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**

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

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

References
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


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

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**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.


**Module – III**


**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:

REFERENCES :

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.