CE 7101 Advanced Vibration Analysis (3-0-0)

Single Degree of Freedom Systems – free and forced response of undamped and damped SDOF, superposition principle, harmonic and periodic loads, impulse response. Multi Degree of Freedom Systems – equations of motion, undamped free vibration, eigenvalue problems, orthogonality of modal vectors, expansion theorem, modal analysis, Rayleigh's quotient.
Continuous Systems – boundary value problem, free vibration, eigenvalue problem, axial vibration of bars, bending vibration of beams, natural modal and orthogonality, expansion theorem, response by modal analysis, kinetic and potential energy for continuous systems.
Elements of Analytical Dynamics – work and energy, principle of virtual work, D'Alembert's principles, Lagrange equation of motion, Hamilton's principle.
Introduction to the Finite Element Method – FEM as a tool for converting continuous systems to a multi degree of freedom systems, axial bar and beam elements, element stiffness and mass matrices, assembly, transformation, and numerical solution of eigenvalue problems.

Textbook:

1. Meirovitch, L.: Elements of Vibration Analysis, Mc Graw Hill Inc.

References:

1. Thomson, W. T.: Theory of Vibration with Applications, CBS Publishers.
2. Clough, R. W., and Penzien, J.: Dynamics of Structures, Mc Graw Hill Inc.
3. Craig Jr. R. R.: Structural Dynamics, John Wiley.
4. Cook, R. D. et al.: Concepts and Applications of Finite Element Analysis, John Wiley.
5. Bathe, K. J.: Finite Element Procedures in Engineering Analysis, Prentice Hall of India.

CE 7401 Pipeline Engineering (3-0-0)

Review of Fluid Mechanics of Pipe Flows, Losses – friction and other losses, Pumping and Gravity Mains, Economic Analysis for Pipe Choice, Pipe Materials, Design Principles – internal pressures and external loads, Surges – causes, problems, analysis by finite difference or method of characteristics methods, Protection Devices, Resonance in Pipe Systems, Mass Oscillation, Stability, Corrosion – internal and external protection, Pipeline Joints, Selection of Pumps and Valves, Flow Measurement, Pipe networks, Standards for Pipeline Engineering.

References:

1. Pipeline Engineers Guild: Pipelines Design, Construction, and Operation, Construction Press, London, 1984.
2. Standards Relevant to Pipeline Industry (BS, BIS, API Standards)
3. John. L. Crammer: Basic Pipeline engineering Manual, Penwell Pub; 1984.
4. Jacques Louis Vincent Genod: Fundamentals of Pipeline Engineering, Gulf Professional Publishing, 1984.
5. J. Paul Tullis: Hydraulics of Pipelines: Pumps, Valves, Cavitation, Transients, Interscience, 1989.
6. M. Hanif Chaudhry: Applied Hydraulic Transients, Van Nostrand Reinhold, 1998.

CE 7402 Cavitation and Two Phase Flows (3-0-0)

Basic Concepts, Cavitation Inception, Growth, and Damage, Different Types of Cavitation, Cavitation in Hydraulic Structures and Machines, Flow Meters, Prevention of Cavitation, Latest Trends in Cavitation Studies.
Two Phase Flows, Homogeneous Separated and Drift Flux Models, Gravity Gravity Dominated Flow Regime, Corrections for Void Fraction and Velocity Distribution in Different Flow Regimes, Pressure Losses due to Multiphase Flow.

References:

1. J. Paul Tullis: Hydraulics of Pipelines: Pumps, Valves, Cavitation, Transients, Interscience, 1989.
2. R.T. Knapp et al.: Cavitation, Mc Graw Hill Inc; 1970.
3. Clement Kleinstruer: Two Phase Flow: Theory and Applications, Taylor and Francis, 2003.

CE7403 Watershed Modelling (3-0-0)

Watershed Characteristics – Watershed – definition, delineation, drainage area, linear measurements, basin shape, watershed relief, descriptors of the drainage area pattern, uniform flow computation, time parameters, land cover and land use.
Hydrologic Processes – Reynolds Transport Theorem, continuity and momentum equations, discrete time continuity, open channel flow, porous media flow, energy balance, transport processes.
Surface and Subsurface Water – sources of streamflow, hydrograph, excess rainfall and direct runoff, abstractions, infiltration equations, SCS method, flow depth and velocity, travel time, stream networks, unsaturated flow, ponding time.
Systems Concept – Hydrologic System Model and Classification.
Deterministic Hydrologic Models – conceptual, lumped/distributed, continuous/event, general/catchment specific, structure of a conceptual model, parameters and calibration.
Soil Erosion Modelling – erosivity and erodibility, processes, USLE and modified/ revised USLE, WEPP, models for erosion processes.
Watershed Modelling – Fundamentals of formulating and calibrating complex watershed models. Watershed Models – classification, uses, structure, analysis vs synthesis, simplified watershed model illustrating model calibration and structure modification.

References:

1. Chow, V. T., Maidment, D. R., and Mays, L. W., Applied Hydrology, Mc Graw Hill Inc; 1988.
2. Linsley, R. K., Kohler, M. A., and Paulhus, J.L.H., Hydrology for Engineers, Mc Graw Hill Inc; 1988.
3. Mcuen, R. H., Hydrologic Analysis and Design, Prentice Hall, 1989.

CE7404 Remote Sensing and GIS in Water Resources Engineering (3-0-0)

Remote Sensing – basic principles and measurements, data requirements, resolution, data analysis. Electromagnetic Radiation – atmospheric windows. Elements of Visual Image Interpretation – location, size, shape, shadow, tone and colours, texture, pattern, height and depth, site, situation and association. Multispectral Remote Sensing – digital image technology terminology, satellites and bands. Thermal Infrared, Active and Passive Microwave and LIDAR Remote Sensing. Remote Sensing of Vegetation – vegetation indices, SR, NDVI, GRABS, MSI, RWC. Remote Sensing of Water and Soils – spectral response, bathymetry.
GIS – components. Maps and GIS – geographic co-ordinate system, map projection. Digital representation of geographic data – raster and vector data representation. Raster and Vector Based GIS Data Processing. DTM. Spatial Analysis and Modelling. Applications In Water Resources.

References:

1. Agarwal, C. S. and Garg, P.K., Textbook on Remote Sensing in Natural Resources Monitoring and Management, Wheeler Publishing, 2000.
2. Burrough, P. A. and McDonell, R.A., Principles of GIS, Oxford University Press, 1998.
3. Chang, Kang-Tsung, Introduction to GIS, Mc Graw Hill Inc; 2002.
4. Jensen, J. R., Remote Sensing of the Environment – An Earth Resources Perspective, Pearson Education, 2000.
5. Lo, C. P., and Yeung, A. K. W#., Concepts and Techniques of GIS, Prentice Hall Inc; 2002.

CE 7406 Surface Water Quality Modelling (3-0-0)

Fundamental Flow and Transport Relationships, Measurement and Analysis of Flows, Reaction Kinetics, Well Mixed and Incompletely Mixed Systems, Review of Numerical Modelling Techniques, Flow and Transport Models for Rivers and Streams – steady and unsteady flow models, Mathematical Models for Lakes and Reservoirs – stratification and heat transfer, circulation and mixing, Mathematical Models for Estuaries – transport and mixing, tidally averaged estuarine models, DO Modelling – Streeter-Phelps model for point and distributed sources, Computer Models, Issues in Modelling.

References:

1. Chapra, S. C.: Surface Water Quality Modeling, Mc Graw Hill Inc; 1997.
2. James, A.: An Introduction to Water Quality Modeling, John Wiley and Sons, 1993.
3. Martin, J. L., and McCutcheon, S.C.: Hydrodynamics and Transport for Water Quality Modeling, Lewis Publishers, 1998.
4. Published Papers in Related Journals

CE 7551 Environmental Geotechnique (3-0-0)

Geo-environmental Practices – municipal waste fills, regulations, hazardous waste management, waste disposal and contaminant issues.
Waste Characterisation – hazardous wastes and toxic substances, source of waste, municipal wastes, hazardous wastes at municipal landfill sites, industrial wastes. Site and Subsurface Investigation. Monitoring Wells.
Clay Minerals – introduction to diffuse double layer theory. Liners – clay and geosynthetic liners, geo membranes, geonets
Hydraulic Conductivity – field and laboratory models, influence of contaminants on hydraulic conductivity. Field Compaction Requirements.
Contaminant Transport – advection, diffusion, dispersion, applicability of contaminant transport concepts to waste management systems, laboratory determination of adsorption and diffusion parameters, computing contaminant migration.
Barriers – trench slurry interactions, permeability, strength of barrier walls, construction methods, slurry characteristics, backfill characteristics, contraction problems, defects.
Liner Systems for Landfill and Surface Impoundments – overview, leakage through liners, lining systems, material stress, construction factors, cover lining systems, specifications.
Leakage Collection and Removal Systems – design and analysis.
Stability Analysis and Design – excavation slope stability, refuse fill stability, cover system stability, settlement analysis.
Strategies for Remediation – remedial planning and implementation, approach, methodology, implementation.
Treatment Techniques and Design – soil washing, stabilization, solidification, electro reclamation, bioremediation.

References:

1. Daniel, D. E. (ed.): Geotechnical Practices for Waste Disposal, Chapman and Hall, 1993.
2. Sharma, H. D. and Lewis, S. P.: Waste Contaminant Systems, Waste Stabilization and Landfills – Design and Evaluation, John Wiley and Sons, 1994.
3. International Conference on SMFF.