ACADEMIC REGULATIONS - R25 FOR M.Tech (REGULAR) DEGREE COURSE

Applicable for the students admitted to M.Tech (Regular) Course from the Academic Year 2025-26 and onwards. The M.Tech Degree of Narasaraopeta Engineering College(Autonomous) affiliated to Jawaharlal Nehru Technological University Kakinada shall be conferred on candidates who are admitted to the program and who fulfil all the requirements for the award of the Degree.

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 (i) in national level qualifying Entrance Test (GATE), (ii) AP PGECET conducted by State Government and (iii) Few Sponsored seats notified by University on the basis of any order of merit as approved by the State Government /JNTUK University, Kakinada subject to reservations as laid down by the Government from time to time.

2. AWARD OF M.Tech DEGREE

2.1 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. Under any circumstances, permission shall not be given to complete the course work beyond four years.

2.2 The student shall register for all 80 credits and secure all the 80 credits.

2.3 The minimum instruction period in each semester is 16 weeks.

3. PROGRAMME OF STUDY

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

M.Tech in

1. CSE/CS&E
2. Digital Electronics and Communication Systems
3. Digital Systems & Computer Electronics
4. Machine Design
5. Power and Industrial Drives
6. Structural Engineering
7. Thermal Engineering
8.VLSI & Embedded Systems

4. ATTENDANCE

4.1 Attendance is calculated separately for each course. Attendance in all classes (Theory/Laboratories) is compulsory. The minimum required attendance in each course is 75%. A student shall not be permitted to appear for the Semester End Examinations (SEE), if his/her attendance is less than 75%.

4.2 Condoning of shortage of attendance (between 65% and 75%) up to a maximum of

10% (*considering the days of attendance in sports, games, NSS activities and medical exigencies*) in each course (Theory/Lab/Seminar) is condoned on production of valid Certificates/documents in the stipulated time mentioned here with:

4.2.1 Students who are admitted as in patients for treatment are only eligible to claim condonation of attendance. Such students under medical exigencies need to Produce (a) Doctor Medical Prescription, (ii) Medical bills duly signed by Doctor/Hospital authorities, (c) Diagnosis reports, if any, (d) Discharge summary issued at the time of discharge and any other supporting documents within two week(s) from the date of discharge.

Note: University at any point of time can inform the college to submit such list/proofs. *Hence, respective HOD shall verify and accord condonation privilege scrupulously*.

4.2.2 Students participation in Sports/Games and NSS activities shall also be permitted for condonation of attendance. In such cases, they need to produce (a) invitation letter from the organizing institute/agency, (ii) participation certificate and any supporting documents within two week(s) from the date of participation to the respective HOD.

4.3 A prescribed fee per course shall be payable for condoning shortage of attendance after getting the approval of College Academic Committee for the same. The College Academic Committee shall maintain all the relevant documents along with the request from the students, whose attendance is condoned.

4.4 Shortage of Attendance below 65% in any course shall in no case be condoned.

4.5 A Student, whose shortage of attendance is not condoned in any course(s) (Theory/Lab/Seminar) in any Semester, is considered as '**Detained in that course(s)**, and is not eligible to write Semester End Examination(s) of such Course(s), (in case of Seminar, his/her Seminar Report or Presentation are not eligible for evaluation) in that Semester; and he/she has to seek re-registration for those course(s) in subsequent Semesters, and attend the same as and when offered.

4.6 A student shall put in a minimum required attendance in at least FOUR courses in I semester for promotion to II Semester; and at least FOUR courses in II semester for promotion to III Semester.

Re-admission / re-registration

4.7 A student shall not be permitted to appear for the Semester End Examinations (SEE) in a course unless they meet the prescribed attendance requirements for that course. Such students may take readmission for the course in the subsequent semester when it is offered by paying the prescribed fee, *at least 30 days before the commencement of classwork*. The HOD concerned must obtain permission from the Principal by submitting the list of students eligible/applied for readmission before the commencement of classwork.

4.8 Students who fail due to **less internal marks (less than 50%)** may register for the course within the maximum permissible duration of the Program.

4.9 In such a case, the candidate must re-register for the course(s) and secure the required minimum attendance. The candidate's attendance in the re-registered course(s) shall be calculated separately to decide upon eligibility for writing the end examination in those course(s).

4.10 In a semester, students are permitted to re-register maximum of THREE

courses.

4.11 Upon re-registration, the student's previous performance in the respective course(s) will be nullified. Re-registration must be completed by paying the prescribed fee at least 30 days prior to the commencement of classwork.

5. EVALUATION

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

5.1 For the theory courses 60 marks shall be awarded based on the performance in the End Semester Examination and 40 marks shall be awarded based on the Internal Evaluation. The continuous / internal evaluation shall be made based on the **average** of the marks secured in the two CIE/Mid Term-Examinations conducted-one in the middle of the Semester and the other immediately after the completion of instruction. Each CIE/midterm examination shall be conducted for a total duration of 120 minutes with 4 questions (without choice) each question for 10 marks. End semester examination is conducted for 60 marks for all FIVE (5) questions (one question from one unit) to be answered (either or).

5.2 For practical courses, 60 marks shall be awarded based on the performance in the End Semester Examinations and 40 marks shall be awarded based on the day-to-day performance as Internal Marks. The internal evaluation based on the day to day work- 10 marks, record- 10 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-**15,** Experimentation- **25,** Results- 10, Viva-voce- 10.

5.3 For Seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to thedepartment 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 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 course 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 Laboratory examination for M.Tech. courses must be conducted with two Examiners, one of them being the Laboratory Class Teacher and the second examiner shall be drawn from the other autonomous colleges.

5.6 Students shall undergo mandatory summer internship / industrial training (credit Course) for a minimum of **eight weeks duration** at the end of second semester of the Programme/Summer Break. A student will be required to submit a summer internship/industrial training report to the concerned department and appear for an oral presentation before the committee. The Committee comprises of a HoD / Professor of the department and two faculty. The report and the oral presentation shall carry 40% and 60% weightages respectively. For summer internship / industrial training, there will be only internal evaluation of 100 marks. A candidate has to secure

a minimum of 50% of marks to be declared successful.

5.7 The objective of comprehensive viva-voce is to assess the overall knowledge of the student in the relevant field of Engineering/Specialization in the PG program. Viva will be conducted in 3rd semester. The examination committee will be constituted by the HoD and consist of Professor of the department and two faculty. For comprehensive viva-voce, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

6. EVALUATION OF SEMINAR/INTERNSHIP/DISSERTATION WORK

All the students admitted under these regulations have to mandatorily comply the requirements of (i) Seminar-I, (ii) Seminar-II, (iii) Comprehensive Viva, (iv) Dissertation Part-A and (v) Dissertation Part-B. Out of these, (i) to (iv) are evaluated by internally by Project Review Committee (PRC) and (v) External Evaluation.

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 Students are required to appear for Seminar-I and Seminar-II in First and Second semester respectively. They shall present before PRC on the topic of their choice/interest preferably on the courses listed in respective semesters. PRC shall advise the students in advance to select topics which strengthen their Dissertation Part-A and Dissertation Part-B.

6.3 Registration of Dissertation/Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses, both theory and practical and duly approved by PRC.

6.4 After satisfying 6.3, student has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work for approval

6.5 If a candidate wishes to change his/her supervisor or topic of the project, he/she can do so with the approval of 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.

6.6 Continuous assessment of Dissertation-Part A and Dissertation-Part B during the Semester(s) will be monitored by PRC. *Dissertation-Part A* will be only internal evaluation by PRC for 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

6.7 The candidate shall submit a status report to the PRC in two stages, each accompanied by an oral presentation, with a minimum interval of three months between the two.

6.8 The work on the project shall be initiated at the beginning of the III Sem and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis *(Dissertation – Part A & Part B)* only with the approval of PRC not earlier than 40 weeks from the date of registration of the project work.

6.9 Three copies of the project thesis, certified by the supervisor, shall be submitted to the PRC along with the plagiarism report.

6.10 The thesis shall be adjudicated by one examiner selected by the Principal. For this, the HOD of the concerned department shall submit a panel of 3 examiners, eminent in that field, with the help of the guide concerned.

6.11 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 *not favourable* again, the thesis shall be summarily rejected. The candidate has to reregister for the project and complete the project within the stipulated time after taking the approval from the Principal.

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 Head of the Department shall coordinate and make arrangements for the conduct of Viva-Voce examination. The Board shall jointly report the candidate's work for a maximum of 100 marks.

6.13 If the report of the Viva-Voce is unsatisfactory (i.e., < 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 Principal.

7. Cumulative Grade Point Average (CGPA)

Marks Range (Max – 100)	Letter Grade	Level	Grade Point
≥ 90	S	Outstanding	10
≥80 to <90	A	Excellent	9
≥70 to <80	B	Very Good	8
≥60 to <70	C	Good	7
≥50 to <60	D	Fair	6
<50	F	Fail	0
		Absent	0

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 undergone by a student, i.e

  SGPA (Si) = $\sum$ (Ci X Gi) / $\sum$ Ci
- Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course.

Computation of CGPA

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

  CGPA = $\sum$ (Ci X Si) / $\sum$ Ci
- Where Si is the SGPA of the i^{th} semester and Ci 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- 0.5) 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/she shall be placed in one of the following classes:

Class Awarded	**CGPA to be secured**	
First Division with Distinction	≥ 7.5 (without supplementary History)	From the CGPA secured from 80 credits
First Class	≥ 6.5	
Second Class	≥ 6.0 to < 6.5	

The secured grade, grade points, status and credits obtained will be shown separately in the memorandum of marks.

8. WITHHOLDING OF RESULTS

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

9. GENERAL

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

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

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

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

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance 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 and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	Both the candidates involved in the malpractice will forefeit their 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	Expulsion from the examination hall and

	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.	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 University 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	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University 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 examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.

11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Malpractices identified by squad or invigilators: Punishments to the candidates as per the above guidelines.

R25 M.Tech CIVIL ENGINEERING

STRUCTURAL ENGINEERING COURSE STRUCTURE & SYLLABUS

I SEMESTER

S.No	Course Name	Category	L	T	P	C
1	Theory of Elasticity	Program Core-1	4	0	0	4
2	Structural Dynamics	Program Core-2	4	0	0	4
3	Matrix Analysis of Structure	Program Core-3	4	0	0	4
4	Program Elective-I		3	0	0	3
	a) Experimental Stress Analysis					
	b) Analytical & Numerical Methods for Structural Engineering					
	c) Design of Reinforced Concrete Foundation					
	d) Structural Optimization					
5	Program Elective II	Elective	3	0	0	3
	a) Bridge Engineering					
	b) Repair and Rehabilitation of Structures					
	c) Advanced Reinforced Concrete Design					
	d) Fracture Mechanics					
6	Advanced Concrete Technology Laboratory	Laboratory-1	0	1	2	2
7	Advanced Structural Engineering Laboratory	Laboratory-2	0	1	2	2
8	Seminar-I	Audit	0	0	2	1
Total Credits/Marks						**23**

II SEMESTER

S.No.	Course Name	Category	L	T	P	C
1	Finite Element Methods in Structural Engineering	ProgramCore-4	4	0	0	4
2	Earthquake Resistant Design	ProgramCore-5	4	0	0	4
3	Stability of Structures	ProgramCore-6	4	0s	0	4
4	Program Elective III		3	0	0	3
	a) Analysis of Tall Structures					
	b) Advanced Steel Design					
	c) Analysis of Off shore Structures					
	d) Structural Health Monitoring					
5	Program Elective IV		3	0	0	3
	a) Theory of Plates and Shells					
	b) Precast and Prefabricated Structures					
	c) Earth Retaining Structures					
	d) Industrial Structures					
6	Computer Aided Design Laboratory	Laboratory-3	0	1	2	2
7	Structural Design Laboratory	Laboratory-4	0	1	2	2
8	Seminar-II		0	0	2	1
Total Credits/Marks						**23**

III SEMESTER

S.No.	Course Name	Category	L	T	P	C
1	Research methodology and IPR Swayam 12 Week MOOC Course		3	0	0	3
2	Summer Internship/ Industrial training (8-10weeks)**		--	--	--	3
3	Comprehensive Viva***		--	--	--	2
3	Dissertation Part-A****		--	--	20	10
Total Credits/Marks						**18**

* Student Attended Summer/ Year Break and Assessment will be done in 3rd Sem

**Comprehensive viva can be conducted courses completing upto Second Semester

*** Dissertation –Part A, Internal Assessment

IV SEMESTER

Sl No.	Course Name	Category	L	T	P	C
1	Project / Dissertation Part-B ****		0	0	32	16
Total Credits/Marks						**16**

****External Assessment

I SEMESTER – SYLLABUS

I Semester	THEORY OF ELASTICITY	L	T	P	C
		3	1	0	4

PEO1: Impart Advanced technical Knowledge and Skills for Specialized careers in Structural Engineering And related Fields that caters to global needs

PEO2: Provide expertise in carrying out project work in advanced structural engineering by using state of are computing , numerical and experiment techniques and to develop interdisciplinary research

PEO3: Train the students to posses good communication and presentation skills with ability to work in teams and contributing significantly to the technological development of the nation

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

CO1: Know the definition of stress and deformation and how to determine the components of the stress and strain tensors.

CO2: Apply the conditions of compatibility and equations of equilibrium.

CO3: Understand how to express the mechanical characteristics of materials, constitutive equations and generalized Hook law.

CO4: Use the equilibrium equations stated by the displacements and compatibility conditions stated by stresses

CO5: Understand index notation of equations, tensor and matrix notation and define state of plane stress, state of plane strain

CO6: Be able to analyze real problem and to formulate the conditions of theory of elasticity applications

CO7: Determine the boundary restrictions in calculations. Solve the basic problems of the theory of elasticity by using Airy function expressed as bi-harmonic function

Detailed Syllabus:

UNIT: 1

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: 2

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: 3

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: 4

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: 5

Torsion of Prismatical 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-Stephen Timoshenko & J. N. Goodier, Mc.Grawhill Publishers

REFERENCES

1. Elasticity: Theory, Applications and Numeric-Martin H. Sadd, Wiley Publishers
2. Theory of Elasticity -Sadhu Singh 3rd Edition, Khanna Publishers

I Semester	STRUCTURAL DYNAMICS	L	T	P	C
		3	1	0	4

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

CO1: Understand the response of structural systems to dynamic loads

CO2: Realize the behavior and response of linear and nonlinear SDOF and MDOF structures with various dynamic loading

CO3: Understand the behavior and response of MDOF structures with various dynamic loading.

CO4: Possess the ability to find out suitable solution for continuous system

CO5: Understand the behavior of structures subjected to dynamic loads under free vibration

CO6: Understand the behavior of structures subjected to dynamic loads Harmonic excitation and earthquake load

DETAILED SYLLABUS:

UNIT I:

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

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

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

Practical Vibration Analysis: Introduction - Stodola method - Fundamental mode analysis - Analysis of second and higher modes - Holzer method - Basic procedure. Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing

differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams.

UNIT V

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 and Distributors
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 Application using Mathematica and Matlab- S. Rajasekharan

I Semester	MATRIX ANALYSYS OF STRUCTURE	L	T	P	C
		3	1	0	4

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

CO1: Perform the structural analysis of determinate and indeterminate structures using Classical compatibility methods, such as method of consistent displacements, force and Equilibrium Methods

CO2: Perform structural analysis using the stiffness method.

CO3: Solve multiple degree of freedom two and three dimensional problems involving trusses, beams, frames and plane stress

CO4: Understand basic finite element analysis

SYLLABUS:

UNIT: 1

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

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

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

UNIT: 4

Additional topics in stiffness methods – discussion of band width – semi band width – static condensation – sub structuring –Loads between joints-Support displacements- inertial and thermal stresses-Beams on elastic foundation by stiffness method.

UNIT: 5

Space trusses and frames - Member stiffness for space truss and space frame– Transformation matrix from Local to Global – Analysis of simple trusses, beams and frames

TEXT BOOKS

1. Matrix analysis of structures-Robert E Sennet-Prentice Hall-Englewood cliffs-New Jercy

2. Advanced structural analysis-Dr. P. Dayaratnam-Tata McGraw hill publishing company limited.

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. Structural Analysis Matrix Approach - Pandit and Guptha, Mc Graw Hil Education.

I Semester	EXPERIMENTAL STRESS ANALYSIS	L	T	P	C
		3	0	0	3

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

CO1: Understand the fundamentals of the theory of elasticity

CO2: Implement the principles and techniques of photo elastic measurement

CO3: Obtain the principles and techniques of strain gage measurement

CO4: Adopt the principles and techniques of moiré analysis

CO5: Apply the principles and techniques of holographic interferometer

CO6: Apply the principles and techniques of brittle coating analysis Understand the fundamentals of the theory of elasticity

SYLLABUS:

UNIT-I

Introduction and Strain measurement methods – Model & Prototype – Dimensional analysis-Factors influencing model design – Scale factors and Model material properties – Methods of model design. Definition of strain and its relation to experimental determinations - properties of strain gauge systems – Mechanical, Optical, Acoustic and Pneumatic types

UNIT-II

Electrical resistance strain gages: Introduction – gauge construction – strain gauge adhesives - mounting methods – gauge sensitivities and gage factor – performance characteristics of wire and foil strain gauges – environmental effects. Analysis of strain gauge data – the three element rectangular rosette – the delta rosette – correction for transverse sensitivity.

UNIT-III

Non – destructive testing: Introduction – objectives of non destructive testing. Ultrasonic pulse velocity method – Rebound Hammer method (Concrete hammer) – Acoustic Emission-application to assessment of concrete quality.

UNIT-IV

Theory of photo elasticity: Introduction – temporary double refraction – Index ellipsoid and stress ellipsoid – the stress optic law – effects of stressed model in a Polariscope for various arrangements- fringe sharpening.

UNIT-V

Two dimensional photo elasticity: Introduction – Iso-chromatic fringe patterns – isoclinic fringe patterns – compensation techniques – calibration methods – separation methods – materials for photo- elasticity – properties of photo-elastic materials.

TEXT BOOKS

1. Experimental Stress Analysis-William F. Riley and James W. Dally, Mc Graw Hill Publications

2. Advanced Mechanics of Solids 3e - L.S. Srinath, Tata Mc Graw Hill Publications

REFERENCE:

1. An Introduction to Experimental Stress Analysis – George Hamor Lee, Wiley Publishers

2. Experimental Stress Analysis-Sadhu Singh, Khanna Publishers

3. Solid Mechanics – S.M.A. Kazimi, Mc Graw Hill Publications

I Semester	ANALYTICAL & NUMERICAL METHODS FOR STRUCTURAL ENGINEERING	L	T	P	C
		3	0	0	3

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

CO1: Understand the fundamentals of the theory of elasticity

CO2: Implement the principles and techniques of photo elastic measurement

CO3: Obtain the principles and techniques of strain gage measurement

CO4: Adopt the principles and techniques of moiré analysis

CO5: Apply the principles and techniques of holographic interferometer

Apply the principles and techniques of brittle coating analysis Understand the

CO6: fundamentals of the theory of elasticity

SYLLABUS:

UNIT-I

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

UNIT-II

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 method

UNIT-III

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

Finite Difference and their Applications: Introduction- Differentiation formulas by Inter polating parabolas – Backward and forward and central differences- Derivation of Differentiation formulas using Taylor series- Boundary conditions- Beam deflection – Solution of characteristic value problems - Richardson’s extrapolation - Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations – Application to Simply Supported Beams, Columns & rectangular Plates.

UNIT-V

Numerical Differentiation: Difference methods based on undetermined coefficients optimum choice of step length– Partial differentiation. Numerical Integration: Method based on interpolation-method based on undetermined coefficient – Gauss – Lagrange interpolation method- Radaua integration method- composite integration method – Double integration using

Trapezoidal and Simpson's method – New Marks Method and Application to Beams – Calculations of Slopes & Deflections.

TEXT BOOKS

1. Introduction to Partial Differential Equations, Sankara Rao. K, , PHI, New Delhi, 1995
2. Numerical Methods For Scientific and Engineering Computations. M. K. Jain- S. R. K. Iyengar – R. K. Jain, New Age International (p) Ltd., Publishers

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, Sultan Chand & Sons, Reprint 1999.
3.Higher Engineering Maths for Engg. And Sciences Venkataraman. M. K, National Publishing Company, Chennai
4.Numerical Methods for Engineering Problems N. Krishna Raju, K.U. Muthu Macmillan Publishers
5.Elements of Partial Differential Equations, Sneddon. I.N, Mc Graw Hill, 1986
6.Computer based numerical analysis by Dr. M. Shanta Kumar, Khanna Book publishers New Delhi

I Semester	DESIGN OF REINFORCED CONCRETE FOUNDATION	L	T	P	C
		3	0	0	3

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

CO1: Attain the perception of site investigation to select suitable type of foundation based on soil category

CO2: Capable of ensuring design concepts of shallow foundation

CO3: Can be efficient in selecting suitable type of pile for different soil stratum and in evaluation of group capacity by formulation

CO4: Design different types of well foundation

SYLLABUS:

UNIT – I

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

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 Equally loaded and Equally Spaced Columns, Analysis of Continuous Strip Footing for Unsymmetric Loading, Analysis of Strip Footing with Unsymmetrical Loads, Detailing of Members

UNIT – III

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

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 Methods of 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

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 Free Standing Basement Walls.

TEXT BOOKS

1. Design of Reinforced Concrete Foundations by P. C Varghese, PHI Learning Private Limited., New Delhi.
2. Swamy saran
1. Design of Reinforced Concrete Structures by N. Subramaniam- Oxford University.
2. Reinforced Concrete Design by Unnikrishna Pillai and Devdas Menon, Tata Mc Graw Hill

I Semester	STRUCTURAL OPTIMIZATION	L	T	P	C
		3	0	0	3

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

CO1: Basic theoretical principles in optimization

CO2: Formulation of optimization models

CO3: Solution methods in optimization

CO4: Methods of sensitivity analysis and post processing of results

CO5: Applications to a wide range of engineering problems

SYLLABUS:

UNIT: 1

Introduction: Need and scope for optimization – statements of optimization problems-Objective function and its surface design variables- constraints and constraint surface- Classification of optimization problems (various functions continuous, discontinuous and discrete) and function behavior (monotonic and unimodal)

UNIT: 2

Classical optimization techniques: Differential calculus method, multi variable optimization by method of constrained variation and Lagrange multipliers (generalized problem) Khun-Tucker conditions of optimality -Fully stressed design and optimality criterion based algorithms introduction, characteristics of fully stressed design theoretical basis-examples

UNIT: 3

Non-Liner programming: Unconstrained minimization-Fibonacci, golden search, Quadratic and cubic interpolation methods for a one dimensional minimization and univariate method, Powel's method, Newton's method and Davidon Fletcher Powell's method for multivariable optimization-Constrained minimization-Cutting plane method-Zoutendjik's method-penalty function methods.

UNIT: 4

Linear programming: Definitions and theorems-Simplex method-Duality in Linear programming-Plastic analysis and Minimum weight design and rigid frame.

UNIT: 5

Introduction to quadratic programming: Geometric programming-and dynamic programming-Design of beams and frames using dynamic programming technique.

TEXT BOOKS

1. Engineering Optimization Theory and Applications – S. S. Rao, Wiley Eastern Limited, New Delhi

REFERENCES

1. Optimization Concepts and Application in Engineering-Belegundu A. D. and Chandrupatla T. R, Cambridge University Press

I Semester	BRIDGE ENGINEERING	L	T	P	C
		3	0	0	3

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

CO1: Design theories for super structure and substructure of bridges

CO2: Design Culvert, R.C.C T Beam Bridge.

CO3: Understand the behavior of continuous bridges, box girder bridges.

C04: Possess the knowledge to design prestressed concrete bridges.

C05: Design Railway bridges, Plate girder bridges, different types of bearings, abutments, piers and various types of foundations for Bridges

SYLLABUS:

UNIT: 1

Masonry arch Bridge design details-Rise, radius, and thickness of arch-Arch ring-Dimensioning of sub structures-Abutments pier and end connections.(Ref: IRC-SP-13)

UNIT: 2

Super Structure: Slab bridge-Wheel load on slab-effective width method-slabs supported on two edges-cantilever slabs-dispersion length-Design of interior panel of slab-Pigeaud's methoddesign of longitudinal girders-Guyon-Messonet method-Hendry Jaegar method-Courbon's theory. (Ref: IRC-21), voided slabs, T-Beam bridges.

UNIT: 3

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

UNIT: 4

Prestressed Concrete and Composite bridges-Preliminary dimensions-flexural and torsional parameters-Courbon's Theory – Distribution coefficients by exact analysis-design of girder section-maximum and minimum prestressing forces-eccentricity-live load and dead load shear forces-cable zone in girder-check for stresses at various sections-check for diagonal tension diaphragms and end block design-short term and long term deflections-Composite action of composite brides-shear connectors-composite or transformed section-design problem. (Ref: IRC: Section-VI)

UNIT: 5

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 Concrete Bridges-M.G. Aswini, V.N. Vazirani, M.M Ratwani, Khanna Publishers
2. Essentials of Bridge Engineering-Jhonson Victor D, 7e, Oxford IBH Publications

REFERENCES:

1. Design of Bridges by N. Krishna Raju CBS Publishers and Distributors
2. Bridge Engineering by S. Ponnuswamy, Mc Grawhill Publications
3. IRC 6- 2016 Standard Specifications and Code of Practice for Road bridges
4. IRC 21-2009 Standard Specifications and code of practice for Road Bridges Section III

I Semester	REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

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

CO1: Recognize the mechanisms of degradation of concrete structures and to design durable concrete structures.

CO2: Conduct field monitoring and non-destructive evaluation of concrete structures.

CO3: Design and suggest repair strategies for deteriorated concrete structures including repairing with composites.

CO4: Understand the methods of strengthening methods for concrete structures

CO5: Assessment of the serviceability and residual life span of concrete structures by Visual inspection and in situ tests

CO6: Evaluation of causes and mechanism of damage

CO7: Evaluation of actual capacity of the concrete structure Maintenance strategies

DETAILED SYLLABUS:

UNIT: 1

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

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

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

UNIT: 4

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

High performance concretes-Introduction-Development of high performance concretes-Materials of high performance concretes-Properties of high performance concretes-Self Consolidating concrete-properties-qualifications

TEXT BOOKS

1. Maintenance Repair Rehabilitation & Minor works of Buildings- P.C. Varghese, PHI Publications
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, Shroff Publishers 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

	CONCRETE DESIGN	3	0	0	3

Course Outcomes: At the end of the course, the student will be able to
CO1 Estimate the deflection of Concrete beams and slabs
CO2 Estimate crack width and its affects
CO3 Design flat slabs, bunkers, silos and chimneys
CO4 Understand the thermal effect on concrete members

Detailed Syllabus:

UNIT: 1

Deflection of Reinforced Concrete Beams and Slabs: Introduction, Short-term deflection of beams and slabs, Deflection due to imposed loads, Short-term deflection of beams due to applied loads, Calculation of deflection by IS 456, Deflection of continuous beams by IS 456, Deflection of slabs. Estimation of Crack width in Reinforced Concrete Members: Introduction, Factors affecting crack width in beams, Mechanisms of flexural cracking, Calculation of crack width, Simple empirical method, Estimation of crack width in beams by IS 456, Shrinkage and thermal cracking.

UNIT: 2

Redistribution of Moments in Reinforced Concrete Beams: Introduction, Redistribution of moments in fixed beam, Positions of points of contraflexures, Conditions for moment redistribution, Final shape of redistributed bending moment diagram, Moment redistribution for a two-span continuous beam, Advantages and disadvantages of moment redistribution, Modification of clear distance between bars in beams (for limiting crack width) with redistribution, Momentcurvature (M - ψ), Relation of reinforced concrete sections. Approximation Analysis of Grid Floors: Introduction, Analysis of flat grid floors, Analysis of rectangular grid floors by Timoshenko's plate theory. Analysis of grid by stiffness matrix method, Analysis of grid floors by equating joint deflections, Comparison of methods of analysis, Detailing of steel in flat grids.

UNIT: 3

Design of Flat Slabs: Introduction, Proportioning of Flat Slabs, Determination of Bending moment and Shear Force, Direct Design method, Equivalent Frame method, Slab Reinforcement.

UNIT: 4

Chimneys : Introduction, Design factors, Stresses due to Self-Weight and Wind load, Stress in horizontal reinforcement, Temperature Stresses, Combined effect of Self Weight, Wind load and Temperature, Temperature stresses in Hoop (Horizontal) Reinforcement.

UNIT: 5

Design of Reinforced Concrete Members for Fire Resistance: Introduction, ISO 834 standard heating conditions, Grading or classifications, Effect of high temperature on steel and concrete, Effect of high temperatures on different types of structural members, Fire resistance by structural

detailing from tabulated data, Analytical determination of the ultimate bending moment, Capacity of reinforced concrete beams under fire, Other considerations.

TEXT BOOKS

1. Advanced Reinforced Concrete Design by P.C. Varghese Prentice Hall India Limited

REFERENCES:

1. Reinforced Concrete Structures by Robert Park & Thomas Paulay, Wiley Publications.
2. Design of Reinforced Concrete Strutures by N. Subrahmanyam, Oxford Publications
3. Advanced Reinforced Concrete Design by N. Krishna Raju, CBS Publishers and Distributers Pvt Ltd

I Semester	FRACTURE MECHANICS	L	T	P	C
		3	0	0	3

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

CO1: Predict material failure for any combination of applied stresses.

CO2: Estimate failure conditions of a structures

CO3: Determine the stress intensity factor for simple components of simple geometry

CO4: Predict the likelihood of failure of a structure containing a defect

DETAILED SYLLABUS:

UNIT: 1

Introduction: Fundamentals of elastic and plastic behaviour of materials-stresses in a plate with a hole – Stress Concentration factor-modes of failure-Brittle fracture and ductile fracture-history of fracture mechanics-Griffiths criteria for crack propagation cracks-Energy release rate, GI GII and GIII -Critical energy release rate GIc , GIIc and GIIIc – surface energy -R curves – compliance.

UNIT: 2

Principles of Linear Elastic Fracture Mechanics: SOM vs Fracture Mechanics -stressed based Criteria for fracture-Stress Intensity Factors-KI K II and K III – Critical stress Intensity Factors, KIc KIIc and KIIc – crack tip plastic zone – Erwin's plastic zone correction –Critical crack length-Load carrying capacity of a cracked component-Design of components based on fracture mechanics.

UNIT: 3

Mixed mode crack propagation-Maximum tangential stress criterion – crack propagation angle -Material characterisation by Crack Tip Opening Displacements (CTOD)-Crack Mouth Opening Displacement (CMOD)-Critical crack tip opening displacement (CTODc) –critical Crack Mouth Opening Displacement (CMODc).

UNIT: 4

Fatigue Crack propagation-Fatigue load parameters Fatigue crack growth curve –Threshold stress intensity factor-Paris law-Retardation effects.

UNIT: 5

Applications of fracture Mechanics to concrete-reasons –strain softening behaviour –Bazant's size effect law.

TEXT BOOKS

1. Elementary engineering fracture mechanics – David Broek – Sijthoff & Noordhoff Netherlands

2. Elements of Fracture Mechanics – Prasanth Kumar, Wiley Eastern Publications

REFERENCES

1. Fracture Mechanics: Fundamentals and applications – T. L. Andrason, PhD, CRC publications

2. Fracture Mechanics of Concrete: Applications of fracture mechanics to concrete, Rock, and other quasi-brittle materials, Surendra P. Shah, Stuart E. Swartz, Chengsheng Ouyang, John Wiley & Son publications

I Semester	ADVANCED CONCRETE TECHNOLOGY LABORATORY	L	T	P	C
		0	1	2	2

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

CO1: Conduct various laboratory tests on Cement, Aggregates

C02: Know strain measurement

C03: Non-destructive testing

C04: Chemical analysis on concrete and Aggregate and Sand

Detailed Syllabus:

List of Experiments:

1. Study on Water / Cement Ratios Vs Workability of different concretes
2. Study on Water / Cement Ratios Vs Strength of different concretes
3. Study of variation of Coarse Aggregate to Fine Aggregates on Workability
4. Study of 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

I Semester	ADVANCED STRUCTURAL ENGINEERING LABORATORY	L	T	P	C
		0	1	2	2

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

CO1 conduct various laboratory tests on Cement, Aggregates

C02 Know strain measurement

C03 Non-destructive testing

C04 Chemical analysis on concrete and Aggregate and Sand

Detailed Syllabus:

List of Experiments:

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

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

II SEMESTER – SYLLABUS

II Semester	FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING	L	T	P	C
		3	1	0	4

Course Outcomes: At the end of the course, the student will be able to
CO1: Develop finite element formulations of 1 degree of freedom problems and solve them
CO2: Understand any Finite Element software to perform stress, thermal and modal analysis
CO3: Compute the stiffness matrices of different elements and system
CO4: Interpret displacements, strains and stress resultants

DETAILED SYLLABUS:

UNIT: 1

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

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

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

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

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

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 Age International (P) Limited

II Semester	EARTHQUAKE RESISTANT DESIGN	L	T	P	C
		3	1	0	4

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

CO1: To learn the fundamentals of seismology and basic earthquake mechanisms, tectonics types of ground motion, and propagation of ground motion.

CO2: Understand qualitative and quantitative representations of earthquake magnitude

CO3: Determine the natural frequency of a single degree of freedom dynamic system for given mass, stiffness and damping properties.

CO4: Determine the maximum dynamic response of an elastic vibrating structure to a given forcing function

CO5: Learn the fundamentals of building code based structural design

CO6: Determine the static design base shear based on the type of structural system, irregularity, location and occupancy.

CO7: Distribute the static base shear to the structure based on vertical distribution of mass horizontal distribution of mass, and centers of rigidity.

CO8: Recognize special conditions such as irregular buildings, building separation, P-delta

DETAILED SYLLABUS:

UNIT: 1

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

UNIT: 2

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: 3

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: 4

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

UNIT: 5

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

TEXT BOOKS

1. Earthquake Resistant Design of Structures Pankaj Agarwal and Manish ShriKhande, Prentice – Hall of India, 2007, New Delhi.
2. Earthquake **Resistant Design of Structures- S.K. Duggal, Oxford Publications**

REFERENCE

1. Bullen K.E., Introduction to the Theory of Seismology, Great Britain at the University Printing
houses, Cambridge University Press 1996.
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)- 2002: General Provisions and Building
5. IS 4928–1993: Code of practice for Earthquake Resistant Design and Construction of Buildings
6. IS 13920-1997: Code of Practice for Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces
7. IS 13935-1993: Guidelines for Repair and Seismic Strengthening of Building

II Semester	STABILITY OF STRUCTURES	L	T	P	C
		3	1	0	4

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

CO1: Analyze different types of structural instabilities

CO2: Execute and work out the inelastic buckling using various methodologies.

CO3: Examine the behaviour of beam columns and frames with and without side sway using classical and stiffness methods

CO4: To be well versed in the lateral buckling, torsional buckling, Flexural torsional buckling of various beams and non-circular sections.

DETAILED SYLLABUS:

UNIT: 1

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

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 force on critical load – Built up columns – Effect of Initial curvature on bars – Buckling of frames – Sway & Non Sway mode

UNIT: 3

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

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

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

REFERENCES:

1. Fundamentals of Structural Stability by George J Simitses & Dewey H. Hodges, Elsevier Publications
2. Elastic Stability of Structural Elements, N.G.R. Ayyangar Macmillan Publications

II Semester	ANALYSIS OF TALL STRUCTURES	L	T	P	C
		3	0	0	3

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

CO1: Know design principles and different types of loading

CO2: Understand various structural systems used for Tall structures.

CO3: Capable of analyzing the tall structures and design of structural elements for secondary effects

CO4: Execute stability analysis, overall buckling analysis of frames, Analysis for various Secondary effects –such as Creep, Shrinkage and Temperature

DETAILED SYLLABUS:

UNIT: 1

Design Criteria Philosophy, Materials – Modern concepts – High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self Compacting Concrete.

UNIT: 2

Gravity Loading – Dead load, Live load, Impact load, Construction load, Sequential loading. Wind Loading – Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading – Equivalent lateral Load analysis, Response Spectrum Method, Combination of Loads.

UNIT: 3

Behavior of Structural Systems- Factors affecting the growth, height and structural form, Behaviour of Braced frames, Rigid Frames, In-filled frames, Shear walls, Coupled Shear walls, Wall–Frames, Tubular, Outrigger braced, Hybrid systems

UNIT: 4

Analysis and Design- Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of structures as an integral UNIT, Analysis for member forces, drift and twist. Computerized 3D analysis. Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance.

UNIT: 5

Stability Analysis- Overall buckling analysis of frames, wall–frames, Approximate methods, Second order effect of gravity loading, P–Delta Effects, Simultaneous first order and P-Delta analysis, Translational instability, Torsional Instability, Out of plumb effects, Effect of stiffness of members and foundation rotation in stability of structures.

TEXT BOOKS

1. Bryan Stafford Smith and Alex Coull, “Tall Building Structures - Analysis and Design”, John Wiley and Sons, Inc., 1991.

2. Structural Design of Multistoried Buildings U.H. Varyaani, South Aisna Publishers

REFERENCE:

1. Structural Analysis and Design of Tall Buildings Bungle S. Taranath, McGraw-Hill, 1988
2. High Tise Building Structures Woflgang Shcueller, John Wiley & Sons Inc
3. Art of the Skyscraper: The Genius of Fazulur R Khan- Ali Mir, Rizzoli International Publications

II Semester	ADVANCED STEEL DESIGN	L	T	P	C
		3	0	0	3

Objectives:
To impart knowledge on behavior and design of various connections, industrial and steel girders.
Outcomes: The learner will be able to design different steel structures.

SYLLABUS:

UNIT-I
Simple Connections – Riveted, Bolted Pinned And Welded Connections: Riveted Connections – Bolted Connections –Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip-Critical connections – 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
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
Eccentric And Moment Connections: Introduction – Beams – Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed Connections –Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections- Welded Bracket Connections – Moment Resistant Connections.

UNIT-IV
Analysis And Design Of Industrial Buildings: Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform. Design of purlins for roofs, design of built up purlins, design of knee braced trusses and stanchions. Design of bracings.

UNIT-V
Design Of Steel Truss Girder Bridges: Types of truss bridges, component parts of a truss bridge, economic Proportions of trusses, self weight of truss girders, design of bridge Compression

members, tension members; wind load on truss girder Bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; sway bracing Design of Lacing.

TEXT BOOKS

1. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. New Delhi.
2. Design of steel structures by N. Subramanian, Oxford University Press
3. Design Steel Structures Volume-II, Ramachandra & Vivendra Gehlot, Scientific Publishes 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

II Semester	ANALYSYS OF OFFSHORE STRUCTURES	L	T	P	C
		3	0	0	3

Course Outcomes: At the end of the course, the student will be able to
CO1 Perform concept development of offshore structure
CO2 Find the wave force on vertical cylinder
CO3 Perform static and dynamic analysis of fixed offshore structure

DETAILED SYLLABUS:

UNIT: 1
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
Conservation mass and momentum, Euler equation, Bernoullis Equation, Potential flow, Classification of waves, small amplitude or Linear Airy's theory, dispersion relationship, water particle kinematics, wave energy.

UNIT: 3
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
Wave force on large bodies-Froude-krylov theory, Diffraction theory.

UNIT: 5
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, Van Nostrand, 1986.

II Semester	STRUCTURAL HEALTH MONITORING	L	T	P	C
		3	0	0	3

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

CO1: Diagnose the distress in the structure by understanding the causes and factors

CO2: Assess the health of structure using static field methods.

CO3: Assess the health of structure using dynamic field tests

C04: Carryout repairs and rehabilitation measures of the Structure

SYLLABUS:

UNIT-I

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

UNIT-II

Structural Health Monitoring: Concept, Various Measures, Structural Safety in Alteration. Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures

UNIT – III

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

UNIT-IV

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

UNIT-V

Introduction to Repairs and Rehabilitations of Structures: 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 and Sons, 2006.

2. Health Monitoring of Structural Materials and Components Methods withApplications, Douglas E Adams, John Wiley and Sons, 2007.

REFERENCES

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

II Semester	THEORY OF PLATES AND SHELLS	L	T	P	C
		3	0	0	3

Course Outcomes: At the end of the course, the student will be able to
CO1: Have a knowledge about various plate theories due to bending
CO2: Gain the knowledge of Navier's solution, Levy's solution and solve for the rectangular and square plates
CO3: Analyze circular plates with various boundary conditions.
CO4: Focus on the finite difference method of solving plate problems.
CO5: Ability to realize the potential energy principle and find the solution of rectangular plates for various loadings
CO6: Understand the behaviour of folded plates and shells.

Detailed Syllabus:

UNIT: 1

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

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

UNIT: 3

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

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

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-Hill book company, INC, New York.

2. Reinforced Concrete Shells and Folded Plates by P.C. Varghese, Prentice Hall India Publications
3. Analysis of Thin Concrete Shells by K. Chandrasekhar, 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

II Semester	PRECAST AND PREFABRICATED STRUCTURES	L	T	P	C
		3	0	0	3

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

CO1: Analyze the prefabricated load carrying members

CO2: Analyze the production technology of prefabrication

CO3: Design and detailing of precast UNIT for factories

CO4: Design single storied simple frames

DETAILED SYLLABUS:

UNIT -I

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

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. Behavior of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls.

UNIT -III

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

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

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 process planning for construction 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 for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.
2. Mokk. L, (1964), Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest

II Semester	EARTH RETAINING STRUCTURES	L	T	P	C
		3	0	0	3

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

CO1: Quantify the lateral earth pressures associated with different earth systems

CO2: Evaluate the mechanical properties of geosynthetics used for soil reinforcement

CO3: Identify the merits and demerits of different earth retaining systems.

CO4: Select the most technically appropriate type of retaining wall for the application from a thorough knowledge of available systems

CO5: Design of retaining structures using appropriate design methods, factors of safety, Earth pressure diagrams and field verification methods

CO6: Aware of current guidelines regarding the design of earth retaining structures.

CO7: Design retaining structures considering both external and internal stability aspects

DETAILED SYLLABUS:

UNIT: 1

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: 2

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

UNIT: 3

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: 4

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

UNIT: 5

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, Gopal Ranjan and Swami Saran, Saritha Prakashan, New Delhi
3. NPTEL course materials on Geo-synthetics and Earth Retaining Structures

II Semester	INDUSTRIAL STRUCTURES	L	T	P	C
		3	0	0	3

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

CO1: Plan the functional requirements of structural systems for various industries.

CO2: Get an idea about the materials used and design of industrial structural elements.

CO3: Realize the basic concepts and design of power plant structures.

CO4: Design power transmission structures.

CO5: Possess the ability to understand the design concepts of Chimneys, bunkers and silos

DETAILED SYLLABUS:

UNIT: 1

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

UNIT: 2

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

UNIT: 3

Design of Folded plates- Design considerations- analysis of folded plates- analysis of multibay folded plates- design of diaphragm beam

UNIT: 4

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

UNIT: 5

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

TEXT BOOKS

1. Advanced Reinforced Concrete design by N. Krishnam Raju, CBS Publications & Distributions

2. Handbook on Machine Foundations by P. Srinivasulu and C. V. Vaidyanathan, Structural Engineering Research Center

3. Tall Chimneys- Design and Construction by S. N. Manohar Tata Mc Grawhill Publishing Company

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. Analysis of Thin Concrete Shells by K. Chandrasekhar, New Age International (P) Ltd

II Semester	COMPUTER AIDED DESIGN LABORATORY	L	T	P	C
		0	1	2	2

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

CO1: Develop Computer Programs for Analysis and Design of various Structural Elements

CO2: Use different Structural Engineering software's to solve various civil Engineering Programs

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 (stick model) 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

II Semester	STRUCTURAL DESIGN LABORATORY	L	T	P	C
		0	1	2	2

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

CO1: Develop Computer Programs for Analysis and Design of various Structural Elements

CO2: Use different Structural Engineering software's to solve various civil Engineering Programs

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

II Semester	SEMINAR II	L	T	P	C
		0	0	2	1

Pre-Requisites: None

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

CO1: Collect research material on some topic and to summaries it report and give to present the same

III SEMESTER

S.No.	Course Name	Category	L	T	P	C
1	Research methodology and IPR Swayam 12 Week MOOC Course		3	0	0	3
2	Summer Internship/ Industrial training (8-10weeks)**		--	--	--	3
3	Comprehensive Viva***		--	--	--	2
3	Dissertation Part-A****		--	--	20	10
Total Credits/Marks						**18**

* Student Attended Summer/ Year Break and Assessment will be done in 3rd Sem

**Comprehensive viva can be conducted courses completing upto Second Semester

*** Dissertation –Part A, Internal Assessment

IV SEMESTER

Sl No.	Course Name	Category	L	T	P	C
1	Project / Dissertation Part-B ****		0	0	32	16
Total Credits/Marks						**16**

****External Assessment