SCHEME OF INSTRICTIONS

AND

DETAILED SYLIABUS

FOR

M.TECH. DEGREE PROGRAMME

IN

WATER RESOURCES ENGINEERING

FROM THE ACADEMIC YEAR 2010 -2011

DEPARTMENT OF CIVIL ENGINEERING

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY:

BURLA, ODISHA

VSS UNIVERSITY OF TECHNOLOGY:BURLA, ODISHA
CIVIL ENGINEERING DEPARTMENT
Curriculum
for
M.TECH – WATER RESOURCES ENGINEERING (REGULAR)

First (Autumn) Semester:-

Course No.	Subjects	L	T	P	C
	Advanced Fluid Mechanics	4	0	0	4
	Engineering Hydrology and Hydrologic Systems	4	0	0	4
	Computational and Statistical Methods	4	0	0	4
	Elective – I	4	0	0	4
	Elective – II	4	0	0	4
	Hydraulic & Hydrologic Engineering Laboratory	0	0	6	4
	Seminar –I	0	0	3	2
	Comprehensive Viva Voce – I				2
	Total =	20	0	9	29

Second (Spring) Semester :-

Course No.	Subjects	L	T	P	C
	Water Resources Systems Planning and Management	4	0	0	4
	Open Channel Hydraulics	4	0	0	4
	Design of Hydraulic Structures	4	0	0	4
	Elective – III	4	0	0	4
	Elective – IV	4	0	0	4
	Computer Aided Design	0	0	6	4
	Seminar –II	0	0	3	2
	Comprehensive Viva Voce – II				2
	Total =	20	0	9	29

Third (Project) Semester:-

Course No.	Subjects	L	T	P	C
	Dissertation interim evaluation	0	0	0	10
	Comprehensive Viva Voce	0	0	0	3
	Seminar on Dissertation	0	0	3	2
	Total =	0	0	3	15

Fourth (Project) Semester:-

Course No.	Subjects	L	T	P	C
	Dissertation Open Defense				5
	Dissertation evaluation				20
	Total =				25

Grand Total = 96

Electives –I & II (First Semester):-

Water Power Engineering

Environmental Systems Engineering

Water Supply Systems

Neuro-Fuzzy Applications in Civil Engineering

Ecology, Microbiology & Environmental Chemistry

Electives – III & IV (Second Semester):-

Land & Water Management

Environmental Evaluation of Water Resources Development Projects

GIS Applications in Water Resources Engineering

Waste Treatment Systems

Computational Hydrodynamics

Sediment Transport

Groundwater Quality, Pollution and Control

Urban Drainage & Sewerage Systems

DETAILED SYLLABUS

SEMESTER - 1

ADVANCED FLUID MECHANICS

(CE/WRE/)

Instruction (Hours / Week) Lectures 4-0-0

Module I

Introduction: Survey of Fluid Mechanics, Structure of Fluid Mechanics Based on Rheological, Temporal Variation, Fluid Type, Motion Characteristic and spatial Dimensionality Consideration, Approaches in Solving Fluid Flow Problems, Fundamental idealizations and Descriptions of Fluid Motion, Quantitative Definition of Fluid and Flow, Reynolds Transport Theorem, Mass, Momentum and Energy Conservation Principles for Fluid Flow.

Potential Flow: Frictionless Irrotational Motions, 2 - Dimensional Stream Function and Velocity Potential Function in Cartesian and Cylindrical Polar Coordinate Systems, Standard Patterns of Flow, Source, Sink, Uniform Flow and irrotational vortex, Combinations of Flow Patterns, method of Images in Solving Groundwater Flow problems, Method of Conformal transformations.

Module II

Viscous Flow and Boundary Layer Theory: Study of Local Behavior, Differential Approaches in Analysis of Viscous Flows, Equations of Motion of a Viscous Flow, Navier – Stokes Equations, Exact and Approximate Solution of N – S Equations, Hele – Shaw Flow, Creeping Flow past a Sphere, Boundary Layer Concept, Prandtl's Boundary Layer Equations, Laminar Boundary Layer Along a Flat Plate, Integral Momentum Equation, Blassius Solution.

Module III

Turbulence in Fluid Flow: Origin of turbulence, Statistical Analysis of Turbulence, Reynolds Equations for Turbulent Flow obtained from N – S Equations, Models for Turbulence, Theories of Turbulent Shear Stresses, Velocity Distribution in Smooth and Rough Pipes, Resistance Coefficients for Pipes, Turbulent Boundary Layer and Boundary Layer Separation.

Module IV

Design and Testing of Models: Design of and Experiment, Dimensional Analysis, Complete Set of Dimensionless Parameters, Dimensional Analysis, Scale effect, Distorted Models, Practical Significance of Key Modeling Parameters, Design of Models and Model Tests.

Diffusion: Equations of Fluid Dynamics for a Mixture of Fluids, Dispersion of Pollutant in a Fluid Medium, Coefficient of Mass Transfer.

References:

1. Wand D.J., and Harleman D.R. (91964) "Fluid Dynamics", Addison Wesley.
2. Schlichting: (1976) "Boundary Layer theory", International Text – Butterworth
3. Lamb, H. (1945) "Hydrodynamics", International Text – Butterworth
4. Lamb, H.R. (1945) "Hydrodynamics", Rover Publications
5. Rouse, H. (1957), "Advanced Fluid Mechanics", John Wiley & Sons, N York
6. White, F.M. (1980) "Viscous Fluid Flow", McGraw Hill Pub. Co, N York
7. Yalin, M.S.(1971), "Theory of Hydraulic Models", McMillan Co., 1971.
8. Mohanty A.K. (1994), "Fluid Mechanics", Prentice Hall of India, N Delhi1

ENGINEERING HYDROLOGY AND HYDROLOGIC SYSTEMS

(CE/WRE/)

Instructions (Hours / Week) Lectures 4-0-0

Module I

Introduction: Hydrologic Cycle, Systems Concept, Hydrologic model classification. Hydrologic Processes: Reynolds Transport Theorem. Atmospheric circulation: Water Vapour, Precipitable water, Thunderstorm cell model. Evaporation: Energy balance method and Aerodynamic method. Evapotranspiration. Subsurface water: unsaturated flow, Richard's equation. Infiltration: Horton's and Phillip's equations. Green-Ampt Method, Ponding time. Surface Water: Hydrograph Analysis, SCS method, Effective Rainfall, Runoff, Runoff Components, Direct Runoff Hydrograph.

Module II

Unit Hydrograph Theory: Linear Time Invariant System, Response Functions of Linear Systems, Derivation of Non Parametric Unit Hydrograph From Single Storm and Multi Storm Events, S - Curve Hydrograph, Instantaneous Unit Hydrotherapy.

Rainfall – Runoff Analysis: Review of Rational Methods, Conceptual Models, Parametric Unit Hydrograph, Clarke, Nash and Dooge Models, Hydrologic Simulation Models, Stanford Watershed Model, Derivation of Unit Hydrograph for Ungagged Catchments, Synthetic Unit Hydrograph.

Module III

Hydrologic Time Series Analysis: Independent and Autocorrelated Data, Structure of a Hydrologic Time Series, Trend, Jump and Seasonality, Stationarity and Ergodicity, Autocovariance and Auto Correlation Function, Correlogaram Analysis, Spectral Analysis, Analysis of Multivariate Hydrologic Series. Modelling of Hydrologic Time Series: Data Generation Techniques, Linear Stochastic Models, Autoregressive, Moving Average, ARMA Models, Modelling of Nonstationary and seasonal Series, Thomas – Feiring Model, ARIMA Models.

Module IV

Hydrologic Flood Routing: Reservoir Routing, Channel Routing, Estimation of Parameters of Flood Routing Models, Flood estimation and flood frequency studies, Real Time Flood Forecasting.

References:

1. Chow, V.T., Maidment, D.R. and Mays, L.W. (1988), "applied Hydrology", McGraw Hill Inc. N York
2. Singh, V.P. (1986), "Hydrologic Systems,", Prentice Hall Inc., N York
3. Haan C.T., (1995), "Statistical Methods in Hydrology", East West Press, New Delhi
4. Viessman, W., Lewis, G.L. and Knapp, J.W. (1989), "Introduction to Hydrology", Harper & Row Publications Inc., Singapore.
5. McCueen R.H. and Snyder, W.M. (1985), Hydrologic Modelling – Statistical Methods and Applications", Prentice Hall Inc. N York.
6. Ponce, W.F. (1987), "Engineering Hydrology", Prentice Hll Inc. N York.
7. Meijerink A.M.J., H.A.M. de Brouwer, C.M. Mannaerts and C.R. Valenzuela, (1994)," Introduction to the use of Geographic Information Systems for Practical Hydrology, ITC Publication No. 23, UNESCO, Paris.
8. Kottegoda (1982), "Stochastic Processes in Hydrology", Prentice Hall, Inc., N Jersey
9. Hydrology and Water resources Engineering, by K.C. Patra, Narosa publishing house, New Delhi

COMPUTATIONAL AND STATISTICAL METHODS

(CE/WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module I

Numerical Solution of Ordinary Differential Equations-Solution by Taylors's Series-Euler's Method-Runge Kutta Methods-Simultaneous and Higher Order Equations-Boundary Value Problems-Applications. Finite Difference Method-Finite Difference. Representation of Differential Equations-Stability-Consistency and Convergence of Partial Differential Equations-Time integration-Finite Difference Methods in Solution of Steady and Unsteady Problem-Jacobi's Method, Gauss Seidel Method, Successive Over Relaxation Method and Method of Characteristics-Application and Examples.

Module II

Finite Element Method-Basic Concepts – Solution of Discrete Problems-Steady State and Time Dependent Continuous Problems-Application of Finite Method through illustrative Examples.
Classification and Presentation of Data – Basic Concepts of Probability – Probability Axioms – Analysis and Treatment of Data – Population and Samples – Measures of Central Tendency – Measures of Dispersion- Measures of Symmetry – Measures of Peakedness.

Module III

Probability Distributions – Discrete and Continuous Probability Distribution Functions – Binomial, Poisson, Normal, Lognormal, Exponential, Gamma Distributions, Extreme Value Distributions – Transformations to Normal Distributions, Selecting A Probability Distribution, Parameter Estimation – Method of Moments, Method of Maximum Likelihood, Probability Weighted Moments and Least Square Method, Joint Probability Distributions.

Module IV

Regression Analysis – Simple Linear Regression, Evaluation of Regression – Confidence Intervals and Tests of Hypotheses – Multiple Linear Regression – Correlation and Regression Analysis

References:

1. Akai, T.J,(1994) "Applied Numerical Methods for Engineers", John Wiley Inc., New York
2. Haan C.T. (1995), "Statistical Methods in Hydrology",. East West Press, New Delhi
3. Huyorkon, P.S. and Pinder, G.F.: "Computational Methods in Subsurface Flow", Academic Press, 1983.
4. Press, W.H., Flannery B.P. and Tenklsky, S.A. and Vetterling, W.T. "Numerical Recipes-The Art of Scientific Computing", Cambridge University Paress, Ccmbridge, 1994.
5. Kosho, B (1997), "Neural Networks and Fuzzy Systems", Prentice Hall of India, N Delhi
6. Rao V and H. Rao, (1996), "C^{++} Neural Networks and Fuzzy Logic, BPB Publications, New Delhi"

WATER POWER ENGINEERING

(CE/WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module-I

Instruction: Sources of Energy, Status of hydro power in the World. Transmission Voltages and Hydro-power, estimation of water power potential, General load curve, load factor, capacity factor, utilization factor, diversity factor, load duration curve, firm power, secondary power, prediction of load.

Module-II

Classification of Hydel Plants: Run off river plants, general arrangement of run off river plants, valley dam plants, diversion canal plants, high head diversion plants storage and pondage, Pumped storage plants: Types of Pumped storage plants, relative merits of two unit and three unit arrangement. Three unit arrangement, reversible pump turbines, problems of operation, power house, efficiency of P-S plants.

Module-III

Water Conveyance: Classification of penstocks, design criteria for penstocks, economical diameter of penstock, anchor blocks, conduit valves, types of valves, bends and manifolds, illustrative, water hammer, resonance in penstocks, channel surges, surge tanks. Intakes: Types of intakes, losses of intakes, air entrainment at intakes, inlet aeration, canals fore bay, tunnels.

Module-IV

Turbines: Introduction, types of turbines, hydraulic features, turbine size, constructional features of turbines, layout arrangements, hydraulic of turbines, basic flow equations, draft tubes, cavitations in turbines, governing of turbines, characteristics of turbines, illustrative examples.Power House Planning: Surface power stations: power house structure, power house dimensions, lighting and ventilation, variations in design of power house.Underground power station: Location of U.G. power station, Types of U.G. power stations, advantages of U.G. power house, components of U.G. power house, types of layout, limitations of U.G. power house structural design of power house.Tidal power: Basic principle, location of tidal power plant, difficulties in tidal power generation, components of tidal power plants, modes of generation, single basin arrangement, double basin system.

References:

1. Water Power Engineering by M.M. Dandekar and K.N. Sharma, Vani Educational Books
2. Irrigation and water resources Engg. By G.L. Asawa, New Age international Publishers.
3. Irrigation and water power Engineering by B.C. Punamia, Pande B.B. Lal (Laxmi Publications Private Limited)

ENVIRONMENTAL SYSTEMS ENGINEERING

(CE/WRE/)

Instructions (Hours / Week) Lectures 4 – 0 – 0

Module I

Physical phenomena: Transport, Gas Transfer – Two film theory, thermal phenomena, Sedimentation, Continuous Flow Models.
Chemical phenomena: Solution Equilibriums, Reaction Kinetics, Carbonate Equilibriums, Colloidal Behavior.

Module II

Biologic phenomena: Organic Materials, Microorganisms, Growth Kinetics, Biochemical Oxygen Demand, Aerobic and Anaerobic Decomposition.;
Ecological Systems: Models, Analytical Solutions, Time Domain Simulation, Continuous Flow Microbiological Systems, Pesticide Concentration, Eutrophication.

Module III

Natural Transport Systems: Basic Models Dissolved Oxygen System, Streams, and Estuaries.
Planning Factors: Water Quality Criteria and Standards, Radiological Health, Environmental Impact Statements, Population Growth Models, Regional Growth Model, Time Capacity, Expansion of Systems.

Module IV

Engineered Transport Systems: Pipe Network Analysis, Water Distribution Systems.
Water Treatment systems: Treatment Trains, Lagoon Systems, Individual Household Systems.

References:

1. Rich, L.G. (1973) “Environmental Systems Engineering”, McGraw Hill Inc.
2. Sincero, A.P. and Sincero, G.A. (1999) “Environmental Engineering - A Design Approach”, Prentice Hall of India, n Delhi.
3. Peavy H.S. Row D.R. and Tchobanaglous G (1995) “Environmental Engineering”, McGraw Hill International Edition
4. Hammer M.J. and Hammer M.J. Jr. (1996), “Water & Wastewater Technology”, Prentice Hall of India, N Delhi

WATER SUPPLY SYSTEMS

(CE / WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module I

Instructions: Water Requirements, Sources of Water, Water Supply Considerations, Water Quality, Drinking Water Standards Secondary Standards – Toxic Water Pollutants, Quality Criteria for Surface Water, Purpose of Water Treatment – Selection of Water Processes , Water – Processing Sludges.

Module II

Conventional treatment Processes: Sedimentation, Type of Sedimentation, Zone Setting, Filtration, Gravity Granular-Media Filtration, Head Losses, Back Washing and Media Fluidization – Pressure Filters – Slow Sand Filters, Coagulation and Flocculation Coagulants, Coagulants, Coagulant Aids, Rapid Mixing Devices, Disinfection, Disinfection Methods, CI2 handling and Dosage, Control of Thms, Fluoridation, Defluoridation.

Module III

Water Softening: Lime soda Process, Variations-Ion Exchange Softening and Nitrate Removal.
Iron and Manganese Removal: Iron Corrosion, Water Stabilization-Cathodic Protection.
Taste and Odour: Methods for Control, Aeration, Adsorption, Control of Algae Growth.
Reduction of Dissolved Salts: Distillation, Reverse Osmosis, Electro dialysis.

Module IV

Transportation and Distribution of Water: Aqueducts, Hydraulic Consideration, Design of Transportation System, Distribution Reservoirs and Service Storage.

References

1. Viessman Jr., Mark J. Hammer (1990) Water Supply and Pollution Control. Mc Graw Hill International Edition.
2. Peavy, H.S., H.S., Row, D.R. and Tchobanaglous, G. (1995) Environmental Engineering. Mc Graw Hill International Edition.
3. Fair, Geyer, Okun (1990) Water Supply Engineering. John Wiley.
4. Turbuit T H Y (1998) “Principles of Water Quality Control”, Pergamon Press.

NEURO FUZZY APPLICATIONS IN CIVIL ENGINEERING

(CE / WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module I

Introduction: Basic concepts of Neural Networks and Fuzzy Logic, Differences between conventional computing and Neuro-Fuzzy computing, Characteristics of Neuro-Fuzzy computing

Fuzzy Set Theory: Basic definitions and terminology and membership functions – Formulation and parameters, basic operations of fuzzy sets – complement, intersection vision, T-norm and T-conorm

Module II

Fuzzy Reasoning and Fuzzy Inference: Fuzzy relations, Fuzzy rules, Fuzzy reasoning, Fuzzy Inference Systems, Fuzzy modeling, Applications of Fuzzy reasoning and modeling in Civil Engineering Problems.

Fundamental concepts of Artificial Neural Networks: Model of a neuron, activation functions, neural processing, Network architectures, learning methods.

Module III

Neural network Models: Feed forward Neural Networks, Back propagation algorithm, Applications of Feed forward networks, Recurrent networks, Hopfield networks, Hebbian learning, Self organizing networks, unsupervised learning, competitive learning.

Neuro - Fuzzy Modelling: Neuro-Fuzzy inference systems, Neuro-Fuzzy control

Module IV

Applications of Neuro-Fuzzy computing: Hydrologic Modelling time series Analysis and modeling, Remote sensing, Environmental Modelling, Construction Management, Fault detection and rehabilitation of structures, Water Management, Prediction of Pile capacity, Transportation/ Traffic planning.

References:

1. Jang, JSR, C.T. Sun and E. Mizutani (1997), “Neuro-Fuzzy and Soft Computing”, Prentice Hall, N J.
2. Haykin, S.(1994), “Neural Networks, A Comprehensive Foundation”, McMillan College Publishing Company.
3. Kosko, B. (1997),”Neural Networks and Fuzzy Systems”, Prentice Hall of India Pvt. Ltd., New Delhi.
4. Klir, George J., T.A. Forger, (1995), “Fuzzy Sets, Uncertainty and Information”, Prentice Hall of India, Pvt. Ltd., New Delhi.
5. Rao V and H. Rao, (1996), “C++” Neural Networks and Fuzzy Logic, BPB Publications, New Delhi.

ECOLOGY, MICROBIOLOGY AND ENVIRONMENTAL CHEMISTRY

(CE / WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module I

Introduction: Levels of Organization in Nature and Scope of Ecology, Structure of Ecosystem, Ecosystem Function, Photosynthesis and respiration, Gross and Net Primary Production, Balance in Nature.

Energy in Ecosystem: Earth's Energy Budget, Ecosystem Energy Budget, Energy Flows Through Ecosystem, Efficiencies of Energy Transfer in Ecosystem, Pyramids, Food Chains and Food Webs, material Cycles in Ecosphere.

Module II

Population and Communities: Population, Some General Characteristics, Growth of Population, Growth Patterns, Dominance and Stability, the Competitive Exclusion Pattern, Survivorship Curves.

Hydrographic Characteristics: Thermal Classification of Lakes, Stratification in Shallow and Deep Lakes, Temperature Cycles in Lakes, Eutrophication, Effects and Control.

Microbiological Aspects in Water and Wastewater Treatment.

Microorganisms-Prokaryotic-EukaryoticCells-Structure-Characteristics-Classification-Ecological Adoption and Application in Environmental Engineering-Cultures-methods-Preservation-Stains and Staining, Virology.

Water Microbiology: Basic Concepts of Microbiology, Structures and Functions of Cell,

Biomolecules, Nature and Extent of microbial World, Metabolism, Energetics and Growth, Pathways of Aerobic and Anaerobic metabolism, Energy Transfer in Metabolism.

Module III

Environmental Factors affecting Microbial Growth – Growth Phases-kinetics-Enzymatic Reactions.

Microbiology of Water, Soil, Air – Distribution of Microorganisms, Indicator Organisms. Air, Water and Milk Borne Diseases – Control, Test for Coliforms E – Coli, Streptococcus, Differentiation of Coliforms, Significance, MPN Index, M.F. Technique, Biological Standards of Raw and Treated Water.

Module IV

Chemistry Aspects in Water and Wastewater Treatment, Significance, Analysis, Significance and Interpretation of Different Characteristics of Water and Wastewater.

Organic Chemistry and Biochemistry of Water and Wastewater, Buffers, Organic Reactions Involved in Water and Wastewater, Bio-Chemical Reactions, Solubility Product, Order of Equations, Rate Control Step, Factors Affecting Biochemical Reactions, Kinetics of Biochemical Reactions, Chemistry of Biodegradation of Foodstuffs, Detergents and Pesticides, BOD., Kinetics of BOD, Factors Affecting BOD,

Principles of Instrumentation Techniques

References

1. Sawyer, C.N. and McCarthy, P.L (1990), "Chemistry for Environmental Engineers", McGraw-Hill Book Co.
2. American Public Health Association Inc. New York, (1989), "Standard Methods for the Examination of Water and Wastewater",
3. McKinney R.E.: (1962) "microbiology for Sanitary Engineers", McGraw Hill Book Company Inc. New York
4. Brock, T.D. (1979) "biology of Microorganisms, Prentice – hall, Englewood Cliffs, N.J."
5. Stainer, R.Y., Adelberg, E.A. and Ingraham, J. (1979), "Microbial World" Prentice Hall, Englewood Cliffs, N.J.
6. Benefield, L.D. Judkins, J.F. and Weand, B.L (1980), "Process Chemistry of Water and Wastewater" Prentice Hall Inc., N.J.
7. Peavy H.S., Row D.R. and Tchobanaglous G (1995), "Environmental Engineering", McGraw Hill International Edition.
8. Tebutt T.H.Y. (1998) "Principles of Water Quality Control" Edition, Pergamon Press

HYDRAULIC AND HYDROLOGIC ENGINEERING LABORATORY

(CE/WRE/)

Instructions (Hours/Week) Lectures 0-0-4

1. Measurement of velocity profile in straight and meandering open channel;
2. Experiments on velocity distribution and Boundary shear in rough and smooth channels,
3. Discharge measurement by weir;
4. Measurement of Shear stress from velocity distribution obtained from Acoustics Doppler Velocimeter (ADV).
5. Measurement of rainfall, evaporation, infiltration, laboratory and field tests.
6. Characteristics of Hydraulic Jump in horizontal and Sloping Channels
7. Determination of Manning's N for Composite Sections
8. Velocity Distribution in Open Channels
9. Performance Characteristics of Centrifugal pumps
10. Measurement of Soil Water Tension and Determination of Soil moisture Potential
11. Rainfall – Runoff Studies
12. Determination of Water Quality and Wastewater Parameters
13. Water Softening by Lime – Soda Process
14. Determination of BOD And COD of a Wastewater
15. Collection of Ambient Samples and their Analyses
16. Determination of Infiltration Characteristics

SEMESTER -II

WATER RESOURCES SYSTEMS PLANNING & MANAGEMENT

(CE/WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module I

Introduction: General Principles of Systems Analysis to Problems in Water Resources Engineering, Objectives of Water Resources Planning and Development, Nature of Water Resources Systems, Socio Economic Characteristics.

Economic Analysis of Water Resources System: Principles of Engineering Economy, Capital, Interest and Interest Rates. Time Value of Money, Depreciation, Benefit Cost Evaluation, Discounting Techniques, Economic and Financial Evaluation, Socio-Economic Analysis.

Module II

Methods of Systems Analysis: Linear Programming Models, Simplex Method, Sensitivity Analysis, Dual Programming, Dynamic Programming Models, Classical Optimisation Techniques, Non-linear Programming, Gradient Techniques, Genetic Algorithm, Stochastic Programming, Simulation, Search Techniques, Multi Objective Optimisation.

Module III

Water Quantity Management: Surface Water Storage Requirements, Storage Capacity and Yield, Reservoir Design, Water Allocations for Water Supply, Irrigation, Hydropower and Flood Control, Reservoir Operations, Planning of an Irrigation System, Irrigation Scheduling, Groundwater management, Conjunctive Use of Surface and Subsurface Water Resources, Design of Water Conveyance and Distribution Systems.

Module IV

Water Quality Management: Water Quality Objectives and Standards, Water Quality Control Models, Flow Augmentation, Wastewater Transport Systems, River Water Quality Models and Lake Quality models.

Legal Aspects of Water & Environment Systems: Principles of Law applied to Water Rights and Water Allocation, Water Laws, Environmental Protection Law, Environmental Constraints on water Resources Development.

References:

1. Loucks, D.P., Stedinger, J.R. and Haith, D.A. (1982) “Water Resources Systems Planning and Analysis”, Prentice Hall Inc. N York
2. Chaturvedi, M.C. (1987), “Water Resources Systems Planning and Management”, Tata McGraw Hill Pub. Co., N Delhi.
3. Hall. W.A. and Dracup, J.A. (1975), “Water Resources Systems”, Tata McGraw Hill Pub. N Delhi
4. James, L.D. and Lee (1975), “Economics of Water Resources Planning”, McGraw Hill Inc. n York
5. Kuiper, E. (1973) “Water Resources Development, Planning, Engineering and Economics”, Buttersworth, London
6. Biswas, A.K. (1976) “Systems Approach to Water Management”, McGraw Hill Inc. N York
7. Major, D.C. and Lenton, R.L., (1979), “Applied Water Resources System Planning”, Prentice-Hall Inc, N.Jersey
8. Taha h A, (1996), “Operations Research”, Prentice Hall of India, N Delhi.

OPEN CHANNEL HYDROULICS

(CE/WRE/)

Instruction (Hours/Week) Lectures 4-0-0

Module I

Basic Concepts of Free Surface Flow, classification of flow, velocity & pressure distribution. Conservation laws, continuity equation, momentum equation, Specific energy, Application of momentum & energy equation, Channel transition, Hydraulic jump. Critical flow.
Uniform flow: flow resistance, equation of flow resistance, compound channel, Computation of normal flow depth.

Module II

Gradually varied flow, Governing equation, classification of water surface profiles, and computation of GVF. Unsteady Rapidly Varied Flow. Application of conservation laws. Positive and Negative Surges. Moving hydraulic Jump, Spillways, Energy dissipaters. Critical slope and limit slope

Module III

Hydraulics of Mobile bed channel, Initiation of Motion of sediment, Critical analysis of Shield's diagram, Bed forms, and Predication of bed form. Sediment load: Suspended load, Bed load, total bed material load, measurement and estimation of sediment load. Design of Stable Channels:, Regime and Tractive force Methods.

Module IV
Introduction to Bridge Hydraulics: Water ways, Afflux, Scour: Local scour, abutment scour, Indian practice of design for scour.

References:

1. Chow, .V.T. (1979) "Open Channel Hydraulics", McGraw Hill . N York
2. Henderson. (1966): "Open Channel Flow", McMillan Pub. London..
3. Subramanya, K (1996)"Flow in Open Channels", Tata McGraw Hill Pub., 1995
4. Grade and Ranga Raju, K.G. (1980): "Mechanics of Sediment Transportation and Alluvial Stream Problems", Wiley Eastem, N Delhi
5. Chaudhry M.H. (1994), "Open – Channel Flow", Prentice Hall of India, N Delhi
6. French, R.H. (1986), "Open Channel Hydraulics", McGraw Hill Pub Co., N York
7. Hamill L. (1999), Bridge Hydraulics, E & FN Spon, London

DESIGN OF HYDRAULIC STRUCTURES

(CE/WRE/)

Instructions (Hours / Week) Lectures 4 – 0 – 0

Module I

Concrete Dams : Investigation and Planning. Forces on Concrete dams, Types of loads, Stability analysis. Safety criteria, Gravity analysis, Internal stress calculation and Galleries. Joints and keys and cooling arrangement. Water stops at joint, closing gaps. Buttress and Arch Dam. Mass concrete for dams: Properties and quality control. Pressure grouting.

Module II

Spiilway : Types, Design principles of Ogee spillway, side channel spillway, Chute spillway, Syphon Spillway, shaft Spillway, Gates & Valves. Energy dissipators and stilling basin design. Outlet works.

Module III

Earth and rock fill Dams : subsurface explorations methods, cutoff trenches, sheet piling cutoffs, upstream blankets, horizontal drainage blankets and filters, toe drains and drainage trenches, pressure relief well. Seepage through embankments, Stability analysis of slopes of homogeneous and zoned embankment type under different reservoir conditions, Upstream and downstream slope protection measures.

Module IV

Diversion Head works: Components, Weir, Design of impervious floor, Khosla's theory

Canal Regulations works: Canal Fall, its type and design methods, Canal outlets.

References:

5. Varshney R.S. (1978) "Concrete Dams", Oxford & IBH Publication Co..
6. Stewart L., Flayd E. Dominy (1960) " Design of Small Dams", Oxford & IBH Publication Co..
7. Punmia B.C. Lal B.B. Pande, Jain A. K. Jain A. K. (1992), "Irrigation and Water Power Engineering", Laxmi Publications (P) Ltd.

GROUNDWATER DEVELOPMENT AND MANAGEMENT

(CE/WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module I

Hydrogeology: Porosity and Permeability of Rocks, Groundwater in Igneous, Metamorphic, Sedimentary Rocks and Non Industrated Sediments, Hydrogeological Regions of India, Surface and Subsurface Geophysical methods for Groundwater Explorations.

Module II

Well Hydraulics: Aquifers and Aquifer Parameters, Darcy's law, Hydraulic Conductivity and its Characteristics, Dupuit Equation, Groundwater Flow Direction Steady Groundwater Flow, Groundwater Flow Equation, Estimation of Aquifer Parameters from Pumping Test Data, Graphical Techniques and their Limitations, Groundwater Well Losses, Interference among Wells, Potential Flow, Image well theory and its Application in Groundwater Flow.

Module III

Water Well Design and Well Drilling: Well Screen, Development and Completion of Well, Rotary Drilling and Rotary Percussion Drilling, maintenance of Wells.

Module IV

Groundwater Management: Conjunctive Use, Alternative Basin Yields, Artificial Recharge of Groundwater, Groundwater Quality. Groundwater Modelling: Groundwater Flow, mathematical, Analog and Digital modeling, Regional Groundwater Modelling.

References:

1. Walton, W.C.(1970) "Groundwater Resources Evaluation", McGraw Hill Inc, n York
2. Todd, D.K. (1995), "Groundwater Hydrology", John Wiley & Sons, Singapore
3. Johnson, E.E. (1966),"Groundwater", E. Johnson Inc. Washington.
4. Raghunath, H.M. (1992) "Groundwater", Wiley Eastern Ltd, N Delhi
5. Sharma, H.D. and Chawla, A.S. (1977), "Manual on Groundwater and Tube Wells", Technical Report No. 18, CBIP, New Delhi,
6. Davis, S.N. and De Weist, R.J.M. (1966), "Hydrogeology", John Wiley & Sons, N York.
7. Domenico (1972),"Concepts and models in Groundwater Hydrology", McGraw Hill Inc. N York
8. Garg, S.P. (1993) "Groundwater and Tube Wells", Oxford and IBH Publishing C. N Delhi.

URBAN DRAINAGE AND SEWERAGE SYSTEM

(CE/WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module I

Urban Hydrological Cycle, Effects of Urbanisation on Catchment Hydrology, Need for Urban Drainage System, Planning Objectives, Interaction of Urban and Surrounding Areas.

Approaches to Urban Drainage, Urban Wastes and Urban Runoff Options for Waste Disposal, Separate and Combined Systems open Channels and closed Conduits, Wastewater and Stormwater Reuse, Data Requirements, Master Drainage Plans.

Module II

Elements of Drainage System Conveyance Elements, Appurtenances, Overflow Structures, Runoff Control, Pumping Stations.

Design Parameters, Design Period, Catchment, Physical Parameters, Process Parameters Rainfall, Water quality Parameters, Instrumentation for Data Collection.

Module III

Quantity of Stormwater, Stormwater Analysis, Rainfall Excess and Abstractions, Calculation of Runoff Volume and Peak Flow Hydrologic and Hydrodynamic methods.

Hydraulic Design of Conveyance Elements, Sizing of sewers and drainage Channels, Design of Appurtenances, Layout of Road Drainage, Layout of Pumping Stations.

Control Runoff and Pollution, On-site Storage and Use of Stormwater, infiltration, Detention and Retention Facilities for Stromwater Treatment, Erosion Control Measures.

Module IV

Stormwater Management Models.

Operation and Maintenance of Urban Drainage Systems. Interaction of Urban Drainage and Solid waste Management, Cleansing of Sewers and Drains, Repairs and Maintenance, Planning.

Operation and AdMaintenance of Urban Drainage Projects, Administrative Structure for Drainage Planning, Design and Operation, Economic and Financial Aspects, Legal Aspects.

References:

1. Hall M.J. (1984), “Urban Hydrology”, Elsevier Applied Science Publishers
2. Geiger, W.F. Marsalek, J.Zudima and Rawls, G.J. (1987 “Manual on Drainage in Urban Areas”, 2 Volumes, UNESCO, Paris.)
3. Geiger, W.F. and Jayakumar, K.V. (Ed.) (1996) “Lecture Notes of the V International Course on Urban Drainage in Developing Countries”, Regional Engineering Collage, Warangal..
4. Wanielista, M.P. and Yousef, Y.A. (1993), “Stormwater Management”, John Wiley and Songs, Inc., New York.

LAND & WATER MANAGEMENT

(CE/WRE)

Instructions (Hours/Week) Lectures 4-0-0

Module I

Irrigation Development in India – Planning of Irrigation Projects, Command Area Development Programmes

Physical and Chemical Properties of Soil, Soil Aeration, Classification of Irrigable Soils, Soil Survey, Soil management.

Module II

Soil – Plant – Water Relationships, Capillary and Non Capillary Pores, Water Relation of Soils, Infiltration, Hydraulic Conductivity, Water Movement through Soils, Soil Water Potential, Soil. Moisture Constants. Plant Water Relations, Rooting Characteristics. Evaporation and Evapotranspiration Measurements, Different methods of Estimating Evapotranspiration, Water Requirements of Crops, Irrigation Scheduling.

Module III

Watershed Management-Objectives-Water Conservation and Harvesting-Soil Erosion-Principles and Causes-estimation of Soil Loss-universal Soil Loss Equation-Control and Conservation-Land Capability Classification.

Module IV

Irrigation management-Land Grading and Field layout, Cropping Patterns, Fertilizers, On-farm Developments, Diagnostic Analysis of Irrigation System, Water Application Methods, Rotational water Distribution, Micro Irrigation, Water Logging and Salt Problems, Rotational Water Affected Soils, Drainage, Participatory Irrigation Management.

Reference:

1. Murthy, V.V.N. (1999), “Land and Water management Engineering”, Kalyani publishers, Ludhiana.
2. Scwabe G.O., Fangmeir, D.D. and Elliot W.J. (1996), “Soil and Water Management Systems”, John Wiley and Sons, N York
3. Michael, B.A.M(1990), “Irrigation”, Vikas Publishing House Pvt. Ltd. N Delhi
4. Withers and Vipond,S.(1980), “Irrigation-Theory and Practice”, Cornell University Press
5. Hutchinson (1973), “Irrigation, Drainage and Salinity”, FAO/UNESCO Publications Rome
6. Asawa; G.L. (1996), “Irrigation Engineering”, New Age International Pub. Co. N Delhi.
7. Hansen, V.E., Israelson O.S. and Stringham G.C. (1979) “Irrigation Principles and Practice”, John Wiley and Sons, N York.
8. Suresh, R.L. (1999), “Soil and Water Conservation Engineering”, Standard Publishing Co, Delhi.

ENVIRONMENTAL EVALUATION OF WATER RESOURCES DEVELOPMENT

(CE/WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module I

Introduction: Environment and its interaction with human activities – Environmental imbalances – Attributes, Impacts, Indicators and Measurements – Concept of Environmental Impact Assessment (EIA), Environmental Impact Statement, Objectives of EIA, Advantages and Limitations of EIA.

Module II

Principles of environmental engineering-Ecological diversity, its importance and conservation – Ecosystem evaluation, landscape- Main ecological elements- Diversity, matrices, patches, corridors – Interrelations of ecological elements in a cultural landscape –Reclamation and environmental engineering – Water resources and ecology – Saving endangered species – Wildlife laws and regulation – International and regional convention on environmental protection – Red data book.

Module III

Environmental Indicators – Indicators of r climate- Indicators for tereestrial subsystems – Indictors for aquatic subsystems – Selection of indicators – Socio-economic indicators- Basic information – Indicators for economy – Social indicators – Indicators for health and nutrition – Cultural indicators – Loss of economic options – Selection of indicators

Environmental issues in water resource development – Land use – Soil erosion and their short and long term effects – Eco system studies – Flora – Fauna – Aquatic and terrestrial ecosystems, ecosystem balance – Disturbance and long term impacts – Changes in quantity and quality of flow – Sedimentation – Environmental impact assessment of water resource development structures – Case studies.

Module IV

Water Quality Impact Assessment: Attributes to be Considered, Water Quality Impact Assessment of Water Resources Projects, Data Requirements of Water Quality Impact Assessment for Dams, Impacts of Dams on Environment, Case Studies.

Methodologies for Carrying Environmental Impact Assessment: Overview of Methodologies Adhoc, Checklist, Matrix, Network, Overlays, benefit Cost Analysis, Choosing A Methodology, Review Criteria.

References:

1. Jain, R.K., Urban, L.V., Stracy, G.S., (1991), “Environmental Impact Analysis”, Van Nostrand Reinhold Co., New York.
2. Rau, J.G. and Wooten, D.C., (1996), “Environmental Impact Assessment”, McGraw Hill Pub. Co., New York.
3. UNESCO, (1987), “Methodological Guidelines for the Integrated Environmental Evaluation of Water Resources Development”, UNESCO/UNEP, Paris
4. Canter, L.W., (1997), “Environmental Impact Assessment”, McGraw Hill Pub. Co., New York

GIS APPLICATION IN WATER RESORUCES ENGINEERING

(CR/WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module-I

Introduction – Scope of Remote Sensing and GIS in Water Resources and Environmental Systems – Geomorphological, Hydrological and Land Use Mapping.

Module-II

Evaluation of Water Resources Potential – Rainfall runoff modeling using remote sensing inputs.
Flood and Drought Studies – Flood plain zoning – inundated areas – evaluation models – Drought assessment and Monitoring. Command Area Studies – Cropping patterns, conditions of crops, irrigation system performance – crop yield estimation.

Module-III

GIS, Hydrology and Resources Management – Watershed development, management options, inventory.Remote Sensing in Snow Cover Studies – Snowmelt Runoff.

Module-IV

Reservoir Sedimentation – Erosion and Deposition – Catchment Area Treatment – Estimation of Sediment Load – Use of Models.Environmental Applications- Urban Stormwater studies – Solid waste management – wetlands, nonpoint source pollution.

References:

1. Meijerink A.M.J., H.A.M. de Brouwer, C.M. Mannaerts and C.R. Valenzuela, (1994), Introduction to the use of Geographic Information Systems for Practical Hydrology, ITC Publication No. 23, UNESCO, Paris.
2. Lillesand T.M. and Kiefer R.W., (1994) “Remote Sensing and Image Interpretation”, John Wiley and Sons, N York.
3. Swain P.H., and S.M. Davis, (1987), “Remote Sensing – The Quantitative Approach”, McGraw Hill Publishing Company, N York.
4. Lyon, J.G. and Mc Larthy, J., (1996), “Wetland and Environmental Application of GIS”, Lewis Publishers, Washington.

WASTE TREATMENT SYSTEMS

(CE/WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module-I

Instructions: General Characteristics of Industrial Effluents, Effects on Environment.
Pretreatment of Industrial Wastewater, Advanced Waste Treatment Methods.

Module-II

Biological Waste Treatment: Aerobic and Anaerobic Treatment Principles, ASP – Conventional ASP, Modifications and Design Equations, Process Design Criteria, Oxygen and Nutrient Requirements.
Oxidation Ponds: Classification and Design of Oxidation Pond. Anaerobic Attached Growth Systems: Advantages of Process, Design of the Trickling Filters, Nitrification and DE nitrification.
Anaerobic Treatment Process: Principles – Design of Digester Tank, Sludge Treatment.

Module-III

Major Industrial Effluents: Sources, Characteristics and Treatment, A) Food industries: Sugar, Dairy, Distilleries B) Chemical: Paper and Pulp, Tanneries, Textiles. Meteorology and Air Pollution: Factors Influencing Air Pollution, Lapse Rates and Dispersion, Atmospheric Stability, Plume Rise, Gaussian Dispersion Models, Application of Tall Chimneys for Pollutant Dispersion. Control of Air Pollution: Mechanisms of Control of Particulate and Gaseous Pollution, Design of Setting Chambers, Cyclones, Scrubbers, Fabric Filters and ESP, Working of Absorption, Adsorption, Combustion and Condensation Equipment, Air Pollution Act.

Module-IV

Soil Waste: Characteristics, Collection, Storage and Disposal Methods, Solid Waste Management, Leachate Analysis and Control Measures.

References:

1. Numerow, N.L. (1975), “Liquid Waste form industry - Theories, Practice and Treatment”, McGraw Hill Publishing. Co., New York
2. Wark K. and Warner L.F. (1981), “Air Pollution, Its Origin and Control”, McGraw Hill Pub. Co., N York
3. Crawford, M. (1980) “Air Pollution theory”, Tat McGraw Hill Pub. Co., N Delhi
4. Metcalf and Eddy (1995) “Wastewater Engineering – Collection, Treatment, Disposal and Reuse”, Tata McGraw Hill Pub. Co., N Delhi.
5. Peavy H.S. Row D.R. and Tchobanaglous G.(1988), “Environmental Engineering”, McGraw Hill International Edition, N York

COMPUTATIONAL HYDRO-DYNAMICS

(CE/WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module-I

Ordinary and Partial differential equations, well-posed, ill-posed problem, Finite difference schemes, Stencil diagrams, basic aspect of discretization, truncation error, implicit and explicit types, accuracy, convergence, errors and stability analysis,

Module-II

Von Neumann method, CFL condition, some hydrodynamic techniques – Lax-Wendroff, MacCormack, Crank-Nicolson, staggered grid, ADI, ADE, pressure correction.

Module-III

SIMPLE and SOLA algorithm, method of characteristics, finite element method. Variational and weighted residual formulations, applications to steady and unsteady flows.

Module-IV

Pollutant dispersion, flood wave propagation, tidal model, applications with computer programming, etc.

References:

1. Computational Fluid Dynamics: John D. Anderson, Jr.
2. Computational Fluid Dynamics: T. J. Chung
3. Computational Fluid Mechanics and Heat Transfer: Series in Computational and Physical Processes in Mechanics and Thermal Sciences: John C. Tannehill, Dale
   A. Anderson and Richard H. Pletcher
4. Computational Methods in Surface/Subsurface Flow & Transport Problems:
   Computational Methods in Water Resources XI, Volume 1 & 2 : A.A. Aldama and J.Aparicio
5. Computational Methods in Subsurface Flow & Transport Problems:
   Computational Methods in Water Resources XI, Volume 2: A.A. Aldama and J. Aparicio
6. Computational Fluid Dynamics: Principles and Applications: J.Blazek

SEDIMENT TRANSPORT

(CE/WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module-I

Properties of sediment. Initiation of motion of sediment. Analysis of non-cohesive sediment movement. Shield's diagram. Critical shear stress, critical velocity, lift on particles, Hydraulic relations for alluvial streams.

Module-II

Sediment Sources & sediment yield: Gross erosion, sediment yield, delivery ratio, estimation of sheet erosion, Universal soil loss equation (USLE), different factors affecting erosion process .Sediment delivery ratio from watershed, flow duration curve and sediment rating curve, reservoir sedimentation: empirical equations, trap efficiency, sediment control method.

Module-III

Fundamentals of sediment transport: general relationships. Bed forms. Wash load, suspended load and Bed load, Rouse equation for suspended sediment load. Sediment discharge formulas by DuBoys, Mayer-Peter & Muller, Schoklitsch, Einstein-Brown and Engelund-Hansen. Sediment sampling,

Module-IV

Introduction to Meandering of rivers and river engineering. Scour: local scour at a bridge & abutment, Indian codal provision for design scour depth.

References:

1. Manuals and Reports on Engineering Practice No. 54, Sedimentation Engineering : Vito A. Vanoni
2. Sediment Transport (Theory and Practice): C.T. Yang
3. Sediment and Ecohydaulics (INTERCOH 2005): T. Kusuda, H. Yamanishi, J. Spearman, and J.Z. Gailani
4. Mechanics of Sediment Transportation and Alluvial Stream Problems: R.J. Garde, K.G. Ranga Raju
5. Sediment Transport (in 3 parts), ASCE: L. van Rijn
6. Hydraulics of Sediment Transport : W.H. Graf
7. Fundamentals of Fluvial Geomorphology: Ro Charlton
8.

GROUNDWATER QUALITY, POLLUTION AND CONTROL

(CE/WRE/)

Instructions (Hours/Week) Lectures 4-0-0

Module-I

Sources of salinity, measures of water quality, chemical analysis, concentration by weight, chemical equivalence, total dissolved solids, hardness, biological analysis, water samples,

Module-II

Water quality criteria, drinking water standards, industrial water criteria, irrigation water criteria, dissolved gases, changes in chemical composition, temperature, saline ground water

Module-III

Sources of Pollution of ground water and causes, liquid waste, municipal and industrial sources, tanks and pipe line leakages, mining activities, agriculture sources and causes, miscellaneous sources and causes, septic tank and cesspool,

Module-IV

Saline waste intrusion, attenuation of pollution, filtration, sorption, chemical processes, dilution, distribution of pollution, pollution potential and evaluation, ground water quality monitoring.

References:

1. Bear and A. Verruijit, Modelling of Groundwater flow and pollution, 1988
2. Groundwater Manuals, A water resources technical Publications, Scientific Publishers, Jodhpur
3. Water quality in catchment eco-system, A.M. Gower, John Wiley & sons.
4. Groundwater Resources Evalution, Walton, Mc Graw Hill.

COMPUTER AIDED DESIGN

(CE/WRE/)

Instructions (Hours/Week) Lectures 3 + 0

1. Parameter Estimation Through Regression
2. Design and Analysis of water Distribution Network
3. Design of Sewer Network
4. Design and Analysis of Hydraulic Structures.
5. Digital Simulation of Regional Aquifers
6. Determination of Design Flood
7. Watershed Modelling:
   a. Unit Hydrograph Models
   b. Synthetic Unit Hydrograph Models
8. Estimation of Crop Water Requirements and design of an Irrigation System
9. Design and Operation of a Reservoir
10. Irrigation Scheduling
11. Diagnostic Analysis of Irrigation Systems
12. Stream Flow Analysis and Simulation
13. Design of Urban Storm water System