



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: UG

Branch: Civil

Subject Code: BE05006021

Subject Name: Engineering Hydrology

w. e. f. Academic Year:	2024-25
Semester:	5
Category of the Course:	Professional Core Course

Prerequisite:	Engineering Mathematics, Fluid Mechanics
Rationale:	Hydrology is essential for understanding the occurrence, distribution, and movement of water on Earth. This course enables students to analyze hydrological processes for the planning and design of water resources systems such as dams, irrigation projects, drainage systems, and flood control measures. It also supports sustainable water management aligned with global development goals.

Course Outcome (Theory):

After learning the course, the students should be able to:

Sr. No.	CO Statement	Marks % Weightage
CO-1	Comprehend hydrological cycle, precipitation processes, and measurement techniques.	R, U
CO-2	Analyze infiltration, evaporation, and runoff processes in a watershed.	U, A
CO-3	Apply unit hydrograph and flood routing methods for hydrological analysis.	A, E
CO-4	Estimate flood discharge using empirical and statistical methods.	A, E
CO-5	Evaluate groundwater flow and well hydraulics for sustainable usage.	U, A, E

Teaching/Learning Scheme in hrs/semester					Total Credits	Assessment Pattern and Marks					Total Marks
L	T	P	PBL*	TH	TH/30	Theory		Practical			
						ESE (E)	PA (M)	PA (I)	PBL(I)	ESE (V)	
45	0	30	15	90	3	70	30	20	30	50	200

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End-Semester Examination, PA = Progressive Assessment

* Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.



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Course Content:

Sr.No.	Content	Total Hrs	% Weightage
1	Introduction to Hydrology, Hydrologic cycle, Scope and applications, Water budget equation, Precipitation and measurement, Mean rainfall estimation	6	14
2	Precipitation Measurement and Analysis: Precipitation variability, rainfall and snow measurement techniques, design of precipitation gauging network, consistency of rain record, filling up of missing record, estimation of mean areal rainfall, IDF and DAD analysis.	6	14
3	Hydrologic Abstractions: Interception and depression storage Evaporation: Factors affecting, measurement and estimation Evapotranspiration: measurement and estimation; Infiltration, factors affecting infiltration, measurement of infiltration, empirical and analytical models of infiltration.	6	14
4	Stream Flow: Runoff process: Measurement of stream flow, factors affecting stream flow; Stage-discharge relationship; Peak discharge estimation; hydrograph analysis, base flow separation, unit hydrograph for stream flow estimation, synthetic unit hydrograph, hydrological modelling	8	18
5	Watershed Management: Watershed and its characteristics; Curve number method; Soil erosion and estimates; Watershed management techniques, Erosion control, Contributions of watershed management to the sustainable development goals, drought analysis and management, watershed simulation.	6	12
6	Groundwater Hydrology: Types of aquifers; Flow and storage parameters; Well hydraulics; Groundwater flow modeling, Hydrogeological and geophysical surveys; Groundwater quality, Contaminant transport modeling; Sea water intrusion.	6	14
7	Flood Routing: Governing equations, Reservoir flood routing, Hydrologic routing: Muskingum method, Estimation of flood, Flood frequency analysis, Gumbel's method.	7	14
	TOTAL	45	100



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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	20	25	20	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

The syllabus of *Engineering Hydrology* directly contributes to

SDG 13	Climate Action: The course strongly supports climate action through study of hydrologic cycle, precipitation variability, and climate impacts, Analysis of floods, droughts, and extreme weather events. Topics like flood routing, rainfall analysis, and watershed management help in climate resilience planning
SDG 11	Sustainable Cities and Communities: Hydrology plays a vital role in urban sustainability, Urban drainage systems, runoff analysis, and flood estimation directly apply to city planning. Watershed management and stormwater control help prevent urban flooding
SDG 15	Life on Land: The course contributes to ecosystem protection by Studying soil erosion, infiltration, and watershed characteristics. Promoting erosion control and sustainable land management practices
SDG 9	Industry, Innovation and Infrastructure: Engineering hydrology is essential for infrastructure development, Design of dams, irrigation systems, drainage networks, and flood control structures. Application of hydrological modeling and data analysis techniques
SDG 2	Zero Hunger: Water management is directly linked to agriculture, Rainfall analysis, evapotranspiration, and irrigation planning improve crop productivity. Watershed and groundwater management ensure reliable water supply for farming
SDG 14	Life Below Water: The course indirectly supports aquatic ecosystems, Study of runoff, groundwater contamination, and pollutant transport. Emphasis on water quality and sustainable water usage

Reference Books:

1. Subramanya, K. (2024). Engineering Hydrology (6th ed.). New Delhi: McGraw Hill Education India



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2. Raghunath, H. M. (2006). Hydrology: Principles, Analysis and Design (Revised ed.). New Delhi: New Age International
3. Chow, V. T., Maidment, D. R., & Mays, L. W. (1988). Applied Hydrology. New York: McGraw-Hill
4. Reddy, P. J. (2016). A Textbook of Hydrology (3rd ed.). New Delhi: Laxmi Publications.

Open source software and website:

1. <http://nptel.ac.in/>

Suggested Course Practical/Assignment List: Students should follow the DTE laboratory manual for assignments and practical

Suggested list of Experiment:

1. Rainfall data analysis (Rain-gauges)
2. Hydrograph plotting analytical and experimental (through rainfall simulator)
3. Infiltration test using double ring infiltrometer
4. Evaporation study through PAN evaporimeter
5. Flood estimation through simulation
6. Groundwater analysis (Darcy's law)

List of suggested activities for Problem Based Learning:

Sr. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Rainfall Data Analysis (Local Study): Collect rainfall data of your city (last 10–20 years) and analyze trends, variability, and intensity.	Duration = 5h, Report preparation = 5h Total = 10h	Based on the report submitted. The report should contain data analysis, graphs, observations, and interpretations
2.	Field Visit: Watershed / Drainage System Study: Study runoff behavior, drainage patterns, and water flow in a nearby watershed or urban drainage system.	Duration = 5h, Report preparation = 5h Total = 10h	Based on observations, field understanding, sketches/photos, and report quality.
3.	Create a Video Lecture: Choose topics like unit hydrograph, infiltration, flood routing, or	Duration = 5h, Video preparation = 5h Total = 10h	Based on the video/report submitted, clarity of concept, and presentation skills.



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	groundwater flow and prepare a video lecture.		
4.	Poster / Chart / PowerPoint Presentation: Topics related to hydrology applications such as rainwater harvesting, watershed management, urban flooding, climate change.	Duration = 6h	Based on poster/chart preparation, technical content, and presentation skills.
5.	Group Discussion on Emerging Topics: Topics such as smart water management, GIS in hydrology, flood prediction systems, sustainable drainage systems.	Duration = 02h each	Based on performance in group discussion, technical depth, and communication skills.
6.	Case Study-Based Learning: Study real-world cases such as floods, droughts, dams, or watershed projects.	Duration of study = 5h, Report preparation = 5h Total = 10h	Based on in-depth study, technical analysis, data collected, and conclusions.
7.	Online Course / Certification: Complete an online course related to hydrology or water resources engineering.	Minimum duration of the course should be 10h	Examination-based assessment and certificate submission.
8.	Hydrograph Analysis Activity: Develop and analyze hydrographs using given rainfall data.	Duration = 8h	Based on accuracy, method used, and interpretation of results.
9.	Groundwater Study (Local Area): Study groundwater levels, borewell usage, and aquifer conditions.	Duration = 5h, Report preparation = 5h Total = 10h	Based on field data, analysis, and sustainability insights.
10.	Mini Project: Rainwater Harvesting Design: Design a rainwater harvesting system for a building or campus.	Duration = 5h, Report preparation = 5h Total = 10h	Based on design accuracy, feasibility, and practical applicability.

Note:

1. All the suggested activities should be related to the subject.
2. The number of hours is suggestive. Faculty can sub-divide the number of hours based on the activity. However, the total number of hours is fixed.
3. For a course, a minimum of 3 to 4 activities shall be conducted. There is no limit to the maximum number of activities; however, no activity shall not be more than 10 hrs.
4. Rubrics for the evaluation can be prepared by the faculty.
