

## • M. Tech. Water Resource Engineering

### Basic Supporting Courses

S. No.	Course Code	Course Title	L-T-P	Credits
1.	MAS 701	Advanced Engineering Mathematics	3-1-0	4
2.	MAS 711	Statistics –I	2-0-1	3
3.	COMP 805	Computer Programming	2-0-1	3

### Core Courses

S. No.	Course Code	Course Title	L-T-P	Credits
1.	SWLE 700	Research Institution/Industrial Visit	0-0-1	1
2.	SWLE 701	Applied Hydrology	2-0-0	2
3.	SWLE 704	Irrigation Management	2-0-1	3
4.	SWLE 705	Drainage of Agricultural Land	3-0-0	3
5.	SWLE 718	Ground Water Development Assessment & Management	2-0-0	2
6.	SWLE 719	Water Resource Systems	2-0-0	2
7.	SWLE 720	Design of Hydraulic Structures	3-0-0	3
8.	SWLE 780	Seminar-I	0-0-1	1
9.	SWLE 800	Field/ Industrial Training	0-0-1	1
10.	SWLE 816	Flow Principles and Distribution System	3-0-0	3
11.	SWLE 880	Seminar –II	0-0-1	1
12.	SWLE 899	Dissertation	0-0-15	15

### Specialized Courses

S. No.	Course Code	Course Title	L-T-P	Credits
1.	SWLE 708	Watershed Development & Management	2-0-1	3
2.	SWLE 721	Integrated River Basin Management	3-0-0	3
3.	SWLE 722	Modeling of Water Resource Systems	2-0-0	2
4.	SWLE 723	Ground Water Pollution	2-0-0	2
5.	SWLE 811	Hydrological Modeling	2-0-0	2
6.	SWLE 815	Irrigation System Management	3-0-0	3
7.	SWLE 817	Watershed Hydrology	3-0-0	3
8.	SWLE 818	Operation Maintenance and Management of Water Resources Project	2-0-0	2
9.	SWLE 819	Impact Assessment of Water Resource Development Projects	2-0-0	2
10.	SWLE 820	Water Quality Assessment and Management	2-0-0	2
11.	SWLE 822	GIS in water Resource Planning and Management	2-0-1	3

## Basic Supporting Courses

**MAS 701      Advanced Engineering Mathematics      4 (3-1-0)**

Gamma, Beta and Legendre's functions, Euler's equations, Lang-range equations, the Ritz method, the Greens functions. Bolazane Weirestrass theorem in finite products. Laplace transforms, Inverse Laplace Transforms and application to differential equations, Fourier series, Fourier transforms, Solution of non linear algebraic and transcendental equation by regula Falsi method. Newton Raphson method.

Newton forward and backward interpolation formula, divided differences. Trapezoidal Rule, Simpsons 1/3 rule, numerical solution of ordinary differential equations by Runge Kutta Method, Picards equations.

**MAS 711      Statistics – I      3 (2-0-1)**

Standard – deviation, coefficient of variation, standards error of mean

Theory of probability : equally likely, mutually exclusive events, definitions of probability, additions & multiplication theorems of probability and problems based on them. Normal & Binomial distributions. Simple correlation & regression, multiple – regression, multiple & partial – correction.

Testing of hypothesis : Concept of Hypothesis, Degree of freedom, levels of significance. Type I & Type II errors  $X^2$ , t, Z & F – Tests. (definition, applications & Problems based on these tests).

**COMP 805      Computer Programming      3 (2-0-1)**

Algorithms & Flow Charts, C programming :Preliminaries, Constants & Variables, Arithmetic Expressions, Input- Output statements, Control Statements, Do-Statements, Subscripted variables, Elementary Format Specifications, Logical Statements & Decision Tables, Function & Subroutines

Computer Oriented Numerical Methods: Solution of Non Linear Equation, Bisection Method, Newton Method, Numerical Integration, Trapezoidal Method, Simpson's 1/3 & 3/8 rule , Curve Fitting, Construction of forward, backward difference table, Interpolation

Application of statistical packages

## Core Courses

**SWLE 700 – Research Institution/ Industrial Visit      1(0-0-1)**

**SWLE 701 - Applied Hydrology      2(2-0-0)**

Basic hydrometeorology; Hydrologic cycle; Intensity-duration-frequency analysis of rainfall data; Interpretation of precipitation data; Stream flow measurement; stage discharge relation; Interpretation of stream flow data; Run-off components and computations; Hydrograph analysis; Characteristics, separation for simple and complex

storms; unit hydrograph theory and its application; derivation of unit hydrograph, S-hydrograph and instantaneous hydrograph; Flood estimation and routing; Stochastic process in hydrology; Hydrologic design of Engineering structures.

**SWLE 704 – Irrigation Management**

**3(2-0-1)**

Water resource availability; Concept of crop water requirement; Direct and Indirect measurements/estimation of crop water requirement; Agrometrological station; Irrigation requirements, Irrigation Scheduling using soil moisture status, Plant – water status and timing criteria; dynamic crop response model; Evapotranspiration models; Selection of Irrigation methods in relation to soil, crop and water supply; Irrigation efficiencies; Field and project supply measurement flumes; crop water production function; Economic analysis of on-farm irrigation using response functions of crops; Design of canal networks; Energy utilization and management in Irrigation.

**Practicals** - On irrigation scheduling, Irrigation efficiencies, crop water requirements, flow measurements, field visits.

**SWLE 705 – Drainage of Agricultural Land**

**3(3-0-0)**

Nature and extent of Drainage Problems; drainage Investigation; Hydraulic conductivity measurement in-situ; Definition and calculation of drainage design criteria under rainfed and irrigated conditions; Steady and transient – state drainage equations; Design, alignment, construction and maintenance of surface and subsurface drainage systems; Design, construction and maintenance of mole drains; Guideline for the selection of envelope materials for subsurface drain; Design, construction and maintenance of well drains; Drainage machineries.

**SWLE 718 Ground Water Development Assessment & Management 2 (2-0-0)**

Hydrologic Cycle and Processes, storage and conduit function of rocks, zones of Aeration and saturation, ground water flow, governing equations, evaluation of Aquifer properties, ground water quality, measurement, construction, design and performance of wells, geomorphic and geologic controls on ground water, ground water exploration, techniques of ground water modeling, Artificial Recharge, Ground Water Recharge, Discharge and Balance

**SWLE 719- Water Resource Systems**

**2(2-0-0)**

Introduction to systems thinking, water resource systems, sustainable development, concepts of water resources planning and management; Overview of socio-economic and environmental issues; mathematical modeling and application of deterministic simulations; linear programming to different water resources problems (reservoirs irrigation and drainage; water supply; and others)

**SWLE 720 -Design of Hydraulic Structures** **3(3-0-0)**

Design, construction and maintenance of irrigation canal and channels, irrigation scheme infrastructure, irrigation structures, hydrometry, irrigation plants, interaction of irrigation and drainage engineering, cost estimation and construction management.

**SWLE 780 –Seminar – I** **1(0-0-1)**

**SWLE 800 –Field/ Industrial Training** **1(0-0-1)**

**SWLE 816- Flow Principles and Distribution System** **3(3-0-0)**

Fluid properties; Fluid flow concepts; Pipe network analysis; pump-pipeline system analysis and design; steady flow in channels; channel network.

**SWLE 880 – Seminar – II** **1(0-0-1)**

**SWLE 899 – Dissertation** **15(0-0-15)**

## **Specialized Courses**

**SWLE 708 – Watershed Development and Management** **3(2-0-1)**

Concept of watershed development and management; collection of hydrological data; watershed characteristics and hydrologic cycle; problems of land degradation; Land use capability classification and topographical characteristics of watershed; Appropriate soil and water conservation measures for agricultural and non-agricultural lands; Grassland development and management; Techniques for dry land farming based on watershed characteristics; water harvesting techniques for hilly and arid regions; Hydrological and sediment monitoring of watershed; Estimation of peak design runoff rate; Planning, management and economic evaluation of watershed development projects; case studies.

**Practicals - Data collection; analysis, planning and management of a given watershed; Field visit.**

**SWLE 721- Integrated River Basin Management**

**3(3-0-0)**

Basin wide planning and management including water quantity and quality and its protection; Land use; socio-economic condition; Integrated water resource planning management including water supply and demand management; urban and rural water development; decision support for river basin management; International river basin management including conflict and resolution and sustainable development.

**SWLE 722- Modeling of Water Resources Systems**

**2(2-0-0)**

Modeling concepts and overview of computer models for surface water systems; Sub-surface water systems; irrigation engineering management and coastal environment; practical application and exercise on selected computer models.

**SWLE 723 -Ground Water Pollution**

**2(2-0-0)**

Overview; groundwater pollution; sources; movement and attenuation of pollutants in aquifers; solute transport models; modeling of saltwater intrusion; management of groundwater pollution.

**SWLE 811 – Hydrological Modeling**

**2(2-0-0)**

Hydrologic events; Concepts of hydrological modeling; Probabilistic and statistical approach in hydrological modeling; Optimization techniques; Reliability test of prediction models; Estimation of model parameters; Data transformation, Calibration and evaluation of hydrologic models.

**SWLE 815- Irrigation System Management**

**2(2-0-0)**

Importance and problems of irrigation system management, major issues, physical and technical aspects, economic aspects, institutional aspects, social aspects, environmental aspects, environmental aspects, management processes, operations and maintenance, analytical tools and techniques, case study example.

**SWLE 817- Watershed Hydrology**

**3(3-0-0)**

Components of hydrologic cycle; hydrologic transport; Statistical method in hydrology; frequency analysis; time series analysis; hydrologic technology; data collection; forecasting; hydrologic design; watershed modeling.

**SWLE 818- Operation, Maintenance and Management of Water Resource Project**

**2(2-0-0)**

Regulation of reservoirs; diversion works and canals; monitoring behaviour of structures; works regulated for maintenance and management; causes of failure of hydraulic structures and their remedial measures.

**SWLE 819- Impact Assessment of Water Resources Development Projects 2(2-0-0)**

Ecosystem, impact assessment methodologies, impact assessment of water resources projects – case studies, equilibrium analysis and sustainable development, policy and legislation.

**SWLE 820 -Water Quality Assessment of Management**

**2(2-0-0)**

Water movement and mixing process, nutrient cycle and budget, trophic dynamics and biological productivity, trophic dynamics and biological productivity, water supply and quality for dynamics and management, impact of pollution and toxic substances.

**SWLE 822- GIS in Water Resource Planning and Management**

**3(2-0-1)**

Introduction of GIS; Creation of digital geographical data; characteristics of GIS; utilization of GIS for water resources; application for hydrologic modeling

**Practicals -** Surface water body mapping, Delineation of watershed, DEM generation: slope, Aspect, flow direction, Flow accumulation, Drainage, network & morphometric analysis