will be able

1. To Design simple Connections – Riveted, Bolted Pinned And Welded Connections.
2. To analysis plastic theory.
3. To gain knowledge on Eccentric And Moment Connections.
4. To analysis and design of industrial buildings.
5. To Design of Steel Truss Girder Bridges

UNIT-I **(09 lectures)**

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 – Prying Action – Combined Shear and Tension for Slip-Critical Connections. Design of Groove Welds - Design of Fillet Welds – Design of Intermittent Fillet Welds – Failure of Welds.

UNIT-II **(09 lectures)**

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

UNIT-III **(09 lectures)**

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 **(10 lectures)**

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, and design of knee braced trusses and stanchions. Design of bracings.

UNIT-V **(10 lectures)**

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 Design of Lacing.

TEXT BOOKS

1. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education PrivateLtd. NewDelhi.
2. Design of steel structures byN. Subramanian, Oxford University Press
3. Design Steel Structures Volume-II, Ramachandra & Vivendra Gehlot, ScientificPublishes Journals Department.

REFERENCE

1. Design of Steel Structures. P. Dayaratnam, S. Chand, Edition 2011-12.
2. Design of Steel Structures Galyord & Gaylord, Tata Mc Graw Hill, Education,Edition 2012.
3. Indian Standard Code – IS – 800-2007.
4. Indian Standard Code – IS – 875 – Part III - 2015

Web References:

1. https://archive.org/details/DesignOfSteelStructuresSKDuggalIndian
2. https://www.smartzworld.com/notes/steel-structures-design-drawing-notes-pdf-ssdd/
3. https://easyengineering.net/steel-structures-books-collection-pdf/

M.Tech I Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

ANALYSIS OF OFFSHORE STRUCTURES

(Professional Elective-III)

Internal marks :30

COURSE CODE: PP21CEE09 **External marks :70**

Course Prerequisite: Structural analysis -I & II

Course Objectives:

1. To impart knowledge on different types of offshore structures
2. To known about water particle kinematics
3. To impart knowledge on wave force estimation.
4. To estimate wave force on large bodies
5. To impart knowledge on analysis of fixed offshore structure.

Course Outcomes:

At the end of the Course, Student will be able

1. Perform concept development of offshore structure
2. Find the wave force on vertical cylinder
3. Find wave force on large bodies
4. Perform static and dynamic analysis of fixed offshore structure

Syllabus

UNIT: 1 **(09 lectures)**

Introduction to different types of offshore structures, Concept of fixed, compliant and floating structures, Law of floatation, fluid pressure and centre of pressure, estimation of centre of gravity, hydrostatic particulars, stability criteria of floating bodies, and motions of a floating body

UNIT: 2 **(09 lectures)**

Conservation mass and momentum, Euler equation, Bernoulli's Equation, Potential flow, Classification of waves, small amplitude or Linear Airy‟s theory, dispersion relationship, water particle kinematics, wave energy.

UNIT: 3 **(09 lectures)**

Wave force estimation- Wave force on small bodies- Morison equation, Estimation of wave force on a vertical cylinder, Force due to current, Effect of marine growth on vertical cylinders.

UNIT: 4 **(10 lectures)**

Wave force on large bodies- Froude- krylov theory, Diffraction theory.

UNIT: 5 **(10 lectures)**

Static and dynamic analysis of fixed offshore structures.

TEXT BOOKS

1. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
2. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.

REFERENCES

1. Hand book of offshore Engineering, Vol I, Subrata Chakrabarti, Offshore Structure Analysis,Inc., Plainfield, Illinois, USA.
2. API RP 2A., Planning, Designing and Constructing Fixed Offshore Platforms, API.
3. McClelland, B & Reifel, M. D., Planning & Design of fixed Offshore Platforms, VanNostrand, 1986.

Web references

1. https://nptel.ac.in/courses/114/106/114106045/
2. https://nptel.ac.in/courses/114/106/114106011/
3. https://onlinecourses.nptel.ac.in/noc20_oe03/preview

M.Tech I Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

EARTHQUAKE RESISTANT DESIGN OF BUILDINGS

(Professional Elective-IV)

Internal marks :30

COURSE CODE: PP21CEE10 **External marks :70**

Course Prerequisite: Structural Dynamics

Course Objectives:

1. To make students to learn basic principles of engineering seismology.
2. To enable the students to learn design concepts of earthquake resistant high-rise buildings.
3. To impart the knowledge on design and ductile detailing of different structural members.
4. To make the students learn Elastic behavior of different materials subjected to cyclic loading.
5. To facilitate the students with all necessary knowledge to choose efficient structural systems and structural layouts.

Course Outcomes:

At the end of the Course, Student will be able to

1. Demonstrate knowledge on seismic effects on various structures.
2. Develop the seismic design concepts for different kinds of building systems.
3. Examine 3D modeling of building systems.
4. Analyze the concepts of elastic behavior of different materials subjected to cyclic loading.
5. Categorize the Seismic evaluation and retrofitting of structures

UNIT – I **(10 lectures)**

Introduction

Engineering seismology - rebound theory - plate tectonics - seismic waves - earthquake sizeand various scales - local site effects - Indian seismicity - seismic zones of India - theory of vibrations - near ground and far ground rotation and their effects

UNIT – II **(10 lectures)**

Seismic Design Concepts

Seismic design concepts - EQ load on simple building - load path - floor and roof diaphragms- seismic resistant building architecture- plan configuration - vertical configuration-pounding effects - mass and stiffness irregularities - torsion in structural system- Provision of seismic code (IS 1893 & 13920) - Building system - frames - shear wall - braced frames -layout design of

Moment Resisting Frames(MRF) - ductility of MRF - Infill wall - Non-structural elements.

UNIT – III **(10 lectures)**

Shear Walls

Calculation of EQ load - 3D modeling of building systems and analysis (theory only) Design and ductile detailing of Beams and columns of frames Concept of strong column weak beams, Design and ductile detailing of shear walls.

UNIT – IV **(09 lectures)**

Base Isolation

Cyclic loading behavior of RC, steel and pre- stressed concrete elements - modern concepts- Base isolation - Adaptive systems - case studies.

UNIT – V **(09 lectures)**

Retrofitting

Retrofitting and restoration of buildings subjected to damage due to earthquakes- effects of earth quakes - factors related to building damages due to earthquake- methods of seismic retrofitting- restoration of buildings

Text Books:

1. Pankaj Agarwal and Manish Shri Khande, Earthquake Resistant Design of Structures, Prentic- Hall of India, 2007, New Delhi.
2. Bullen K.E., Introduction to the Theory of Seismology, Great Britain at the University Printing houses, Cambridge University Press 1996.

Reference Books:

1. Seismic design of reinforced concrete and masonry buildings by Paulay and Priestley
2. Earthquake Resistant Design and Risk Reduction- David Dowrick
3. IS 4326 -1998: Earthquake Resistant Design and Construction of Buildings
4. IS 1893 (Part 1 to 5)- 2016: General Provisions and Building
5. IS 4928–1993: Code of practice for Earthquake Resistant Design and Construction ofBuildings
6. IS 13920-2016: Code of Practice for Ductile Detailing of Reinforced Concrete Structuressubjected to Seismic Forces
7. IS 13935-1993: Guidelines for Repair and Seismic Strengthening of Building
8. Relevant code of practices. IS 1893-2002

Web References:

1. https://www.scribd.com/document/339796689/Earthquake-resistant-design-of-structures-by-pankaj-agarwal-pdf
2. http://www.ndma.gov.pk/sep/books/b2.pdf
3. http://rahat.up.nic.in/sdmplan/Earthquake/AnnexureI-V/AnnexureII_earthqk.%20prac.-1.pdf-- Code Book

M.Tech I Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

PRECAST AND PREFABRICATED STRUCTURES

(Professional Elective-IV)

Internal marks :30

COURSE CODE: PP21CEE11 **External marks :70**

Course Prerequisite: Structure analysis- I & II

Course Objectives:

1. to impart need for prefabrication principles.
2. To enable the students to learn about Prefabricated Load Carrying Members
3. To make students to know about joints.
4. To impart knowledge on Production Technology
5. To make students to learn about Applications - Designing and detailing of precast UNIT for factory structures

Course Outcomes:

At the end of the Course, Student will be able to

1. Analyze the prefabricated load carrying members
2. Analyze the production technology of prefabrication
3. Know about expansion joints in precast construction.
4. Design and detailing of precast UNIT for factories
5. Design single storied simple frames

Syllabus

UNIT -I **(09 lectures)**

Need for prefabrication – General Principles of Prefabrication - Comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization – Materials – Modular coordination – Systems –Production – Transportation – Erection.

UNIT –II **(09 lectures)**

Prefabricated Load Carrying Members-Planning for components of prefabricated structures, disuniting of structures, design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses, beams, columns, symmetric frames. Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls.

UNIT –III **(09 lectures)**

Joints - Joints for different structural connections, effective sealing of joints for water proofing, provisions for non-structural fastenings, expansion joints in precast construction.

UNIT –IV **(10 lectures)**

Production Technology - Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening. Hoisting Technology - Equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

UNIT –V **(10 lectures)**

Applications - Designing and detailing of precast UNIT for factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, singe span single storied simple frames, single storied buildings, slabs, beams and columns. Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

TEXT BOOKS

1. Precast Concrete Structures- Kim S Elliott, CRC Press
2. CBRI, Building materials and components, India, 1990
3. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based processplanning forconstruction and manufacturing, Academic Press Inc., 1994
4. Koncz T., Manual of precast concrete construction, Vols. I, II and III,Bauverlag, GMBH,1971.

REFERENCES

1. Structural design manual, Precast concrete connection details, Society forthe studies in theuse of precast concrete, Netherland Betor Verlag, 1978.
2. Mokk. L, (1964), Prefabricated Concrete for Industrial and PublicStructures, PublishingHouse of the Hungarian Academy of Sciences, Budapest.

M.Tech I Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

EARTH RETAINING STRUCTURES

(Professional Elective-IV)

Internal marks :30

COURSE CODE: PP21CEE12 **External marks :70**

Course Prerequisite: Geotechnical Engineering.

Course Objectives:

1. To make the students to know earth pressure theories.
2. To enable the students to judge the stability of retaining walls.
3. To train the students be knowledgeable of current US guidelines regarding the design of earth retaining structures.
4. To enable the students to analysis sheet pile structures.
5. To help the students design the most technically appropriate and cost effective type of retaining wall.

Course Outcomes:

At the end of the Course, Student will be able to

1. Solve earth pressure on various earth retaining structures such as gravity retaining walls, Sheet pile, bulkheads, bracing/struts and cofferdams.
2. Evaluate the mechanical properties of geo synthetics used for soil reinforcement. Constructing of sheet pile with and without anchors.
3. Select the most technically appropriate type of retaining wall for the application.
4. Summarize the current guidelines regarding the design of earth retaining structures.

Syllabus

UNIT: I **(09 lectures)**

Earth pressures – Different types and their coefficients- Classical Theories of Earth pressure – Rankine‟s and Coulomb‟s Theories for Active and Passive earth pressure- Computation of Lateral Earth Pressure in Homogeneous and Layered soils- Graphical solutions for Coulomb‟s Theory in active and passive conditions.

UNIT: II **(09 lectures)**

Retaining walls – different types - Type of Failures of Retaining Walls – Stability requirements Drainage behind Retaining walls – Provision of Joints – Relief Shells.

UNIT: III **(09 lectures)**

Sheet Pile Structures – Types of Sheet piles – Cantilever sheet piles in sands and clays – Anchored sheet piles – Free earth and Fixed earth support methods – Rowe‟s moment reduction method – Location of anchors and Design of Anchorage system.

UNIT: IV **(10 lectures)**

Soil reinforcement – Reinforced earth - Different components – their functions – Design principles of reinforced earth retaining walls.

UNIT: V **(10 lectures)**

Braced cuts and Cofferdams: Lateral Pressure in Braced cuts – Design of Various Components of a Braced cut – Stability of Braced cuts – Bottom Heave in cuts. – types of cofferdam, suitability, merits and demerits – Design of single – wall cofferdams and their stability aspects – TVA method and Cummins‟ methods.

TEXT BOOKS

1. Principles of Foundation Engineering 7e by Braja Das, Cengage Learning
2. Foundation analysis and design by Bowles, J.E. – McGraw Hill

REFERENCES

1. Soil Mechanics in Engineering Practice – Terzaghi, K and Ralph, B. Peck 2e. – John Wiley &Sons.,
2. Analysis and Design of Foundations and Retaining Structures, Samsher Prakash, GopalRanjan and Swami Saran, Saritha Prakashan, New Delhi
3. NPTEL course materials on Geo-synthetics and Earth Retaining Structures

Web References:

1. https://www.cedengineering.com/userfiles/Geol%20Eng%20-%20Earth%20Retaining%20Structures.pdf
2. http://engineeringbookspdf.com/download/2017/08/310817/Soil%20Retaining%20Structures%20Development%20of%20Models%20for%20Structural%20Analysis.pdf
3. https://www.pdfdrive.com/geotechnical-engineering-d33654601.html

M.Tech I Year II Semester **Course Structure**

L	T	P	C
0	0	4	2

COMPUTER AIDED DESIGN LABORATORY

Internal marks :30

COURSE CODE: PP21CEL03 **External marks :70**

Course Objectives:

1. To impart knowledge on Computer Programs for Analysis and Design of various Structural Elements
2. To illustrate Use different Structural Engineering software‟s to solve various civil Engineering programs

Course Outcomes:

At the end of the Course, Student will be able to

1. Develop Computer Programs for Analysis and Design of various Structural Elements
2. Use different Structural Engineering software‟s to solve various civil Engineering programs

Syllabus:

Analysis and Design using STADD, STADD FOUNDATION, ETABS, ANSYS

1. Programming for beams subject to different loading
2. Analysis and Design of reinforced concrete multistoried building
3. Analysis of plane and space truss
4. Analysis of plane and space frame
5. Determination of mode shapes and frequencies of tall buildings using lumped mass (stickmodel) approximation

NOTE: A minimum of Four from the above set have to be conducted.

REFERENCE:

Computer aided design laboratory (Civil Engineering) by Shesha Prakash and Suresh.S

M.Tech I Year II Semester **Course Structure**

L	T	P	C
0	0	4	2

STRUCTURAL DESIGN LABORATORY

Internal marks :32

COURSE CODE: PP21CEL04 **External marks :70**

Course Objectives:

1. To impart knowledge on Computer Programs for Analysis and Design of various Structural Elements
2. To illustrate Use different Structural Engineering software"s to solve various civil Engineering programs

Course Outcomes:

At the end of the Course, Student will be able to

1. Develop Computer Programs for Analysis and Design of various Structural Elements
2. Use different Structural Engineering software's to solve various civil Engineering programs

Syllabus

Analysis and Design using STADD, STADD FOUNDATION, ETABS, ANSYS

1. Wind analysis on tall structure
2. Analysis of pre stressed concrete bridge girder
3. Analysis of Cylindrical shell
4. Analysis of Bridge Pier and Abutment
5. Dynamic Analysis of Multistory structure

NOTE: A minimum of Four from the above set have to be conducted.

REFERENCE:

Computer aided design laboratory (Civil Engineering) by Shesha Prakash and Suresh.S

M.Tech I Year II Semester **Course Structure**

L	T	P	C
0	0	4	2

MINI PROJECT WITH SEMINAR

Internal marks :100

COURSE CODE: PP21CEM01

SEMINAR

Course Outcomes:

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

1. Collect research material on some topic and to summaries it report and give to present the same

DESIGN PROJECT

Course Outcomes:

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

1. Analyse, design and prepare a report on Special Design topic related to Structural Engineering

DISSERTATION / THESIS

Course Outcomes:

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

1. Identifying the topic after thorough review of literature on chosen topic and Can able to do the Project either Experimental Work or analytical Work

M.Tech II Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

DESIGN OF PRE- STRESSED CONCRETE STRUCTURES

(Professional Elective-V)

Internal marks :30

COURSE CODE:PE21CEE13 **External marks :70**

Course Prerequisite: Reinforced Concrete Structures.

Course Objectives:

1. To impart knowledge on prestressing, pre-tensioning and posttensioning systems
2. To enable students to learn about deflections of prestressed concrete members.
3. To learn about composite constructions
4. To impart knowledge on prestressed concrete slabs
5. To know about continuous beams

Course Outcomes:

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

1. Explain the principle, types and systems of prestressing and analyze the deflections
2. Determine the flexural strength and design the flexural members, end blocks.
3. Analyze the statically indeterminate structures and design the continuous beam.
4. Design the tension and compression members and apply it for design of piles.
5. Analyze the stress, deflections, flexural and shear strength and apply it for the design of bridges.
6. Analyze the Composite construction of Pre- stressed and in- situ concrete

Syllabus

UNIT I: **(09 lectures)**

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

UNIT II: **(09 lectures)**

DEFLECTIONS OF PRESTRESSED CONCRETE MEMBERS: Importance of Control Of Deflections – Factors Influencing Deflection – Short-term Deflections of Un cracked Members – Prediction of Long-time Deflections – Deflections of Cracked Members – Requirements of IS 1343-2012.

Ultimate Flexural Strength of Beams: Introduction, Flexural theory using first principles – Simplified Methods – Ultimate Moment of Resistance of un tensioned Steel.

UNIT III: **(09 lectures)**

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

sections.

UNIT IV: (10 lectures)

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 pre stressing- Types of Prestressed Concrete Pipes- Design of Prestressed Concrete Pipes - Prestressed Concrete Poles.

UNIT V: (10 lectures)

CONTINUOUS BEAMS: Advantage of Continuous Members – Effect of Pre stressing in determinate Structures – Methods of Achieving Continuity – Methods of Analysis of Secondary Moments – Concordant Cable Profile – Guyon‟s Theorem. Redistribution of moments in a continuous beam.

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

TEXT BOOKS

1. Prestressed Concrete, 6e by N. Krishna Raju, Mc Graw Hill Publishers
2. Prestressed Concrete by K. U.Muthu, PHI Learning Pvt Limited

REFERENCES:

1. Prestressed Concrete Analysis and Design, Antone E. Naaman 2e, Techno Press 3000
2. Design of Prestressed Concrete- T. Y. Lin, Ned H. Burns 3e, Wiley Publications
3. Design of prestressed Concrete by E.G. Nawy
4. Prestressed Concrete by N. Rajagopalan, Narosa Publishing
5. IS1343 2012 Prestressed concrete Code of Practice

Web References:

1. https://drive.google.com/file/d/1q273r_kykMnH3JI4WcFyxZjy0HNAWgZc/view
2. https://www.scribd.com/doc/132460689/Design-of-Prestressed-Concrete-Structures- 3rd-Edition

M.Tech II Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

STRUCTURAL HEALTH MONITORING

(Professional Elective-V)

Internal marks :30

COURSE CODE:PE21CEE14 **External marks :70**

Course Prerequisite: Repairs and rehabilitation of Structures

Course Objectives:

1. To make students to learn the distress in the structure, causes and Factors
2. To impart the knowledge of the health of structure using static field methods
3. To enable the student's health of structure using dynamic field tests.
4. To make students to study repairs and rehabilitation measures of the structure.

Course Outcomes:

After completion of the course the student will be able to

1. Diagnosis the distress in the structure understanding the causes and factors.
2. Assess the health of structure using static field methods.
3. Assess the health of structure using dynamic field tests.
4. Suggest repairs and rehabilitation measures of the structure

Syllabus

UNIT – I **(09 lectures)**

Introduction

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.

Structural Health Monitoring: Concepts, Various Measures, Structural Safety in Alteration.

UNIT – II **(10 lectures)**

Structural Audit

Assessment of Health of Structure, Collapse and Investigation- Management, SHM procedure

UNIT – III **(09 lectures)**

Static Field Testing

Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

UNIT – IV **(10 lectures)**

Dynamic Field Testing

Types of Dynamic Field Test & Response Methods, Stress History Data, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT – V **(10 lectures)**

Introduction to R & Rs

Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

Text Books:

1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley
2. Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.

Reference Books:

1. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
2. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007.

Web References:

1. https://www.sciencedirect.com/science/book/9780124186910
2. http://fmcet.in/CIVIL/CE2071_uw.pd

M.Tech II Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

INDUSTRIAL STRUCTURES

(Professional Elective-V)

Internal marks :30

COURSE CODE:PE21CEE14 **External marks :70**

Course Prerequisite: Structural Analysis, RCC

Course Objectives:

1. To make students to learn principles of design of industrial building.
2. To enable students to design different components of industrial structure sand to detail the structures.
3. To impart knowledge on evaluating the performance of the pre-engineered buildings.
4. To illustrate the concept of power plant structures- bunkers and silos chimney andcooling towers.
5. To train the students to distinguish the power transmission structures, transmission line towers and tower foundations.

Course Outcomes:

At the end of the Course, Student will be able to

1. Illustrate the planning and functional requirements of industrial building.
2. Analyze the components of industrial building.
3. Design different pre-engineered buildings.
4. Distinguish the principles of power plant structures-bunkers and silos-chimney and cooling towers.
5. Summarize the power transmission structures, transmission line towers and tower foundations

Detailed Syllabus:

UNIT: I **(09 lectures)**

Planning and functional requirements-classification of industries and industrial structures-planning for layout-requirements regarding lighting ventilation and fire safety-protection against noise and vibrations

UNIT: II **(09 lectures)**

Industrial buildings- roofs for industrial buildings (Steel) - design of gantry girder-design of corbels and nibs- machine foundations

UNIT: III **(09 lectures)**

Design of Pre Engineered Buildings

UNIT: IV **(10 lectures)**

Power plant structures-Bunkers and silos- chimney and cooling towers- Nuclear containment structures

UNIT: V **(10 lectures)**

Power transmission structures- transmission line towers- tower foundations- testing towers

TEXT BOOKS

1. Handbook on Machine Foundations by P. Srinivasulu and C. V. Vaidyanathan, StructuralEngineering Research Center
2. Tall Chimneys- Design and Construction by S. N. Manohar Tata McGrawhill PublishingCompany

REFERENCES:

1. Transmission Line Structures by S. S. Murthy and A. R. Santakumar McGraw Hill
2. SP 32: 1986, Handbook on functional requirements of Industrial buildings
3. Design of steel structures by N. Subramanian

Web References:

1. https://authors.library.caltech.edu/26539/1/Tangshan/Volume4_Chapter_6.pdf
2. https://www.scribd.com/doc/127930829/Advanced-Reinforced-Concrete-Design-by-Krishna-Raju

M.Tech II Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

ARTIFICIAL INTELLIGENCE TECHNIQUES

(Open Elective-I)

Internal marks :30

COURSE CODE:PE21CEO01 **External marks :70**

Course Objectives:

1. To know about introduction of artificial intelligence
2. To impart knowledge on neural networks models
3. To enable students about learning and training
4. To impart knowledge on Fuzzy Logic
5. To know about Fuzzy Relations

Course Outcomes:

At the end of the Course, Student will be able to

1. Asses the applicability, strengths and weakness of problems and methods for particular engineering problem
2. Can develop intelligent system for particular problem

UNIT-I **(09 lectures)**

Artificial Intelligence (AI): Introduction: Principal Characteristics of AI, Expert system, components, classification, Decision Support Systems (DSS). Introduction to Neural Networks: Biological Neuron, Neural Processing, History of ANN, Adaline and Madaline, Perceptron and its characteristics.

UNIT-II **(09 lectures)**

Neural Networks Models: ANN components, input, output and hidden layers, threshold function,weights. Feed forward network. Hopfield network.

UNIT-III **(09 lectures)**

Learning and Training: Objective of learning, Supervised and Unsupervised learning, Hebb'srule, Delta Rule. Back propagation algorithm. Factors effecting network training.

UNIT-IV **(10 lectures)**

Fuzzy Logic: Crispness, Uncertainty, Vagueness, Fuzzyness, history of Fuzzy logic, motivation,Fuzzy sets.

UNIT-V **(10 lectures)**

Fuzzy Relations, Fuzzy association memory, Fuzzy events, Means, Variances. Fuzzy if thenRules, Fuzzy Implications.

REFERENCE:

1. Neural Networks and Fuzzy Systems by Bart. Kosko, Prietence hall of India, 1994.
2. Artificial Neural Networks by Robert J. Schalokoff.
3. Fuzzysets Uncertainity an information by George.J.Klir and Tina, Pretence Hall of India, NewDelhi

M.Tech II Year I Semester **Course Structure**

L T P C

3 0 0 3

CONSTRUCTION MANAGEMENT

(Open Elective-I)

Internal marks :30

COURSE CODE:PE21CEO02 **External marks :70**

Course Objectives:

1. To impart knowledge on management process
2. To learn about construction projects
3. To know about resource planning
4. To impart knowledge on contracts
5. To learn about management information system

Course Outcomes:

At the end of the Course, Student will be able to

1. Able to plan, coordination, and control of a project from beginning to completion.
2. Adopting the most effect method for meeting the requirement in order to produce a functionally and financially viable project.

UNIT –I **(09 lectures)**

Management process- Roles. Management theories. Social responsibilities. Planning and strategic management. Strategy implementation. Decision making: tools and techniques – Organizational structure. Human resource management- motivation performance- leadership.

UNIT-II **(09 lectures)**

Classification of Construction projects, Construction stages, Resources- Functions of Construction Management and its Applications. Preliminary Planning- Collection of Data- Contract Planning – Scientific Methods of Management: Network Techniques in construction management - Bar chart, Gant chart, CPM, PERT- Cost & Time optimization.

UNIT-III **(09 lectures)**

Resource planning - planning for manpower, materials, costs, equipment. Labour -Scheduling - Forms of scheduling - Resource allocation. budget and budgetary control methods

UNIT-IV **(10 lectures)**

Contract - types of contract, contract document, and specification, important conditions of contract – tender and tender document - Deposits by the contractor - Arbitration. negotiation - M.Book - Muster roll -stores.

UNIT-V **(10 lectures)**

Management Information System - Labour Regulations: Social Security - welfare Legislation - Laws relating to Wages, Bonus and Industrial disputes, Labour Administration - Insurance and Safety Regulations - Workmen's Compensation Act -other labour Laws - Safety in construction: legal and financial aspects of accidents in construction. occupational and safety hazard assessment. Human factors in safety. Legal and financial aspects of accidents in construction. Occupational and safety hazard assessment.

REFERENCE:

1. Ghalot, P.S., Dhir, D.M., Construction Planning and Management, Wiley Eastern Limited,1992.
2. Chitkara,K.K., Construction Project Management¸ Tata McGraw Hill Publishing Co, Ltd., New Delhi,998.
3. Punmia,B,C., Project Planning and Control with PERT and CPM, Laxmi Publications, New Delhi,1987.
4. Sengupta, B. &Guha, H, Construction Management and Planning by: Tata McGraw-hill publications.

M.Tech II Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

GREEN TESCHNOLOGY

(Open Elective-I)

Internal marks :30

COURSE CODE:PE21CEO03 **External marks :70**

Course Objectives:

1. To know about introduction to green technology
2. To impart knowledge on cleaner production project development and implementation
3. To learn about Pollution Prevention and Cleaner Production Awareness Plan
4. To impart knowledge on Availability and need of conventional energy resources
5. To gain knowledge on Green Fuels and biomass energy

Course Outcomes:

At the end of the Course, Student will be able to

1. Enlist different concepts of green technologies in a project
2. Understand the principles of Energy efficient technologies
3. Estimate the pollution prevention and cleaner awareness plan
4. Estimate the carbon credits of various activities
5. Recognize the benefits of green fuels with respect to sustainable development.

UNIT- I **(09 lectures)**

Introduction: Green Technology – definition- Importance – Historical evolution – advantages and disadvantages of green technologies-factors affecting green technologies- Role of Industry, Government and Institutions – Industrial Ecology – role of industrial ecology in green technology. Cleaner Production (CP): Definition – Importance – Historical evolution - Principles of Cleaner Production–Benefits–Promotion – Barriers – Role of Industry.

UNIT- II **(09 lectures)**

Cleaner Production Project Development and Implementation:
Government and Institutions – clean development mechanism, reuse, recovery, recycle, raw material substitution-Wealth from waste, case studies. Overview of CP Assessment Steps and Skills, Process Flow Diagram, Material Balance, CP Option Generation – Technical and Environmental Feasibility analysis – Economic valuation of alternatives - Total Cost Analysis – CP Financing – Preparing a Program Plan – Measuring Progress- ISO 14000.

UNIT- III **(09 lectures)**

Pollution Prevention and Cleaner Production Awareness Plan – Waste audit – Environmental Statement, carbon credit, carbon sequestration, carbon trading, Life Cycle Assessment - Elements of LCA – Life Cycle Costing – Eco Labeling.

UNIT –IV **(10 lectures)**

Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Non- conventional energy sources: Solar Energy-solar energy conversion technologies and devices,their principles, working and application.

UNIT- V **(10 lectures)**

Green Fuels – Definition-benefits and challenges – comparison of green fuels with conventional fossil fuels with reference to environmental, economical and social impacts- public policies and market-driven initiatives.

Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in Indian context; tidal and geothermal energy.

REFERENCES:

1. 'Pollution Prevention: Fundamentals and Practice' by Paul L Bishop (2000), McGraw HillInternational.
2. 'Cleaner Production Audit' by Prasad Modak, C.Visvanathan and MandarParasnis (1995),Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok
3. 'Non-conventional Energy Sources' by Rai G.D.
4. 'Energy, The Solar Hydrogen Alternative' by Bokris J.O.
5. Waste Energy Utilization Technology' by Kiang Y. H.
6. 'Solar Energy' by Sukhatme S.P.
7. 'Pollution Prevention and Abatement Handbook – Towards Cleaner Production' by WorldBank Group (1998), World Bank and UNEP, Washington D.C.
8. 'Handbook of Organic Waste Conversion' by Bew

M.Tech II Year I Semester **Course Structure**

L	T	P	C
0	0	20	10

DISSERTATION PHASE-I / INDUSTRIALPROJECT

(To be continued and Evaluated next Semester)

COURSE CODE: PP21CEP01

SEMINAR

Course Outcomes:

1. Collect research material on some topic and to summaries it report and give to present the same

DESIGN PROJECT

Course Outcomes:

1. Analyse, design and prepare a report on Special Design topic related to Structural Engineering

M.Tech II Year II Semester **Course Structure**

L	T	P	C
0	0	32	16

DISSERTATION PHASE-II / PROJECT

(Continued from III Semester)

COURSE CODE: PP21CEP02

DISSERTATION / THESIS

Course Outcomes:

1. Identifying the topic after thorough review of literature on chosen topic and Canable todo the Project either Experimental Work or analytical Work

AUDIT 1 and 2: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:
Students will be able to:

1. Understand that how to improve your writing skills and level of readability Learn about what towrite in each section
2. Understand the skills needed when writing a Title Ensure the good quality of paper atvery first-time submission

Syllabus		
Units	**CONTENTS**	**Hours**
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity andVagueness	4
2	Clarifying Who Did What, Highlighting Your Findings, Hedging Criticizing, Paraphrasing and Plagiarism, Sectionsof a Paper, Abstracts. Introduction	4
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4
4	key skills are needed when writing a Title, key skills are needed 4 when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	
5	skills are needed when writing the Methods, skills needed when 4 writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	
6	useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	4

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.Highman'sbook .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York DordrechtHeidelberg London, 2011

AUDIT 1 and 2: DISASTER MANAGEMENT

Course Objectives: -

Students will be able to:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance inspecific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches,planning and programming in different countries, particularly their home country or thecountries they work in

Syllabus		
Units	**CONTENTS**	**Hours**
1	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
2	**Repercussions Of Disasters And Hazards**: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	4
3	**Disaster Prone Areas In India** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4
4	**Disaster Preparedness And Management** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	4
5	**Risk Assessment** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	4
6	**Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4

Suggested Readings:

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

AUDIT 1 and 2: VALUE EDUCATION

Course Objectives

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Syllabus

Unit	Content	Hours
1	• Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. • Moral and non- moral valuation. Standards and principles. • Value judgements	4
2	• Importance of cultivation of values. • Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. • Honesty, Humanity. Power of faith, National Unity. • Patriotism.Love for nature ,Discipline	6
3	• Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. • Punctuality, Love and Kindness. • Avoid fault Thinking. • Free from anger, Dignity of labour. • Universal brotherhood and religious tolerance. • True friendship. • Happiness Vs suffering, love for truth. • Aware of self-destructive habits. • Association and Cooperation. • Doing best for saving nature	6
4	• Character and Competence –Holy books vs Blind faith. • Self-management and Good health. • Science of reincarnation. • Equality, Nonviolence ,Humility, Role of Women. • All religions and same message. • Mind your Mind, Self-control. • Honesty, Studying effectively	6

Suggested reading

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, OxfordUniversity Press, New Delhi

Course outcomes

Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values 3.Developing the overall personality

AUDIT 1 and 2: PEDAGOGY STUDIES

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policymaking undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Syllabus

Units	Content	Hours
1	□ **Introduction and Methodology:** □ Aims and rationale, Policy background, Conceptual framework and terminology □ Theories of learning, Curriculum, Teacher education. □ Conceptual framework, Research questions**.** □ Overview of methodology and Searching.	4
2	• Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. • Curriculum, Teacher education.	2
3	• Evidence on the effectiveness of pedagogical practices • Methodology for the in depth stage: quality assessment of included studies. • How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? • Theory of change. • Strength and nature of the body of evidence for effective pedagogical practices. • Pedagogic theory and pedagogical approaches. • Teachers‟ attitudes and beliefs and Pedagogic strategies.	4
4	• Professional development: alignment with classroom practices and follow-up support • Peer support • Support from the head teacher and the community. • Curriculum and assessment • Barriers to learning: limited resources and large class sizes	4
5	□ **Research gaps and future directions** □ Research design □ Contexts □ Pedagogy □ Teacher education □ Curriculum and assessment □ Dissemination and research impact.	2

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare,31 (2): 245-261.

2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation,Journal ofCurriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, „learning to read" campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

AUDIT 1 and 2: STRESS MANAGEMENT BY YOGA

Course Objectives

1. To achieve overall health of body and mind
2. To overcome stress

Syllabus

Unit	Content	Hours
1	• Definitions of Eight parts of yog. (Ashtanga)	8
2	Yam and Niyam. Do`s and Don‟t‟s in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	8
3	• Asan and Pranayam 1. Various yog poses and their benefits for mind & body 2. Regularization of breathing techniques and its effects-Types of pranayam	8

Suggested reading

1. “Yogic Asanas for Group Tarining-Part-I” : Janardan Swami YogabhyasiMandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

AUDIT 1 and 2: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Objectives

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Syllabus

Unit	Content	Hours
1	Neetisatakam-Holistic development of personality • Verses- 19,20,21,22 (wisdom) • Verses- 29,31,32 (pride & heroism) • Verses- 26,28,63,65 (virtue) • Verses- 52,53,59 (dont"s) • Verses- 71,73,75,78 (do"s)	8
2	• Approach to day to day work and duties. • ShrimadBhagwadGeeta : Chapter 2-Verses 41, 47,48, • Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, • Chapter 18-Verses 45, 46, 48.	8
3	• Statements of basic knowledge. • ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68 • Chapter 12 -Verses 13, 14, 15, 16,17, 18 • Personality of Role model. ShrimadBhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, • Chapter 4-Verses 18, 38,39 • Chapter18 – Verses 37,38,63	8

Suggested reading

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department),Kolkata
2. Bhartrihari"s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya SanskritSansthanam, New Delhi.

Course Outcomes

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality andachieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Studyof Neetishatakam will help in developing versatile personality of students