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	**INTRODUCTION:** • Hydrologic cycle, water budget equation, world water quantities, residence time, systems concept, transfer function operators, hydrologic model classification.	03
2	**HYDROLOGIC PROCESSES:** • Reynold's Transport Theorem, continuity equation, momentum equation, energy equation, discrete time continuity.	03
3	**ATMOSPHERIC HYDROLOGY:** • 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; • Thunderstorm Cell model, IDF relationships,	08

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Civil Engineering

Pre-requisites:

1. Undergraduate Hydrology.

Coordinators:

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	spatial averaging methods of rainfall; • Factors affecting evaporation, estimation and measurement of evaporation, energy balance method, aerodynamic method, Priestly-Taylor method, and pan evaporation.	
4	**SUB-SURFACE WATER:** • Soil moisture, porosity, saturated and unsaturated flow; Richard's equation, infiltration, Horton's Phillip's, and Green Ampt methods, parameter estimation, ponding time concepts.	04
5	**SURFACE WATER:** • Catchment storage concept, Hortonian and saturation overland flow, streamflow hydrographs, base-flow separation. • Phi-index, ERH & DRH, algorithm for abstraction using Green-Ampt equation, SCS method, overland and channel flow modeling, time area concepts, and stream networks**.**	06
6	**UNIT HYDROGRAPH:** • General hydrologic system model, response functions of a linear hydrologic systems and their inter-relationships, convolution equation; definition and limitations of a UH; • UH derivation from single and complex storms; UH optimization using regression. matrix, and LP methods; • Synthetic unit hydrograph, S-Curve, IUH**.**	06
7	**HYDROLOGIC STATISTICS:** • Probability concepts, random variables, laws of probability, PDFs & CDFs; • Normal and Binomial distributions; Statistical parameters: expected value, variance, skewness, and peakedness; • Fitting of a probability distribution, methods of moments and maximum likelihood: Testing the goodness of fit, Chi-square test; • Frequency analysis: return period, probability plotting, Extreme value distributions, frequency factors, Log-Pearson distribution, confidence limits**.**	08
8	**GROUNDWATER HYDROLOGY:** • Occurrence of groundwater, aquifers & their properties, Darcy's law, permeability, transmissibility, stratification, confined groundwater flow, unconfined groundwater flow under Dupit's assumptions; • Well hydraulics, steady flow into confined and unconfined wells; Unsteady flow in a confined aquifer.	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.