

# Advanced Hydrology - Video course

## COURSE OUTLINE

This course has been designed to present the principles of advanced hydrology at a postgraduate level.

At the end of the course, a serious student is expected have a thorough understanding of the fundamental mechanisms of various components of hydrologic cycle e.g. atmospheric water, rainfall, infiltration, evaporation, surface flow, sub-surface flow, groundwater flow, and hydrograph analysis;

And learnt the statistical techniques such as statistical properties of a PDF, probability distributions employed in hydrology, fitting probability distributions, testing goodness of fit, frequency analysis, and reliability analysis.

### Contents:

Hydrologic cycle, systems concept, hydrologic model classification;

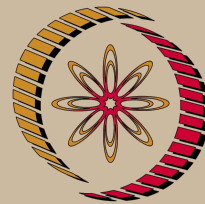
Reynold's Transport Theorem, continuity equation, momentum equation, and energy equation;

Atmospheric hydrology; Hydrologic processes, precipitation, evaporation, surface flow, sub-surface flow, and groundwater flow;

Unit hydrograph, various response functions and their interrelationships; Hydrologic statistics, statistical parameters, fitting a probability distribution, testing goodness of fit, frequency analysis, and reliability analysis.

## COURSE DETAIL

Sl. No.	Topic	No. of Hours
1	<b>INTRODUCTION:</b> <ul style="list-style-type: none"> <li>Hydrologic cycle, water budget equation, world water quantities, residence time, systems concept, transfer function operators, hydrologic model classification.</li> </ul>	03
2	<b>HYDROLOGIC PROCESSES:</b> <ul style="list-style-type: none"> <li>Reynold's Transport Theorem, continuity equation, momentum equation, energy equation, discrete time continuity.</li> </ul>	03
3	<b>ATMOSPHERIC HYDROLOGY:</b> <ul style="list-style-type: none"> <li>Atmospheric circulation, water vapor, formation of rainfall, types and forms of precipitation, precipitable water, monsoon characteristics in India, rainfall measurement, density and adequacy of rain gauges;</li> <li>Thunderstorm Cell model, IDF relationships,</li> </ul>	08



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## Civil Engineering

### Pre-requisites:

- Undergraduate Hydrology.

### Coordinators:

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	<p>spatial averaging methods of rainfall;</p> <ul style="list-style-type: none"> <li>• Factors affecting evaporation, estimation and measurement of evaporation, energy balance method, aerodynamic method, Priestly-Taylor method, and pan evaporation.</li> </ul>	
4	<p><b>SUB-SURFACE WATER:</b></p> <ul style="list-style-type: none"> <li>• Soil moisture, porosity, saturated and unsaturated flow; Richard's equation, infiltration, Horton's Phillip's, and Green Ampt methods, parameter estimation, ponding time concepts.</li> </ul>	04
5	<p><b>SURFACE WATER:</b></p> <ul style="list-style-type: none"> <li>• Catchment storage concept, Hortonian and saturation overland flow, streamflow hydrographs, base-flow separation.</li> <li>• Phi-index, ERH &amp; DRH, algorithm for abstraction using Green-Ampt equation, SCS method, overland and channel flow modeling, time area concepts, and stream networks.</li> </ul>	06
6	<p><b>UNIT HYDROGRAPH:</b></p> <ul style="list-style-type: none"> <li>• General hydrologic system model, response functions of a linear hydrologic systems and their inter-relationships, convolution equation; definition and limitations of a UH;</li> <li>• UH derivation from single and complex storms; UH optimization using regression. matrix, and LP methods;</li> <li>• Synthetic unit hydrograph, S-Curve, IUH.</li> </ul>	06
7	<p><b>HYDROLOGIC STATISTICS:</b></p> <ul style="list-style-type: none"> <li>• Probability concepts, random variables, laws of probability, PDFs &amp; CDFs;</li> <li>• Normal and Binomial distributions; Statistical parameters: expected value, variance, skewness, and peakedness;</li> <li>• Fitting of a probability distribution, methods of moments and maximum likelihood: Testing the goodness of fit, Chi-square test;</li> <li>• Frequency analysis: return period, probability plotting, Extreme value distributions, frequency factors, Log-Pearson distribution, confidence limits.</li> </ul>	08
8	<p><b>GROUNDWATER HYDROLOGY:</b></p> <ul style="list-style-type: none"> <li>• Occurrence of groundwater, aquifers &amp; their properties, Darcy's law, permeability, transmissibility, stratification, confined groundwater flow, unconfined groundwater flow under Dupit's assumptions;</li> <li>• Well hydraulics, steady flow into confined and unconfined wells; Unsteady flow in a confined aquifer.</li> </ul>	07

**References:**

1. Applied Hydrology by Ven T. Chow, David R. Maidment, and Larry W. Mays, McGraw Hill International Editions.
2. Engineering Hydrology by K. Subramanya, Tata McGraw Hill Publishing Company, New Delhi.