GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering- Civil (Structural Engg)

Level: Post Graduate

Subject Code: ME03000181

Subject Name: Groundwater Engineering

w.e.f.Academic Year:	2024-25
Semester:	3
Category of the Course:	MOPEC

Prerequisite:	Basics of Civil Engg, Irrigation Engg, Hydraulics
Rationale:	The proposed course will provide basic understanding about groundwater engineering which will start with the introduction of surface and subsurface waters, different types of aquifers, various important concepts e.g. porosity, permeability, hydraulic conductivity, specific yield, types of flows etc. Further, the course would also discuss basic laws which govern groundwater flow. There will be discussion on importance of pumping tests, groundwater modelling and groundwater recharge techniques.

Course Outcome:

After Completion of the Course, Student will able to:

No.	Course Outcomes
01	Apply basics of fluid flow through porous media.
02	Estimate aquifers characteristics using pumping tests.
03	Predict ground water variation using modeling techniques.
04	Plan ground water basins, prevent sea water intrusion, and control pollution in aquifers.
05	Develop groundwater extraction plans, and apply appropriate remediation techniques for contaminated groundwater

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	0	3	70	30	0	0	100

Course Content:

Unit No.	Content	No.of Hours	% of Weightage
1.	INTRODUCTION Occurrence of ground water, geological formations as aquifers; types of aquifers, ground water movement, Darcy's law, permeability and its measurement, tracing of ground water movement, fundamental equations for steady and unsteady ground water flow, flow nets.	6	10
2.	WELL HYDRAULICS Steady and unsteady flow in confined, semi-confined and unconfined aquifers, radial flow, superposition; multiple well system. Different methods of well construction; construction of well casings and screens, natural and artificial gravel packed wells. Safe yields, estimation, pumping and recuperation tests, Infiltration galleries,	14	25
3.	ARTIFICIAL RECHARGE OF GROUND WATER Ground-water replenishment, Artificial recharge of ground water, different methods, merits, demerits , selection criteria for various methods, cone of depression	7	15
4.	GROUNDWATER MODELING TECHNIQUES Porous media models, analog models, electric analog models, digital computer models	6	15
5.	SALT WATER INTRUSION Concept, interface and its location, control of intrusion.	6	10
6.	TRANSPORT OF POLLUTANTS IN GROUND WATER Pollutant transport, Plume Transport, source identification, tracer methods.	6	10
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

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

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC:Create(asperRevisedBloom'sTaxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.
3. Jacob and Bear, Hydraulics of Groundwater, McGraw Hill, 1997.
4. K N Mutreja, Applied Hydrology, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1990.
5. P Vijay Singh, Elementary Hydrology, Prentice Hall, INDIA,1992.

(b) Open source software and website:

https://nptel.ac.in/courses/105103026

Groundwater Engineering - Course (nptel.ac.in)

Suggested Project List: ---

1. Development of a 3D aquifer model using GIS data
2. Design and evaluation of artificial recharge systems
3. Assessing the sustainability of groundwater extraction in a heavily populated region
4. Visit to Gujarat coastal region and collecting data of salt water intrusion from Govt dept/agencies

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