### Semester I

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<th>CODE</th>
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<td>3. Hydropower</td>
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Note: The Contact Hours for the calculation of load of teacher
- Seminar – 1 Hr/week/student
- Project - 2 Hr/week/student
UNIVERSITY OF PUNE
M.E. (CIVIL) (HYDRAULIC ENGINEERING)

SEMESTER I

Subject Code 501301

COMPUTATIONAL METHODS IN HYDRAULICS

Teaching Scheme:
Lectures: 3 Hrs./Week
Credits: 3

Examination Scheme:
Theory Paper: 100 Marks
Credits: 3

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1. **Numerical Methods**:
   Partial differential equation Laplace and Poisson’s equation-solution, method of characteristics for solution of initial boundary value problems-it’s use, relaxation method, finite difference method.

2. **Statistics & Probability**:
   Various distribution binomial, normal, log-normal, Poisson, Beta B, gamma distribution, Pearson type I,II & II distribution test of significance, Chi square test, correlation, simple and multiple regression, Markov Chain, Markov process.

3. **Numerical Integration**:
   Simpson’s rule, trapezoidal rule, Guass, Quadrature formulae.

4. **Complex Variables**:
   Schwarz Christoffel transformation, Conformal mapping, Jukowski transformation, Complex integration, Taylors expansion, Application to boundary value problem.

**Reference Books**

1. Computational Fluid Dynamics – Anderson.

1. **Introduction:**
   Objectives: of water resource planning and management its Necessity. Aspects of water resources planning-Engineering Social of Water Resources Planning and Management Economic aspects.

2. **Economic Planning:**
   Cost benefit studies of single and multipurpose projects – Multi objective planning models. Irrigation management policy, farmers’ participation, formation of water users cooperative societies, integrated approach in WRE, state water disputes, state of art integrated water resources management-Different bodies in water resources planning and their introduction-Global Water Partnership, ICOLD, ICID etc.

3. **Preparation of feasibility reports.**

**Reference Books**

UNIVERSITY OF PUNE
M.E. (CIVIL) (HYDRAULIC ENGINEERING)

SEMESTER I

Subject Code 501303

FLUID MECHANICS

Teaching Scheme:       Examination Scheme:
Lectures : 3 Hrs./Week  Theory Paper : 100 Marks
Credits : 3

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1. **Kinematics of flow**:
   Continuity Equation in polar and cylindrical coordinates, solving laplace’s equation by graphical & relaxation method, conformal mapping. Standard two dimensional flow pattern, source, sink, doublet and their combination.

2. **Laminar Flow**:
   Navier Stokes equation-derivation, exact flow between parallel plates-it’s exact solution, flow near an oscillating plate & suddenly accelerated plate.

3. **Boundary Layer Theory**:
   Karman’s momentum integral equation, Karman Pohlhausen’s solution, boundary layer separation.

4. **Turbulent Flow**:
   Reynold’s equation of motion, typical solution, Energy and Momentum equation, Statistical theory of turbulence, Isotropic and homogeneous turbulence, probability density function.

5. **Principles of Compressible Flow**:
   Compressible fluid flow-fundamental equation, continuity equation, energy equation, velocity of propagation. Pressure, density and temperature in terms of Mach No, Normal shock in one dimensional compressible flow & compressible flow around immersed bodies.

**Reference Books**
1. Applied Hydrodynamics – H.R. Vallentine, ELBS Publication
2. Fluid Mechanics-Grade & Mirajgaonkar
UNIVERSITY OF PUNE
M.E. (CIVIL) (HYDRAULIC ENGINEERING)

SEMESTER I

Subject Code 501304
ELECTIVE - I
REMOTE SENSING AND G.I.S. IN WATER RESOURCES ENGINEERING

Teaching Scheme:
Lectures : 3 Hrs./Week

Examination Scheme:
Theory Paper : 100 Marks
Credits : 3


2. Introduction to G.I.S. Data collection and input processing in G.I.S. Types of database – Spatial database, Attribute database, Data quality and errors in G.I.S.


Reference Books


UNIVERSITY OF PUNE  
M.E. (CIVIL) (HYDRAULIC ENGINEERING)  

SEMESTER I  

Subject Code 501304  
ELECTIVE - I  
DAM ENGINEERING  

Teaching Scheme : Lectures : 3 Hrs./Week  
Credits : 3  

Examination Scheme:  
Theory Paper : 100 Marks  
Credits : 3  

1. Gravity Dams :  
Forces acting on the gravity dams earthquake force-pseudostatics and dynamic response approach, load classifications, stability analysis, distribution of shear and normal stresses, principle stresses, Stress concentration around openings, foundation treatments. Design of concrete dam. Reservoir operation.  

2. Arch Dams :  
General concepts of trail load theory, elasticshell methods, thik cylinder theory.  

3. Earth Dam :  
Seepage through dam and its foundations, stability analysis for sudden drowdown condition, steady seepage condition, end of constructions, seismic effects, pore pressures, protection of upstream and downstream slopes.  

4. Rockfill Dams :  
Relevant rockfill characteristics, general design principal method of construction and compaction.  

5. Buttress Dam :  
Concepts and Design.  

6. Spillways :  
Determination of capacity, types of spillways e.g. ogee, siphon, chute, side shaft. Their hydraulic design, crest profile, energy dissipater and divide walls.  

7. Spillway Gates :  
Vibration, types of gates-trainer, durm, vertical lift and automatic gates.  

Reference Books  
1. Concrete Dams – R.S. Varsheny  
2. Irrigation Water Resources & Water Power Engineering P.N. Modi  
UNIVERSITY OF PUNE
M.E. (CIVIL) (HYDRAULIC ENGINEERING)

SEMESTER I

Subject Code 501304

ELECTIVE - I
SYSTEM TECHNIQUES IN WATER RESOURCE ENGINEERING

Teaching Scheme: Examination Scheme:
Lectures: 3 Hrs./Week Theory Paper: 100 Marks
Credits: 3

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1. **System Concepts** :
System concepts, definitions, needs for system approach, different types of
system parameters and variables.

2. **Linear Programming** :
Revision, Big M Method, duality, sensitivity analysis. Application of Linear

3. **Non Linear Programming** :
Unconstrained one Dimensional search methods, Dichotomous search method,
Fibonacci, Golden section, multivariable unconstrained, gradient techniques,
steepest ascent and descent methods, Newton’s methods, Application of
Dichotomous search method, Fibonacci & Golden section to the various sectors of
Water Resource Engineering, FP methods, constrained Lagrangian multiplier
techniques, Kuhn Tucker’s conditions, penalty function methods.

4. **Dynamic Programming** :
Principle of optimality, recursive equations. Application of Dynamic
programming to Water Resource Engineering.

5. **Stochastic Methods** :
Queueing theory, simulation technique, sequencing model, Markov’s process.

6. **Capitalisation** :
Annuity, benefit-cost analysis. Benefit Cost Analysis for multi purpose water
resource projects.

7. **Geometric Programming** :
Polynomial, unconstrained minimization problem, arithmetics geometric
inequality, solution of unconstrained geometric programming, constrained
minimization, geometric programming with mixed inequality constrained.

8. **Games Theory**.
**Reference Books**

2. Operation Research – Taha Hamdey A.
1. **Steady flow in simple pipelines:**
Pump characteristics, pipeline analysis water Hammer: Fundamental equations, elastics waves in conduites, boundary effects, numerical and graphical methods.

2. **Surge Tank:**
Differential equation for surge tank, method of solution, simple, and differential surge tanks with expanded chambers.

3. **Pipe network analysis (steady state & transient):**
Tree type networks, closed loop systems, general pipe system, computer analysis, use of PIPE2000(KYPIPE) and related programs, transient flow in pipe systems, introduction to SURGE program.

4. **Open Channel Hydraulics:**
Classification of open channel flows, gradually varied flows, water surface profiles, floodplain hydraulics, use of HEC_RAS(HEC2) program, use of Pipe2000-SWMM program.

**Reference Books**


1. **Introduction**:
   Concept of hydroinformatics scope of internet and web based modeling in water resources engineering.

2. **Introduction to multi criterion decision support system – Components for modeling software.**

3. **Introduction to Simulation**:
   Different simulation techniques – Applications of simulation techniques in hydraulics.

4. **Introduction to Artificial Neural Networks**:
   Networks and its training-Back propagation algorithm, Conjugate gradient algorithm, Cascade correlation algorithm, Applications of ANN in WRE.

5. **Genetic Algorithm (G.A.)**:
   Concept, Basic principle of GA, Working principle of GA. Coding, Fitness function, GA. Operations, Reproduction, Cross over Mutation, Applications of GA, in WRE.

**Reference Books**


Subject Code 501306

LAB PRACTICE I

Teaching Scheme: Practical : 6 Hrs./Week
Examination Scheme: Term Work : 50 Marks

Credits : 3

This should be based on the syllabi above.

1. To study growth of a boundary layer along a flat plate detailed investigation.

2. Assignment based on dam break problem or model study on a hydraulic structure or open channel.

3. Assignment based on Chow’s method or standard step method for gradually varied flow

4. Design of any type of irrigation scheme

5. Use of software for water resource planning

6. Visit to a hydraulic structure & preparation of visit report.
UNIVERSITY OF PUNE
M.E. (CIVIL) (HYDRAULIC ENGINEERING)

SEMESTER I

Subject Code 501307

SEMINAR I

Teaching Scheme:
Practical : 4 Hrs \ Week

Examination Scheme:
Term Work : 50 Marks
Credits : 2
1. Review of uniform flow formulae and design of channels

2. Hydraulic Jump :
   Formations of jump in expanding and contracting channel, jump type, jump control, jump on sloping floors.

3. Gradually Varied Steady flow :
   Gradually varied steady flow and rapidly varied steady flow in open channels, surface profiles in GVF-analysis, different method of computations, Chow’-s methods, standard step method, finite difference method.

4. Spatially Varied Flow :
   Differential Equation of spatially varied flow, profile computation.

5. Stratified Flow :
   Equation of motion, exchange coefficients, turbulence theory, waves.

6. Flood Routing :
   Muskinghum method, finite difference scheme, channel roating storage, method of characteristics, differential form of Momentum Equation.

7. Unsteady Flow :
   Waves, celerity of wave, boundary conditions, standing and progressive wave, positive and negative surges, Dam break problem, deep water, group velocity, solitary wave.
Reference Books

1. Open Channel Hydraulics – Ven Te Chow, Mc-Graw Hill.


4. Open Channel Hydraulics-French, Mc-Graw Hill.
1. **Introduction**:
   Depth area duration analysis, Unit hydrograph theory, IUH, Rainfall runoff models-SWM, Tanks, CLS models, Evaporation, Interception, Depression storage, infiltration, their determination.

2. **Flow Generation**:
   Stochastic processes-classification, time series & its components, various statistical distributions & their uses in hydrology, plotting, position, frequency factors, extreme value theory, synthetic generation of yearly and monthly flows in hydrology.

3. **Floods**:
   Flood estimation by various methods, forecasting of floods, flood frequency analysis, Gumble’s, Pearson type I.II.III. distribution Log-normal method, design flood for various hydraulic structures.

4. **Ground Water Hydraulics**:
   Ground water-defination, aquifers, vertical distribution of subsurface water. Darey’s Law-its range of validity, Dupuit Forchheimer assumption, application of Darcy’s law to simple flowsystems governing differential equation for confined and unconfined aquifers, fully & partially penetrating wells, interference of wells, pumping test with steady & unstady flow, method of image.

5. **Ground Water Development**:
   Ground water Exploration, well types, well construction & design, screens, perforations & gravel packs, pumping equipment, quality of ground water, pollution of ground water.

6. **Ground Water Conservation**:
   Ground water budget, seepage from surface water artificial recharge.
7. Potential Theory:
Formulations of Boundary value problems, conformal mapping & its application to simple cases.

8. Use of Finite Element Method for Ground Water Modelling

Reference Books

1. **Introduction**:
   Significant sediment properties, beginning of sediment movement-shields analysis and other methods.

2. **Bed forms and Resistance**:
   Bed formation, flow regimes, their significance, resistance analysis.

3. **Sediment Transport**:
   Modes of sediment transport, bed load transport Dubuoy’s methods, Einstein’s, Meyer Pater Muller’s methods and other methods, suspended load transport, total load transport microscopic and methods. Use of remote sensing in determining the sediment load.

4. **Design of Stable Channels**:
   Regimes methods, Kennedy’s method, Lacey’s methods, Bunch, Simmon-Albertston method and others methods. Tractive force approach.

5. **Sediments Measurements**:
   Bed load measurements, suspended load measurements.

6. **Aggradation, Degradation, silting of reservoirs.**

7. **River Morphology**:
   Planform river bends, channel characteristics, bifurcations, confluences, river gauging.

8. **River Training**:
   Classification of river training problems, river training methods, guide bank, Groynes or spurs, deflectors, cut offs, pitched island.

**Reference Book**
1. Sediment Transport – R.J. Garde
1. Soil water Relationships:
Water storage zones and relative equilibrium states, flow of water in saturated and unsaturated soil, soil moisture determination.

2. Water-Soil Plant Relationships:
Evaporation, transpiration, consumptive use.

3. Salinity and Alkalinity in irrigated soil

4. Soil Erosion and conservation

5. Drip Irrigation:
General concept, advantages, disadvantages, elements, design concepts.

6. Lift Irrigation:
General concept, elements of lift irrigation schemes, design consideration involved in intake well, jackwell, rising main, distribution system, concept of cost economics.

7. Sprinkler Irrigation:
General concept, advantage and disadvantages, components of the system, types of sprinklers, design concept.

8. Command area, development, onfarm structures, water supply to fields-rotation warabandi.


10. Drainage of Irrigated Land:
Need and purpose of drainage, water logging, design and construction of drainage systems, Ministry of agriculture- WMD recommendations.

**Reference Books**
1. Irrigation, Water Resources & Water Power Engineering, P.N. Modi
# ELECTIVE – III

**COASTAL ENGINEERING**

**Teaching Scheme:**

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- M.\(\square\). Use of linear theory, wave characteristic formulae.
- M.\(\square\). Use of wave table (Weigel, 1996).
- M.\(\square\). Construction of wave refraction diagram by hand.
- M.\(\square\). Construction of wave refraction diagram.
- M.\(\square\). Use of Rayleigh’s distribution for statistical waves.
- M.\(\square\). Calculation of wave energy density spectrum.
- M.\(\square\). Estimation of surface wind speed from weather maps.
- M.\(\square\). Making of wave hindcast/forecast(s).
- M.\(\square\). Relation between energy density spectrum to “significant” wave height.
- M.\(\square\). Construction of a storm surge frequency plot.
- M.\(\square\). Construction of a near shore wave climate frequency plot.
- M.\(\square\). Calculation of the longshore energy flux factor.
- M.\(\square\). Calculation of the longshore sediment transport rate.
- M.\(\square\). Preparation of an engineering sediment budget study.
- M.\(\square\). Relation between beach volume change to shoreline change (erosion/accretion).
M. Beach sand gradation analysis. (VAT)

M. Littoral Environmental Observation (LEO) program.

M. Estimation of shoreline change using a non-line model.

M. Make an appropriate coastal engineering shoreline protection study (E2 Method).

**Reference Book**

1. **Introduction**:

2. **Classification of Hydropower Plant**:
   General Management of running of river plants. Storage, pondage, diversion, canal plants, valley dam plants. Pumped storage plants, advantages & disadvantages, types. Tidal power plants.

3. **Powerhouse**:
   Components, Structural details of powerhouse.

4. **Penstocks**:
   Classification, design criteria, water hammer phenomenon, surge tanks, design procedures & details classification, canal surges.

5. **Turbines**:

6. **Design of micro hydel power plants.**

**Reference Book**

1. Water Power Resources Engineering - Dandekar
1. Nature of waste inputs to water systems, points source and non-point source loading rates.

2. River flow, diffusion and dispersion regimes, pollutant transport mechanisms and modeling Lake and estuaries models, microorganism survival models, dissolve oxygen models, eutrophication reduction, toxic substances and heat management. Application of computer – based models, for water quality and contaminant transport. Contaminant decay modeling.


5. Urban drainage and runoff control; meteorological data analysis, deterministic and stochastic modeling.

6. **Flood Control:**
   Structural and nonstructural alternatives. Effects of hydraulic structures on river surface profiles and sediment transport.

7. **Power Generation:**
   Hydro and thermal power generation. Low flow augmentation. Economics and decision making.

**Reference Book**

SEMESTER II

Subject Code 501313

LAB PRACTICE II

Teaching Scheme:
Practical: 6 Hrs./Week

Examination Scheme:
Term Work: 50 Marks
Credits: 3

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2. Seepage characteristics of various types of soil.
3. Assignments based on sediment transport – Einstein bed load functions,

    OR

    Stable channel design using tractive force theory.

    OR

    Use of resistance laws.

5. Assignments based on non linear programming or dynamics or geometric programming or linear programming with sensitivity analysis.
6. Use of software for solving pipe network problems.
UNIVERSITY OF PUNE  
M.E. (CIVIL) (HYDRAULIC ENGINEERING)

SEMESTER II

Subject Code 501314

SEMINAR II

Teaching Scheme: Practical : 4 Hrs./Week  
Examination Scheme:  
Term Work : 50 Marks  
Credits : 2

1) Seminar II report and the examination shall be based on the literature survey and the work for the dissertation in the IIInd semester.
UNIVERSITY OF PUNE
M.E. (CIVIL) (HYDRAULIC ENGINEERING)

SEMESTER III

Subject Code 501301

SEMINAR III

Teaching Scheme: Examination Scheme:
Practical: 4 Hrs./Week Term Work: 50 Marks
Credits: 2

1) Seminar III report and the examination shall be based on the literature survey and the work for the dissertation in the IIIrd semester.
UNIVERSITY OF PUNE
M.E. (CIVIL) (HYDRAULIC ENGINEERING)

SEMESTER III

Subject Code 501316

PROJECT STAGE I

Teaching Scheme :
Practical : 18 Hrs./ Week

Examination Scheme:
Term Work : 50 Marks
Credits : 6
The Project work will start in semester III, and should preferably be a live problem in the industry or a macro-issue having a bearing of performance of the construction industry and should involve scientific research, design, collection and analysis of data, determining solutions and must preferably bring out the individuals contribution.

The dissertation should be presented in a standard format.
The termwork should be continuously evaluated as per the norms / guidelines set up by the B.O.S. for its assessment of 200 Marks.

The oral examination shall be conducted with the help of approved external examiner.