

## Engineering Hydrology

<b>Course Code</b>	<b>Credit Hours</b>
<b>CE-358</b>	<b>2-1</b>

### Course Description

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.

### Text Book:

1. Ghumman, A. R. (2006) Engineering Hydrology: An Introduction. Prosperous Pakistan Publishers, Lahore, Pakistan.

### Reference Book:

1. Raghunath, H.M. (1988). Hydrology: Principles, Analysis & Design, Wiley Eastern, India.
2. Punmia, B.C. (1984). Irrigation & Water Power Engineering, Standard Publishers Distributors, New Dehli, India
3. Sharma R.K. A Textbook of Water Power Engineering--Including Dams Engineering, Hydrology and Fluid Power Engineering - S. Chand and Company Ltd, New Delhi
4. Linsley R K, Kohler M A, and Paulhus L H (1988) Hydrology For Engineers, McGraw Hill, Paperback - 1988, ISBN
5. Bedient P B, Huber W C & Vieux B E (2012), Hydrology and Floodplain Analysis (5th Ed.), Pearson, 2007
6. Chow V T, Maidment D R and Mays L W (1988). Applied Hydrology, McGraw-Hill.

### Prerequisites:

Nil

### ASSESSMENT SYSTEM FOR THEORY

	<b>Without Project (%)</b>	<b>With Project/Complex Engineering Problems (%)</b>
Quizzes	15	10-15
Assignments	10	5-10
Mid Terms	25	25

Project	-	5-10
End Semester Exam	50	45-50

### **ASSESSMENT SYSTEM FOR LAB**

Lab Work/ Psychomotor Assessment/ Lab Reports	70%
Lab Project/ Open Ended Lab Report/ Assignment/ Quiz	10%
Final Assesment/ Viva	20%

### **Teaching Plan**

<b>Week No</b>	<b>Topics/Learning Outcomes</b>
1	<u>Introduction</u> <ul style="list-style-type: none"> <li>• Introduction to Engineering Hydrology</li> <li>• Significance and Practical Uses</li> <li>• Hydrological Cycle</li> <li>• Water Balance Equation</li> </ul>
2	<u>Meteorology</u> <ul style="list-style-type: none"> <li>• The Atmosphere and its Components</li> <li>• Relative Humidity, Dew Point and Saturation Deficit</li> <li>• Solar Radiation,</li> <li>• Measurement of Air Temperature, Relative Humidity, Radiation, Sunshine, Atmospheric Pressure and Wind Velocity with Direction</li> </ul>
3-5	<u>Precipitation</u> <ul style="list-style-type: none"> <li>• Factors necessary for the formation of Precipitation</li> <li>• Types of Precipitation</li> <li>• Forms of Precipitation</li> <li>• Measurement</li> <li>• Precipitation Data Interpretation</li> <li>• Precipitation Data Analyses</li> <li>• Computation of Average Rainfall over a Basin</li> </ul>
6-7	<u>Evaporation and Transpiration</u> <ul style="list-style-type: none"> <li>• Factors affecting Evaporation.</li> <li>• Measurement of Evaporation</li> <li>• Evapotranspiration</li> </ul>

8	<u>Streamflow</u> <ul style="list-style-type: none"> <li>• Water Stage and its Measurement</li> <li>• Selection of Site for Stage Recorder</li> <li>• Selection of Control and Metering Station</li> <li>• Methods of Measurement of Streamflow</li> </ul>
9	<b>Mid Semester Exam</b>
10-12	<u>Runoff and Hydrograph</u> <ul style="list-style-type: none"> <li>• Factors affecting Runoff.</li> <li>• Estimating the Volume of Runoff</li> <li>• Characteristics and Components of Hydrograph</li> <li>• Hydrograph Separation</li> <li>• Estimating the Volume of Direct Runoff</li> <li>• Introduction to the concept of Unit Hydrograph</li> <li>• S-curve Preparation</li> </ul>
13-14	<u>Streamflow Routing</u> <ul style="list-style-type: none"> <li>• Introduction to Flood and its Causes</li> <li>• Flood Frequency and Duration Analysis</li> <li>• Design Flood and Return Period</li> <li>• Reservoir Routing</li> <li>• Channel Routing</li> <li>• Introduction to Hydrological Modeling</li> <li>• Flood Control</li> </ul>
15	<u>Groundwater</u> <ul style="list-style-type: none"> <li>• Sources and Discharge of Groundwater</li> <li>• Water Table and Artesian Aquifers</li> <li>• Aquifer Characterization</li> <li>• Pumping Test</li> <li>• Tubewell Technology</li> </ul>
16	<u>Advanced Hydrology</u> <ul style="list-style-type: none"> <li>• Remote Sensing</li> <li>• Cloud Seeding</li> <li>• Artificial Intelligence in Engineering Hydrology</li> </ul>
17-18	<b>End Semester Exam</b>

**Practical**

Experiment No	Description
1	Measurement of Pan Evaporation
2-5	Effect of Various Conditions of the Catchment Area and its Slope on the Rainfall-Runoff Relationships: <ul style="list-style-type: none"> <li>a. Long duration storm (<math>t_r &gt; t_c</math>) on dry catchment</li> <li>b. Short duration storm (<math>t_r &lt; t_c</math>) on dry catchment</li> <li>c. Short duration storm (<math>t_r &lt; t_c</math>) on saturated catchment</li> <li>d. Short duration storm (<math>t_r &lt; t_c</math>) on impermeable catchment</li> <li>e. Effect of catchment slopes on runoff hydrograph</li> </ul>
6	To study the rainfall-runoff characteristics of an urban catchment
7	Effect of Multiple Storms on the Runoff Hydrograph
8	OEL: Flood wave arrival time computation in lab flume
9	HEC-HMS: Getting Familiar with the Software
10	To draw a cone of depression for a single well in an unconfined aquifer pumping at a constant discharge
11	To draw cones of depression for multiple wells in an unconfined aquifer pumping at a constant discharge