

## **ELECTIVE-I (BCE404)**

### **Advanced Mechanics of Materials (4-0-0) : Credits-04**

#### **Module-I**

Theories of Failure: Maximum normal stress theory, maximum normal strain theory, maximum shearing strain theory, maximum strain energy theory, maximum distortion energy theory, maximum octahedral shearing stress theory, Comparison of failure theories for 2-D stress system. Mohr's theory of failure.

#### **Module-II**

Unsymmetrical bending: Properties of beam cross section, slope of neutral axis, stress and deflection in unsymmetrical bending, shear centre.

Curved Beams: Bending of beams with large initial curvature, Stress distribution in beam with rectangular, circular cross section, stresses in crane hooks, rings and chain links.

#### **Module-III**

Elementary concept of elasticity, stresses in 3D, equation of equilibrium and compatibility, plane stress and plane strain. Computer analysis of 2D state of stress and strain at a point.

Repeated stresses and fatigue in metals, Concept of stress concentration, notch and stress concentration factors.

#### **Module-IV**

Experimental stress analysis: Resistance strain gauges, strain rosettes, 2D photoelastic methods of stress analysis, stress optic law, light and dark field in a polariscope, isoclinic and isochromatic fringe patterns.

#### Reference Books:

1. Advanced Mechanics of Solids by L. S. Srinath
2. Advanced Mechanics of Materials by Kumar & Ghai

## 2. Theory of Plates and Shells (3-1-0): Credits-04

Plates: Pure bending of plates, Slope and curvature of slightly bent plates, relationship between moment and curvature, strain energy in bending of plates.

Differential equations for symmetrical bending of circular plates under lateral loads. Uniformly loaded, concentrically loaded and loaded at the center of simply supported and fixed circular plates. Differential equation of the deflection surface and boundary conditions of laterally loaded rectangular plates by classical theory. Solutions of simply supported rectangular plates due to sinusoidal loads, uniformly distributed loads and concentrated load by Navier's Solution, Levy approach.

Shells: Membrane theory of symmetrical loaded shells of revolution, Spherical shells, conical shells, Membrane theory of cylindrical shells and shells of Double curvature such as Hyperbolic paraboloids and elliptic paraboloids, conoids.

Circular cylindrical shells loaded symmetrically with respect to its axis, particular cases of symmetrical deformation of circular cylindrical shells, cylindrical tanks of uniform wall thickness.

Structural Design: Design of spherical dome.

### Essential Reading

1. S P Timoshenko and S. W. Krieger ,Theory of Plates and Shells
2. O.P Billington, Thin Shell Concrete Structures

### Supplementary Reading

1. Eduard Ventsel & Theodor Krauthammer, Thin Plates & Shells: Theory, Analysis, & Applications CRC; 1st edition, 2001
2. Maan H. Jawad, Theory and design of plate and shell structures, Kluwer Academic Pub
3. Philip L. Gould, Analysis of shells and plates, Pearson Higher Education

### **3. Traffic and Transportation Planning (3-1-0): Credit-04**

#### **Module -I**

Urban transportation planning process & concepts: Role of transportation and changing concerns of society in transportation planning; transportation problems and problem domain; objectives and constraints; flow chart for transportation planning process-inventory, model building, forecasting and evaluation stages, planning in system engineering framework; concept of travel demand and its modelling based on consumer behaviour of travel choices-Independent variables, travel attributes.

#### **Module –II**

Methods of Travel Demand Estimation: Assumptions in Demand Estimation-Sequential, Recursive and Simultaneous Process -Introduction to Transportation Planning Practices; Definition of Study Area, Zoning. Trip Generation Analysis: Trip Generation Models-Zonal Models, Category analysis, Household Models, Trip Attractions of Work Centres & Commercial Trips Trip Distribution Analysis: Trip End and Trip Interchange Models; Trip Distribution Models –Growth Factor Models, Gravity Models, Opportunity Models and their calibration; Estimation of Travel Demand based on link volume philosophy.

#### **Module –III**

Mode Split and Route Split analysis: Mode Split Analysis-Mode Choice Behaviour, Competing Modes, Mode Split Curves, Probabilistic Models and Two Stage Mode Split Analysis; Route Split Analysis-Elements of Transportation Networks, Coding, Minimum Path Tress, Diversion Curves, All-or-Nothing Assignment, Capacity Restrained Assignment, Multipath Assignment

#### **Module – IV**

Landuse-Transportation Models: Location models -Opportunity Models, Lowry based Landuse-Transportation Models – Allocation Function, Constraints, Travel Demand Estimation – Iterative Solutions, Matrix Formulation, Dynamic and Disaggregated extensions.

#### **References**

1. Hutchinson, B.G., Principles of Urban Transportation System Planning, Mc-Graw Hill 1974.
2. Khisty, C J., Transportation Engineering – An Introduction, Prentice-Hall, NJ
3. Dickey, J.W., Metropolitan Transportation Planning, Tata Mc-Graw Hill 1980

4. ITE (1982), 'Transportation and Traffic Engineering Hand Book', Chapters 10,12, and 17, Prentice Hall, New Jersey
5. Kanafani, A., Transportation Demand Analysis, McGraw-Hill.
6. Oppenheim, N., Applied Models in Urban and Regional Analysis, Prentice-Hall, NJ.
7. Bruton M.J., Introduction to Transportation Planning, Hutchinson of London.
8. Oppenheim N., Applied Models in Urban and Regional Analysis, Prentice-Hall.
9. Dickey J.W., et. al., Metropolitan Transportation Planning, Tata McGraw-Hill.
10. Gallion A.B and Eisner S., The Urban Pattern, Affluated East-West Press, New Delhi.
11. Wilson, A.G, Urban and Regional Models in Geography and Planning, John Wiley and Sons.

### **3. WASTE MANAGEMENT AND POLLUTION CONTROL (3-1-0) CREDIT: 04**

#### **Module-I**

Industrial Waste Water Treatment: Sources, Quantification and characterization of effluent, Waste water treatment process, Primary and secondary treatment of waste water, Aerobic and anaerobic treatment processes, various reactor configurations

#### **Module-II**

Industrial Air Quality Management: Sources, Quantification and characterization of emission, Control of particulate from flue gas, Particle dynamics, Particle size distribution, Dispersion and diffusion of pollutants in air, Gaussian dispersion equation, different types of dispersion models, Selection and design of air pollution control equipments: gravitational settling chamber, cyclone, bag filter, electrostatic precipitator, various type of scrubbers, Control of fugitive emission, Procedure for sampling of particulate matter in stacks

#### **Module-III**

Advanced Waste Water Treatment Processes: Fundamentals and mechanism of adsorption, adsorption isotherms, absorption, membrane separation and chemical oxidation processes and their design principles.

#### **Module-IV**

Waste Water and Air Quality Management in specific industries: Power plant, Fertilizer plant, Steel plant, Alumina refinery and smelters, Pulp and paper, Sugar and distillery, Dairies, Cement, Sponge iron industries

**Reference books:**

1. Wastewater treatment processes, Metcalf and Eddy, Tata McGraw hill
2. Environmental Engineering, Peavy and Rowe, Tata McGraw Hill

**4. GROUNDWATER ENGINEERING (3-1-0): CREDIT-04**

**Module-I**

Groundwater Occurrence: Groundwater hydrologic cycle, origin of groundwater, rock properties effecting groundwater, vertical distribution of groundwater, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, porosity, Specific yield and Specific retention.

Groundwater Movement: Permeability, Darcy's law, storage coefficient. Transmissivity, differential equation governing groundwater flow in three dimensions derivation, groundwater flow equation in polar coordinate system. Groundwater flow contours their applications.

**Module – II**

Analysis of Pumping Test Data – I: Steady flow groundwater flow towards a well in confined and unconfined aquifers – Dupuit's and Theim's equations, Assumptions, Formation constants, yield of an open well interface and well tests.

Analysis of Pumping Test Data – II: Unsteady flow towards a well – Non equilibrium equations – Thesis solution – Jacob and Chow's simplifications, Leak aquifers.

**Module – III**

Surface and Subsurface Investigation: Surface methods of exploration – Electrical resistivity and Seismic refraction methods. Subsurface methods – Geophysical logging and resistivity logging. Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation.

Artificial Recharge of Groundwater: Concept of artificial recharge – recharge methods, relative merits, Applications of GIS and Remote Sensing in Artificial Recharge of Groundwater along with Case studies.

**Module – IV**

Saline Water Intrusion in Coastal aquifer: Occurrence of saline water intrusions, Ghyben- Herzberg relation, Shape of interface, control of seawater intrusion. Groundwater Basin Management: Concepts of

conjunction use, Case studies.

*TEXT BOOKS:*

1. Groundwater Hydrology - David Keith Todd [ John Wiley & Son, New York.]
2. Groundwater - H.M.Raghunath [Wiley Eastern Ltd.]

*REFERENCES :*

1. Groundwater Systems Planning & Management - R.Willes & W.W.G.Yeh [Prentice Hall of India.]
2. Applied Hydrogeology - C.W.Fetta [CBS Publishers & Distributors]

## **5. Machine Foundation (3-1-0): Credit-04**

### **Module I**

General Theory: Resonance and its effect; Theory of single-degree,two degree and multiple-degree of freedom system; Transient Response.

### **Module II**

Evaluation of Design Parameters: Importance of design parameters; Geometric properties of machine foundations; Physical properties of the elastic base and their experimental evaluation

### **Module III**

Analysis and Design of Block Type Machine Foundation: Mode of vibration of a block foundation; Methods for dynamic analysis; Foundation for machines inducing periodical and impact-type forces.

### **Module IV**

Vibration Isolation: Active and passive type isolation; Methods of isolation in machine foundation; Isolation in existing machine foundation.

