- # M. Tech Irrigation & Drainage 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 Course

A) 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 702	Soil –Water Plant relationship	2-0-1	3
4.	SWLE 703	Fluid Mechanics & Open Channel Hydraulics	2-0-0	2
5.	SWLE 704	Irrigation Management	2-0-1	3
6.	SWLE 705	Drainage of Agricultural Land	3-0-0	3
7.	SWLE 706	Hydraulic Structure & Machinery	2-0-0	2
8.	SWLE 780	Seminar-I	0-0-1	1
9.	SWLE 800	Field /Industrial Training	0-0-1	1
10.	SWLE 801	Irrigation System Design	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 709	Soil Salinity and Water Quality	2-0-0	2
3.	SWLE 710	Ground Water Development & Tubewells	2-0-0	2
4.	SWLE 711	Crop Environmental Engineering	2-0-0	2
5.	SWLE 712	Air Photo Interpretation & Remote Sensing	2-0-1	3
6.	SWLE 803	Flow Through Porous Media	2-0-0	2
7.	SWLE 804	Planning Execution & Management of Irrigation & Drainage Projects	2-0-0	2
8.	SWLE 805	Irrigation Management Under Controlled Environment	2-0-0	2
9.	SWLE 806	Economic Evaluation of Irrigation & Drainage Projects	2-0-0	2
10.	SWLE 807	Irrigated Crops	2-0-0	2
11.	SWLE 808	Minor Irrigation & Well Hydraulics	2-0-0	2

DETAIL SYLLABUS

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 Course

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 702 - Soil-Water-Plant Relationship 3(2-0-1)

Soil water retention; Infiltration and water uptake; Measurement of soil water content; concept and measurement of soil water potential, Metric potential and Solute potential; Water exchange in plant cells and tissues; Water movement through the plant systems; Concept and measurement of transpiration and Evapotranspiration; Energy and water balance; Factors affecting plant-water status, Metabolic and other characteristics for efficient water use; Availability of soil water for plant growth; Response of plant to water deficit; Effect of salinity on internal water deficit and plant growth.

Practicals - Practical on Soil Physical Characteristics, Soil moisture, Evaporation, Transpiration, Evapotranspiration and plant water status.

SWLE 703 – Fluid Mechanics and Open Channel Hydraulics 2(2-0-0)

Fluid flow concept and its Kinematics; Flow Characteristics; Flow measurements; Euler's equation; Ideal fluid flow; Vortex; Irrotational and rotational flow velocity potential; stream function; flow net; Characteristics of open channel flow; steady-unsteady, uniform, Non-uniform, laminar and turbulent flow; Energy and momentum principles; Critical flow computation and application; Boundary layer concept; Velocity distribution and instability of uniform flow; Gradually varied flow theory and analysis; Method of Computation; Channel design; Hydraulic Jump concept and its application.

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 706 – Hydraulic Structures and Machinery 2(2-0-0)

Design, construction and maintenance of irrigation channels; Design of discharge control structures; Design of surface and underground pipe line systems; Design, construction and maintenance of irrigation canals; Design construction and maintenance of small irrigation water storage structures.
Principles, types, operations, performance and maintenance of irrigation pumps; Total pumping head; study of characteristics curves for different pumps; Pump selection, Power unit selection, Economic aspects of irrigation pumping machinery.

SWLE 780 – Seminar – I 1(0-0-1)

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

SWLE 801 – Irrigation System Design 3(3-0-0)

Physics of surface irrigation; Design and evaluation procedure for border, check basin and furrow irrigation; Guidelines for operation and maintenance of surface irrigation methods.

Description of Quick coupling, dragline and movable sprinkler irrigation systems and center Pivot system; Design installation, operation and maintenance of sprinkler irrgation systems; spray losses and drop size distribution in sprinkler irrigation systems and efficiency evaluation.
Suitability of drip irrigation system under Indian conditions; Types of drip irrigation systems; Emitter types; Emitter construction; Discharge principles for emitters; Design of drip irrigation systems; water and salt distribution; Emitter clogging; water treatment; Automation; Field performance and evaluation; Irrigation scheduling concept; Flow measurement and system maintenance; Fertigation.

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 709 – Soil Salinity and Water Quality 2(2-0-0)

Scope and significance of salinity and sodicity; Source and accumulation of soluble salts; Extent and distribution of salt affected soils; Salinity and sodicity management; Soil salinity profiles; Plant response to salinity; Salt tolerance evaluation' Leaching and salinity control; Leaching requirement and methods.
Composition of irrigation water; Suitability of water for irrigation; Salinity management techniques through irrigation; Waste water treatment and re-use for irrigation; Salt and water balance models; Guidelines for inter-predation of water quality for irrigation.

SWLE 710 – Groundwater Development and Tubewells 2(2-0-0)

Occurrence, distribution and movement of ground water; Geological formations for ground water supply; Steady and unsteady flow in confined, unconfined and semiconfined aquifers; Groundwater fluctuations and recharge; Deriving aquifer characteristics from pumping tests; Groundwater survey and assessment of groundwater balances; Groundwater modeling, Groundwater contamination; Design, construction and maintenance of well and tubewells; Development of wells; Selection of pumps and prime movers; well performance; Economics of pumping.

SWLE 711 – Crop Environmental Engineering 2(2-0-0)

Environmental aspects of plant growth; Radiation and energy balance in plant canopies; Momentum transfer; Heat and Mass transfer of soil and plant environment; Partitioning of heat in dry and wet systems; Micrometrology of crops; evapotranspiration; Photosynthesis; respiration and water use efficiency; Design and operation of controlled environment facilities; Instrumentation and techniques for monitoring plant environment.

SWLE 712 – Air Photo Interpretation and Remote Sensing 3(2-0-1)

Types of arial photography and factors affecting its quality; Instruments, equipment and material needed for arial photography and its interpretation; Techniques for interpretation of arial photography.
Basic principles of remote sensing and its application in agriculture and land management; It's use in agricultural and water resource assessment and watershed management; Factor's affecting quality of remote sensing; Imaginaries and techniques and material needed for its interpretations.
Practicals - Analysis and interpretation of remote sensing data; Educational tour.

SWLE 803 – Flow Through Porous Media 2(2-0-0)

Soil physical characteristics related to water movement; Movement of soil water; Energy concept of soil water; Flow of water in saturated and unsaturated soils; Water retention and flow in field soils; Basic flow equations; Steady and unsteady flow and its boundary value problems; Darey's, Laplace, Dupuit and Boussinsq equations and approximation; Numerical solution of flow problems.

SWLE 804 – Planning, Execution and Management of Irrigation and Drainage Projects 2(2-0-0)

Timing, sequence and strategy for the irrigation and drainage projects; Procedure for planning of irrigation and drainage projects; Climatelogical, topographical and water resource survey; Calculation techniques for irrigation and drainage project supply requirements; Legal, organizational and financial aspects of irrigation and drainage project; Responsibilities of different operation offices; Recommended channels for operating irrigation and drainage projects; Modernization and Management of irrigation and drainage projects; Education and training; Case studies.

SWLE 805 – Irrigation Management under Controlled Environment 2(2-0-0)

Design and construction of green house, Polyhouse and low cost polyhouse; Methods and instrument of controlling microclimate, selection of crop for different agroclimatic regions; Selection, design and installation of irrigation systems in green house/polyhouse; Fertigation; Automation; hydrophonic; Economic analysis.

SWLE 806 – Economic Evaluation of Irrigation & Drainage Projects 2(2-0-0)

General principles of project evaluation; Private and social cost and benefit of irrigation and drainage projects. Distinction between economic and financial analysis; Techniques for analyzing farm accounts for preparing farm plans and making financial projections. Fixed and variable cost; Benefit cost ratio; Nature of cost and benefits; Sensitivity and risk analysis; Calculation of future/present values and annuities; Case studies.

SWLE 807- Irrigated crops 2(2-0-0)

Irrigated agriculture in relation to crop production; irrigated crops around the world; Soil and climatic condition; selection of irrigation methods for irrigated field condition vegetable and fruit crops; Agronomical practices for major irrigated crops in India,

Drainage requirement for irrigated crops, Economic analysis of major irrigated crops, field visit.

SWLE 808 – Minor Irrigation and Well Hydraulics 2(2-0-0)

Definition, Scope and progress of minor irrigation works in U.P.; Geological formation for ground water supply; Ground water development; Methods for ground water exploration; Lithological investigations and aquifer studies; Design and construction of water storage reservoirs; Equilibrium and non-equilibrium flow to wells; Theim's, Theis, Jacob's and Chow's methods; Multiple well system. Construction and Maintenance of wells and tube wells; Well Rehabilation; Ground water quality; design and development of wells; Filter; Case studies.