

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

## Water Resources Management

Subject Name Advance Fluid Mechanics

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| Sr.No | Course content   |
|-------|--|
| 1.    | Flow in pipes:<br>Equation of fluid motion, Momentum and Energy equations, Navier-Stokes equation exact and approximate solutions, laminar and turbulent flow in pipes, Boundary layer theory, boundary stress, skin drag, water hammer analysis.  |
| 2.    | Flow in channels:<br>Steady-non uniform flow, water surface profiles and its computation, Design of channel transitions, unsteady flow - propagation of positive and negative waves, surges in channel resulting from gate operation, application of Method of Characteristics, Finite Difference and Finite element methods to transient flow in open channels, flow in mobile boundary channel, spatially varied flow, Dispersion in open channel. |

### List of Experiments:

1. Water surface profile in open channel flow
2. Pipe friction
3. Laminar and turbulent flow in pipes
4. Propagation of positive and negative waves
5. Surges in channel resulting from gate operation

### Reference Books:

- 1 Engineering Hydraulics - Hunter Rouse.
- 2 Engineering Fluid Mechanics - Narasimhan.
- 3 Open channel Hydraulics - V.T.Chow
- 4 Open channel flow - Henderson
- 5 Open channel hydraulics - Richard H. French
- 6 Flow through open channel – K. Subramanya
- 7 Flow through open channel – K. G. Ranga Raju
- 8 Open Channel Flow – M. Hanif Chaudhry
- 9 Fluid Mechanics – Granger
- 10 Fluid Mechanics – Streeter & Wiley

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

## Water Resources Management

Subject Name Hydrology And Watershed Management

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| Sr.No | Course content  |
|-------|---|
| 1     | Engineering Hydrology<br>Hydrological cycle, precipitation, forms, measurement, distribution, storm pattern and analysis, Catchment characteristics for producing run-off, infiltration, rainfall-runoff relation etc, Hydrograph analysis, transportation of streams, stream gauging, measurement of stage, discharge, relationship, most probable flood standard project flood, Synthetic hydrograph, Flood routing |
| 2     | Watershed Management<br>Watershed, Small Watershed, Characteristics of Watersheds-Size, Elevation & Slope, Aspect & Orientation, Watershed shape, Drainage Network; Watershed Equilibrium, Watershed improvement, method for reducing flood peaks, Soil conservation, Afforestation, channel improvement, detention basins, Water Harvesting.   |
| 3     | Stochastic Hydrology:<br>Probability, Distribution of random variation, probability fitting, correlation and regression analysis, stochastic process, Time series analysis, Synthetic flow generation model   |
| 4     | Catchments models<br>Stochastic and deterministic models, Conceptual and Emperical models, Dynamic and Numerical models, Single Event Rainfall-Runoff Models, Continuous Simulation Models, Model Calibration & Validation  |

### List of Experiments:

1. Use of automatic weather station
2. Measurement & Study of Rainfall
3. Measurement & Study of Temperature
4. Measurement & Study of Wind Velocity
5. Measurement & Study of Moisture Content

### Reference Books:

1. Hydrology & Soil Conservation Engineering – Ghansyamdas
2. Stochastic Water Resources Technology – N.T. Kottegoda
3. Applied Hydrology – Mutreja
4. Engineering Hydrology – K. Subramanya
5. Hydrology – Raghunath
6. Engineering Hydrology – J. Rami Reddy
7. Stochastic Hydrology – J. Rami Reddy
8. Applied Hydrology – Maidment & V. T. Chow
9. Introduction to Hydrology – Warren Viessman, Jr. & Garry L. Lewis, Pearson Education
10. Watershed Hydrology – Peter E. Black, Prentice Hall.

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

## Water Resources Management

Subject Name Design of Hydraulic Structure

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| Sr.No | Course content   |
|-------|--|
| 1     | Investigation for dam-site<br>Different types of dams, selection of type of dams, Gravity Dams, criteria for stability analysis, design of Gravity dams by different methods, Foundation treatment and construction of gravity dams, Stress concentration at a gallery in gravity dams, design of penstocks and intake structures. |
| 2.    | Design of Earth dams,<br>Determination of Earthen dam section to suite available materials and foundation conditions, seepage through earthen dam, methods of controlling seepage, criteria for safe design of earthen dam, Criteria for design of filters, Relief wells, Stability of earthen dams.                               |
| 3     | Design of spillway and energy dissipation works.   |

### List of Tutorial:

1. Classification of dam
2. Forces acting on gravity dam as per IS-6512
3. Stability analysis of gravity dam
4. Design of Gravity dam
5. Design of Spillway
6. Preliminary section of earth dam and design of earth dam
7. Filter design for earth dam
8. Stability of earth dam
9. Location of phreatic line in earth dam section with horizontal filter and without filter

### Reference Books:

- 1 Design text books in Civil Engineering -Serge Leliavsky.
- 2 C.B.I. Publication No.12 of Government of India
- 3 Irrigation Engineering - Bharatsingh
- 4 Relevant Indian standards
- 5 Irrigation Water Resources - Dr.P.N.Modi
- 6 Irrigation – Dr. B. C. Punamia
- 7 Irrigation and Hydraulic Structures – S. K. Garg
- 8 Theory and Design of Hydraulic Structures – Varshney & Gupta
- 9 Water Resources Engineering- Larry Mays
- 10 Hydraulic Structure -Novak
- 11 Irrigation Engineering -Asawa

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

## Water Resources Management

Subject Name Water Resources Engineering

| Sr.No | Course content  |
|-------|---|
| 1     | Introduction:<br>The hydrologic cycle, importance of water resources  |
| 2     | Precipitation:<br>Types of precipitation, geographical distribution, time distribution, variability, measurement, average depth over area, depth area duration  |
| 3     | Evaporation and Transpiration: Factor affecting, measurement, evaporation in reservoirs, methods of prevention  |
| 4     | Infiltration:<br>Introduction, factor affecting, measurement  |
| 5     | Runoff :<br>Runoff process; relation of storm period and rainfall, factors affecting runoff methods of computation; gauging runoff of stream; stage discharge relationships interpretation of stream flow records |
| 6     | Hydrograph Analysis:<br>Components of the hydrograph; Separation of base flow, components unit hydrographs, S-hydrographs   |
| 7     | Floods:<br>Causes of floods, methods of estimation of floods. Design floods, damages, flood routing through reservoirs, methods of flood control, flood forecasting and warning                                   |
| 8     | Groundwater Hydrology:<br>Occurrence and movement of groundwater, surface and subsurface investigation of groundwater, flow through saturated porous medium   |

### List of Tutorials:

1. Water resources and their characteristics
2. Geographical distribution and finding average precipitation
3. Horton's equation on infiltration
4. Example based on unit hydrograph method
5. S-curve hydrograph and synthetic hydrograph
6. Flood routing methods, ground water flow in steady and unsteady condition
7. Explain Darcy's law

### Reference Books:

1. Hydrology and Water Resources Engineering by S. K. Garg
2. Watershed Hydrology by Peter E. Black
3. Engineering Hydrology - K. Subramanya
4. Hydrology by H. M. Raghunath
5. Hydrology and Water Resources Engineering by James & Lee

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

## Water Resources Management

Subject Name Hydropower Engineering

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| Sr.No | Course content  |
|-------|---|
| 1     | Introduction:<br>Sources and forms of energy, types of power plants, elements of hydropower scheme, hydropower development in India. Power house structures-substructure and superstructure Layout and dimensions, design considerations. Hydropower plants classification: Surface and underground power stations, Low medium-high head plants-layout and components, pumped storage plants, tidal power plants, microtidal units. Load and power studies: load curve, load factor, load duration curve, firm capacity, reservoir capacity, capacity factor. |
| 2     | Penstocks and power canals:<br>Classification of penstocks, Design of Penstocks, economic diameter, bends, anchor blocks, surges in canals design criteria of power canals. Intake structures: Location function and types of intakes, energy losses at intake trash rock, design of intakes.   |
| 3     | Water hammer and surge tanks:<br>Rigid and elastic water column theories, water hammer pressure. Behavior of surge tanks, types of surge tanks, hydraulic design, design of simple surge tank-stability   |
| 4     | Hydraulic turbines and types and classification, constructional features, hydraulic analysis, selection, characteristic curves, governing of turbine, draft tubes-types, hydraulic principles, and design. Gates and valves-types. Design of air vent.  |

### List of Tutorials:

1. Sources and form of energy
2. Lay out of power house and design consideration
3. Features of Hydro power plants
4. Detail of penstocks and power canal
5. Water hammer and surge tank problems
6. Hydraulic turbine and main types of governing of turbine

### Reference Books:

1. Water power Development : Mosonyi
2. Hydroelectric hand book: Creagar, W.P. and Justin, J.D., John Wiley & Sons, New York.
3. Davis' Handbook of applied hydraulics : Zipparro, V. J. and Hasen H., Mc-Graw Hill, Inc., New York
4. Hydropower structures : R.S.Varshiray, Nem Chand and Bros. Roorkee
5. Water Power Engineering: M.M.Desmukh, Dhanpat rai and Sons.
6. Water Power Engineering: M.M.Dandekar and K.N.Sharma, Vikas Pub.House

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

## Water Resources Management

Subject Name Remote Sensing And Application

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| Sr.No | Course content  |
|-------|---|
| 1     | Definition, Components of Remote Sensing  |
| 2     | Active and Passive Remote Sensing, Platforms, Electro Magnetic Radiation  |
| 3     | EMR spectrum, Scattering of EMR, EMR interaction with Earth Surface Materials, Spectral Signature, spectral characteristics   |
| 4     | Satellites, Satellite Sensors, Resolution, Description of Multi Spectral Scanning, Interpretation of Satellite Images, Characteristics of Digital Satellite Image   |
| 5     | Image enhancement, Filtering, Classification, Integration of GIS and Remote Sensing, Environmental Monitoring Techniques from remote sensing images, Applications of Remote Sensing in Civil Engineering, Water resources, Urban Analysis, Watershed Management, Environmental management, Construction Management, Resources Information Systems |

### List of Tutorials:

1. Various Component parts of Remote Sensing
2. Type of Remote Sensing
3. Study of EMR Spectrum
4. Ground truth Study
5. Type of Satellite Sensors
6. Images and its interpretation
7. Application of Remote Sensing in civil Engineering

### Reference Books:

1. Gibson P.J. and Power C.H., Introductory Remote Sensing, Rotledge London, 2000
2. Jensen, J.R., Remote sensing of the environment, Prentice Hall, 2000
3. Lillesand T.M. and Kiefer R.W., "Remote Sensing and Image Interpretation
4. John Wiley and Sons, Inc, New York, 1987

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

## Water Resources Management

Subject Name Ground Water Management

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| Sr.No | Course content  |
|-------|---|
| 1.    | Availability of ground water, types of aquifers, ground water investigation methods, aquifer parameters and their determination, development of ground water. |
| 2     | Well hydraulics, types of wells, multiple well system, well design criteria, construction and maintenance.  |
| 3     | Groundwater basin management and conjunctive use, artificial recharge of aquifers, methods of artificial recharge   |
| 4     | Sea Water intrusion in coastal aquifers, methods of its prevention and control, Groundwater pollution remediation and legislation                             |
| 5     | Introduction to ground water flow and contaminant transport process   |

### List of Experiments:

1. Measurement of hydraulic permeability using Darcy's Apparatus
2. Use of rainfall Simulator for artificial recharge
3. Aquifer parameters and ground water basin management

### Reference Books:

1. Groundwater Resources Evaluation – W. C. Walton
2. Geohydrology – Roger Dewlest
3. Groundwater Hydrology – D. K. Todd
4. Numerical analysis by Analog and Digital models for seepage and groundwater flows- D.R.Ruston & S.C.Redshow
5. Groundwater – H. M. Raghuna
6. Numerical Ground Water Hydrology -A.K.Rastogi

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

## Water Resources Management t

Subject Name Water Resources Planning

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| Sr.No | Course content  |
|-------|---|
| 1.    | River valley development projects, estimation of available water resources and demand patterns, Fixing objectives, Data required for project formulation, Study of various alternatives, Feasibility, Planning of multipurpose projects, Economics of water resources projects, Benefit-cost analysis, case discount flow methods, Dynamics of project analysis   |
| 2     | Economic planning by project purpose, Methods of allocation, cost to various purposes of project, Reservoir capacity, reservoir working tables, Reservoir operation for optimum benefits, simulation techniques, Water law and policies, Interstate and international problems, Economic, environmental and social impact on water resources projects, Risk and uncertainty considerations in water resources planning, financing of water development projects.. |

### List of Experiments:

1. Use of Theodolite
2. Total Station for preparation of contour Maps
3. Use of Plannimeter for Calculation of area of contour maps
4. Preparation of area elevation and capacity elevation curve
5. To find out the capacity of Reservoir from capacity elevation curve

### Reference Books:

1. Economics of water resources planning – L. Douglas James
2. Water resources engineering – Linsley & Franzini
3. Water resources project economics - Edward Kuiper
4. Water resources development - Edward Kuiper
5. Principles of Water Resources Planning – S. Goodman
6. Management of water projects - OECD
7. Water Resources Planning – N.S.Grigg
8. Water Resources Planning and Management – Helweg O. G
9. Water Resources Planning -Mahapatra



# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

## Water Resources Management

Subject Name Design of Canal Network and Regulation Work

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| Sr.No | Course content  |
|-------|---|
| 1     | Introduction to Canal net work Planning.  |
| 2     | Design of stable channels in alluvial soils, unlined and lined canals,  |
| 3     | Design of canal regulation works and cross drainage works and outlet structures.  |
| 4     | Detail design of canals and distribution system.  |
| 5     | Khosla's theory for design of structures on permeable foundations,  |
| 6     | Application of Khosla's theory for design of hydraulic structures like barrage, weir, cross regulator, head regulator, canal falls and others |

### List of Tutorials:

1. Design of barrage
2. Design of Fall
3. Design of canal network & regulation work
4. Tutorial on stable channels.
5. Tutorial on Lined and unlined canals
6. Tutorial on regulation and CD works and outlet structures
7. Tutorial on detailed design of canals and distribution system
8. Tutorial on khosla's theory and design of structures on permeable foundation
9. Tutorial on weir, cross regulator work, head regulator.

### Reference Books:

1. Design text books in Civil Engineering -Serge Leliavsky.
2. C.B.I. Publication No.12 of Government of India
3. Irrigation Engineering – Bharatsingh
4. Hydraulics of sediment transport - W.H.Graf
5. Relevant Indian standards
6. Irrigation Water Resources - Dr.P.N.Modi
7. Irrigation – Dr. B. C. Punamia
8. Irrigation and Hydraulic Structures – S. K. Garg
9. Theory and Design of Hydraulic Structures – Varshney & Gupta

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

## Water Resources Management

Subject Name Water Supply and Drainage

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| Sr.No | Course content  |
|-------|---|
| 1     | Planning of water supply scheme, feasibility study.   |
| 2     | Intake, radial collector well, storage sump and service reservoirs, pumps and its selection   |
| 3     | Measurement of flow and SCADA, Different types of pipe materials, Appurtenances, Losses in pipes, Analysis of pipe network using EPANET.  |
| 4     | Prediction of flood for urban storm drainage, Rational method, hydraulics of flow in open channel, hydraulic design of storm sewer, Storm water detention and selection of detention pond |

### List of Tutorials

1. Feasibility study of water supply and water treatment plant
2. Population forecasting method and estimation of water demand
3. Study of SCADA, EPANET based pipe network
4. Urban storm water drainage parameters and design methods
5. Design of Pumps

### Reference Books:

1. Manual of Water Supply and Treatment, CPHEEO, Ministry of Urban Development, New Delhi
2. Hydrosystem Engineering and Management, Mays, L.W. and Tung, Y.K., McGraw Hill New York
3. Applied Hydrology, Chow, V.T, Maidment, D.R. and Mays, L.W., McGraw Hill
4. Computer Assisted Floodplain Hydrology and Hydraulics, Hoggan, D.H., McGraw hill New York

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

## Water Resources Management

Subject Name Hydro System Engineering And Management

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| Sr.No | Course content   |
|-------|--|
| 1     | Introduction to the concept of a system engineering, System application to water resources engineering.                            |
| 2     | Optimization techniques, graphical, Linear Dynamic and stochastic programming  |
| 3     | Simulation and mathematical modeling of water resources systems Application to reservoir optimization and multireservoir planning. |
| 4     | Optimal allocation of water resources for various uses. Case studies.  |
| 5     | Introduction to soft computing models Like ANN, GAGP & Fuzzy Logic, and Hybrid Techniques.   |

### List of Tutorials

1. Discuss the application of system engineering in the field of water resources
2. How the liner programming problem can be solve by graphical method
3. What are the advantage and limitation of linear programming?
4. Enlist the different optimization technique and briefly discuss them.
5. Discuss 1-langrangian multiplayer 2-kuhn-tucker condition for non-linear Programming
6. Differentiate stochastic and deterministic variables
7. Explain application of simulation and modelling technique water resources

### Reference Books:

1. Water resources system engineering - Hall & Dracup
2. System Approach to water resources management edited by A.K.Biswas
3. Introduction to operation research-Computer oriented Algorithmic Approach-Billy E.Gillett
4. Optimisation-theory and application – S.S.Rao
5. Hierarchical analysis of water resources system – Yacov Y. Haimes
6. Water Resources planning and Management – Louks, stedinger and Haith
7. Hydro system Engineering and Management – L. W. Mays & Y. K. Tung
8. Water Resources Systems Planning and Management – Chaturvedi
9. Applied Water Resources System Planning – David C. Major & Robert Lanton
10. Mathematical Foundations for design in Civil Engineering–Robert M. Star & R. M. Nicholas
11. Optimal Control of Hydro systems - Larry W Mays

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

## Water Resources Management

Subject Name Stochastic Models in Water Resources

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| Sr.No | Course content   |
|-------|--|
| 1     | Concept of Probability, Distribution Function, Parameter Estimation, Method of Moments.  |
| 2     | Maximum Likelihood, Least square, Probability Distribution, Structure of hydrological time series, trend and seasonality   |
| 3     | Auto covariance and correlation function, Spectral analysis, data generation techniques.   |
| 4     | Linear stochastic models, AR models, MA models, ARMA models, Modelling of non-stationery time series, Seasonal series, Thomas-Fiering Model, ARIMA Models, Periodic Models, Multi-Site Modelling |

### List of Tutorials

1. Problem based on mean model
2. Mediation and standard deviation
3. Probability distribution
4. Auto covariance and correlation function
5. Spectral analysis
6. Problem on data generation techniques

### Reference Books

1. Jayarami Reddy P., Stochastic Hydrology, Laxmi Publication, 2003.
2. Hippel K.W., McLeod A.I., Panu U.S., Singh V.P., Fang L., Stochastic and Statistical Methods in Hydrology and Environmental Engineering, Springer, 1994.
3. Marco J.B., Harboe R., and Salas J.D., Stochastic Hydrology and Its Use in Water Resources Systems Simulation and Optimization, NATO Advanced Study Institute, Peniscola, Spain, September 18-29, 1989.
4. McCuen, R.H. and Snyder, W.M., Hydrological Modeling - Statistical Methods and applications, Prentice Hall, 1998

# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 2

## Water Resources Management

Subject Name Infra Structure Engineering and Management

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| Sr.No | Course content  |
|-------|---|
| 1     | Challenges of managing infrastructure   |
| 2     | Life cycle analysis concept.  |
| 3     | Infrastructures need assessment, Performance and Indicators.  |
| 4     | Various Infrastructure Systems such as Transportation Services, Water and Wastewater Systems, Buildings and Structures, Energy Facilities |
| 5     | Database Management, Data Need and Data Analysis, Performance Evaluation Modelling and Failure Analysis                                   |
| 6     | Maintenance Rehabilitation and Reconstruction Strategies, Dealing with New and Alternatives   |
| 7     | Integrated infrastructure management systems, Infrastructure management system applications   |

### List of Tutorials

1. Infrastructure and its impact on development
2. Infrastructure need assessment
3. Infrastructure systems
4. Study of transportation network and water resources
5. Collection and analysis of data
6. Infrastructure system application, and case study of any infrastructure project

### Reference Books:-

1. Grig N.S., Infrastructure engineering and management, Wiley-Interseience, 1988
2. Hudson W.R., Haas R., Uddin W., Infrastructure Management, McGraw-Hill, 1997