# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Master of Engineering**

**Level: PG**

**Branch: Civil (Water Resource Engineering)**

**Course / Subject Code: ME01033051**

**Course / Subject Name: Water Use Management**

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| w. e. f. Academic Year: | 2024-25 |
| Semester: | 1st Semester |
| Category of the Course: | PEC |

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| **Prerequisite:** | Fundamental knowledge of irrigation engineering, soil water plant relationship, consumptive use of water. |
| **Rationale:** | Students will be able to understand irrigation efficiency, methods of irrigation, methods of application of irrigation water, irrigation scheduling, surface and sub-surface drainage system, automation and regulation of the canal. They will be able to explore advancement in irrigation system, smart irrigation. |

**Course Outcome:**

After Completion of the Course, Student will able to:

| No | Course Outcomes | RBT Level |
|---|---|---|
| 01 | Understand quality and compute efficient use of irrigation water. | R,U,A |
| 02 | Understand soil-water-plant relationship and determine consumptive use of crops | U,A,N |
| 03 | Design irrigation systems with advanced techniques. | A,N,E |
| 04 | Identify and resolve the problems for optimizing the crop production. | A,N |
| 05 | Analyze automation and control of canals, Operate and maintain irrigation projec | 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.** | Soil-Water-Plant-Atmosphere Relationship:<br>Soil surveys and irrigability classification, water quality, Irrigation water standards, Soil water-plant relationship. | 6 | **13** |
| **2.** | Methods of crop improvement, Soil fertility management, Saline and alkaline soils, Plants response to saline soils, Salt-tolerant crops, Reclamation and Management of Salt affected soils | 4 | **14** |
| **3.** | Crop Water Requirement and Irrigation Scheduling:<br>Crop planning and crop patterns, Determination of consumptive use of crops, Irrigation efficiency, Irrigation scheduling, use of WEAP and CROPWAT | 6 | **13** |
| **4.** | Irrigation Water Application Methods, Simulation of flow in surface irrigation systems, Irrigation Water Conveyance and Measurement of Irrigation Water, Irrigation Systems Design, Performance Evaluation of Irrigation System, Sensitivity analysis, parameter estimation, Conjunctive use of surface water and groundwater, Water logging and Drainage of Agricultural Lands, Design and Performance Evaluation of Drainage Systems | **12** | **30** |
| **5.** | Advances in Irrigation Systems: Crop & Soil Sensors, Micro-Irrigation, Renewables-based Irrigation, Internet of Things (IoT), Smart Irrigation Controllers, Remote Sensing, Remote Monitoring, Leak Detection Systems, Rain Gun System, Water Quality modeling, Desalination of irrigation water, Weather-based irrigation controllers. | **7** | **14** |
| **6.** | Automation, control and regulation of canals, Operation and management of irrigation projects, Command area development organization and their role in water management, Modernization of existing irrigation projects. | **7** | **16** |
| | **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** | **20** | **10** |

*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. Irrigation-Theory and practice - A.M.Michael
2. Modern irrigated soils - D.W. James, R.J. Hanks & Jurinak
3. Crop water requirements FAO publications No. 24
4. Arid Land Irrigation in Developing countries, Environmental problems & effects Pergamon press Oxford University
5. Sprinkler Irrigation – Melvyn Kay
6. Drip Irrigation – S. K. Sharma
7. Surface Irrigation Systems – Walker & Skogerboe
8. Drainage Manual

**(b) Open source software and website:**

- NPTEL: https://nptel.ac.in/
- NPTEL IITM YouTube Channel: https://www.youtube.com/user/nptelhrd
- MIT Open Course Ware: https://ocw.mit.edu/
- Scilab: https://www.scilab.org/
- Python: https://www.python.org/
- Matplotlib: https://matplotlib.org/
- FreeFem++: http://www.freefem.org/
- OpenFOAM: https://www.openfoam.com/

**List of Laboratory/Learning Resources Required:**

1. Soil-Water-Plant-Atmosphere Relationship.
2. Crop Water Requirement and Irrigation Scheduling.
3. Soil fertility and Salt affected soils.
4. Irrigation Water Conveyance and Measurement of Irrigation Water.
5. Water Application Methods.
6. Irrigation Systems Design & Performance Evaluation of Irrigation System.
7. Advances in Irrigation Systems
8. Water logging & Drainage of Agricultural Lands.
9. Canal Automation & Modernization of Irrigation Projects
10. Command area development

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| 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. |

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| PO6 | An ability to use appropriate techniques, skills, and modern engineering tools necessary for engineering practice and commit to professional ethics and responsibilities. |

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