

Course title: Applied hydrology and meteorology						
Course code: WSW 167	No. of credits 3	L-T-P distribution: 29-13-0	Learning hours: 42			
Pre-requisite course code and title (if any): None						
Department: Department of Regional Water Studies						
Course coordinator(s): Ms. Ranjana Ray Chaudhuri		Course instructor(s): Ms. Ranjana Ray Chaudhuri				
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Course type: Compulsory Core		Course offered in: Semester 1				
Course description This course will introduce the concepts of hydrology and understanding the basic methods and techniques to analyze the different factors governing the hydrological cycle. It would provide the students with an overview of monitoring and evaluation of hydrologic elements and accurately analyze the parameters involved. A field-trip or a large-scale laboratory experiment in the current semester or subsequent semesters will provide an exposure to the monitoring of hydro-meteorological parameters in practice. It would prepare the students to take up future water resource management courses.						
Course objectives						
<ul style="list-style-type: none"> ▪ Introduce students to various methods of estimation and analysis of rainfall data. ▪ Use techniques to assess stream flow both in natural conditions and in times of flood. ▪ Prepare students to take up any advanced course in water resources engineering and management. ▪ Expose students to estimate all parameters and characteristics related to hydrological aspects of catchment studies. 						
Course content						
Module	Topic			L	T	P
1	Introduction: Definition and scope of the subject, world water resources, the Indian scenario, the hydrologic cycle, global atmospheric and ocean circulation, meteorology, air masses and frontogenesis.			4	0	0
2	Precipitation: process, types, monsoon and jet streams, mechanism of Indian monsoon and rainfall pattern, southern ocean oscillation and influence on monsoon, cyclones, measurement, assessment of precipitation in gauged and un-gauged basins, hydrological data. Global climate change and influence on precipitation			4	2	0
3	Analysis of Precipitation data: requirement of rain gauges, data consistency check and data gap estimation, supplementing missing precipitation records, presentation of rainfall data-mass curve and hyetograph, precipitation variability, estimation of mean precipitation over an area, depth area relationship, intensity-duration-frequency relationship, moving average curve, probable maximum precipitation			4	2	0
4	Infiltration: Definition and factors affecting infiltration, infiltrometers, infiltration indices, infiltration equations, infiltration curves, determination of infiltration rates, phi index and Horton's equation. Estimation of losses from precipitation: evaporation and transpiration. Measurement and estimation of evaporation, evaporation formulae. Measurement and estimation of evapotranspiration, depression storage, interception.			3	1	0
5	Runoff: components, water yield, flow duration curve, flow mass curve, rainfall runoff correlations, hydrograph, factors affecting flood hydrograph. Unit Hydrograph (UH)-definition, assumptions, limitation, derivation of UH from storm hydrograph, derivation of UH of longer duration from UH of shorter duration, derivation of UH of shorter duration from UH of longer duration, derivation of storm hydrograph from UH. Synthetic unit hydrograph and instantaneous unit hydrograph			4	4	0
6	Estimation and measurement of discharge Requirement of a stream gauging station, measurement of stage			2	0	0
7	Flood studies: Estimation of flood peak, classification of hydrological modelling-Rational method, empirical formulae, Unit Hydrograph techniques, SCS method. Hydrologic processes, continuity equation, momentum and energy equations, for hydrologic routing. Flood Routing concept and techniques, hydrologic reservoir routing using Modified Puls method, hydrologic channel routing using Muskingum			4	4	0

	method, introduction to hydraulic routing. Flood frequency analysis, estimation of magnitude, empirical formulae, importance of flood studies.			
8	Groundwater hydrology: Introduction to basic concepts of groundwater hydrology: Aquifers & their properties, hydraulics of wells	4	0	0
	Total	29	13	0
Evaluation criteria				
Minor 1	15%			
Minor 2	15%			
Tutorial and Quizzes	20%			
End-term exam	50%			
Learning outcomes				
Students will be capable of performing spatial and temporal analysis of rainfall and runoff data at all scales of planning and management involving watersheds and river basins.				
Students will be to assess drought situations, flood scenarios and normal flows in streams and catchments using the skills developed during this course				
Real life field application challenges like differences in urban and rural hydrologic processes due to human intervention can be identified and inputs can be provided for design of hydraulic structures.				
Pedagogical approach				
Classroom teaching will involve black board, power point presentations, derivations and case study analysis. The sessions will be interactive and students will be expected to make presentations on specific research topics. These will be from the modules of the syllabus.				
Materials				
Textbooks				
Chow V.T. (1988). <i>Applied Hydrology</i> , Tata McGraw Hill Publishing Co.				
Patra K.C. (2011). <i>Hydrology and Water Resources Engineering</i> , Narosa Publishing House.				
Subramanya K. (2004). <i>Engineering Hydrology</i> , Tata McGraw-Hill, New Delhi.				
Suggested Reading				
Black P.E. (1996) <i>Watershed Hydrology</i> , Lewis Publishers.				
Jain S.K., Agarwal P.K. and Singh V.P. (2007) <i>Hydrology and Water Resources of India</i> , Springer, The Netherlands.				
Raghunath H.M. (2006) <i>Hydrology</i> , Newage International (P) Ltd., New Delhi.				
Shaw E.M (2004) <i>Hydrology in Practice</i> , 3rd Ed, Routledge.				
Singh G., Venkataraman C., Sastry G. and Joshi B.P. (1990) <i>Manual of Soil and Water Conservation Practices</i> , Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.				
Singh V.P. (1993) <i>Elementary Hydrology</i> , Prentice Hall, Englewood, New Jersey.				
Suresh R. (2005) <i>Watershed Hydrology</i> , Standard Publishers Distributors, New Delhi.				
Ward A.D. and Elliot W.J. (eds.) (1995) <i>Environmental Hydrology</i> , Lewis Publishers.				
Journals				
Journal of Atmospheric Research				
Journal of Hydrology				
International Journal of Climatology				
Water Resources Research				
Advances in Water Resources				
Additional information (if any):				
Student responsibilities				
The nature of the course demands that the students shall attend all lectures and tutorials. It is expected that students will submit assignments on time, take all class tests. Discipline will be maintained in class at all times.				

Course reviewers

1. Prof N.K. Goel, Professor of Hydrology, Department of Hydrology, IIT Roorkee, Uttarakhand, India
2. Prof. Narendra. Kanhe, Principal, Guru Nanak Institute of Engg. and Management, Dahegaon, Near Radha Soami Satsang Place, Katol Road, Nagpur