CIVIL ENGINEERING DEPT.

2023-2022

Ph.D.- STRUCTURES

COLLEGE OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT
Ph.D STUDY-STRUCTURAL ENGINEERING
FIRST SEMESTER

Item	code	Subjects	Units	HOURS	
				T	P
1	Eng.Civil 601	ADVANCED ENGINEERING MATHEMATICS (II)	2	2	--
2	Eng.Civil 602	PLASTICITY APPLICATIONS	2	2	--
3	Eng.Civil 603	STABILITY OF STRUCTURES	2	2	--
4	Eng.Civil 604	PRESTRESSED CONCRETE	2	2	--
5	Eng.Civil 605	THEORY OF SHELLS	2	2	--
6	Eng.Civil 606	ENGLISH LANGUAGE	1	--	2
TOTAL			**11**	**10**	**2**

SECOND SEMESTER

Item	code	Subjects	Units	HOURS	
				T	P
1.	Eng.Civil 607	DYNAMICS OF STRUCTURES	2	2	--
2.	Eng.Civil 608	RELIABILITY OF STRUCTURES	2	2	--
3.	Eng.Civil 609	ADVANCED STEEL STRUCTURES	2	2	--
4.	Eng.Civil 610	SPECIAL TOPICS	2	2	--
5.	Eng.Civil 611	NONLINEAR FINITE ELEMENT	3	3	--
6.	Eng.Civil 612	ENGLISH LANGUAGE	1	--	2
TOTAL			**12**	**11**	**2**

ADVANCE ENGINEERING MATHEMATICS (II)\ Eng.Civil 601

- Two Dimensional Partial Differential Equations:
  - Vibrating strings and membranes
    a. Transversely vibrating string
    b. Transversely vibrating membranes
    c. Steady state string and membranes
  - Two dimensional consolidation equation
  - Two Dimensional Laplace equation
  - Applications.
- Solution of plate equations/ Navier solution
- Optimization
  - Introduction to optimization
  - Objective of optimization
  - Generalized optimization problem
  - Single variable optimization without and with constraints
  - Multivariable optimization without and with constraints
  - Optimization using numerical search technigues
  - Applications

PLASTICITY APPLICATIONS \ Eng.Civil (602)

General Theory

- Analysis of Stress and strain in plasticity
- Matrices of stress and strain and rate of change of strain.
- Rate of change in tension and compression.
- Two and Three dimension system in tension and compression.
- Three dimension mohr circular
- Strain – Deformation relationship

Yield criteria (yield surface)

- criteria of Tresca
- criteria of Von- Mises
- Equation of Brandel – Russe
- Equation of Levi – Mises
- Work Harding

Perfecting plastic body

- Combined Tension Torsion in circular rode.
- Elasto plastic flexural in beam
- Axisymmetric axis strain
- Louder band Theory
- Plane stress : line of discontinues
- Thick wall cylinder
- Cylindrical tube and compression
- Plastic stress in the layer under Tension –compression

Plastic analysis structure

- Plane frame
  - Lower and upper theory in plastic analysis
  - Combined mechanism theory
  - Minimum weight design theory
  - Estimation of Deformation
- Space structure three dimension
- Grillage
- Complex frame
- Arches

Plastic bending in circular plate

- Plastic bending in rectangular
- Steel plate
- Reinforced concrete plate

STABILITY OF STRUCTURES\ Eng. Civil (603)

1. General principle-Bifurcation and Energy approaches.
2. Stability of simple structures.
3. Beam-Columns, bending and axial thrust
4. Material and geometric nonlinearatiy.
5. Beam column under lateral loadings.
6. Stability function
7. Torsional bukling of beam.
8. Stability of rigid frames.
9. Bukling of plates and shells.

Prestressed Concrete /Eng. Civil (604)

1. Introduction.
2. Materials and Prestressing systems.
3. Analysis of sections for flexure.
4. Design of sections for flexure;

(i) Service load design.
(ii) Strength design.
(iii) Cable Profile.
(iv) End Block design of Pre-Tensioned and Post-Tensioned members.

5. Design of Prestressed tension members.
6. Design of Prestressed Compression Members.
7. Design of Prestressed concrete slabs.

THEORY OF SHELLS\ Eng.Civil 605

- Thin Shells.
- Cylindrical Shells.
  - Membrane theory of Cylindrical Shells.
    - Equations of Equilibrium.
    - Stresses in a simply Supported Shell.
    - Cylindrical Shells with Circular Directrix.
    - Cylindrical Shells with Cycloidal Directrix.
    - Cylindrical Shells with Catenary Directrix.
    - Cylindrical Shells with Parabolic Directrix.
  - Bending Theory of Cylindrical Shells.
    - Expressions for Strain and Change in Curvature.
    - Strains in a Circular Cylindrical Shell.
    - Change in Circumferential Curvature.
    - Stress Resultants.
    - The Finster walder Theory
    - The D-k-j Theory.
- Shells of Double Curvature.

- Surface of Revolution.
    - Membrane Theory.
    - Equations of Equilibrium.
    - The Spherical Shell.
    - Rotational hyperboloid Shell.
- Bending Theory of Surface of Revolution.
    - Equations of Equilibrium.
    - Expressions for Strains and Change of Slope of the Meridian Tangent,
      and Curvatures.
- General Membrane Theory of shell with Double Curvature.
    - Geometrical Relations.
    - Equations of Equilibrium.
- Bending Theory of Shallow Shells of Double Curvature.
    - Vlasov Bending Theory.
    - Equations of Equilibrium.
    - Stress-Strain and Moment-Curvature Relations.

Dynamics of Structure (607)

Multi-dgree-of-freedom (MDOF) system
General Properties Matrices for Vibrating System

- Flexibility Matrix
- Stiffness Matrix
- Inertia Properties: Mass Matrix
- The Eigenproblem in Vibration Analysis
- Static Condensation of the Stiffness Matrix

Equations of motion and undamped free vibration

- Hamilton s Principle and the Lagrange Equation
- Natural Vibration Frequencies
- Natural Vibration Modes
- Orthogonality of Natural Modes
- System Admiting Rigid-Body Modes
- Generalized Mass and Stiffness Matrices
- Free Vibration Response to Initial Condition
- Approximate Method for Estimating the Fundamental Frequency

Numerical Solution Methods for Natural Frequencies and Mode Shapes

- General Solution Methods for Eigenproblems
- Inverse Vector Iteration
- Forward Vector Iteration
- Generalized Jacobi Method
- solution Methods for Large Eigenproblems

Analysis of Dynamic Response by Mode Superpotion

- Mode Displacement Method for Undamped System
- Model Participation Factor
- Mode superposition Solution for System with Classical Damping
- Numerical Evaluation of Model Response
- Normal Mode Response to Support Motions
- Response Spectrum Analysis
- Mode Acceleration Method

Analysis of Dynamic Response by Direct Interation

- Basic Concepts of Direct Integration Methods
- The Central Difference Method
- The Wilson-0 Method
- The Newmark Method
- Practical Considerations for Damping
- Stability and Accuracy of Direct Integration Method
- Direct Integrations Versus Mode superposition

Continuous system

Vibrations of Continuous system

- Longitudinal Vibration of a Uniform Rod
- Transverse Vibration of a Pretensioned Cable
- Free Transverse Vibration of Uniform Rod
- Orthogonality of Normal Modes
- Undamped Forced Vibration of beams by Mode Superposition
- Approximate Method

Practical Applications

Earthquakes and Earthquake Ground Motion

- Causes of Earthquakes
- Faults
- Seismic Waves
- Earthquake Intensity
- Earthquake Magnitude
- Seismicity
- Earthquake Ground Motion
- Earthquake Damage Mechanisms

Earthquake Response Structures

- Time-History Analysis: Basic Concepts
- Earthquake Response Spectra
- Earthquake Design spectra
- Response of MDOF system
- Generalized SDOF system
- In-Bulding Response spectrum
- Inelastic Response
- Sesmic design Codes

Blast Loads on Structures

- Sources of Blast Loads
- Shock Waves
- Determination of Blast Loads
- Strain-Rate Effects
- Approximate Solution Technique for SDOF System

Reliability Theory of Structures (608)

- The Safety problem.
- Limit states, Safety margin and Safety factors.
- Simulation methods.
- Measures of structural reliability.
- Reliability of structural system.
- Statistical uncertainty and model uncertainty.
- Codes and structural reliability.

Advanced steel Structural (609)

- Steels and Properties.
- Tension and Compression members.
- Laterally supported members.
- Laterally torsional buckling.
- Frames – Braced and Unbraced.
- Welding.
- Composite Steel – concrete; beams, slabs, columns and frames.

Special Topics, Eng. Civil (610)

1. Design of Beam-Column joints for gravity and lateral loads.
2. Strut-and Tie method for the design of Joints.
3. Design considerations for fatigue of concrete and steel.
4. Assigned Limit method for the design of R. C. Frames.
5. Introduction and general description and objective
6. Metals: constitutive relation-fracture-fatigue-crack
7. Plain concrete: constitutive relation-fracture-crack crush
8. R.C.: constitutive relation-bond-steel behavior.
9. Application-formulation of different problems and simple soluation.

NON LINEAR FINITE ELEMENT civil eng (611)

1. Introduction and review on finite element and programming
2. Nonlinear formulation in one degree of freedom
3. Material nonlinearity constitutive relation-types: nonlinear elasticity, plasticity, ect…
4. Geometrical nonlinearity: small and large strain, formulations
5. Nonlinear solution method: Newton Raphson method
6. Time integration for nonlinear dynamic problem: Newmark and Nilson methods
7. Coupled problem: introduction-types-formulation-simple cases solution
8. Error estimation: principle, calculation
9. Computer applications on the above topics