GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering
Level: PG
Branch: Civil (Water Resource Engineering)
Subject Code : ME02033041
Course / Subject Name : Hydro informatics

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	Hydrology and Water Resources
Rationale:	To address water-related issues by integrating social and technical knowledge.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Understand an overview of Hydro informatics tools and techniques needed to develop hydrologic model	U
02	Gain hands-on-experience in Quantum GIS (open source GIS software) that is being widely used for analyzing and processing geo-spatial data	N
03	Provide a theoretical framework for hydrological modelling	E
04	Design and develop an integrated hydrologic model for a river basin using SWAT	C
05	Apply the hydrologic model to evaluate different management alternatives for informed decision-making.	A

**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.	Introduction Introduction to Hydroinformatics, Theoretical overview of hydrology, Decision support system, Spatial decision support systems, Web based information system, Theoretical overview of Soil and Water Assessment Tool (SWAT), Hydrologic and Water Quality System (HAWQS), Overview of emerging techniques, Structure of hydro information systems	6	10
2	Acquisition and Processing of Hydroinformatics Data Input data used in water management, overview of information sources including map servers, Web based data distribution, access and processing, Automated data collection, data storage, , Projection, Datum and Co-ordinate system, Geo-referencing / Digitizing, GIS overlay operations, DEM /DTM, Soil mapping, soil properties	9	20
3	Simulation Models in Water Management Data-driven modeling for water systems, Model classification, Models overview, Modeling accuracy, Spatial techniques for Surface water Hydrology Modelling, Surface-Water Hydrology Models, Application of simulation models in water management (rainfall-flow models, simulation of water flow, modeling of groundwater flow), Integration of different interfaces, file formats and standards	9	20
4	Processing and evaluation of modeling Provision and processing of input data, DEM analysis, Watershed delineation, Land-use classification, HRU delineation, weather database, SWAT model set-up, Processing and evaluation of modeling results (using GIS), Interpretation of the SWAT model output, Development of alternate management scenarios, Model calibration, validation, Sensitivity analysis and uncertainty principles, Theoretical Overview of uncertainty methods in SWAT-CUP	9	20

5	Applications Hydroinformatics for Climate Change Impact Assessment and Regional Flood Frequency Analysis; Example of a Hydrologic Information System, Management practices, Geospatial technologies for Water Resources Monitoring and Forecasting, Water Quality modelling, Flood forecasting, Operation, management in decision making, development of decision support systems for water and climate.	12	30
	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	**10**	**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. Modeling Hydrologic Change by Mccuain, CRC Publishers.
2. Longley, Paul A., M. F. Goodchild, D. J. Maguire, and D. W. Rhind. 2005. Geographic Information Systems and Science, 2nd Ed., Wiley, 536 pages.
3. S. L. Neitsch, J. G. Arnold, J. R.Kiniry, and J. R. Williams. 2009. Soil and Water Assessment Tool Theoretical Documentation. Texas Water Resources Institute Technical Report no: 406.
4. Abbaspour, K. C. 2015. SWAT-CUP: SWAT calibration and Uncertainty Programs.
5. Abbott, M. B., "Hydroinformatics: Information Technology and the Aquatic Environment", Avebury Technical, Aldershot, 1991.
6. Chang, K (2005). Introduction to Geographic Information Systems, Tata Mc Graw Hills Edition, NewDelhi
7. Burrough and McDonnel, Principles of Geographical Information System, Oxford University Press, 1998
8. Praveen kumar, Jay Alameda, Peter Bajcsy; Hydroinformatics, Taylor & Francis, 2006

(b) Open source software and website:

1. SWAT: Soil and Water Assessment Tool http://swat.tamu.edu/

Suggested Course Practical List:

1. Introduction to Quantum GIS, Data models, Projections, Geo-referencing / Digitizing, GIS overlay operations
2. DEM/DTM
3. Watershed delineation
4. Model set-up - Watershed delineation, HRU delineation, weather database
5. Model set-up: reading/interpreting outputs
6. Management practices; calibration and Validation (Manual procedure)
7. Sensitivity and Uncertainty analysis using SWAT CUP

List of Laboratory/Learning Resources Required:

Suggested Project List:

Suggested Activities for Students: If any

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