• M. Tech. Agricultural Water Management

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 702	Soil Water Plant Relationship	2-0-1	3
4.	SWLE 705	Drainage of Agricultural Land	3-0-0	3
5.	SWLE 710	Ground Water Development & Tubewells	2-0-0	2
6.	SWLE 800	Field/ Industrial Training	0-0-1	1
7.	SWLE 813	Agricultural Water Management –I	3-0-0	3
8.	SWLE 814	Agricultural Water Management –II	3-0-0	3
9.	SWLE 816	Flow Principles and Distribution System	3-0-0	3
10.	SWLE 780	Seminar-I	0-0-1	1
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 707	Advanced Soil and Water Conservation Engineering	3-0-0	3
2.	SWLE 708	Watershed Development & Management	2-0-1	3
3.	SWLE 714	Agricultural Meteorology	3-0-0	3
4.	SWLE 715	Wasteland Development & Management	2-0-0	2
5.	SWLE 801	Irrigation System Design	3-0-0	3
6.	SWLE 807	Irrigated Crops	2-0-0	2
7.	SWLE 808	Minor Irrigation and Well Hydraulics	2-0-0	2
8.	SWLE 815	Irrigation System Management	2-0-0	2
9.	SWLE 817	Watershed Hydrology	3-0-0	3
10.	SWLE 820	Water Quality Assessment and Management	2-0-0	2
11.	SWLE 821	Environmental Impact of Irrigated Agriculture	2-0-0	2
12.	SWLE 823	Non–point Source Pollution Engineering	3-0-0	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 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 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 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 800 –Field/ Industrial Training   1(0-0-1)

SWLE 813- Agricultural Water Management – I   3(3-0-0)

Classification of climate; system approach to water management; crop irrigation system; soil-plant atmosphere systems; water production function types and characteristics; canal capacity factor for better regulation of supplies; optimum decisions for investment in Agricultural Water Management.

SWLE 814- Agricultural Water Management – II   3(3-0-0)

Model building in water management systems; Water quality models; conjunctive water resource use models; economic models; mathematical modeling for efficient utilization of limited water supplies and planning for optimal water use; optimization by simulation.

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 780 –Seminar – I   1(0-0-1)

SWLE 880 – Seminar – II   1(0-0-1)

SWLE 899 – Dissertation   15(0-0-15)

Specialized Courses

SWLE 707 – Advanced Soil and Water Conservation Engineering   3(3-0-0)

Basic concepts of soil erosion; control of soil erosion; Mechanics of wind and water erosion; water and wind erosion control practices; concept of runoff and its estimation; Design, construction and maintenance of vegetated waterways; Planning, Design, Construction and maintenance of terraces, contours and bunds; Design of water harvesting structures and farm ponds; Flood control and routing; Design of landslide control structures; Selection of appropriate irrigation and drainage systems for efficient soil and water conservation; cost analysis.

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 714 – Agricultural Meteorology 3(3-0-0)

Definition and Scope; solar radiation; Radiation balance; crop response to solar radiation; Soil heat flux and soil temperature; air temperature and sensible heat flux; Heat transport and temperature profile in plant canopies; Wind and turbulent transport; crop response to humidity; Transport of water vapour from evaporating surfaces to air; Effect of microclimate on evaporation and evapotranspiration; Micrometeorological methods for estimating evapotranspiration; Advection; Photosynthesis; Environmental factors controlling photosynthesis, Light- energy conversion and photosynthesis efficiency, photosynthesis and water use efficiency, Field measurement of photosynthesis; Carbon-dioxide balance; Frost and Frost control; Methods for improving water use efficiency; Instrumentation in Agricultural Meteorology.

SWLE 715 – Waste Land Development and Management 2(2-0-0)

Land suitability classification according to USBR; Land suitability categories according to FAO framework; Land evaluation; Mapping of degraded soil through soil survey; Land degradation in arid and semi-arid regions, Land degradation due to erosion, Land degradation management by conservation practices; Causes, reclamation and management of water logged and salt affected soils; Rehabilitation and management of ravine lands; Selection, Design and management of irrigation and drainage systems in wastelands; Economic evaluation of wasteland development projects.

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 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.

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 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 821-Environmental Impact of Irrigated Agriculture   **2(2-0-0)**

Nutrient cum hydrologic balance of agricultural lands; water quality assessment; human and plant health problems.

SWLE 823- Non-Point Source Pollution Engineering   **3(3-0-0)**

Engineering principles involved in assessment and management of nonpoint source (NPS) pollution. Effect of NPS pollution on ecosystem integrity. Use of GIS/mathematical models to quantify extent of pollution. Design/implementation of best management practices. Discussion of Total Maximum Daily Load (TMDL) principles and processes.