CE 5001: MATERIAL SCIENCE & CONCRETE TECHNOLOGY

Theory:

Unit-1:

Structure of Solid materials, Atoms and bonds, Inter-atomic and Intermolecular bonds, Crystals, Classification of solids.

Mechanism of elastic and plastic actions in Tension, Compression, Pure bending and torsion, Elastic and inelastic Properties of solids, dislocations, Strain hardening, Triaxial stress.

Unit-2:

CREEP: Components of creep fracture, analysis of creep curves, method of predicting creep strength, Designing of creep.

FATIGUE: Fatigue loading, mechanism, factors affecting creep fatigue properties, S.N. Diagrams.

HARDNESS: Relation between hardness of different Atomic structure measurement of hardness with other mechanical properties.

Unit-3:

CONCRETE MATERIALS: Cement, Manufacture, Composition, Structure, Hydrated Cement Paste, heat of Hydration, Test for physical properties, different types of Cements, properties of aggregates.

FRESH CONCRETE: Workability, Factors affecting, Testing, vibration analysis of fresh concrete.

STRENGTH OF CONCRETE: Nature of strength, Factors affecting, Autogenous heating, Maturity of concrete, Fatigue strength, Impact strength.

Unit-4:

ELASTICITY SHRINKAGE AND CREEP: Modulus of elasticity, Dynamic Modulus, poisons ratio, early volume changes, swelling, shrinkage, creep factors influencing creep nature. Rheological models, effects and design for creep.

DURABILITY OF CONCRETE: Permeability of concrete, Thermal properties of concrete, resistance of concrete to Fire, Resistance to abrasion, Electrical properties, Acoustic properties, Chemical attack.

Unit-5:

TESTING OF HARDENDED CONCRETE: Destructive and non destructive testing of concrete, Tests on composition of hardened concrete, variation of test results, Accelerated testing of concrete.

MIX DESIGN: Basic consideration, factors in choice of mix. Proportion, Methods of mix design, I.B.C. Murdock, A.C.I. Method based on Road note No. 4, Design of different types of concrete: light weight and high density.

Books & References Recommended:

1. Concrete Technology by Neville
2. Concrete Technology by Shetty

CE-5002 : SYSTEM MATHEMATICS & MATHEMATICAL MODELLING

Theory:

Unit-1 :

Concept of a System & System Analysis, Mathematical Modelling. Introduction to Mathematical Programming Techniques viz – Non Linear Programming, Geometric Programming, Quadratic Programming, Linear Programming, Dynamic Programming, Game Theory ect. Assignment & Transportation problems, their formulations & solutions.

Unit-2:

Linear Programming, formulation, Graphical solution, Simplex method, BIG-M & Two Phase methods, Duality in LP, Revised Simplex.

Unit-3 :

Network Analysis, CPM-PERT technique, Project Optimality Analysis, Updating, Dynamic Programming, Stage Coach Problem & its D.P. solution.

Unit-4 :

Measures of Central Tendency, Central Limit Theorem, Statistical Frequency distributions, Additional and Multiplication laws of Probability, Baye's Theorem, Mathematical Expectation, Binomial, Poisson, Normal 't', 'F' & Square Distributions, Tolerance limits, Confidence limits, Tests of Significance, Analysis of Variance.

Unit-5 :

Linear & Non-linear Regression Analysis, Testing of Hypothesis, Acceptance Sampling, Fundamentals of Simulation, Introduction to Sensitivity Analysis, its limitations.

Books & Reference Recommended:

1. Operation Research by Phillips & Ravindran
2. Operation Research by TAHA
3. Probability, Statistics & Decision in Civil Engineering by Benjamin & Cornell
4. Optimization by S.S. Rao

CE 5203: DESIGN OF DIVERSION STRUCTURES

Theory:

Unit-1:

INTRODUCTION: Diversion scheme and their components, water distribution network, components of network Introduction to various structures provided in a distribution network.

CANALS: Design of canals, Kennedy's and Lacey's Theory of Channel Design, Design of Stable Channels considering concepts of sediment transport, Design of Lined Channels.

Unit-2:

STRUCTURES ON PERVIOUS FORMATIONS: Introduction, Bligh's Creep Theory, Lane's Weighted Creep Theory, Potential Flow. Theory, Properties of Flow Net, Plotting of Flow Net, Khosla's Theory of Independent variables, Method of Electrical Analogy, Seepage Force and Safety against piping, Inverted Filter, Design Considerations, Design for Surface and Sub-Surface Flow, Scour Considerations, Structural Designing.

Hydraulic Jump Phenomenon, Critical Flow, Normal and Sequent Depths, Critical Depth, Forms of Hydraulic Jump, Plotting of Pre-jump and Post jump Profiles, Energy Dissipation in Jump Formation.

Unit-3:

CANAL HEAD WORKS: Weirs and Barrages, Distinction, Types of Weirs, Layout of Diversion Headwork, Design of Vertical Drop Weir, Concrete Weir, Design of Barrage, Effect of Construction of a Headwork on the River Regime, Design of Head Regulator as Intake at the Headwork site, Design of Wing walls.

Unit-4:

CANAL REGULATION STRUCTURES: Necessity of Functions and Regulation Structures like Head and Cross Regulators, Canal Falls, C.D. Works, Outlets etc. Type of Falls, C.D. Work and Outlets, Design of Junction (HR & CR), Design of Sharda Type Fall, Glacis Fall, Baffle Fall.

Unit-5:

CROSS DRAINAGE WORKS: Introduction to Transitions, Contracting Transitions, Expanding Transitions, Mitra's and Chaturvedi's Approach for Design of Transition, Hind's Transitions. Design of Aqueduct, Syphon Aqueduct, Super passage, Canal Syphon. Sediment Control and Exclusion at Headworks, Sediment Excluder & Ejector, Design of Sediment Excluder, Design of Sediment Ejector. Outlet works, Design of Sluice, Meters, Venturi Flume, Standing Wave Flume, Parshall Flume, Escapes.

Books & Recommended:

1. Theory & Design of Irrigation Structures Vol.II by Varshnay Gupta & Gupta.
2. Irrigation & Water Power Engg. By Punmia Lal.
3. Irrigation & Hydraulic Structure by S.K. Garg.

CE 5204 HYDROLOGIC ANALYSIS

Theory:

Unit-1:

Introduction, Review of Hydrological Cycle Components, Precipitation, Measurement, Collection and Preliminary Processing of Data, Runoff from Empirical Formulae.

PRECIPATION ANALYSIS: Depth Area Relations, D.A.D. Analysis, maximization of Storm, Intensity Duration-Frequency Relationship, Probable Maximum Precipitation, Probable Maximum Maximum storm, Critical strom sequences for estimation of Design Flood Hydrograph.

Uni-2:

ABSTRACTIONS FROM PRECIPITATION: (a) Evaporation: Evaporation Process, Evaluation of Evaporation, Measurement, Empirical formulae, Water Budget and Mass Transfer Methods, Energy Budget Method, Methods of Reducing Evaporation from Reservoirs.(b) Evapotranspiration : Transpiration, Evapotranspiration, Measurement of Evapotraspiration, Lysimenters, Analytical Estimation of Evapotranspiration, Penman's Method, Empirical Formulae.(c) Initial Loss: Interception and its Measurement, Depression Storage.(d) Infiltration: Infiltration Process, Infiltration Capacity, Measurement of Infiltration, Infiltrometer, Rainfall Simulator, Infiltration Indices.

Unit-3:

STREMFLOW MEASUREMENT: Introduction, Measurement of Stage, Measurement of Streamflow, Area Velocity Method, Dilution Technique, Indirect Methods, Rating Curve and its Extension, Hydrometry Stations.

RUNOFF: Runoff Characteristics of Streams, Yields, Dependable Yield, Rainfall-Runoff Correlation, Watershed Simulation, Flow-Duration Curve.

Unit-4:

HYDROGRAPH ANALYSIS: Hydrograph & its Components, Direct Runoff and Base Flow, Analysis of Recession Curve, Recession Constants, Base Flow Separation, Effective Rainfall, Unit Hydrograph & its Applications, Derivation of Unit Hydrograph, Conventional Method, Collin's Method, Method of Least Squares, Instantaneous Unit Hydrograph, Change of Unit Period of a U.H., S-Curve, Relationship Between UH & IUH, Averaging of U.H., Conceptual Models for IUH Derivation, Derivation of U.H. by Nash Model & Clark's Concept, U.H. for Ungauged Catchments, Snyder Method, Taylor & Schwartz Method, Dimension-less U.H., Limitations of U.H.

Unit-5:

DESIGN FLOOD: Definition, Peak Flood Determination Methods, Rational Method, Empirical Formula, Unit Hydrograph Approach using PMS, Flood Frequency Studies, Frequency Factors, Gumbel's Method, Log Pearson Type III Method, Power Transformation Method.

FLOOD ROUTING: Reservoir Routing, Modified Puls Method: Channel Routing, Hydraulic and Hydrologic Routing, Saint Venant's Equation, Kinematic Wave Routng, Muskingham Method, Modified Muskingham Method, Muskingham Cunge Method, Variable Coefficient Method.

Books Recommended:

1. Engg. Hydrology by Subramanya
2. Hydrology by K.N. Mutreja
3. Hydrology by Jaya Remi Raddy

CE 5206: GROUND WATER HYDROLOGY

Theory:

Unit-1:

INTRODUCTION: Hydrological Cycle, History of Ground Water Resource: Evaluation, Ground Water Investigations.

GROUND WATER FLOW AND AQUIFER PROPERTIES: Interstices, Porosity, Specific Yield and its determination, Coefficients of Storage, Permeability and Transmissibility, Water Yield Properties, Characteristics of Aquifers, Ground Water Exploration, Presentation of Hydro Geological Data.

Unit-2:

WELL HYDAULICS: Darcy's Law, Volume Elasticity of Aquifers, Differential Equations Governing Ground Water Flow. Hydrogeological Boundaries, Flow from and to Streams, Numerical analysis of Water Levels, Drawdown, Nonleaky Isotropic Artisan Aquifer, Nonleaky Anistropic Artisan Aquifer, Water Table Aquifer, Leaky Aquifer, Boundary Conditions, Salt Water Encroachment.

Unit-3:

WATER WELL DESIGN AND CONSTRUCTION: Grain size Distribution Curves, Artificial and Natural pack, Production Wells, Screens and Castings, Production Well Specifications, Production Well Construction, Collector Wells, Well Production Test, Maintenance of Production Wells.

Unit-4:

GROUND WATER RECHARGE AND RUNOFF: Recharge by Vertical Leakage, Artificial Recharge, Ground Water Models, Ground Water Runoff, Hydrologic Budget, Ground Water Budget.

QUALITY OF GROUND WATER: Chemical Analysis, Dissolved Constituents and Gases, medionclides, Absorption and Sulphate Reduction Physical Analysis and Bacterial Analysis, Interpretation of Chemical Analysis, Relationship of Quality to Use, Changes in Quality.

Unit-5:

HYDROGEOLOGY SYSTEMS ANALYSIS: Analytical Approach, Model Aquifiers and Mathematical Model Computation by Digital Computer, Electric Analog Computer Approach, Analog Models, Excitation Response apparatus.

DEVELOPMENT AND MANAGEMENT OF AQUIFERS: Ground Water Development Problems, Ground Water Use, Ground Water Rights, Ground Water Legislation, Land Subsidence due to Ground Water Withdrawals.

Books Recommended:

1. Ground Water by Ragunath.
2. Ground Water Hydrology by Todd.
3. Ground Water by Walton.
4. Analysis of Pumping Test Data, ILRI Publication.

CE 5242: COMPUTER PROGRAMMING

Theory:

Unit-1:

Computer organization, Hardware and Software, Input and Output devices, analog and digital computers, personal computer organization.

Unit-2:

Principles of programming and flow charting, programming language, interpreter and compiler language, Fortran Language or Basic language of programming Variables and Constants, Statements, Conditional and non-conditional transfer of controls, Do loops and computed GO TO statements, DIMENSION statements.

Unit-3:

Subscripted variables, Function and subroutine programmes.

Unit-4:

Overall structure of fortran programme – Structured programming, programming errors – logical errors, machine errors, truncation errors, syntax errors etc.

Unit-5:

Computer programming for Numerical methods.

Books & References Recommended:

1. Ram Kumar, Tata Mc Graw Hill Co. Ltd., New Delhi, Programming with Fortran 77.
2. S.Lipschutz & A Pue, Mc Graw Hill Co. LW., Theory and Problems of Programming with Fortran.

CE 5252: DESIGN OF STORAGE STRUCTURES

Theory:

Unit-1:

INTRODUCTION: Storage Scheme and their components, Types of Structures used.
RESERVOIR PLANNING AND INVESTIGATION: Review of Reservoir Planning and Investigation Aspects, Reservoir Sedimentation, Measurement of Sediment Yield, Trap Efficiency, Distribution of Sediment, Life of Reservoir, Sedimentation Control, Apportioning of Costs of Multi-purpose River Valley Projects.
DAMS: General Selection of type of Dam, Site Selection, Economic Size, Geological Investigations, Investigation Programme, Engineering Properties of Foundations, Foundation Treatment, River Diversion Aspects for Construction of Dam.

Unit-2:

EARTH DAMS: Introduction, Foundation for Earth Dams, Causes of failure, Design Criteria, Prevention of Embankment Corrosion, Seepage through dams, Pheratic Line, Stability of Slopes, Seepage Control through Foundations, Drainage in Earth Dams, Selection of Type of Earth Dam, Foundation Treatment, Maintenance of Earth Dams.
ROCK FILL DAMS: Definition and Types, Foundation requirements and Treatment, Membrane cutoff, Embankment Design, Membrane Design.

Unit-3

GRAVITY DAMS: General, Profile Shape, Forces acting on the Dam and their Estimation, Earthquake forces and their Effects, I.S. Load Combinations, Design Concepts and Criteria, Gravity Method of Stability Analysis, Stress Analysis, Internal stresses, Openings in Gravity Dams and Stress Concentration Around Opening, Design of Galleries and Shafts, Joints and keys in Gravity Dams, Design of High Dams.

Unit-4:

SPILLWAYS: Need, Functioning, Capacity Determination, detailed Design of Ogee Spillways, Introduction to Design of Syphon, Chute, Side Channel and Shaft Spillways, Considerations of Side Walls.
GATES and VALVES: General, Types of Control Gates, Control Valves, Spillway Gates and their Functioning, Introduction to design of Radial Gates, Introduction to design aspects of Arch and Buttress Dams, Raising and Strengthening of Concrete Dams, Instrumentation in Dams, Economical Construction of Concrete Dams.

Unit-5:

ENERGY DISSIPATING DEVICES: Necessity, Location and Types of Energy Dissipaters, Hydraulic Jump Type and Bucket Type Dissipaters, Design of I.S. Stilling Basins, Type I to IV, Design of Solid and Slotted Roller Buckets, Design of Trajectory Bucket Type of Dissipaters.

Books & References Recommended:

1. Concrete Dams by R.S. Varshnay.
2. Concrete Dam by H.D. Sharma
3. Earth & Rock Fill Dams by Bharat Singh & H.D. Sharma.
4. Hand book of Dam Design by Golze.

CE 5253 : STOCHASTIC HYDROLOGY

Theory :

Unit-1

INTRODUCTION: Definition and Terminologies, Stochastic and Time Series models, Characteristics of Annual Periodic, Multi-Variate and Intermittent Hydrologic Time Series.

PROBABILITY AND STATISTICS: Basic Concepts of Probability and Probability Distribution, Samples and Population, Properties of Random Variables, Moments and expectations for Univariate Distribution Random Varibles, Tendency, Dispersion Symmetry, Peakedness, Moments of Expectations for Jointly Distributed Ramdom Variables.

Unit-2:

PROBABILITY DISTRIBUTIONS: discrete Probability Distributions viz. Binomial, Poision, Exponential distributions, Continuous Probability Distributions viz Normal, Lognormal, Extreme Value Type 1 and 3, Pearson, Log Person Type 3 and Gamma Distributions.

PARAMETER ESTIMATION: General Methods of Parameter Estimation, Method of Moments, Maximum Likelihood, Probable Weighted Moment Method, Principle of Maximum Entropy.

Unit-3:

CONFIDENCE INTERVALS AND HYPOTHESIS TESTING: Confidences Intervals, Mean and Variance of Normal Distribution, One side confidence intervals, Hypothesis Testing for different cases, Chi-Square Goodness of fit Test. The Kolmogorov-Smirnov Test., D-Index Test.

Unit-4:

TIME SERIES MODELLING: Analysis of Hydrologic Time Series, Cross Correlation, Serial Correlation, Variance and Covariance, Spectral Analysis, First Order Markov Process, Multi Site Markov Model.

Unit-5:

Autoregressive Modelling, First and Second Order Models for Annual and Periodic Time Series Description of ARMA Modelling of Annual and Periodic Time Series, limitations, Auto Regressive Integrated Moving Average Modelling of Time Series, Multiplicative ARIMA Modelling of Periodic Time Series, Pre-Treatment of Historical Data Model Selection and Application.

Books & References Recommended:

1. Stochastic Hydrology by Jaya Rani Raddy.
2. Statistical Methods in Hydrology by C.T.Haan.
3. Hydrologic Time Series Modelling y Sales & Delleur.
4. Frequency & Risk Analysis by G.W.Kile.
5. Frequency Analysis, NIH Publication.

CE 5255: WATER RESOURCES SYSTEMS ENGINEERING

Theory:

Unit-1:

INTRODUCTION: Introduction to Water Resources Planning, Concept of a system, Terminology and Definition of Terms, Need of Systems Analysis of Water Resources Problems, Systems Approach, Characteristics of Systems Analysis Applications.

Problems in Water Resources Engineering: Development Problems, Design Problems, Operational Problems, recapitulation, Statistical Applications, Stochastic Processes and Water Storage, Storage Control Problems.

Evaluation of Time Streams of Benefits and Costs, Project Sizing Interest and Discount Rate, Determination of Net Economic Benefit Discounting Technique, Cost Estimation Procedures, Basic Investment, Timing Problems, Feasibility of Interim Alternatives.

Unit-2:

MATHEMATICAL PROGRMMING TECHNIQUES: Review of Various Mathematical Programming techniques viz. Method of Lagrangian Multipliers, Linear Programming, Dynamic Programming, Integer Programming, Goal Programming, Simulation and Search Methods.
Introduction, The Monte Carlo Method, Generation of Synthetic Stream flow data, Case Studies.

Unit-3:

DETERMINISTIC RIVER BASIN MODELLING: Reservoir Capacity Determination, Mass Diagram Analysis, Sequent Peak Analysis, Optimization Analysis, Capacity Expansion Problem using Integer Programming and Dynamic Programming Models.

Unit-4:

Reservoir Operation Problem, Deterministic & Stochastic D.P. Models, Reservoir Storage Yield Models, Flood Control Problem, Model Synthesis, Case Studies.

Unit-5:

IRRIGATION PLANNING AND OPERATION: Model for Optimal Cropping Pattern, Irrigation Planning Model, Resource Inputs, Crop Diversification, Annual Costs, Annual Net Income and Net Benefits, Irrigation Operation Model, Case Studies.

Books & References Recommended:

1. Planning & Analysis of Water Resources Systems by Loucks, Stedinger & Haith.
2. Stochastic Water Resources Technology by N.T. Kottegoda.
3. Water Resources Systems by Vedula & Majumdar.

CE 5256: WATER MANAGEMENT

Theory:

Unit-1:

INTRODUCTION: General, Surface Water Sources, Ground Water Sources, Need for Planned Utilization of Water Resources, Economics of Water Resources Utilization.

Irrigation requirement: Soil Water Plant Atmospheric relationship, Irrigation Efficiency, Water Requirements of Field Crops, Evapotranspiration, Effective Rainfall, Field Capacity and its determination, Wilting Coefficient, Crop Planning, Cropping Pattern, Criteria for Irrigation Scheduling.

Unit-2:

ON FARM DEVELOPMENT: Introduction, On Farm Development, Land Consolidation, Water Courses Pipe System, Field Drains, Land Grading and Field Layout, Maintenance of Water Courses.

Planning for Release of Water in Conveyance System, Methods of Water Measurement, Weirs, Parshall Flumes, Orifices and Metergates, Tracer Method, Measurement within outlet command.

Unit-3:

IRRIGATION SCHEDULING: Delivery Systems, Delivery by Rotation, Continuous Supply, Rotation Planning, Operation of Canals and Branches, Night Irrigation, Improvement in Irrigation Efficiencies, Diversion Scheme.

Unit-4:

WATER APPLICATION METHODS: Evaluation of Basic Variables and Efficiencies in Irrigation Methods, Border Irrigation, Check Basin Irrigation, Furrow Irrigation, Sprinkler Irrigation, Drip Irrigation, Sub-Surface Method.

DRAINAGE: Introduction, Surface, Sub-Surface and Vertical Drainage, Conjunctive use of Ground and Surface Water.

Unit-5:

QUALITY OF IRRIGATION WATER: Introduction, Quality of Water from Different Sources, Estimation of Quality Parameters for Irrigation Water and their Suitability, Management of Irrigation with Saline Water, Choice of Crops and Varieties, Use of Manures and Fertilizers.

Operation and Management of Water Courses and Drainage Channels, Gated Structures, Tail Escapes.

Books & References Recommended:

1. Irrigation Engg. By A.M. Micheal.
2. Crop Water Requirements – FAO Publication No. 24.
3. Yield Response to Water – FAO Publication No. 39.

CE 5271: ADVANCE HYDROLOGICAL MODELLING

Theory:

Unit-1:

MODELLING STRATEGIES: Objectives, Choice of Model, Conclusions and Prospects.

Soil water modelling: Simple Water balance Models, Complex Models, Remote Sensing of Soil Moisture Model Applications to Forestry.

Unit-2:

GROUND WATER MODELING: Review of Numerical Methods: Implicit and Explicit, Finite Difference Formulation of Leaky Aquifers, Discrete Kernal Approach, Stream – Aquifer Interaction, Finite Element Application to Ground Water Modelling.

Unit-3:

LUMPED CATCHMENT MODELS: The catchment, Lumped Models, Development of Conceptual Model, The Institute of Hydrology Model, Model Selection Criteria, Model fitting Techniques, Application of Conceptual Models to Hydrological Forecasting.

Unit-4:

VARIABLE SOURCE AREA MODELS: Concept, Studies of Watershed process, The Model VSAS 1 and VSAS 2 Models.

Distributed models: Nature of Distributed Models, Choice of Model Structure, Setting up of Model, Application of model.

Unit-5:

ADVANCED CONCEPTS IN CHANNEL ROUTING: Emprical Models, Linearized Models, Hydrological Models, viz, Storage Routing, Muskingham, Muskingham – Cunge, Lag and Route, Simplified Hydraulic Models, Finite Element Models, Dynamic Wave Model, Routing in Channel Networks.

Books & References Recommended:

1. Mathematical Models in Hydrology by Clarke, FAO Publication No.19.
2. Hydrological Modelling of Watersheds by C.T. Haan.
3. Hydrological Modelling by McCuen.

CE 5272: ENVIRONMENTAL IMPACT ASSESSMENT OF WATER RESOURCES PROJECTS

Theory:

Unit-1:

ECOLOGICAL CONCEPTS: Overview, Ecosphere, Energy Flow in Ecosystems, Nutrient cycles, Components of Ecosystems and Relationship between them, Biotic interaction, Climatic changes, Green House Effect.

Unit-2:

IMPACT ASSESEMENT : Introduction including scope of Assessment in various Water Resources Projects, Nature of Impact in terms of Adverse and Beneficial, Short term and Long term, Identification of Attributes, Data Collection and Environmental Studies at the Planning Stage.

Unit-3:

IMPACT PREDICTION: Qualitative and Quantitative Methods.

Unit-4:

Scope, Adhoc Methods, Check lists, Matrix Methods, Index Method, Networks Simulation and Modelling, Environmental Evaluation System, Cost Benefit Analysis.

Unit-5:

MANAGEMENT AND ENHANCEMENT MEASURES: Monitoring & Evaluation, Rehabilitation and Resettlement, Water Logging and Salinization, Preventive and Remedial measures, Conjuctive use of Ground Water and Surface Water, Soil and Water Conservation, Maintenance of Minimum Flow. Health Hazard Mitigation, Wasteland Development, Major Legislation in Direct and Related Areas, Public Participation.

CE 5273: FINITE ELEMENT APPLICATION IN WATER RESOURCES

Theory:

Unit-1:

INTRODUCTION: Nature of problems encountered during the design of River Valley structures, limitations of classical approach.

Fundamentals of Finite Element Techniques: An introduction to the Finite Element Method, Solution of Equations, Eigen-value problem, basic concept of Finite Element Method, Development of B & D Matrices and Element Matrix-K_e Assemble of Elements into Structure Matrix – K. Introduction of Boundary Conditions.

Unit-2:

FORMULATION AND SOLUTION OF FEM PROBLEMS: Structure of a Simple Finite Element Programme for Solving Plane Stress/Plane Strain Elastic Problems, Major Programming Steps, Organization of Input/Output data, Practical Computer solution of a Plane Stress/Plane Strain problem on either Foundations, Dams, Tunnels or Power House Structures.

Unit-3:

ISOPARAMETRIC ELEMENTS, Eight Node Parabolic Element, Jacobian Matrix, Numerical Integration, Axi-symmetric and 3-D problems, Introduction of Seepage, Uplift and Temperature Forces, Dynamic and Non Linear Problems of flow and heat transfer.

Unit-4:

APPLICATION OF FEM TO W.R. PROBLEMS: Application on Analysis and Design of Foundations, Gravity Dams, Earthen Dams, Tunnels, Power House Structure, Case Histories of Applications in India and Abroad.

Unit-5:

GROUND WATER MODELING BY FEM: Steady Flow Problems, Transient Flow Problems, Non Linear Problems, Graphical Representation of Results of various Models.

CE 5274: REGIONAL WATER RESOURCES PLANNING AND ITS ECONOMICS

Theory:

Unit-1:

WATER RESOURCES PLANNING: Importance of Water Planning, Elements of Project Formulation and Appraisal, Demand Analysis.

Unit-2:

COMPREHENSIVE REGIONAL PLANNING, Environmental, Ecological and Social Impacts, Water Laws, Additionally Supplied Water, Case Studies.

Unit-3:

WATERSHED HYDROLOGY: Geomorphology of Drainage Basins, Landuse and Capabilities, Watershed Management Techniques.

Unit-4:

REMOTE SENSING and use of Satellite Imageries in Formulation of data base, Hydrology of Agricultural, Forest and Range Lands, Soil Erosion and Control.

Unit-5:

ECONOMICS AND FINANCIAL ANALYSIS OF W.R.PROJECT:

Mathematics of Finance : Interest, Present Value Annuties.

Cost Comparison : Capital Cost, Annual Cost, its Comparison & Variation.

Measurement of Benefits : Flood Control, Agricultural Water Supply, Water Power, Reclamation and Navigation.

Analysis of Benefit Cost Ratio, Selection of Project.

CE 5275: REMOTE SENSING APPLICATIONS TO WATER RESOURCES

Theory:

Unit-1

PHOTOGRAMMETRY AND AIR PHOTO INTERPRETATION: Basic Definitions, Types and Photographs used, Vertical/ oblique photographs, Parallax and its estimation, Parallax Correction, Simple Elements of Air Photo Interpretation, Drainage Density, Bifurcation Required, Applications to various Water Resources Surveys.

Unit-2:

REMOTE SENSING AND DATA ANALYSIS: Fundamentals of Ideal Remote Sensing Systems, Laws Governing Electro-Magnetic radiations, Spectral Signatures, Sensors, Platforms and their Characteristics, Fundamentals of Processing and Analysis of Remotely Sensed Data by Digital Technique, Details of System and Equipments required for Analysis.

Unit-3:

DIGITAL ANALYSIS of CCT's, Supervised and Unsupervised Classification Techniques, Details of Available Software and Computer Programmes.

Unit-4:

APPLICATIONS: Application to analysis of terrain, Land use and Vegetal Cover, Snow cover and Water Quality, Soil Classification and other hydrologic parameters, Collection of Ground Truth Data, Hydrologic Models for large, medium an Small Catchments based on Remotely Sensed Parameters, Case Studies of Rainfall-Runoff Simulation Models, Remote Sensing of Soil moisture and its Applications in Ground Water Modelling.

Unit-5:

DATA BASE DEVELOPMENT: Need for data information System, Geographical Information System, Geographical Information Systems, Digitizing Techniques, Interfacing of Different Data Bases for Hydrological Studies.