GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Civil Engineering

Course / Subject Code: ME01065011

Course / Subject Name : Advanced Hydrology and water resources Engineering

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

Prerequisite:	Basic Knowledge of Hydraulics and Hydrology, Precipitation, Hydrograph and floods .
Rationale:	Water is one of the basic needs for the survival of the human beings. This subject provides an insight to the different components of hydrologic cycle, which in turn will help in finding the yield of a particular water source. Moreover, flood estimation (time as well as magnitude) is very important for the design of hydraulic structures and minimizing the damage to the life and property. Study of advance hydrology makes students conversant to the different methods available for flood forecasting/estimation.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Computation of mean precipitation from a catchment , infiltration rate and Infiltration Capacity.	N,U,R
02	Calculate various aquifer properties and safe yield.	N,U
03	Design tube wells of different types and open wells.	C,N,A
04	Calculate required reservoir capacity and carry out flood routing.	N,A,U
05	Carry out the modeling for surface and ground water flow phenomena.	C,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.	MODULE 1 : Rainfall data and its processing- frequency analysis-probability distribution and itsapplication hydrology. -IDF Curves and DAD curves and its derivation and uses. Water losses -Infiltration-Hortans' and Green Ampt model Runoff-Indices. Hydrograph-components- base flow separation- unit hydrograph- S and synthetic hydrograph. Case studies relating to water shed management.	12	25
2.	MODULE 2 : Ground water flow and well hydraulics - Aquifer parameters-land subsidence due tooover pumping- steady radial flow in to a well-well in uniform flow-steady flow withuniform charge-and steady flow in to a well confined, unconfined and leaky aquifers-well near aquifer boundaries-multiple well systems-partially penetratingwells --pumping tests. Non equilibrium for pumping test-Theis method. - Jacob's Method-Chow's method. Salt water intrusion, ground water basin development, and Artificial recharge.	12	25
3.	MODULE 3 : Open wells — Design of open well —yield test.- Methods of construction-dug wells.Tube wells, Design Screened wells, Selection of screen size yield of well, well lose, determination of well loss, by step pumping method, Test holes, well logs, shallow tube wells, drilling on rocks, screen installation well completion , well development, testing wells for yield, failure of tube wells, collectorof radial wells, cavity wells and infiltration galleries.	10	25
4.	MODULE 4 : Yield estimation: flow duration curve and mass curve —reservoir capacity and design. Hydrologic equation and water balance studies-flood routing studies. Floods-estimation: Empirical -Rational formula- hydrograph method-flood frequency analysis- Gumbel's and Log-pearson type III. Regression — Linear and non-linear - correlation- Methods of assessing error in hydrologic data and hydrologic computation. Modelling — Classification of models based various criteria — Physically based models —Classification of PDEs- Methods for solution — FDM —Explicit and Implicit equation -solution procedure for Laplace and Unsteady ground water flow equation- and FEM (Basic concepts only).	11	25
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**20**	**20**	**20**	**10**	**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. Chow , V.T., D.R. Maidment and L.W. Mays, Applied Hydrology, McGraw Hill Book company, Singapore,1988.
2. Ciriani T.A -Mathematical models for surface water hydrology.
3. Duggal and Soni, Elements of Water Resources Engineering, New Age International, 1996.
4. Garg S.P, Ground water and tube wells, Oxford &IBH New Delhi, 1982.
5. McCuen, R. H. Hydrologic analysis and design, Prentice Hall, Eaglewood Cliffs, New Jersey, 1989.
6. Mutreja K. N. ": Applied Hydrology ", Mcgraw hill Education India Pvt. Ltd.
7. Raghunath H.M..- Groundwater , New Age International, 2007.
8. Raghunath H.M..-Hydrology H.M Wiley Eastern Ltd Newdelhi,1985.
9. Singh, V.P. Elementary Hydrology. Prentice Hall of India, New Delhi, 1994.
10. Subramanya, K. Engineering Hydrology, Tata Mcgraw Hill, Newdelhi,1994.
11. Tood D. K.-Ground water hydrology, Wiley Eastern.
12. Viessman,L and Knapp.-Introduction to hydrology.

(b) Open source software and website:
HEC RAS, QGIS, SMS,

Suggested Course Practical List: If any

1. Rainfall Data Analysis
2. Infiltration analysis Hortons Equation Single and double wall Infiltrometer
3. Rainfall simulator
4. Artificial Recharge Techniques
5. Well testing for yields
6. Gumbels Flood frequency Analysis
7. Groundwater flow Physical model

List of Laboratory/Learning Resources Required:

Rain gauge station, Current meter

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