

HYDRAULICS AND WATER RESOURCES ENGINEERING

CEMAC 501 ADVANCED ENGINEERING MATHEMATICS

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

PARTIAL DIFFERENTIAL EQUATIONS

Formation by elimination of arbitrary constants and arbitrary functions – Solutions of equations by the methods of separation of variables in case of simple boundary conditions pertaining to (i) one dimensional wave equation and (ii) two dimensional wave equation satisfied by vibrating membrane (No numerical problems).

UNIT – II

SPECIAL FUNCTIONS

Gamma and Beta functions Bessel – function – Legendre polynomials – Recurrence relations for $J_m(x)$ and $P_n(x)$. Orthogonality of Legendre Polynomials – Rodrigues formula.

UNIT – III

STATISTICS

Emperical distributions – Log-normal-Binomial, poisson, gamma, extreme value and uniform distributions – Estimation of parameters by method of moments and maximum likely hood methods – Multiple correlation and regression.

UNIT – IV

COMPLEX VARIABLES & LAPLACE TRANSFORMS

Complex variables – Cauchy – Reimann equations – Laplace equation – Conformal transformations including Joukowski's and Schwaz and Christoffel transformations.

Laplace transformation of Impulse function (Dirac-Delta function) and its applications to differential equation.

UNIT – V

NUMERICAL METHODS

Numerical solutions of partial differential equations – Laplace and poisson equations by iteration method, heat equation by Schmidt method.

Reference Books :

1. Dr. B.S. Grewal, Higher Engineering Mathematics.
2. S.C. Gupta, V.K. Kapur Foundations of Mathematics Statistics.

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CEHWC 502 ADVANCED FLUID MECHANICS

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT - I

KINEMATICS OF FLUID MOTION:

Methods of describing fluid motion - Lagrangian and Eulerian methods - Material derivative and acceleration – Translation, rate of deformation, Rotation, Circulation and Vorticity.

UNIT - II

IDEAL FLUID FLOW:

Simple patterns of 2-dimensional flow - Uniform flow, Source, sink, vortex flow, Superposition of elementary flows – Doublet – Rankine-half body - Rankine oval, flow about a circular cylinder and flow about a rotating cylinder.

REAL FLUID FLOW:

UNIT - III

VISCOUS FLOW :

Introduction - General viscosity law-Navier-Stokes equations for viscous incompressible fluid – Exact solutions, Parallel flow, Couette flow, Hagen-Poiseuille flow, flow between two concentric rotating cylinders – Approximate solutions, Steady flow past a sphere at low Reynolds number.

UNIT - IV

BOUNDARY LAYER :

Boundary layer equations - Laminar boundary layer - Blasius solution - other approximate solutions -Boundary layer transition - Turbulent boundary layer - Laminar sublayer -Separation of boundary layer and control of boundary layer.

UNIT - V

TURBULENT FLOW :

Mixing length theory, similarity hypothesis - Velocity distribution in turbulent flow - power law - Universal velocity distribution - logarithmic law - smooth and rough boundaries - Universal resistance laws - Moody's diagram.

Reference Books :

1. H.R.Vallentine, "Applied Hydrodynamics - H.R.Vallentine".
2. S.Narasimham, "Engineering Fluid Mechanics - Vol.I and Vol.II".
3. Foundations in Fluid Mechanics - Yuan.
4. Introduction to Fluid Mechanics and Fluid Machinery by S.K.Som and G.Biswas.

CEHWC 503 HYDROGEOLOGY AND GEOPHYSICAL EXPLORATION OF GROUNDWATER

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

Unit-I : Introduction :

Definitions of Hydrogeology – Interdisciplinary subject - Exploration of ground water – Aquifer properties - Porosity, permeability and hydraulic head- Direction and speed of movement of groundwater.

Unit-II : Groundwater in different rock formations

Rock types – Yield of groundwater from Igneous, metamorphic, sedimentary rocks, coastal deposits and glacial deposits - Groundwater indicators – Reservoir indicators – Surface indicators – Boundary indicators.

Unit - III: Methods of Exploration- 1

Theory of electrical resistivity - Sounding and profiling - Four electrode system – Wenner and Schlumberger configuration-Cumulative resistivity method – Tagg's master curves.

Electrical logging - Spontaneous potential logging - Interpretation from logs.

Unit – IV: Methods of Exploration - 2

Types of waves- elastic constants – Refraction method of measurement – its interpretation - Reflection method of measurement – its interpretation.

Soil temperature survey – Magnetic survey – Gravity survey.

Unit - V: Methods of Exploration- 3

Application of Remote sensing method to delineate groundwater potential zones-thematic maps – Assessment of status of groundwater development.

Radioactive logging , Induction logging, sonic logging- interpretation from logs.

Drilling time, factors influencing and use of drilling time, applications of drill stem test data, wire line formation test.

Reference Books:

1. Raghunath H M (1998) "Groundwater" New Age International Publishers
2. Davis S.N. and Dewiest R.I.M. (1967) "Hydrogeology" – John Wiley sons.
3. Griffith,D.H and King R.F (1966) "Applied geophysics for Engineers and geologists" Pergamen Press.
4. Todd,D.K. (1980) "Groundwater Hydrology" John Wiley and sons, New York.
5. R.Kirsch (edited by) " Groundwater Geophysics- A tool for hydrogeology" 2nd edition, Springer Publications.

CEHWC 504 CONCRETE DAMS

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

PLANNING AND SELECTION OF DAMS:

Planning - Investigation Programme - Economic height of dam - Life of dam- Reservoir operations.

DAM FOUNDATION DESIGN:

Dam foundation problems - Foundation related to Geological investigations – Foundation investigation methods-Foundation Treatment.

UNIT - II

RIVER DIVERSION:

Diversion scheme - Diversion flood - Tunnels - Over-topping of Cofferdams - Case studies of Diversion schemes.

GRAVITY DAMS:

Profile - Loads - Design Concepts and Criteria – Stability analysis- Internal stress analysis – Grouting operations.

UNIT - III

HOLLOW AND BUTTRESS DAMS:

Hollow gravity dam - Buttress dams - Types - Design of deck, transition and Buttress.

ARCH DAMS :

Classification - Layout - Design of an arch dam - thin and thick cylinder theories - Trial load analysis.

UNIT - IV

SPILLWAYS:

Selection - Factors affecting - Components - Design principles of ogee spillway, Side channel, chute, siphon and shaft spillways.

UNIT - V

ENERGY DISSIPATORS:

Hydraulic jump type stilling basins and appurtenant works - Jet diffusion and free jet stilling basins - Bucket type energy dissipaters.

INSTRUMENTATION IN DAMS:

Necessity - Embodied instruments in dam section - Foundation measurements - Deformation measurements of dam body.

Reference Books:

1. H.D. Sharma - “Concrete Dams”.
2. R.S.Varshney - “Concrete dams”.
3. K.B.Khuslani and Mandra Khuslani - Dams Part I; Gravity dams Vol.II.
4. Dam Engineering by Creager, Justin and Hinds.
5. Dr P.N. Modi, Irrigation Water Resources and Water Power Engineering, Standard Book House Publications.

CEHWP 507 WATER RESOURCES ENGINEERING (PRACTICAL)

Practicals / week : 3 Hrs
University Exam : 3 Hrs

Sessional Marks : 40
End Exam Marks : 60

List of Experiments

1. Determination of kinetic Energy Correction factor α and Momentum correction factor β
2. Characteristics of Hydraulic Jump on Horizontal and sloping channels.
3. Pumps- Characteristics curves and system losses, efficiency curves
(Under different speeds).
4. Computation of Gradually Varied Flow profiles
5. Resistivity Survey
6. Helishaw Model
7. End depth – A flow measuring device
8. Planning of a water resources project and preparation of report

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CEHWC 601 ADVANCED HYDROLOGY

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT - I

DETERMINISTIC HYDROLOGY

Intensity - Duration - Frequency curves, Depth - Area - Duration Curves – Hydrograph Analysis – Unit Hydrographs - Bernard's Distribution graph – Synthetic unit hydrograph – Instantaneous Unit graph - Clark's and Nash's conceptual models - Flood frequency analysis - Gumbel's and Log-Pearson Type III distributions.

STOCHASTIC HYDROLOGY

UNIT - II

STOCHASTIC PROCESSES :

Description - Classification - Stationarity - Persistence - Tests - Time series - Classification - Components - Trend - Cyclic and Stochastic Components - Methods of Investigation.

UNIT - III

AUTOCORRELATION ANALYSIS

Autocorrelation coefficients - Correlogram - Moving Average and Auto-regressive processes (First order and second order).

UNIT - IV

SPECTRAL ANALYSIS

Line spectrum- continuous spectrum-Spectral density function for an Independent process – Spectrum of a moving average process-Spectrum of an autoregressive process.

UNIT - V

SYNTHETIC FLOW GENERATION MODELS

Classification - Single site annual models - First order and second order AR models – Seasonal Models – Thomas-Fiering and Rosener and yevjevich models.

GENERATION OF RANDOM NUMBERS

Uniformly distributed random numbers - Normal random numbers - Random numbers of other distributions.

Reference Books :

- 1) H.M.Raghunath, "Hydrology".
- 2) R.S.Varshney, "Engineering Hydrology".
- 3) Mutreja, "Applied Hydrology".
- 4) P.Jayarami Reddy, "Stochastic Hydrology".
- 5) V.Yevjevich, "Stochastic Processes in Hydrology".

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CEHWC 602 WATER RESOURCES ECONOMICS, PLANNING AND MANAGEMENT

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

ENGINEERING ECONOMY – 1

Significance of Engineering Economy – Steps involved in Engineering Economy study – Cost and types of coefficient – Benefits and types of benefits – Importance of Benefit / Cost analysis. Cost and benefit studies of single purpose and multi purpose projects

UNIT – II

ENGINEERING ECONOMY – 2

Discounting formulae such as compound amount formula, present worth formula, capital recovery formula, series present worth formula. Economics of combined flood control projects – Graphical illustration of optimization in water resource projects

UNIT – III

PLANNING OF WATER RESOURCES PROJECTS

Significance of planning – Steps involved in planning – Physical factors influencing planning – Common pit falls – Environmental effects – Selection of project plan – Investigations.

UNIT – IV

MANAGEMENT OF WATER RESOURCES – 1

Surface Water Resources : Reservoirs – Capacity estimation of demands – Optimal reservoir operations – Rule curves and operating tables for reservoirs – Reservoir sedimentation – Losses – Clearance.

Ground Water Resources : Aquifer types – Estimation of yield of wells – Ground water prospecting. Conjunctive use – Related aspects – Management of water logging.

UNIT – V

MANAGEMENT OF WATER RESOURCES – 2

Drought – Definitions – Causes – Types – Floods – Causes – Flood control measures – Flood forecasting methods.

Water laws – Functions of water laws – Riparian rights – Interlinking of rivers and related issues.

Reference Books :

1. N.S.Grigg, “Water Resources Planning”.
2. Ray.K.Linsley.Joseph.B.Franzini. “Water Resources Engineering”
3. V.K.Sharma, “Water Resources Planning and Management”.
4. Garg, “Hydrology and Water Resources Engineering.
5. Modi P.N., “Irrigation Water Resources and Water Power Engineering”

CEHWC 603 THEORY OF SEEPAGE AND GROUNDWATER MOVEMENT

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

Chapter I : Movement of groundwater

Darcy's flow - Range of validity of Darcy's law - permeability coefficient – laboratory and field methods of measurement - General hydrodynamic equation.

Chapter II : Steady state flows

Bboundary conditions – flow nets – construction and analysis of flow nets – flow nets for anisotropic soils.

Chapter III : Unconfined flows

Dupuit's theory of unconfined flow – basic considerations- Two-dimensional flow on a horizontal impervious boundary - Free surface subjected Infiltration and Evaporation - groundwater flow with an inclined lower impervious boundary – Pavlosky's solutions.

Chapter IV : Conformal transformations and mapping techniques

Geometrical representation of $w = f(z)$ and $z = f(w)$, application of the mapping function $z = w^2$ - Reciprocal function $w = 1/z$ - Velocity hodograph – impervious boundary – boundary of reservoir – surface of seepage –free surface– flow characteristics at singular points of flow domain – example of velocity hodograph.

Chapter V : Artificial recharge of groundwater

Concept of recharge – methods- waste water recharge for reuse – Artificial recharge for energy purposes.

References :

1. Groundwater and Seepage : M.E. Harr ,Mc Graw Hill pubs.
2. Ground water Hydrology : D.K. Todd, John Wiley & Sons

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CEHWC 604 IRRIGATION WATER SYSTEMS AND MANAGEMENT

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

INTRODUCTION

Importance of Irrigation –Advantages and Disadvantages of Irrigation –Irrigation in India.

SOIL-WATER- PLANT RELATIONSHIP

Soil Properties Influencing Soil-Water Relationship – Classification of Soil Water – Soil Water Constants - Role of Water in Plants — Water Deficit and Plant Responses.

ESTIMATING WATER REQUIREMENTS OF CROPS

Water Requirements of Crops – Evapotranspiration and Consumptive Use – Methods of Estimating Evapotranspiration – Irrigation Requirement.

UNIT – II

METHODS OF IRRIGATION

Classification of Irrigation Methods – Surface Irrigation Methods – Subsurface Irrigation Methods –Sprinkler Irrigation Methods – Drip Irrigation Method – Prospective New Methods of Irrigation.

Fundamental principles; Development and distribution of Irrigation Systems; System design process.

SURFACE SYSTEM DESIGN

Definitions - Furrow system design - Level basin system design - Graded border system design.

UNIT – III

SPRINKLER SYSTEM DESIGN

Uniformity and adequacy of water application - Evaporation and wind drift - Components of system design - Distribution system design and layout - Centre pivot system, Linear Move system - Big Gun and Boom sprinkler systems.

UNIT – IV

TRICKLE SYSTEM DESIGN:

Concept of the trickle system - Emitters - Flow through laterals - Filtration and water treatment systems - Fertilizer injection systems.

UNIT – V

QUALITY OF WATER AND IRRIGATION WITH SALINE WATER

Quality of Irrigation Water –Irrigation with Saline Water – Growing Crops in Salt Affected Areas – Improving Quality of Saline Water – Leaching Requirements of Saline Soil.

WATER MANAGEMENT IN HIGH WATER TABLE AREAS

Causes and Effects of Waterlogging – Preventive Measures – Design of Surface and Subsurface Drainage Systems to Treat Waterlogging.

REFERENCE BOOKS:

1. Richard H. Cuenea (1989), “Irrigation System Design (An Engineering Approach)”
Published by Prentice Hall Inc.
2. Deniel P. Louchs, Jerry R.Stedinger and Danglass A Haith, “Water Resources Systems Planning and Analysis” Published by Prentice-Hall Inc.
3. “Irrigation Water Management – Principles and Practice” – Dilip Kumar Majumdar
published by Prentice Hall of India private limited
4. Garg, “Hydrology and Water Resources Engineering.
5. Modi P.N., “Irrigation Water Resources and Water Power Engineering”

CEHWP 607 COMPUTING TECHNIQUES (PRACTICAL)

Practicals / week : 3 Hrs
University Exam : 3 Hrs

Sessional Marks : 40
End Exam Marks : 60

Use of spread sheets, Software like MATLAB, Statistical Software, and GIS Software like Arc Info, etc.

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ELECTIVES

01. CIVIL ENGINEERING SYSTEMS

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT - I

INTRODUCTION:

Introduction to system approach to Civil Engineering problems - System analysis, design and system components - Universe and environment - Features, phases and methodology of operations research.

UNIT - II

LINEAR PROGRAMMING:

Basic terminology, Assumptions, advantages, limitations - Formulation of LPP - Graphical solution - multiple optimal solutions - Simplex method for maximization and minimization programs - Duality - Formulation of dual problems only - Advantages of Duality.

UNIT - III

TRANSPORTATION MODELS AND INTEGER PROGRAMMING:

Statement of transportation problems - Solutions by NWCM, LCM and Vogel's approximation method.

Cutting plane algorithm (all integer case) - Branch and bound method.

UNIT - IV

GOAL PROGRAMMING:

Goal Programming Versus Linear Programming - Concept of Goal Programming - Model formulation - Graphical method - Modified simplex method of Goal Programming.

UNIT - V

DYNAMIC PROGRAMMING:

Formulation and solution of Dynamic Programming problems - Application of Dynamic Programming to shortest route problems and resource allocation problems.

Reference Books :

1. S.S.Rao, "Engineering Optimization - Theory and Practice".
2. M.P.Gupta and J.K.Sharma."Operational Research for Management".
3. Shenov G.V., Srivastava, U.K. Sharma S.C., "Operational Research for Management".
4. Ven Te Chow, "Hand Book of Applied Hydrology".

02. UNSTEADY FLOWS IN CLOSED CONDUITS AND OPEN-CHANNELS

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT - I

UNSTEADY FLOW IN CLOSED CONDUITS:

Basic equations of unsteady flow through closed conduits, methods of water hammer analysis,

UNIT - II

Graphical methods, characteristics, water hammer analysis from valve operations.

UNIT - III

Water hammer analysis with surge tanks and air chambers - Mass oscillations in surge-tanks.

UNSTEADY FLOW IN OPEN-CHANNELS:

UNIT - IV

Basic equations of unsteady flow in open-channels - Waves and surges - classification - characteristics - Analysis of Flood waves in rivers and channels,

UNIT - V

Surges in power channels, navigation canals, etc.

Reference Books :

1. Streeter, V.L. and Wylie E.B. "Hydraulic Transients" Mc. Graw Hill.
2. Puranakian J., "Water Hammer Analysis" (Prentice Hall/power)
3. George and Rich "Hydraulics Transients".
4. Henderson F.M. (1986), "Open Channel Flows" (Coiler McMillian).
5. J.J. "Water Waves", (Interscience publishers 1957).

03. HYDRAULIC MODELLING AND EXPERIMENTAL TECHNIQUES

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT - I

HYDRAULIC MODELLING

Hydraulic models - Scale effects - Distorted models - movable bed models - Analogy methods - Design and analysis of experiments - errors in experiments.

UNIT - II

EXPERIMENTAL TECHNIQUES AND MEASUREMENTS

Velocity and pressure measuring Instruments - Pitot cylinder, Pitot sphere, - Anaemometers- Pressure transducers.

UNIT - III

Discharge measuring techniques - Classification of methods - Constriction methods, rotometer - Area-velocity method - Dilution methods and techniques - Special techniques and measuring structures.

UNIT - IV

Measurement of two phase flows - measurement of sediment content in water flows - air-water mixture.
Test rigs - Wind and water tunnels - Drag balances.

UNIT - V

Flow visualization techniques.

Reference Books :

1. Huntley, H.E. Dover (1967), "Dimensional Analysis"
2. B.B.Sharp (1982), "Hydraulic Modeling" Published by Butter Worths.
3. Troskolousky (1960), "Hydrometry" Pergamon Press, London.
4. Addison, H. Chapman and Hall (1940), "Hydraulic Measurements".
5. Bradshaw, P.(1964), "Experimental Fluid Mechanics", Pergamon Press,
6. Ed. Richard, J. Goldstein, "Fluid Mechanics Measurements" published by Hemisphere Publishing Corporation (Distributed by Springer-Verlag).

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04 . ENVIRONMENTAL HYDRAULICS

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT-I

TURBULENT DIFFUSION AND DISPERSION IN STEADY FREE SURFACE FLOWS :

Governing Equations - Vertical and transverse diffusion and longitudinal dispersion - Numerical Dispersion - Vertical diffusion in a continuously stratified environment.

UNIT -II

TURBULENT, BUOYANT SURFACE JETS AND ASSOCIATED PHENOMENA:

Introduction - Basic mechanics of turbulent jets - Buoyant surface jets - Zone of flow establishment - fully developed jet regime - upstream cooling water wedges - outlet channel - middle zone - intake upstream of the inlet.

UNIT -III

APPLICATIONS TO WATER QUALITY MODELLING IN STREAMS, RIVERS ESTUARIES, BAYS, HARBOURS AND LAKES:

Waste load allocation principles - Nature of inputs - Mass loading rates - Continuous and intermittent waste sources.

UNIT -IV

Discharge of residual materials into streams and rivers - Time variable analysis - Engineering Controls - Solution for steady - state flow condition.

UNIT -V

Physical aspects of Estuaries, Distribution of Water quality in Estuaries - Tidal dispersion coefficient - Slack tide sampling - Modeling of Estuaries - ideal Estuary and real estuaries.

Lake wise water quality response to inputs - Steady state lake models.

Reference Books :

1. Richard H. French : "Open-Channel Hydraulic" (Ch.10 and 11).
Mc Graw-Hill Book Company (1986).
2. Robert V.Thamann and John A Nueller : "Principles of Surface Water Quality Modelling and Control", Harper and Row Publishers, New York (1987).
3. A.T.Appa : "Coastal and Estuary Hydrodynamics", Mc Graw Hill Book Company, Inc., New York (Engg. Society Monographs).

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05. ECOHYDRODYNAMICS

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT -I

INTRODUCTION:

Ecohydrodynamics - definition and scope - history of development.

ACQUATIC ECOSYSTEMS:

Classification and characteristics.

UNIT -II

STREAM FLOW AND WATER PLANTS:

Influence of water plants and stream velocity and other characteristics - Turbulence and its ecological effects - Photosynthesis and light attenuation.

UNIT -III

STREAM FLOW AND MICRO-ORGANISMS:

Growth law of Micro-organisms - Self-purification theory from macroscopic view point: Aerobic bacteria in rivers - fundamental equations - BOD and DO limited regions - Self-purification theory microscopic view point.

UNIT -IV

LAKE, OCEAN AND PLANKTON:

Eco-hydrodynamics of photo-plankton patchiness - Physical and biological interpretation of plankton patchiness - Spectrum of photoplankton abundance - Effect of turbulence on photoplankton production in a medium sized environment.

UNIT -V

BIOLOGICAL ACCUMULATION AND DIFFUSION:

Concentration factor - non-linear model for biological accumulation - radio active pollution of small fish.

Reference Books :

1. MikioHino, "Ecohydrodynamics" "Advances in Hydro Sciences" (ed. V.T.Chew), Vol.12.
2. "Hydraulics and Environment". Journal of Hydraulic Research, Extra Issue. Vol.29, 1991 (IAHR).

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06. COASTAL HYDRODYNAMICS

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT -I

WATER WAVES:

Definitions - Basic equations of wave motion - Wave generation and propagation - Wind generated waves - Analysis of wave recordings - Forecasting of waves - Waves in shoaling waters - Diffraction and reflection of waves - Generation of long shore currents - Prediction of waves in shallow water - Oscillations in a harbour - Ship waves.

UNIT -II

TIDES AND CURRENTS:

Equilibrium tide - Dynamic modifications of the equilibrium tide - modification of tidal patterns - Tidal streams - Tidal bores - Sea surface as a levelling datum.

UNIT -III

WAVE FORCES ON STRUCTURES :

Selection of wave characteristics - Forces on continuous structures - Dissipation of wave energy - Wave forces on cylinders - Spectral analysis of wave loadings.

UNIT -IV

DATA COLLECTION:

Current measurements - Types of current meters - floats and drift recorders - Salinity and Temperature measurements; Tidal measurement - Tidal gauges - Wave measurements - Wave recorders - observations –

UNIT -V

Analysis and interpretation of wave recordings; Hydrographic Survey - Measurement of sediment movement.

Reference Books :

1. "Coastal Hydraulics (2nd Edn)" by A.M.Muir Wood and C.A. Feeming, Published by John-Wiley and Sons (Newyork).
2. "Mechanics of Wave forces on off-shore structures" by Sarpakaya and Issacson, Van Nostrand and Reinhold Press (1981).
3. "Coastal Engineering (Vols. I x II)" by Richard L. Silvester, Published by Elsvier Scientific Publishing Company.

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07 . RIVER WATER MANAGEMENT

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT -1

INTRODUCTION:

Planning and analysis of Water Resources Systems –Probability concepts and methods.

UNIT -II

WATER RESOURCES PLANNING UNDER UNCERTAINTY:

Distributions of random events - Stochastic process and time series - Planning with uncertainty - analysing systems with dynamic uncertainty.

UNIT -III

DETERMINISTIC RIVER BASIN MODELLING:

Flood control alternatives - Hydro power production - Withdrawals and Diversions - Model synthesis -Expansion of water resources systems.

UNIT -IV

SYNTHETIC STREAM FLOW GENERATION:

Statistical streamflow generation models - Multisite models - Multiseasonal models - Model selection and parameter estimation - Stream flow generation from precipitation data.

UNIT -V

STOCHASTIC RIVER BASIN PLANNING MODELS :

Reservoir operation - Single reservoir design and operation - Multiple - Site River Basin Planning Models.

Reference Books :

1. “Water Resources System Planning and Analysis” by Daniel P.Loucks, Jerry R. Stedinger and Douglass A. Haith (Published by Prentice - Hall Inc.)

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08. SEDIMENT TRANSPORTATION

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT -I

SCOUR CRITERIA:

Critical velocity and critical shear stress equations - lift force mechanism - Shear stress distribution - Direct determination - Shear measurement - Shear meter, Preston tube - Bank scour - Design of stable channels - Stable and unstable cross sections.

UNIT -II

BED LOAD:

Dubuoys and Schoklitch type equations - Einstein bed load equations - physical, empirical and Analytical relations - Bagnold and Yelin's models - Equations considering bedform motion - Saltation as a mode of particle transport.

SUSPENDED LOAD:

Earlier studies - Diffusion - Dispersion model - Theoretical considerations - Vertical distribution of suspended matter - Calculation of suspended load - Lane's et al., Einstein approaches longitudinal distribution of suspended matter.

UNIT -III

TOTAL LOAD:

Indirect determinations - Einstein's bed load functions - Modified Einstein procedure - Bagnold's and Chang's et al approaches - Direct determinations - Laursen's, Bishop's et al., and Graf's et al approaches - Comparison and Application of bed material load equations - hydraulic effects on sediment transport.

REGIME CONCEPT:

Canals in regime - Kennedy's, Lindley, Lacey, Blench's and Simen's et al contributions - Rivers in regime - Regime equations for width, depth and velocity - Meandering of rivers - longitudinal river profiles.

UNIT -IV

BEDFORM MECHANICS:

Bedforms - Experimental investigations - Theoretical studies - Exner's, Potential flow and Real fluid sediment models - Bedform and flow resistance.

COHESIVE MATERIAL CHANNELS :

Cohesive materials and their properties - Scour criteria - Sedimentation - Flocculation problem - Transportation problem.

UNIT -V

SEDIMENT MEASURING DEVICES :

Bedload measuring devices - Direct measurement - Box, Bucket, Pan and Pit type samplers - Indirect measurement - Suspended-load measuring devices - Total load measuring devices - Tracing methods.

Reference Books :

1. Graf - "Hydraulics of sediment transport".
2. A.J.Randkavi - "Loose boundary hydraulics".

09 . COASTAL ENGINEERING

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT -I

COASTAL ZONE PROCESS:

General, Sediment properties; measurement and sampling techniques - fundamental principles of movement - bed load and suspended load transport.

UNIT -II

Role of coastal sedimentation process - Long shore drift - Beach Evaluation Models - General sediment transport models - On-shore and off-shore sediment transport.

UNIT -III

Beach nourishment - Coast and Bed Morphology - Regime of the Coast and Sea Beach - Sand features - Features of Estuaries - Coastal and Beach features.

UNIT -IV

COASTAL PROTECTION :

Identification of the problem - Restoration of the Beach - Groynes and Rivetments - Off-shore Breakwaters, Bays and Artificial Headlands - Beach replenishment.

UNIT -V

DESIGN PRINCIPLES OF COASTAL AND HARBOUR STRUCTURES :

Break water - types - Waves, Jetties and Piers; Docks - different types.

Reference Books :

1. "Coastal Hydraulics" (2nd Edn) By A.M. Muir Wood and CA Fleming, John Wiley and Sons (Newyork).
2. "Coastal Engineering" (Vol. 1 & 2) by Richard L. Silvester, Elsevier Scientific Publishing Company.

10. WATERSHED MANAGEMENT AND MODELLING

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT -I

WATERSHEDMANAGEMENT-I:

Basin characteristics - Classification of effective watershed management methods - Factors affecting integrated watershed management - Watershed inventory.

UNIT -II

WATERSHED MANAGEMENT II :

Problem definition and scope - Consultation process - Developing workable management options - Evaluation of constraints and criteria - Simple assessment methods.

WATERSHED MODELLING I :

Runoff components- correlation coefficient, linear regression- least square's method, coefficient of determination, t-and F-test; Types of model- black box, parametric and physically based;cuvilinear relations, multi-linear regression model.

UNIT -III

WATERSHED MODELLING II :

API & wetness performance, calibration, validation, errors, coefficient of efficiency and other tests, graphical methods. Simple parametric models- Curve Number Method, its modification, variable source area models; quasi- physically based models; a simple physically based model.

UNIT -IV

SOIL CONSERVATION:

Soil loss estimation - Universal soil loss equation; soil erosion principles - Gully erosion - Design of permanent gully control structures - Stream bank erosion - Erosivity and erodability, Engineering measures to control erosion - Terracing, bunding, vegetated waterways. Wind erosion and control practices.

UNIT -V

ARTIFICIAL GROUNDWATER RECHARGE TECHNIQUES AND WATER HARVESTING TECHNIQUES:

Artificial recharge - Considerations - Methods - Induced Infiltration - Water Spreading - Flooding - Artificial recharge basins and distches - Natural channel modifications - Recharge pits and shafts - Recharge wells. Farm ponds- Percolation tanks.

Reference Books :

1. Prof. R.Suresh, "Watershed Hydrology" Standard Publishers.
2. Isobel W. Heathiote."Integrated Watershed Management - Principles & Practices".
3. Schwab, G.O. & Others, "Soil and Water Conservation Engg."
4. Prof.R.Suresh, "Soil and Water Conservation Engg.", (Standard Publishers).
5. Wayne A. Pettyjohu, "Introduction to Artificial Ground Water Recahrge" Scientific Publishers, Jodhpur.
6. Murthy J.V.S., "Wastershed Management".

11. WATER POWER ENGINEERING

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT -1

INTRODUCTION :

Sources of energy - Development of water power in India - Advantages and disadvantages of hydropower - Estimation of water power potential- Power house components.

UNIT II

ELECTRICAL LOAD CHARACTERISTICS:

Load curve - Load factor - Capacity factor - Utilization factor - Diversity factor - Load duration curves - Firm power and secondary power load prediction.

UNIT -III

HYDROPOWER PLANTS :

Classification of hydel plants - Runoff river, valley dam, and diversion canal plants - Flow duration curves - Storage and pondage - pumped storage plants - Types - Two unit and three unit arrangements - Efficiency of pumped storage plants - Tidal power plants - Basic principle - Components - Modes of generation - Estimation of energy.

UNIT -IV

WATER CONVEYANCE SYSTEM :

Intakes - Types - Hydraulic design of intakes and accessories - power canals - Penstocks - Classification - Design criteria - diameter - Anchor blocks - Design criteria - Water hammer - Surge tanks - Channel surges.

UNIT -V

HYDRAULIC TURBINES:

Selection - Setting of turbines - Cavitation in turbines – Design of Francis turbine.

Reference Books :

1. M.M. Dandekar and K.N.Sharma - Water Power Engineering.
2. Emmil Mosonye - Water Power Development, Vol. I & II.

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12. REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT -I

FUNDAMENTALS :

Energy-electromagnetic radiation, radiation principles, electromagnetic spectrum, ideal remote sensing system, energy interaction with atmosphere, atmospheric windows, Energy interaction with earth surface feature, spectral signature.

UNIT – II

SENSOR SYSTEM

Introduction – Types – Satellites – Indian Remote Sensing Satellite-Types of sensors, Characteristics of Sensors IFOV – Indian Remote Sensing Sensors – LISS-WIFS-PAN.

VISUAL DATA ANALYSIS

Introduction – Types of Data Products – Image Interpretation Techniques - Elements of Image Interpretation – Keys.

UNIT – III

DIGITAL IMAGE PROCESSING : Introduction – Overview – Preprocessing – Radiometric correction – Geometric correction – Rectification – Enhancement Techniques – Contrast stretch – Edge enhancement – Filtering Techniques – Classification Techniques – Supervised and unsupervised classification.

UNIT – IV

GEOGRAPHICAL INFORMATION SYSTEM : Definition, functions of GIS, types of data-spatial, non spatial, point,line,polygon, vector and raster. Database,digitizer,scanner,spatial analysis, modeling in GIS,DEM,DTM, path analysis. Introduction to GIS packages.

UNIT – V

APPLICATION OF REMOTE SENSING AND GIS TO WATER RESOURCES:

Land Use Land Cover mapping, determination of crop characteristics, ground water, pollutant mapping, snow mapping, rainfall measurement, weather monitoring, soil classification, watershed prioritization, solid waste collection, water supply.

Reference Books

1. F.F. Sabins Jr., Remote Sensing Principles and Interpretation.
2. Lille and Kiefer, Remote Sensing Principles and Image Interpretation.
3. C.P.Lo, Principles of Geographic Information Systems.
4. J.R. Jensen, Principles of Remote Sensing.
5. Prithvish Nag, M. Kudrat, Digital Remote Sensing.
6. Meijerink M J, HAM de Brouwer, C M Mannaerts, C R Velenzuela, (1994), “Introduction to the Use of Geographical Information systems for practical Hydrology”, ITC publication no.23,UNESCO, Paris.

13. GROUND WATER DEVELOPMENT

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT -I

Well hydraulics: Steady radial flow to a well, Unsteady radial flow in confined Aquifer, Jacob's Method, Chow's Method, Unsteady radial flow in unconfined and leaky aquifer, Well flow near aquifer boundaries, Characteristic Well Losses, Specific Capacity.

UNIT -II

Water well drilling methods: Methods for Constructing Shallow Wells: Dug Wells, Bored Wells, Driven Wells, Jetted Wells; Methods of Constructing Deep Wells: Cable Tool Method, Rotary Method, Air Rotary Method, Rotary - Percussion Method, Reverse Circulation Rotary method.

UNIT -III

Well Completion, Well Casings, Cementing, Screens, Gravel Packs; Well Development: Pumping, Surging, Surging with Air, Backwashing with Air, Hydraulic Jetting, Chemicals; Pumping Equipment: Total Pumping Head, Pumps for Shallow wells, Pumps for Deep Wells

UNIT -IV

Sanitary Protection of Wells, Well Rehabilitation, Horizontal Wells :Infiltration Galleries, Horizontal Pipes, Collector wells; Well Disinfection, Well Maintenance, Testing for Yield, Methods of Measuring Water Level: Slug Tests, Bailing.

UNIT -V

Saline Water Intrusion in Aquifers: Occurrence, Ghyben-Herberg relation between fresh and saline water, Shape of the fresh-Salt water interface, Structure of the fresh-salt water interface, Control of saline water intrusion , Groundwater Basin Management.

Reference Books:

1. Todd, D.K. Ground Water Hydrology, John Wiloy & Sons, Inc. : New York. 1969 (Chapters : 5 and 14).
2. H.M Ragnath ,Ground Water, New Age International Publishers.(Chapter: 5 and 16)
3. Inc. Ground Water and Wells. Edward E.Johnson, Inc. Saint Paul, Minnesta, 1966. (Chapters: 5 through 7, 10 through 17,19,21 and 22).
4. Koutz, R.R. and MEDenne I, A.J. : Ground-water Development. Correspondence course study guide. The Pennsylvania state University, Agency for International Development/U.S. Dept. of State.
5. Walton W.C. : Groundwater Resource Evaluation McGraw Hill Co.
6. Hacks (T.G.) : Pump Operation and Maintenance, McGraw Hill Book Co., 1858. (Chapters: 1 through 4, 10, 11).
7. McGregor, K : The Drilling of Rock. C.R. Books Ltd. 1967.
8. Anderson, K.E. : Water Well Handbook Missouri Water Well and Pump Contractors Assoc. Inc. 1963.
9. Brantly, J.E. Rotary : Drilling Handbook. Palmer Publications, New York.
- 10 Gatling, C. : Petroleum Engineering Drilling and Well Completion, Prantice-Hall, Inc., 1960.