Course title: Hydrology			
Course code: NRE 162	**No. of credits:** 3	**L-T-P:** 30-15-0	**Learning hours:** 45
Pre-requisite course code and title (if any):			
Department: Natural and Applied Sciences			
Course coordinator:		**Course instructor:** Prof V Subramanian	
Contact details: subra42@gmail.com			
Course type: Elective		**Course offered in:** Semester 2	

Course Description

This course will introduce the concepts of hydrology. It would also provide an understanding of 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. A field-trip or a large-scale laboratory experiment will provide an exposure to the monitoring of hydro-meteorological parameters in practice. It would prepare the students to take up water resource management later on, leading to sustainable development.

Course objectives

1. Analyse precipitation data in detail, presentation of rainfall data and calculation of missing precipitation data
2. Assess precipitation losses like evaporation, transpiration and infiltration
3. Measure discharge and calculate runoff using empirical formulae

Course content

Module	Topic	L	T	P
1.	Introduction Hydrology – Definition, need and historical perspective; hydrologic cycle; concept of water budget, world water balance, Indian scenario, the monsoon system.	2	0	0
2.	Precipitation The precipitation process, its forms and types; characteristics of precipitation, global and Indian context; measurement of precipitation, rain gauge network, determination of optimal number of rain gauge stations.	2	0	0
3.	Analysis of Precipitation data Preparation of data, data consistency check and estimation of missing data; presentation of rainfall data – mass curve and hyetograph, precipitation variability, estimation of mean precipitation over an area, depth area relationship, frequency of point rainfall, intensity-duration-frequency relationship, probable maximum precipitation.	4	2	0
4.	Losses from precipitation Evaporation – the process, measurement and estimation; Evapotranspiration – the process, measurement and estimation of potential maximum evapotranspiration; Interception losses; Depression storage, Infiltration – the process, measurement and estimation, Infiltration indices.	3	2	0
5.	Measurement of discharge Streamflow measurement methods – direct and indirect methods; Concept and need for stage-discharge relationships; measurement of stage; measurement of velocity; Stage-discharge relationship – permanent and shifting control.	3	2	
6.	Runoff Runoff characteristics and its components, hydrograph, classification of streams; Runoff volume, water yield, rainfall-runoff relationship; flow	3	2	

	duration curve, flow mass curve; determination of storage volume – mass curve method and sequent peak algorithm; overview of droughts; surface water resources of India.			
7.	Flood hydrographs Flood hydrograph - definition, elements and factors affecting flood hydrograph; Direct runoff hydrograph and effective rainfall hyetograph, Unit Hydrograph – definition, assumptions, limitation, derivation of UH from storm hydrograph, derivation of UH of different durations – method of superposition and S-curve technique, derivation of storm hydrograph from UH; distribution graph; synthetic UH	5	4	0
8.	Analysis of floods Estimation of flood peak – Rational method, empirical formulae, Unit Hydrograph techniques, flood frequency studies; Overview of Flood Routing concept and techniques, hydrologic routing.	5	2	0
9.	Groundwater hydrology Basic concepts and definitions; forms of subsurface water; Darcy's law; aquifers – definition, types, flow of water to a well in confined and unconfined aquifers.	3	1	0
	Total	**30**	**15**	

Evaluation criteria

- Tests 1 & 2: 20% each
- Assignments/Quizzes: 20 %
- Test 3: 40%

Learning outcomes

- Ability to estimate flood peaks, fix capacity reservoir of reservoirs
- Ability to quantify rainfall data, estimate return period of extreme rainfall events
- Prepare to take up advanced courses in water resources in future semesters

Pedagogical approach

Materials

Required text

1. Chow V.T. (1988) *Applied Hydrology,* Tata McGraw Hill Publishing Co.
2. Patra K.C. (2011) *Hydrology and Water Resources Engineering,* Narosa Publishing House.
3. Subramanya K. (2004) *Engineering Hydrology,* Tata McGraw-Hill, New Delhi.

Suggested readings

1. Black P.E. (1996) *Watershed Hydrology,* Lewis Publishers.
2. Chow V.T. (1988) *Applied Hydrology,* Tata McGraw Hill Publishing Co.
3. Jain S.K., Agarwal P.K. and Singh V.P. (2007) *Hydrology and Water Resources of India,* Springer, TheNetherlands.
4. Patra K.C. (2001) *Hydrology and Water Resources Engineering,* Narosa Publishing House.
5. Shaw E.M (2004) *Hydrology in Practice,* 3rd Ed, Routledge.
6. Singh G., Venkataraman C., Sastry G. and Joshi B.P. (1990) *Manual of Soil and Water Conservation Practices,* Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Singh V.P. (1989) *Hydrologic Systems, Vol–I and II,* Prentice Hall, New Jersey.
8. Singh V.P. (1993) *Elementary Hydrology,* Prentice Hall, Englewood, New Jersey.
9. Subramanya K. (2004) *Engineering Hydrology,* Tata McGraw-Hill, New Delhi.
10. Suresh R. (2005) *Watershed Hydrology,* Standard Publishers Distributors, New Delhi.
11. Viessman W., Lewis and Gary L. (2002) *Introduction to Hydrology,* Prentice Hall.
12. Ward A.D. and Elliot W.J. (eds.) (1995) *Environmental Hydrology,* Lewis Publishers.
13. Ward R.C. and Robinson M. (1990) *Principles of Hydrology,* McGraw Hill.

Journals 1. Hydrology Journal of IAH 2. Journal of Hydrology 3. Journal of Spatial Hydrology
Advanced Reading Material
Additional information (if any)
Student responsibilities The students are expected to submit assignments in time and come prepared with readings when provided

Course reviewers: