

**COURSE CODE:** CE-357  
**COURSE NAME:** WATER RESOURCES ENGINEERING AND MANAGEMENT

**CREDIT HOURS:** Theory = 02  
 Practical = 01  
 Total = 03

**CONTACT HOURS:** Theory = 32  
 Practical = 48  
 Total = 80

**PREREQUISITE:** Nil

**MODE OF TEACHING:**

Instruction: Two hours of lecture per week 67%  
 Practical: Three hours of Lab work per week 33%

**COURSE DESCRIPTION:**

This course is designed to familiarize the students of Geo-informatics engineering with the knowledge of water resources engineering. This course introduces to the students the principles of hydrology, including the hydrological cycle and its impact on water resources availability, catchment water balance, measurement of catchment rainfall and its analysis, measurement of flow in natural rivers and channels. Also, it introduces fundamentals of subsurface flow emphasizing the role of groundwater in the hydrologic cycle and the relation of groundwater flow to geologic structure of earth. It will introduce with the river engineering such as river morphology, River survey. Finally, the introduction with the applications of RS and GIS in water resources modelling and simulations.

**COURSE OBJECTIVES:**

To understand the principles of hydrology, including the hydrological cycle and its impact on water resources availability. Learn fundamentals of subsurface flow emphasizing the role of groundwater in the hydrologic cycle and aquifer development. Understand the river morphology and behavior of river flows under specific circumstances. To learn the role/applications of GIS and RS in water resources modelling and simulations.

**RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):**

The course is designed so that students will achieve the PLOs:

- |   |                                  |                                     |    |   |                          |
|---|----------------------------------|-------------------------------------|----|---|--------------------------|
| 1 | Engineering Knowledge:           | <input type="checkbox"/>            | 7  | Ethics:                                 | <input type="checkbox"/> |
| 2 | Problem Analysis:                | <input checked="" type="checkbox"/> | 8  | Individual and Collaborative Team Work: | <input type="checkbox"/> |
| 3 | Design/Development of Solutions: | <input type="checkbox"/>            | 9  | Communication:                          | <input type="checkbox"/> |
| 4 | Investigation:                   | <input type="checkbox"/>            | 10 | Project Management:                     | <input type="checkbox"/> |
| 5 | Tool Usage:                      | <input type="checkbox"/>            | 11 | Lifelong Learning:                      | <input type="checkbox"/> |
| 6 | The Engineer and Society:        | <input type="checkbox"/>            |    |   |                          |

**COURSE LEARNING OUTCOMES:**

Upon successful completion of the course, students will be able to:

S.No	CLO	Domain	Taxonomy Level	PLO
1	Analyze the catchment water yield by using the basic principles of engineering hydrology.	Cognitive	4	2
2	Analyze rainfall-runoff transformation for storms of various duration and intensity.	Cognitive	4	2
3	Analyze the flood wave to predict its spatio-temporal characteristics in a river reach or a reservoir.	Cognitive	4	2
4	Practice the effects of various storm and catchment characteristics on rainfall-runoff relationships conduction laboratory experiments and computer based integrated models.	Psychomotor	3	-

**TOPICS COVERED:****Theory:**

Week	Topics
1	Introduction to Water Resources of Pakistan
2	Introduction to Surface Water Hydrology
3- 4	Precipitation, AI in climate prediction and projections
5	Evapotranspiration
6	Runoff, AI in Streamflow predictions (rainfed and hydrologically complex catchments)
7- 9	Hydrograph
10	Stream Gauging
11-13	Flood Routing
14	Basic Definitions & Law in Ground Water Hydrology
15	Well Hydraulics
16	Tube Well Construction
17-18	<b>ESE</b>

**Practical:**

No	Topic
1	Development of a Hydrograph for Long Duration Storm ( $t_p > t_c$ ) on Dry Catchment
2	Development of a Hydrograph for Short Duration Storm ( $t_p < t_c$ ) on Dry Catchment
3	Development of a Hydrograph for Short Duration Storm ( $t_p < t_c$ ) on Saturated Catchment
4	Development of a Hydrograph for Short Duration Storm ( $t_p < t_c$ ) on Impermeable Catchment
5	Effect of Catchment Slopes on Hydrograph
6	Development of a Hydrograph for Single & Multiple Storms on a Catchment
7	Development of a Hydrograph from Moving Storm
8	Development of a Unit Hydrograph & Its Application
9	Development of Water Table Contour Map
10	Effect of Interflow on the Runoff Hydrograph
11	Snowmelt Runoff Model (SRM): Getting Familiar with the Software and integration with GIS and RS
12	HEC-HMS: Getting Familiar with the Software and integration with GIS and RS
13	HEC-RAS: Getting Familiar with the Software, data required and extraction using GIS and RS

## TEXT AND MATERIAL:

### Textbook(s):

- a. Ghumman, A. R. (2006) Engineering Hydrology: An Introduction. Prosperous Pakistan Publishers, Lahore, Pakistan.
- b. Raghunath, H.M. (1988). Hydrology: Principles, Analysis & Design, Wiley Eastern, India.
- c. P. Ph. Jansen (Ed.), Principles of River Engineering: The Non-tidal Alluvial River, Addison- Wesley Educational Publishers Inc., 1979.

### Reference Books:

- a. Punmia, B.C. (1984). Irrigation & Waterpower Engineering, Standard Publishers Distributors, New Dehli, India
- b. Sharma R.K. A Textbook of Waterpower Engineering--Including Dams Engineering, Hydrology and Fluid Power Engineering - S. Chand and Company Ltd, New Delhi
- c. Linsley R K, Kohler M A, and Paulhus L H (1988) Hydrology for Engineers, McGraw Hill, Paperback - 1988, ISBN
- d. Bedient P B, Huber W C & Vieux B E (2012), Hydrology and Floodplain Analysis (5th Ed.), Pearson, 2007

## ASSESSMENT SYSTEM:

### 1. CLOs Assessment

Cognitive	Psychomotor	Affective
Spreadsheet	Rubrics	-

### 2. Relative Grading

<b>Theoretical / Instruction</b>			67%
	<i>Assignments 10%</i>		
	<i>Quizzes 10%</i>		
	<i>Mid Semester Exam 30%</i>		
	<i>End Semester Exam 50%</i>		
<b>Practical Work</b>			33%
<i>Laboratory Work</i>		70%	
	<i>Laboratory Attendance 20%</i>		
	<i>Laboratory Report 20%</i>		
	<i>Laboratory Quiz 30%</i>		
<i>Viva/Quiz</i>		30%	
<b>Total</b>			<b>100%</b>