GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Civil (Water Resource Engineering)

Course / Subject Code: ME01033011

Course / Subject Name: Hydrology And Watershed Management

w. e. f. Academic Year:	2024-2025
Semester:	1st Semester
Category of the Course:	PCC

Prerequisite:	Elementary knowledge of hydrology and probability concepts.
Rationale:	The students will get equipped with understanding of various topics viz; stream gauging, flood routing, watershed management. Students are introduced with calculation of stochastic hydrology and various models in rainfall-runoff.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Acquire basic principles of watershed hydrology and hydrological processes.	R,U
02	Conduct Hydrograph analysis, Watershed analysis and management,	U,A,N
03	Modeling of watershed and application of GIS technology in watershed management.	A,N
04	Apply Stochastic processes in hydrology.	A,N
05	Solve real world problems using hydrological principles in watershed management.	A,N,E

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Watershed Hydrology: Hydrologic processes, Occurrence and Variability of rainfall in India, Surface & Sub-surface water resources in India, Precipitation, Mass curve, Hyetograph, Depth Area Duration curve, Intensity Frequency Duration curve, most probable flood, standard project flood, interception, Infiltration, Evaporation, Runoff , measurement of stream flow, Stage - discharge rating curve, sediment rating curve, Hydrograph analysis, unit hydrograph theory, S-curve, Synthetic hydrograph	**9**	**20**
2.	Watershed Management: Concept of watershed, watershed management, classification of Watersheds, Drain basin characteristic, Geomorphology of watersheds - Linear, aerial and relief aspects of watersheds - stream order, drainage density and stream frequency, exercise on geomorphic parameters of watersheds. Different stakeholders and their relative importance, watershed management policies and decision making. Sustainable integrated watershed management, Interlinking of Rivers, Soil erosion and conservation. Watershed Management Practices in Arid and Semi-arid Regions. Integrated water resources management, conjunctive use of water resources, rainwater harvesting, roof catchment system. Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water legislation and implementations, Case studies.	**10**	**25**
3.	Flood and drought: Flood management, flood routing through channels and reservoir, flood control and reservoir operation, case studies on flood damage. Stormwater management, design of drainage system, Drought Management, Drought assessment and classification, drought analysis techniques, drought mitigation planning. Water Conservation and Recycling.	**9**	**20**

4.	Stochastic Hydrology: Random Variables (RVs), Distribution of random variation, Probability, Probability Distributions, Properties of Random Variables, Parameter Estimation. Commonly used Distributions in Hydrology, Hydrologic Data Generation, Introduction to Time Series - stationarity, Correlation and regression analysis, stochastic process, Time series Analysis, Frequency analysis, Extreme value analysis.	**8**	**20**
5.	Watershed Modeling: Standard modeling approaches and classifications, system concept for watershed modeling, modeling of rainfall-runoff process, subsurface flows and groundwater flow, Model calibration, validation and sensitivity analysis. Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management.	**9**	**15**
	Total	**45**	**100**

PO1	An ability to independently carry out research /investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program .
PO4	An ability to apply advanced knowledge and skills appropriate to civil engineering.

PO5	An ability to think critically and apply appropriate logic, analysis, judgment and decision making and to function as an effective member or leader of engineering teams to achieve common goals.
PO6	An ability to use appropriate techniques, skills, and modern engineering tools necessary for engineering practice and commit to professional ethics and responsibilities.

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**20**	**20**	**20**	**20**	

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:
(a) Books:

1. Hydrology & Soil Conservation Engineering– Ghansyam das
2. Applied Hydrology–Mutreja
3. Engineering Hydrology–K. Subramanya
4. Engineering Hydrology–J. Rami Reddy
5. Stochastic Hydrology– J. Rami Reddy
6. Applied Hydrology–Maidment & V. T. Chow
7. Introduction to Hydrology–Warren Viessman, Jr.& Garry L. Lewis, Pearson Education
8. Hydrology: Principles Analysis and Design- Raghunath, H. M.
9. Time-series Modelling of Water Resources and Environmental Systems- Hipel, K. and McLeod, A., Elsevier, 1993.
10. Introduction to Probability Models- Ross, S.M., Academic Press, Elsevier. 2007.
11. Stochastic Water Resources Technology- Kottegoda, N.T. , Macmillan, London 1980.
12. Statistical Methods in Hydrology- Hann, C.T., First East- West Press Edition, New Delhi, 1995.
13. Statistical Models in Hydrology- Clarke, R.T., John Wiley, Chinchester, 1994.

14. Random Functions and Hydrology- Bras, R.L. and Rodriguez-Iturbe , Dover Publications, New York, USA, 1993.

(b) Open source software and website:

https://onlinecourses.nptel.ac.in/noc24_ag05/preview
https://onlinecourses.swayam2.ac.in/cec21_ge14/preview
https://nptel.ac.in/courses/105101010
https://archive.nptel.ac.in/courses/105/108/105108079/
https://nptel.ac.in/courses/105104029
https://nptel.ac.in/courses/105103213
https://archive.nptel.ac.in/courses/105/105/105105214/

Suggested Course Practical List: If any

1. Use of automatic weather station
2. Measurement & analysis of Rainfall
3. Calculation of runoff
4. Measurement & analysis of Temperature
5. Computation of infiltration capacity
6. Hydrograph analysis
7. Flood frequency analysis

List of Laboratory/Learning Resources Required:

1. Rain gauges
2. Weather station
3. Rainfall simulator
4. Infiltrometers

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