

- **M. Tech Soil & Water Conservation 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

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 705	Drainage of Agricultural Land	3-0-0	3
6.	SWLE 707	Advanced Soil & Water Conservation Engineering	3-0-0	3
7.	SWLE 708	Watershed Development & Management	2-0-1	3
8.	SWLE 780	Seminar-I	0-0-1	1
9.	SWLE 800	Field /Industrial Training	0-0-2	2
10.	SWLE 802	Design of Soil & Water Conservation Structures	2-0-0	2
11.	SWLE 880	Seminar –II	0-0-2	1
12.	SWLE 899	Dissertation	0-0-15	15

Specialized Courses

S. No.	Course Code	Course Title	L-T-P	Credits
1.	SWLE 709	Soil Salinity and Water Quality	2-0-0	2
2.	SWLE 712	Air Photo Interpretation & Remote Sensing	2-0-1	3
3.	SWLE 713	Land Reclamation	2-0-0	2
4.	SWLE 714	Agricultural Meteorology	3-0-0	3
5.	SWLE 715	Waste Land Development & Management	2-0-0	2
6.	SWLE 716	Watershed Planning & Management –I	2-0-0	2
7.	SWLE 717	Watershed Planning & Management –II	2-0-0	2
8.	SWLE 803	Flow Through Porous Media	2-0-0	2
9.	SWLE 809	Soil, Erosion, Transportation & Sedimentation	3-0-0	3
10.	SWLE 810	Forest Watershed Management	2-0-0	2
11.	SWLE 811	Hydrological Modelling	2-0-0	2
12.	SWLE 812	Planning Execution & Management of Soil & Water Conservation Projects	2-0-0	2
	SWLE 817	Watershed Hydrology	2-0-1	3

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 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 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 780 –Seminar – I**1(0-0-1)****SWLE 800 –Field/ Industrial Training****1(0-0-1)****SWLE 802 – Design of Soil and Water Conservation Structures****2(2-0-0)**

Selection, design and stability analysis of earth fill, rock fill and concrete gravity dams; Design of drop spillway, chute spillway and pipe spillway; Phenomena of hydraulic jump; energy dissipation; Design of outlet and control structures; Operation and maintenance of small dams and conservation structures.

SWLE 880 – Seminar – II**1(0-0-1)****SWLE 899 – Dissertation****15(0-0-15)****Specialized Courses****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 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 713 – Land Reclamation**2(2-0-0)**

Causes of Land degradation; salinity and sodicity; extent of water logging and salinity problem in India and U.P.; De-salinization and de-sodification; Reclamation and management of saline soils; Leaching method and period; Salt Balance; Salinity control and Leaching requirements; Estimating Leaching requirements; Reclamation and management of sodic soils; Reclamation of water logged and salt affected soil through drainage systems; Afforestation of salt affected soils; Selection, operation and maintenance of Land Reclamation machinery; Economic and social aspects of Land Reclamation.

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 716 -Watershed Planning & Mgmt - I**2(2-0-0)**

Concept of characteristics of watershed, Hydrologic cycle, problems of Land degradation, causes and consequences of watershed deteoration, Identification of watershed Management, people's participation in watershed Management, Socio

economic survey of watershed, Land use capability, classification, appropriate soil and water conservation measures for watershed Management, Integrated multi disciplinary approach for watershed Management, field visit.

SWLE 717 Watershed Planning & Mgmt - II

2(2-0-0)

Concept of watershed planning, Analysis of data and preparation of layout, Development of master plan, causes of Land degradation, Survey, monitoring, reclamation and conservation of Agricultural and forest lands, hill slopes and ravines, conjunctive use of water, Greenery and forestry, Rain water harvesting, Dryland Agriculture, Selection of crops, Horticulture, tree culture and Deforestation – National Land use policy, legal and social aspects, GIS and Remote sensing application in watershed management.

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; Darcy's, Laplace, Dupuit and Boussinesq equations and approximation; Numerical solution of flow problems.

SWLE 809 – Soil Erosion, Transportation and Sedimentation

2(2-0-0)

Mechanics of soil erosion, Importance and source of sediment transport; Field investigation and survey; Mechanics of sediment transport; Deposition and estimation of transported sediments in channels and reservoirs; Bed load estimation models; Estimation of sediment yield of a watershed; Sediment yield and transport models; Control of suspended and bed load movement through watershed planning and management.

SWLE 810 – Forest Watershed Management

2(2-0-0)

Concept, characteristics and hydrology of forest watershed; Investigation of streams; Impact of land use changes; Deforestation, road building and other forest uses on forest stream quality and quantity; Radiation energy and water balance; Interception process and estimation; Precipitation and run-off estimation; Soil erosion in forest watershed; Selection and design of soil and water conservation structures; Simulation of hydrological processes in forest watershed.

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 812 – Planning, Execution and Management of Soil and Water Conservation Projects **2(2-0-0)**

Procedure for planning of soil and water conservation projects; Survey and investigation; Analysis of watershed problems; Calculation techniques of different watershed parameter; Legal, organizational and financial aspects of soil and water conservation projects; Responsibilities of different operation offices; Economic and financial analyses of soil and water conservation projects; Project evaluation; Management of soil and water conservation projects; Education, training and peoples participation in watershed development projects; Case study.

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.