JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR ANANTAPUR-515002 (A.P) INDIA

ACADEMIC REGULATIONS COURSE STRUCTURE AND DETAILED SYLLABI OF MASTER OF TECHNOLOGY IN STRUCTURAL ENGINEERING

Regular Two Year P.G. Degree Course (Applicable for the batches admitted from 2012-13)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
Academic Regulations For The Award Of Full Time M.Tech. P.G. Degree
(WITH EFFECT FROM THE ACADEMIC YEAR 2012-13)

The Jawaharlal Nehru Technological University Anantapur shall confer M.Tech. Post Graduate degree to candidates who are admitted to the Master of Technology Programs and fulfill all the requirements for the award of the degree.

1.0 ELIGIBILITY FOR ADMISSIONS:

Admission to the above programme shall be made subject to the eligibility, qualifications and specialization prescribed by the University for each programme, from time to time.

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

2.0 **COURSE WORK:**

2.1 A Candidate after securing admission must pursue the M.Tech. course of study for Four semesters duration.

2.2 Each semester shall be of 20 weeks duration including all examinations.

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

3.0 ATTENDANCE:

3.1 A candidate shall be deemed to have eligibility to write end semester examinations if he has put in atleast 75% of attendance on cumulative basis of all subjects/courses in the semester.

3.2 Condonation of shortage of attendance up to 10% i.e., from 65% and above and less than 75% may be given by the college on the recommendation of the Principal.

3.3 Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence.

3.4 If the candidate does not satisfy the attendance requirement he is detained for want of attendance and shall reregister for that semester. He / she shall not be promoted to the next semester.

4.0. 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 practicals, on the basis of Internal Evaluation and End Semester Examination.

4.1 For the theory subjects 60% of the marks will be for the External End Examination. While 40% of the marks will be for Internal Evaluation, based on the better of the marks secured in the two Mid Term-Examinations held, one in the middle of the Semester (I-IV units) and another immediately after the completion of instruction (V-VIII) units with Three questions to be answered out of four in 2hours, evaluated* for 40 marks.

*****Note: All the Questions shall be of equal weightage of 10 marks and the marks obtained for 3questions shall be extrapolated to 40 marks, any fraction rounded off to the next higher mark

4.2 For practical subjects, 60 marks shall be for the End Semester Examinations and 40 marks will be for internal evaluation based on the day to day performance.

4.3 For Seminar there will be an internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful. The assessment will be made by a board consisting of HOD and two internal experts at the end of IV semester instruction.

4.4 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 Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

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

5.0 RE-REGISTRATION FOR IMPROVEMENT OF INTERNAL EVALUATION MARKS:

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

5.1 The candidate should have completed the course work and obtained examinations results for I & II semesters.

5.2 He should have passed all the subjects for which the Internal evaluation marks secured are more than 50%.

5.3 Out of the subjects the candidate has failed in the examination due to Internal evaluation marks secured being less than 50%, the candidate shall be given one chance for each Theory subject and for a maximum of **three** Theory subjects for Improvement of Internal evaluation marks.

5.4 The candidate has to re-register for the chosen subjects and fulfill the academic requirements.

5.5 For each subject, the candidate has to pay a fee equivalent to one third of the semester tuition fee and the amount is to be remitted in the form of D.D. in favour of the

Registrar, JNTUA payable at Anantapur along with the requisition through the Principal of the respective college.

5.6 In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects stand cancelled.

6.0 EVALUATION OF PROJECT WORK:

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

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

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

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

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

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

6.6 Three copies of the Thesis / Dissertation certified in the prescribed from by the supervisor & HOD shall be presented to the HOD One copy is to be forwarded to the University and one copy to be sent to the examiner.

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

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

1.	Very Good	Grade A
2.	Good	Grade B
3.	Satisfactory	Grade C
4.	Not satisfactory	Grade D

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

7.0 AWARD OF DEGREE AND CLASS:

A candidate shall be eligible for the award of respective degree if he satisfies the minimum academic requirements in every subject and secures 'satisfactory' or higher grade report on his thesis/dissertation and viva-voce. Based on overall percentage of marks obtained, the following class is awarded.

First class with Distinction:	70% or more
First class	below 70% but not less than 60%
Second class	below 60% but not less than 50%

8.0 WITH – HOLDING OF RESULTS:

If the candidate has not paid dues to the university or if any case of in-discipline is pending against him, the result of the candidate shall be withheld and he will not be allowed/ promoted into the next higher semester. The issue of degree is liable to be withheld in such cases.

9.0 TRANSITORY REGULATIONS:

Candidates who have discontinued or have been detained for want of attendance or who have failed after having undergone the course in earlier regulations and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to 4.5 and 2.3 sections. Whereas they continue to be in the academic regulations they were first admitted.

10.0 GENERAL:

i. **The academic regulations should be read as a whole for purpose of any interpretation**.
ii. **Disciplinary action for Malpractice / improper conduct in examinations is appended**.
iii. **There shall be no places transfer within the constituent colleges and affiliated colleges of Jawaharlal Nehru Technological University Anantapur.**
iv. **Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".**
v. **In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.**
vi. **The University may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the University.**

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RULES FOR DISCIPLINARY ACTION FOR MALPRACTICE / 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.	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.

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 University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	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.
6.	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.

7.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from 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. If the impostor is an outsider, he will be handed over to the police and a case is registered against him.
8.	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.

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.	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.
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 special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
   (i) A show cause notice shall be issued to the college.
   (ii) Impose a suitable fine on the college.
   (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
Course Structure and syllabi for
M.Tech- Structural Engineering
Offered by Department of Civil Engineering
for affiliated Engineering Colleges 2012-13

I YEAR I Semester

S. No	Course code	Subject	Theory	Lab.	Credits
1.	12D20101	Higher Engineering Mathematics	4		4
2.	12D20102	Advanced Structural Analysis	4		4
3.	12D20103	Theory of Elasticity and Plasticity	4		4
4.	12D20104	Theory and Analysis of Plates	4		4
5.	12D20105a 12D20105b 12D20105c	Elective – I 1. Experimental Stress Analysis 2. Advanced Structural Design 3. Low cost Housing Techniques	4		4
6.	12D20106a 12D20106b 12D20106c	Elective – II 1. Prestressed concrete 2. Maintenance and Rehabilitation of Structures 3. Advanced Foundation Engineering	4		4
7.	12D20107	Concrete Laboratory - I		3	2
		contact periods/week	24	3	
			Total 27		26

I YEAR II Semester

S. No	Course code	Subject	Theory	Lab.	Credits
1.	12D20201	Structural Dynamics	4		4
2.	12D20202	Finite Element Method	4		4
3.	12D20203	Stability of Structures	4		4
4.	12D20204	Analysis of shells and folded plates	4		4
5.	12D20205a 12D20205b 12D20205c	Elective – III 1. Design of Bridges 2. Concrete Technology 3. Earthquake Resistant Structures	4		4
6.	12D20206a 12D20206b 12D20206c	Elective – IV 1. Advanced steel structures 2. Building Construction Management 3. Fracture Mechanics	4		4
7.	12D20207	Concrete Laboratory - II		3	2
		contact periods/week	24	3	
			Total 27		26

II YEAR (III & IV Semesters)

S. No	Course code	Subject		credits
1	12D20401	Seminar		2
2	12D20402	Project work		16

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M.Tech I semester (SE)

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(12D20101) HIGHER ENGINEERING MATHEMATICS

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

2. **HAMILTON PRINCIPLE** – Lagranges equations generalized dynamic exitations- constraints in dynamical systems.

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

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

5. **NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS** – parabolic equations Bender – Schmidt method – Bender – Schmidt recurrence equation, Crank – Nicholson difference method.

6. **EIGEN VALUES AND EIGEN VECTORS** – general method – Power method, spectral method.

7. & 8 **INTRODUCTION TO FINITE ELEMENT METHOD** – weighted Residual methods, least square method, Galerkin's method – Finite elements – Inter polating over the whole domain – one dimensional case, two dimensional case – application to boundary value problems.

TEXT/REFERENCE BOOKS :

1. Numerical methods for Engineers by Steven C.Chapra and Raymond P.Canale – McGraw Hill Book company.
2. Applied Numerical Analysis by Curtis.F.Gerald – Addeson Wesley Publishing company.
3. Higher Engineering Mathematics by B.S.Grewal, Khanna Publishers.
4. C – Language and numerical methods by C-Xavier, New Age International publishers.
5. Computational methods for partial differential equations by M.K. Jain, SKR Lyengar, R.K.Jain.

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(12D20102) ADVANCED STRUCTURAL ANALYSIS

1. INDETERMINACY-Determination of static and kinematic indeterminacies of two-dimensional and three-dimensional portal frames, pin jointed trusses and hybrid frames-coordinate systems –structural idealization.

2. INTRODUCTION TO MATRIX METHODS OF ANALYSIS-Flexibility and stiffness matrices-Force displacement relationships for axial force, couple, torsional moments – stiffness method of analysis and flexibility method of analysis.

3 & 4. ANALYSIS OF CONTINUOUS BEAMS- stiffness method and flexibility method of analysis –continuous beams of two and three spans with different end conditions-internal hinges.

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

6. ANALYSIS OF TWO-DIMENSIONAL PINJOINTED TRUSSES - stiffness and flexibility methods-computation of joint displacement and member forces .

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

8. EQUATION SOLVERS-solution of system of linear algebraic equations-direct inversion method-gauss elimination method-Cholesky method-banded equation solvers-frontal solution technique.

TEXT/REFERENCE BOOKS :

1. Cotes, R.C., Couties, M.G., and Kong, F.K., Structural Analysis, ELBS.
2. MC.Guire, W.,and Gallagher, R.H., Matrix Structural analysis, John Wiley and sons.
3. John L.Meek., Matrix Strucstural Analysis, McGraw Hill Book company.
4. Structural Analysis by Pundit & Gupta
5. Structural Analysis by C.S.Reddy.
6. Structural Analysis – R.C.Hibbeler
7. Intermediate Structural Analysis – C.K.Wang.

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(12D20103) THEORY OF ELASTICITY AND PLASTICITY

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

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

3.TWO DIMENSIONAL PROBLEMS IN RECTANGULAR COORDINATES:
Solution by polynomials-Saint Venant's principle-Determination of displacements-bending of simple beams-application of Fourier series for two dimensional problems - gravity loading.

4.TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES :
General Equation in polar co-ordinates - stress distribution symmetrical about an axis – Pure bending of curved bars- strain components in polar coordinates-Displacements for symmetrical stress distributions-simple symmetric and asymmetric problems-General solution of two dimensional problem in polar coordinates-Application of the general solution of two dimensional problem in polar coordinates-Application of the general solution in polar coordinates.

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

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

7.TORSION OF PRISMATICAL BARS:

Torsion of prismatic bars- Elliptical cross section-other elementary solutions-membrane anology-Torsion of rectangular bars-solution of torsional problems by energy method-use of soap films in solving torsionol problems-hydro dyanmical analogies-Torsion of shafts, tubes, bars etc.

8.THEORY OF PLASTICITY:

Introduction- concepts and assumptions -yield criterions.

TEXT/REFERENCE BOOKS :

1. Timoshenko, S., Theory of Elasticity and Plasticity, McGraw Hill Book company.
2. Advnced Strength of materials by Papoov, McGraw Hill Book company.
3. Theory of Elasticity and Plasticity by Sadhu Singh. Khanna Publishers.
4. Chen, W.F. and Han, D.J.Plasticity for structural Engineers, Springer – Verlag, New York.
5. Lubliner, J., Plasticity theory, Mac Millan Publishing Co., New York.
6. Foundations of Solid Mechanics by Y.C.Fung.
7. Advanced Mechanics of Solids by L.S. Srinath.

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(12D20104) THEORY AND ANALYSIS OF PLATES

1. DERIVATION OF PLATE EQUATIONS –In plane bending and transverse bending effects.

2. RECTANGULAR PLATES: Plates under various loading conditions like concentrated, U.D.L and hydrostatic pressure- Navier and Levy's type of solutions for various boundary conditions.

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

5. PLATES UNDER SIMULTANEOUS BENDING AND STRECTHING: Derivation of the governing equation and application to simple cases.

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

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

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

REFERENCE BOOKS:

1. Timoshenko, S., and Krieger, S.W., Theory of plates and shells, McGraw Hill Book company.
2. Szilard, R., Theory and Analysis of Plates, Prentice Hall Inc.
3. N.K.Bairagi, Plate analysis, Khanna Publishers, Delhi.

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ELECTIVE-I
(12D20105a) EXPERIMENTAL STRESS ANALYSIS

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

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

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

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

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

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

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

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

Reference Books :-

1.Experimental stress analysis by J.W.Dally and W.F.Riley
2. Experimental stress analysis by Dr.Sadhu Singh.
3. Experimental Stress Analysis by L.S.Srinath, McGraw Hill Company Publishers.

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ELECTIVE-I
(12D20105b) ADVANCED STRUCTURAL DESIGN

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 - Calculation of deflection by BS 8110 - Deflection calculation by Eurocode - ACI Simplified Method - Deflection of continues beams by IS 456 - Deflection of Cantilevers - Deflection of Slabs

2. ESTIMATION OF CRACKWIDTH IN REINFORCED CONCRETE MEMBERS:

Introduction - Factors affecting Crackwidth in beams - Mechanism of Flexural cracking Calculation of crack widths - Simple Empirical method - Estimation of Crackwidth in - beams by IS 456 of BS 8110 - Shrinkage and Thermal Cracking

3.DESIGN OF REINFORCED CONCRETE DEEP BEAMS:

Introduction - Minimum Thickness - Steps of Designing deep beams - Design by IS 456 - Design according to British Practice - ACI Procedure for design of deep beams - Checking for local failures - Detailing of deep beams

4. SHEAR IN FLAT SLABS AND FLAT PLATES:

Introduction - Checking for One-way (wide beam) shear - Two-way (Punching) shear Permissible punching shear - Shear due to Unbalanced Moment (Torsional moments) Calculation of j values - Strengthening of column areas for moment transfer by torsion which produces shear - Shear Reinforcement Design - Effect of openings in Flat slabs - Recent Revisions in ACI 318 - Shear in Two – way Slabs with beams.

5.DESIGN OF PLAIN CONCRETE WALLS:

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

6.DESIGN OF SHEAR WALLS:

Introduction - Classification of shear walls - Classification according to behavior - Loads in shear walls - Design of Rectangular and flanged shear walls - Derivation of formula for moment of Resistance of Rectangular shear walls

7.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 - Analystical determination of the ultimate bending moment capacity of reinforced concrete beams under fire - Other considerations

8.PIPES : General Aspects – Classification of R.C.C. Pipes – Design principles – Reinforcements in Pipes – Tests on Pipes – Design Examples – Design of Non Pressure R.C.C. Pipes for Culverts – Design Examples.

TEXT/REFERENCE BOOKS:

1. P.Purushothaman, Reinforced concrete Structural Elements: Behaviour, analysis and Design, TATA McGraw Hill.
2. C.E. Reynolds and J.C. Steedman, Reinforced Concrete Desigers Hand bood, A view point publication.
3. Limit State Design of Reinforced Concrete Structures by P.Dayaratnam, Oxford & IBH Publishers.
4. Advanced RCC by N.Krishna Raju, CBS Publishers & Distributors.
5. Reinforced cement concrete Structures – Devdas Menon & Unnikrishna Pillai, Tata McGraw Hill

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ELECTIVE-I
(12D20105c) LOWCOST HOUSING TECHNIQUES

FIRST SEMESTER

1. a) HOUSING SCENARIO
Introduction - Status of urban housing - Status of Rural Housing

b) HOUSING FINANCE:
Introduction to - Existing finance system in India - Government role as facilitator - Status of Rural Housing Finance - Impediments in housing finance and related issues

2. a**) LAND USE AND PHYSICAL PLANNING FOR HOUSING**
Introduction - Planning of urban land - Urban land ceiling and regulation act - Efficiency of building bye laws - Residential Densities

b) HOUSING THE URBAN POOR
Introduction - Living conditions in slums - Approaches and strategies for housing urban poor

3. DEVELOPMENT AND ADOPTION OF LOW COST HOUSING TECHNOLOGY
Introduction - Adoption of innovative cost-effective construction techniques - Adoption of precast elements in partial prefatroices - Adopting of total prefactcation of mass housing in India- General remarks on pre cast roofing/flooring systems -Economical wall system - Single Brick thick load bearing wall - 19cm thick load bearing masonery walls - Half brick thick load bearing wall - Flyash gypsym brick for masonary - Stone Block masonery - Adoption of precast R.C. plank and join system for roof/floor in the building

4. ALTERNATIVE BUILDING MATERIALS FOR LOW COST HOUSING
Introduction - Substitute for scarce materials – Ferrocement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - Alternative building maintenance

5. LOW COST INFRASTRUCTURE SERVICES:

Introduction to - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy

6. RURAL HOUSING:

Introduction to traditional practice of rural housing-continuous Mud Housing technology

Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs

7&8. HOUSING IN DISASTER PRONE ARES AS

Introduction – Earthquake - Damage to houses - Disaster prone areas - Type of Damages and Repairs of non-engineered buildings - Repair and restoration of earthquake Damaged non-engineered buildings recommendations for future constructions Requirement's of structural safety of thin precast roofing units against Earthquake forces Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety

TEXT BOOKS

1. Building materials for low – income houses – International council for building research studies and documentation.
2. Hand book of low cost housing by A.K.Lal – Newage international publishers.
3. Properties of concrete – Neville A.M. Pitman Publishing Limited, London.
4. Light weight concrete, Academic Kiado, Rudhai.G – Publishing home of Hungarian Academy of Sciences.
5. Low cost Housing – G.C. Mathur.
6. Modern trends in housing in developing countries – A.G. Madhava Rao, D.S. Ramachandra Murthy & G.Annamalai.

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ELECTIVE-II
(12D20106a) PRESTRESSED CONCRETE

1.INTRODUCTION: Development of prestressed concrete –Advantages and Disadvantages of PSC over RCC –General principles of pre-stressing-pre tensioning and post tensioning –Materials used in PSC-high strength concrete –High tension steel-Different types /methods/systems of prestressing.

2.LOSSES OF PRESTRESS: Estimation of the loss of prestress due to various causes like elastic shortening of concrete ,creep of concrete, shrinkage of concrete, relaxation of steel, slip in anchorage, friction etc.

3.FLEXURE: Analysis of sections for flexure in accordance with elastic theory-Allowable stresses-Design criteria as per I.S code of practice –Elastic design of Beams (rectangular, I and T sections) for Flexure –Introduction to partial prestressing.

4&5. SHEAR, BOND, BEARING AND ANCHORAGE: shear in PSC beams –Principal stresses –Conventional elastic design for shear-transfer of prestress in pretensioned members-transmission length –Bond stresses-bearing at anchorage –Anchorage zone stresses in post-tensioned members-Analysis and design of end blocks by Guyon, Magnel and approximate methods –Anchorage zone reinforcements.

6.DEFLECTIONS: Introduction-Factors influencing deflections-short term and long term deflections of uncracked and cracked members.

7.STATISTICALLY INDETERMINATE STRUCTURES: Introduction –advantages and disadvantages of continuity –Layouts for continuous beams-primary and secondary moments –Elastic analysis of continuous beams-Linear transformation-Concordant cable profile-Design of continuous beams.

8.CIRCULAR PRESTRESSING: Introduction –Circumferential prestressing Design of Prestressed concrete tanks –vertical prestressing in tanks-Dome prestressing.

REFERENCE BOOKS:

1. Prestressed Concrete by S. Krishnam raju
2. Prestressed Concrete by S. Ramamrutham
3. T.Y.Lin, Design of Prestressed Concrete Structures, Asian Publishing house, Bombay.
4. Y.Guyon, Prestressed Concrete, Vol.I&II, Wiley and Sons.
5. F.Leonhhardt, Prestressed concrete Design and construction, Wilhelm Ernst and shon, Berlin.
6. C.E.Reynolds and J.C. Steedman, Reinforced concrete designers hand book, A view point publication.
7. Edward P.Nawy, Prentise Hall – Prestressed Concrete.
8. Prestressed Concrete – by Raj Gopalan.

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ELECTIVE-II
(12D20106b) MAINTENANCE AND REHABILITATION OF STRUCTURES

1. **GENERAL**: Quality assurance for concrete construction, As built concrete properties, strength, permeability, volume changes, thermal properties, cracking.

2. **INFLUENCE ON SERVICEABILITY AND DURABILITY**:- Effects due to climate, temperature, chemicals, wear and erosion, design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, inhibitors, resistant steels, coatings cathodic protection.

3. **MAINTENANCE AND REPAIR STRATEGIES** :- Inspection, Structural Appraisal, Economic appraisal, components of quality assurance, conceptual bases for quality assurance schemes.

4&5 MATERIALS FOR REPAIR :- Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete.

6&7. TECHNIQUES FOR REPAIR & RETROFIT: - Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning, Fibre reinforced polymer

8.CASE STUDIES :- Repairs to overcome low member strength, Deflection, cracking, chemical disruption, weathering, wear, fire, leakage, marine exposure.

TEXT/REFERENCE BOOKS:

1. Dension Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical, U.K.
2. RT.Allen and S.C. Edwards, Repair of concrete Structures, Blakie and sons, UK.
3. MS. Shetty, Concrete Technology – Theory and practice, S.Chand and company, New Delhi.
4. Santhakumar, A.R.Training Course notes on damage assessment and Repair in low cost housing RHDC-NBO Anna University, Madras.
5. Raikar, R.N.learning from failures – deficiencies in Design, construction and service – R&D centre (SDCPL), Raikar Bhavan, Bombay.
6. N.Palaniappan, Estate Management, Anna Institute of Management, Madras.
7. F.K.Garas, J.L.Clarke, GST Armer, Structural Assessment, Butterworths, UK.
8. A.R. Santhakumar, Concrete chemicals – Theory and applications, Indian society for construction Engineering and Technology, Madras.

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ELECTIVE-II

(12D20106c) ADVANCED FOUNDATION ENGINEERING

1&2 .SHALLOW FOUNDATIONS-I: General requirements of foundations. types of shallow foundations and the factors governing the selection of type of shallow foundation. Bearing capacity of shallow foundations by Terzaghi's theory and Meyerhof's theory (derivation of expressions and solution to problems based on these theories). Local shear and general shear failure and their identification

3.SHALLOW FOUNDATIONS-II: Bearing capacity of isolated footing subjected to eccentric and inclined loads. bearing capacity of isolated footing resting on stratified soils-Button's theory and Siva reddy analysis. Analysis and structural design of R.C.C isolated, combined and strap footings.

4.DEEP FOUNDATIONS-I: Pile foundations-types of pile foundations. estimation of bearing capacity of pile foundation by dynamic and static formulae. Bearing capacity and settlement analysis of pile groups. Negative skin Friction, Pile load tests.

5.DEEP FOUNDATIONS-II: Well foundations-Elements of well foundation. forces acting on a well foundation. Depth and bearing capacity of well foundation. Design of individual components of well foundation (only forces acting and principles of design). Problems associated with well sinking.

6.SHEET PILE WALLS: Cantilever sheet piles and anchored bulkheads, Earth Pressure diagram,Determination of depth of embedment in sands and clays-Timbering of trenches-Earth Pressure diagrams-forces in struts.

7&8.FOUNDATIONS IN PROBLEMATIC SOILS: Foundations in black cotton soils-basic foundation problems associated with black cotton soils. Lime column techniques-principles and execution. Under reamed piles-principle of functioning of under reamed pile-Analysis and structural design of under reamed pile. Use of Cohesive Non Swelling (CNS) layer below shallow foundations.

TEXT BOOKS:

- Analysis and Design of Foundations and Retaining Structures-Shamsher Prakash,Gopal Ranjan and Swami Saran.
- Foundation Engineering by Brije.M.Das, Printice Hall Publishers**.**

Reference Books:

- **Analysis and Design of Foundations-J.E.Bowles**
- **Foundation Design and Construction-Tomlinson**
- **Foundation Design-Teng.**
- **Geotechnical Engg – C.Venkatramaiah**

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(12D20107) CONCRETE LABORATORY - I

List of Experiments:

1. Workability
   - (a)Slump Test
   - (b)Compaction Factor Test
   - (c)Vee-Bee Test
2. Flakiness Test
3. Elongation Test
4. Specific Gravity of
   - (a) Cement
   - (b) Coarse Aggregate
   - (c) Fine Aggregate
5. Bulk density of
   - (a) Fine Aggregate
   - (b) Coarse Aggregate
6. Fineness Modulus of
   - (a) Fine Aggregate
   - (b) Coarse Aggregate
7. Compressive strength of Cement
8. Mix Design of Concrete and Casting of Specimen.
9. Young's Modulus of Concrete
10. Fineness by Blain's apparatus for cement, fly ash, Silica.

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(12D20201) STRUCTURAL DYNAMICS

1.THEORY OF VIBRATIONS: Introduction –Elements of a vibratory system – degrees of freedom-continuous systems –lumped mass idealization –Oscillatory motion –Simple harmonic motion –pictorial representation of S.H.M - free vibrations of single degree of Freedom (SDOF) systems –undamped and Damped –Critical damping –Logarithmic decrement –Forced vibrations of SDOF systems-Harmonic excitation –Dynamic magnification factor- Bandwidth.

2.INTRODUCTION TO STRUCTURAL DYNAMICS: Fundamental objective of dynamic analysis-types of prescribed loading- Methods of discretization- Formulation of the equations of motion.

3.SINGLE DEGREE OF FREEDOM SYSTEM: Formulation and solutions of the equation of motion - free Vibration response –response to harmonic, periodic, Impulsive and general Dynamic loading –Duhamel integral

4.MULTI DEGREE OF FREEDOM SYSTEM: selection of the degree of freedom – Evaluation of structural property matrices-Formulation of the MDOF equations of motion –Undamped free vibrations-Solution of Eigen value problem for natural frequencies and mode shapes- Analysis of dynamic response –Normal coordinates –Uncoupled equations of motion –Orthogonal properties of normal modes-mode superposition procedure

5&6. PRACTICAL VIBRATION ANALYSIS: Stodola method- Fundamental mode analysis –analysis of second and higher modes –Holzer's method –basic procedure – transfer matrix procedure

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

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

REFERENCE BOOKS:

- Dynamics of structures by Clough & Penziem
- Structural dynamics by Mario Paz
- I.S:1893(latest)“ code of practice for earthquakes resistant design of stuctures”
- Anderson R.A fundamentals of vibration, Amerind Pulblishing Co.,
- A.K.Chopra, “Structural Dynamics for Earthquake Engineering”,Prentice Hall.
- R. Narayana Iyangar, Theory of Vibrations.

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(12D20202) FINITE ELEMENT METHODS

1.INTRODUCTION-Concepts of FEM –steps involved –merits &demerits –energy principles –Discretization –Rayleigh –Ritz method of functional approximation.

2.ELASTIC FORMULATIONS: Stress equations-strain displacement relationships in matrix form-plane stress, plane strain and Axi-symmetric bodies of revolution with axi symmetric loading

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

4&5. TWO DIMENSIONAL FEM-Different types of elements for plane stress and plane strain analysis –Displacement models –generalized coordinates-shape functions-convergent and compatibility requirements –Geometric Invariance –Natural coordinate system-area and volume coordinates-Generation of element stiffness and nodal load matrices –static condensation.

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

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

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

REFERENCE BOOKS:

- **Finite element method by O.C.Zienkiewicz**
- **Finite element analysis -Theory & programming by G.S.Krishna murthy**
- **Introduction to finite element method –Tirupathi Chandra panla &Belugunudu**
- **Introduction to finite element method –J.N.Reddy**
- **Cook, R.D., Concepts and Applications of Finite Element Analysis, John Wiley and Sons Inc., New york.**
- **Bathe K.J.., finite Element Procedures in Engineering Analysis, Prentice Hall.**
- **Gallagher R.H., & Wilson Finite Element Analysis Fundamentals, Prentice Hall Inc.,**
- **Hinton and Owen, Finite Element Programming, Academic Press, London.**
- **Finite element methods by P.Seshu.**

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(12D20203) STABILITY OF STRUCTURES

1&2. ELASTIC BUCKLING OF BARS: Buckling of a bar with intermediate compressive forces and distributed axial loads –Buckling of bars with change in cross section –Effect of shear force on critical load –Built up columns-Elastic buckling of straight columns –Effect of shear stress on buckling-Eccentrically and laterally loaded columns –energy methods –Buckling of a bar on elastic foundation.

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

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

5.MATHEMATICAL TREATMENT OF STABILITY PROBLEMS: Buckling problem orthogonality realation –Ritz method-Timoshenko method, Galerkin method

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

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

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

REFERNCE BOOKS:

- **Stability of metalic structure by Bleich –Mc Graw hill**
- **Theory of Beam columns Vol I by chen & Atsuta Mc.Graw Hill**
- **Smitses,Elastic stability of structures, Prentice Hall.**
- **Timoshenko, S., and Gere., theory of Elastic stability, Mc Graw Hill Book company.**
- **Brush and Almorth., Buckling of bars plates and shells, Mc Graw Hill book company.**
- **Chajes, A., Principles of Structural Stability Theory, Prentice Hall,1974**
- **Ashwini Kumar, stability theory of structures, TATA Mc Graw Hill publishing company Ltd, New Delhi.**
- **Elastic stability by Bleaigh.**
- **Z.P. Bazant- Stability structures, CRC-Press.**

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(12D20204) ANALYSIS OF SHELLS AND FOLDED PLATES

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

2&3. CYLINDRICAL SHELLS: Derivation of governing DKJ equation for bending theory, details of Schorer's theory, Applications to the analysis and design of short shells and long shells. Introduction of ASCE manual co-efficients for design.

4&5. INTRODUCTION TO SHELLS OF DOUBLE CURVATURE: (other than shells of revolution:) Geometry and analysis of elliptic paraboloid, rotational paraboloid and hyperbolic paraboloid shapes by membrane theory.

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

7&8. SHELLS OF DOUBLE CURVATURE-Surfaces of revolution .Derivation of equilibrium equations by membrane theory, Applications to spherical shell and rotational Hyperboloid

TEXT / REFERENCE BOOKS:

1. Design and construction of concrete shell roofs by G.S. Rama Swamy – CBS Publishers & Distributors, 485, Jain Bhawan Bhola Nath Nagar, shahotra, Delhi.
2. Fundamentals of the analysis and design of shell structures by Vasant S.kelkar Robert T.Swell – Prentice hall, Inc., Englewood cliffs, new Jersy -02632.
3. N.k.Bairagi, Shell analysis, Khanna Publishers, Delhi.
4. Billington, Ithin shell concrete structures, Mc Graw Hill Book company, New york, St. Louis, Sand Francisco, Toronto, London.
5. ASCE Manual of Engineering practice No.31, design of cylindrical concrete shell roofs ASC, Newyork.

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ELECTIVE-III
(12D20205a) DESIGN OF BRIDGES

1. **INTRODUCTION** – Classification, investigations and planning, choice of type – economic span length – IRC specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations.
2. **DESIGN OF BOX CULVERTS** – General aspects – Design loads – Design moments, shears and thrusts – Design of critical section.
3. **DESIGN OF SLAB BRIDGES** – Effective width of analysis – workings stress design and detailing of slab bridges for IRC loading.
4. **T-BEAM BRIDGES** – Introduction – wheel load analysis – B.M. in slab – Pigaud's theory – analysis of longitudinal girders by Courbon's theory working stress design and detailing of reinforced concrete T-beam bridges for IRC loading.
5. **PRESTRESSED CONCRETE BRIDGES** – General features – Advantages of Prestressed concrete bridges – pretensioned Prestressed concrete bridges – post tensioned Prestressed concrete Bridge decks. Design of post tensioned Prestressed concrete slab bridge deck.
6. **BRIDGE BEARINGS** – General features – Types of bearings – forces on bearings basis for selection of bearings – Design principles of steel rocker and roller bearings and its design – Design of elastometric pad bearing detailing of elastometric pot bearings.
7. **PIERS AND ABUTMENTS** – General features – Bed block – Materials for piers and abutments – typies of piers – forces acting on piers – Design of pier – stability analysis of piers – general features of abutments – forces acting on abutments – stability analysis of abutments.
8. **BRIDGE FOUNDATIONS** – General Aspects – Types of foundations – Pile foundations – well foundations – caisson foundations.

TEXT/REFERENCES :

1. Essentials of bridges engineering – D.Hohnson Victor oxford & IBH publishers co-Private Ltd.
2. Design of concrete bridges MC aswanin VN Vazrani, MM Ratwani, Khanna publishers.
3. Bridge Engineering – S.Ponnuswamy.
4. BRowe, R.E., Concrete Bridge Design, C.R.Books Ltd., London.
5. Taylor F.W., Thomson, S.E., and Smulski E., Reinforced concrete Bridges, John wiley and sons, New york.
6. Derrick Beckett, an Introduction to Structural Design of concrete bridges, surrey University; press, Henlely – thomes, oxford shire.
7. Bakht.B.and Jaegar, L.G. bridge Analysis simplified, Mc Graw Hill.
8. Design of Bridges – N.Krishna Raju – Oxford & IBH
9. Design of Bridge structures – FR Jagadeesh, M.A. jaya Ram – Eastern Economy edition.

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(ELECTIVE-III)
(12D20205b) CONCRETE TECHNOLOGY

1. **CEMENTS AND ADMIXTURES**: Portland cement – Chemical composition - Hydration, setting and finenesses of cement – structures of hydrated cement – mechanical strength of cement gel - water held in hydrate cement paste – Heat of hydration of cement – Influence of compound composition on properties of cement – tests on physical properties of cement – I.S. specifications – Different types of cements – Admixtures.

2. **AGGREGATES**: Classification of aggregate – particle shape and texture – Bond strength and other mechanical properties of aggregate specific gravity, Bulk density, porosity, absorption and moisture in aggregate – soundness of aggregate – Alkali – aggregate reaction, Thermal properties – sieve analysis – Fineness modulus – grading curves – grading requirements – practical grading – Road note No.4 grading of fine and coarse aggregates gap graded aggregate – maximum aggregate size.

3. **FRESH CONCRETE**: Workability – factors affecting workability – measurement of workability by different tests – Effect of time and temperature on workability – segregation and bleeding – mixing and vibration of concrete – quality of mixing water.

4. **HARDENED CONCRETE**: Water/cement ratio-Abram's law – Gel space ratio – effective water in mix – Nature of strength of concrete – strength in tension and compression- Griffith's hypothesis – factors affecting strength – autogeneous healing –Relation between compression and tensile strength – curing and maturity of concrete Influence of temperature on strength – Steam curing – testing of Hardened concrete – compression tests – tension tests – factors affecting strength – flexure tests – splitting tests – Non destructive testing methods.

5. **ELASTICITY, SHRINKAGE AND CREEP**: Modulus of elasticity – dynamic modulus of elasticity – poisson's ratio – Early volume changes – swelling – Draying shrinkage - Mechanism of shrinkage – factors affecting shrinkage – Differential shrinkage – moisture movement carbonation shrinkage-creep of concrete – factors influencing creep – relation between creep and time – Nature of creep – Effect of creep.

6. **MIX DESIGN**: Proportioning of concrete mixes by various methods – fineness modulus, trial and error, mix density, Road Note. No. 4, ACI and ISI code methods – factors in the choice of mix proportions – Durability of concrete – quality control of concrete – Statistical methods – High strength concrete mix design

7&8 **SPECIAL CONCRETE'S**: Light weight concretes –light weight aggregate concrete- Mix design – Cellular concrete - No fines concrete – High density concrete – Fiber reinforced concrete – Different types of fibers - factories affecting properties of FRC – Applications polymer concrete – types of polymer concrete properties of polymer concrete applications

TEXT/ REFERENCE BOOKS:

1. A. M. Neville, 'Properties of concrete ', Pitman Publishing Limited, London.
2. F.M.Lea, 'Chemistry of cement and concrete' 3rd ed., Edward Arnold.
3. Text book of concrete Technology – PD Kulkarni, R.K.Ghosh, Y.R. Phull – Newage international
4. Concrete Technology –M.S.Shetty.
5. Concrete Technology by ML Gambhir 3rd edition, TATA Mc Graw Hill Publishing company.
6. P.K.Mehta – Concrete Technology
7. Concrete Technology: Krishna Raju

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(ELECTIVE-III)

(12D20205c) EARTHQUAKE RESISTANT STRUCTURES

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

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

3&4. **DESIGN APPROACHES:** Methods of analysis – selection of analysis – equivalent lateral force procedure seismic base shear – seismic design co-efficient - vertical distribution of seismic forces and horizontal shear – twisting moment - Over turning moment – vertical seismic load and orthogonal effects lateral deflection – P- Δ characteristics effect – soil structure Interaction
Earthquake records for design – factors affecting Accelerogram characteristics - artificial Accelerogram – zoning map.
Dynamic – analysis procedure: Model analysis – Inelastic – time history analysis Evaluation of the results.

5&6. **EARTHQUAKE – RESISTANT DESIGN OF STRUCTURAL COMPONENTS AND SYSTEMS:**
Introduction – monolithic reinforced – concrete structures – precast concrete structures – Prestressed concrete structures – steel structures – composite – structures, masonry structures – Timber structures.

7&8. **FUNDAMENTALS OF SEISMIC PLANNING**: Selection of materials and types of construction form of superstructure – framing systems and seismic units – devices for reducing. Earthquake loads,

TEXT / REFERENCE BOOKS:

- Design of earthquake resistant structures by Minoru Wakabayashi.
- A.K.Chopra, Strucutural Dynamics for Earthquake Engineering", Prentice – Hall.
- R.W.Clough and Penzium 'Dynamics of structures'. Mc Graw – Hill, 2nd edition.
- N.M Newmark and E.Rosenblueth, Fundamentals of Earthquake Engineering' prentice hall.
- David Key, Earthquake design practice for buildings." Thomas telford,London.
- R.L. Wegel, Earthquake Engg; Prentice Hall 12nd edition.
- J.A. Blume, N.M. Newmark, L.H. Corning., Design of Multi –storied Buildings for Earthquake ground motions', Portland Cement Association, Chicago,1961
- I.S.Codes No. 1893,4326,13920.
- Earthquake Resistant Design by Pankaj Agarwal & Manish Shrikande, Printice Hall Publishers.

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(ELECTIVE-IV)
(12D20206a) ADVANCED STEEL STRUCTURES

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

2&3. **ANALYSIS OF MULTI-STOREYED FRAMES USING APPROXIMATE METHODS**

a) Cantilever method &
b) Portal method

4. **ANALYSIS OF MULTI-STOREY FRAMES USING SUBSTITUTE FRAME METHOD**.

5. **DESIGN OF GANTRY GIRDER –** Introduction – Loads acting on the gantry girder – permissible stresses - types of gantry girders and crane sails – crane data – maximum moments and shears – design procedure (restricted to electrically operated cranes)

6. THEOREMS OF PLASTIC ANALYSIS, APPLICATIONS TO THE CASES OF RECTANGULAR PORTAL FRAMES.

7. **GENERAL METHODS OF PLASTIC DESIGN:** combining mechanics methods, plastic moment redistribution method; Application to few cases of simple two storied rectangular portal frames including estimation of deflection.

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

BOOKS FOR REFERENCE:

1. Plastic analysis of structures by B.G.Neal
2. Steel Skeleton V.I and II by Baker
3. Design of steel structures by Vazarani and Ratwani
4. Strength of materials (Vol-II)) by Timoshenko.
5. Analysis of Steel Structure by Manohar.
6. Analysis of Steel Structure by Pinfold
7. Analysis of Steel Structure by Arya & Azmani
8. Analysis of Steel Structure by Relevant IS codes.
9. Analysis of Steel Structure by Punmia, B.C.

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(ELECTIVE-IV)
(12D20206b) BUILDING CONSTRUCTION MANAGEMENT

Unit-I & II
INTRODUCTION – Types constructions-public and private contract managements – scrutinizing tenders and acceptance of tenders, contracted, changes and terminating of contract – subcontracts construction organizations – organizational chart-Decentralization payrolls and records – organization chart of a construction company.

Unit-III:
CONSTRUCTION PRACTICES – Time Management – bar chart, CPM, PERT – Progress report

Unit –IV:
RESOURCES MANAGEMENT AND INVENTOR- Basic concepts equipment management, material management inventory control.

Unit-V & VI:
ACCOUNTS MANAGEMENT – Basic concepts, Accounting system and book keeping, depreciation, Balance sheet, profit and loss account, internal auditing. Quality control by statistical methods, sampling plan and control charts, safety requirements.

Unit-VII & VIII:
COST AND FINANCIAL MANAGEMENT – Cost volume relationship, cost control system, budget concept of valuation, cost of equity capital management cash. Labor and industrial; laws – payment of wages act. Contract labor, workmen's compensation, insurance, industrial disputes act.

REFERENCE:

1. Construction Management and planning by B.Sengupata and H.Gula(Tata McGraw Hill)
2. Construction Management by Atkinson(Elsevier)
3. in principle land practice by EEC beech(Longman)
4. Robert Schultheis, Mary Summer "management information systems-The Management View."TATA Mc Graw Hill Edition, New Delhi.
5. Kwakye, A.A , Construction Project Administration Addison Wesley Longman, London.
6. Keith Davis, Human Behavior at Work, Mc Graw Hill, USA.
7. Sehroeder, R.G., Operations Management, Mc Graw Hill, USA.
8. james C.Van Horne, Financial Management and Policy, Prentice Hall of India Pvt.Ltd., 4th Ed., NewDelhi.
9. Varshney R.L. and Maheswari, K.I., Managerial Economics, Sultan Chand.
10. Frank Harrison, E., The Managerial Decision Making Process, Houghton Mifflin Co.Boston.

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M.Tech II semester (SE)

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(ELECTIVE-IV)
(12D20206c) FRACTURE MECHANICS

1. SUMMARY OF BASIC PROBLEMS AND CONCEPTS:
Introduction - A crack in a structure - The stress at a crack tip - The Griffith criterion The crack opening displacement criterion - Crack Propagation - Closure

2. THE ELASTIC CRACK – TIP STRESS FIELD :
The Airy stress function - Complex stress functions - Solution to crack problems - The effect of finite size - Special cases - Elliptical cracks - Some useful expressions

3. THE CRACK TIP PLASTIC ZONE:
The Irwin plastic zone correction - The Dugdale approach - The shape of the plastic zone - Plane stress versus plane strain - Plastic constraint factor - The thickness effect

4. THE ENERGY PRINCIPLE:
The energy release rate - The criterion for crack growth - The crack resistance (R curve) - Compliance , The J integral (Definitions only)

5. PLANE STRAIN FRACTURE TOUGHNESS:
The standard test - Size requirements - Non-Linearity - Applicability

6. PLANE STRESS AND TRANSITIONAL BEHAVIOUR:
Introduction - An engineering concept of plane stress - The R curve concept

7. THE CRACK OPENING DISPLACEMENT CRITERION:
Fracture beyond general yield - The crack tip opening displacement - The possible use of the CTOD criterion

8. DETERMINATION OF STRESS INTENSITY FACTORS:
Introduction - Analytical and numerical methods - Finite element methods, Experimental methods (An Ariel view only)

REFERENCES:

1. Elementary engineering fracture mechanics - David Broek, Battelle, Columbus - laboratories, Columbus, Ohieo, USA.
2. Fracture and Fatigue Control in Structures - John M.Barsom, Senior consultant United states Steel corporation & Stanley T.Rolfe, Ross H.Forney, Professor of Engineering, University of Kansas.

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(12D20207) CONCRETE LABORATORY-II

1. Accelerated curing test on Concrete cubes.
2. Non destructive test on concrete.
3. Study of effect of dosage of super plasticizer on Strength and workability of concrete.
4. Mix design of high strength concrete including casting and testing of specimens.
5. Mix design of fly ash concrete including casting and testing of specimens.
6. Determination of coefficient of permeability of concrete.
7. Determination of drying shrinkage of concrete.
8. Bending test on a RCC beam under.
   a) single point load
   b) Three point load