

III Year - II Semester

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<b>4</b>	<b>0</b>	<b>0</b>	<b>3</b>

## **WATER RESOURCES ENGINEERING-I**

### **Course Learning Objectives:**

The course is designed to

- introduce hydrologic cycle and its relevance to Civil engineering
- make the students understand physical processes in hydrology and, components of the hydrologic cycle
- appreciate concepts and theory of physical processes and interactions
- learn measurement and estimation of the components hydrologic cycle.
- provide an overview and understanding of Unit Hydrograph theory and its analysis
- understand flood frequency analysis, design flood, flood routing
- appreciate the concepts of groundwater movement and well hydraulics

### **Course Outcomes**

At the end of the course the students are expected to

- have a thorough understanding of the theories and principles governing the hydrologic processes,
- be able to quantify major hydrologic components and apply key concepts to several practical areas of engineering hydrology and related design aspects
- develop Intensity-Duration-Frequency and Depth-Area Duration curves to design hydraulic structures.
- be able to develop design storms and carry out frequency analysis
- be able to determine storage capacity and life of reservoirs.
- develop unit hydrograph and synthetic hydrograph
- be able to estimate flood magnitude and carry out flood routing.
- be able to determine aquifer parameters and yield of wells.
- be able to model hydrologic processes

### **SYLLABUS:**

**UNIT I Introduction:** Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.

**Precipitation:** Types and forms, measurement, raingauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm

**UNIT-II Abstractions from Precipitation:** Initial abstractions.

**Evaporation:** factors affecting, measurement, reduction

**Evapotranspiration:** factors affecting, measurement, control

**Infiltration:** factors affecting, Infiltration capacity curve, measurement, infiltration indices.

**UNIT-III Runoff:** Catchment characteristics, Factors affecting runoff, components, computation- empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.

**Hydrograph analysis:** Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph.

**UNIT-IV Floods:** Causes and effects, frequency analysis- Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management.

**Flood Routing:** Hydrologic routing, channel and reservoir routing-Muskingum and Puls methods of routing.

**UNIT-V Groundwater:** Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, types of wells, Darcy's law, Dupuit's equation- steady radial flow to wells in confined and unconfined aquifers, yield of a open well-recuperation test.

**UNIT VI Advanced Topics in Hydrology:** Rainfall-runoff Modelling, instantaneous unit hydrograph (IUH) - conceptual models - Clark and Nash models, general hydrological models- Chow - Kulandaiswamy model.

**Text Books:**

1. Engineering Hydrology, Jayarami Reddy, P., Laxmi Publications Pvt. Ltd., (2013), New Delhi
2. Irrigation and Water Power Engineering, B. C. Punmia, Pande B. B. Lal, Ashok Kumar Jain and Arun Kumar Jain, Lakshmi Publications (P) Ltd.

**References:**

1. Engineering Hydrology Subramanya, K, Tata McGraw-Hill Education Pvt Ltd, (2013),New Delhi.
2. Irrigation Engineering and Hydraulic Structure, Santosh Kumar Garg, Khanna Publishers.
3. Applied hydrology, Chow V. T., D. R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt Ltd, (2011), New Delhi.
4. Water Resources Engineering, Mays L.W, Wiley India Pvt. Ltd, (2013).