

Department of Soil and Water Conservation

M.Sc. Programme

<i>Course No.</i>	<i>Title of the course</i>	<i>Credits</i>
1 st Semester		
SWC-501	Soil Erosion and Conservation	2+1
SWC-502	Watershed Management	2+1
SWC-503	Principles & Management of Physical constraints of soil	2+1
SWC-504	Biological Aspects of Soil Conservation	2+1
SWC-505	Land Leveling and Grading	1+2
2 nd Semester		
SWC-551	Wasteland Development and Management	2+0
SWC-552	Restoration of Chemically Degraded Soils	2+1
SWC-553	Land Use Planning, Soil Survey, Mapping and Interpretation	2+1
SWC-554	Agricultural Hydrology	2+1
SWC-555	Soil Water Plant Relationship	2+1
SWC-556	Conservation of Natural Resources Through Agroforestry System	2+1
SWC-557	Rainwater Harvesting and Water Conservation	2+1
SWC-558	Micro-irrigation in Agriculture	2+1
3 rd Semester		
SWC-601	Principles of Agricultural Drainage	2+1
SWC-602	Pedogenic Evolution in Soil and Classification	2+1
SWC-603	Water Management and Crop Production	2+1
SWC-604	Soil Moisture Conservation in Rainfed Farming	2+1
SWC-605	Principle and Applications of Remote Sensing in Soil and Water Conservation	2+0
SWC-649	Seminar –I	1+0
4 th Semester		
SWC-651	Soil and Water Resource Planning	2+0
SWC-652	Pollution and Conservation of Natural Resources	2+0
SWC-699	Seminar-II	1+0
SWC-700	Master's Research	0+20

Details of Courses

M.Sc. Programme

SWC 501 Soil Erosion and Conservation (2+1)

History of soil erosion, definition, classification. Nature and extent soil erosion in India. Mechanics of soil erosion by water and glaciers. Factors and processes of soil erosion; its impact on environment and biosphere. Universal soil loss equation – defining all parameters and its use. Rainfall erosivity and soil erodibility. Mechanics of wind erosion – factors, process, wind erosion equation. Management of soil and nutrient losses. Shifting cultivation – principles, extent and impact. Methods of soil erosion control – vegetative measures like crop rotation, afforestation, agrostological technique, etc. and mechanical measures like contour bunding, trenching, gully plugging, strip cropping, terracing, etc. Conservation farming system. Reclamation of ravine lands. Sand dune stabilization. Grazing and its impact on soil erosion. Forest fire and soil erosion. Control measures of grazing and forest fire.

Practical: Measurement of flow of runoff water. Collection and quality analysis of runoff water. Analysis of texture and structure of soil. Calculating dispersion ratio, erosion ratio, erodibility index. Measuring rainfall and calculating erosivity index. Measuring soil plasticity, penetrability, porosity etc. Dumpy level survey for preparation of contour map. Land use study using Transect method. Identification of different grasses used for soil conservation.

SWC 502 Watershed Management (2+1)

Concept and definition of watershed, classification of watershed, shape and nature, importance of watershed management and its role in conservation of natural resources – soil, water and vegetation. Concept of water harvesting and runoff recycling, preparation of watershed management plan, selection of pond size and design of a pond, sedimentation problem in watershed, seepage control, watershed management for runoff and sediment control – economical aspects of watershed management.

Practical: Precipitation measurement, rainfall probability analysis, rainfall-runoff relationship, area measurement by theissen polygon method, isohyetal method, watershed mapping and its delineation, visit to water shed management area.

SWC 503 Principles and Management of Physical Constraints of Soil (2+1)

Soil as a physical system, soil physical environment. Type of physical constraints. Physical constraints in relation to yield potential. Soil texture, soil structure, poorly aerated soil, compact soil. Soil water and its availability. Soil crust and clod formation problems and their prevention. Management of paddy soil, water permeability of paddy land. Soil conditioners and modifiers of soil structure. Soil moisture stress and plant growth. Soil moisture characteristics, Seedling emergence and root growth in relation to soil moisture stress. Soil moisture movement – concept of moisture potential. Techniques of soil moisture measurements. Soil temperature regimes. Root growth characteristics and moisture extraction pattern. Soil consistency, root-shoot ratio, mechanical impedance and aeration status.

Practical: Mechanical analysis of soil, Analysis of soil structure, soil moisture determination, use of tensiometer, soil moisture meter, determination of some physical properties in soil, determination of soil temperature.

SWC 504 Biological Aspects of Soil Conservation (2+1)

Concept of conservation farming and irrigation, role of vegetation, conservation tillage and mulch in various land, climate conditions. Biological measures in dryland, rainfed, arid, semi-arid, and humid lands. Water use efficiency soil fertility, selection of draught tolerant plants, role of grasses, legumes in conservation, pasture and range-land management and its improvement. Management of waterways, canal bank, bench terrace through biological means.

Practical: Identification of different species of grass, legumes and trees; Water use efficiency under different biological conservation aspects.

SWC 505 Land Leveling and Grading (1+2)

Concept and need for land leveling and grading. Criteria for land leveling, layout of field for irrigation and drainage systems. Survey and design for land grading. Topographical survey, Preparation of contour map, methods of land grading and calculation. Land shaping for composite farming. Computation of cut and fill adjustments.

Practical : Measure the elevation of ground surface with dumpy level and GPS. Preparing contour map. Estimation of earthwork for land leveling. Estimation of earthwork for land grading. Estimation of earthwork for different kinds of land shaping. Layout and design of irrigation channel and drainage channel.

SWC 551 Wasteland Development and Management (2+0)

Wasteland – definition, concept, development and classification. Estimates of wastelands in India. Degraded forest lands – extent of degraded forests – history and causes of degradation. Assessment and criteria for soil degradation, sedimentation and desertification. Role of climatic factors (water and temperature) for soil degradation. Technological development for management of various types of wastelands - hot desert, saline-alkali, ravine, coastal soils, laterites, rocky eroded hill slope, coal mine areas etc. Environmental consideration for the wasteland development.

SWC 552 Restoration of Chemically Degraded Soils (2+1)

Land degradation- type, factors, distribution, processes and impacts on soil productivity. Formation, nature and properties of problem soils. Land restoration and conservation techniques of reclamation of chemically degraded and problem soils. Acid soils – nature distribution, formation and properties, effect of acidic, halomorphie and hydromorphie conditions on plant growth and nutrient availability. Acid sulphate soils – occurrence, distribution, characteristics and effects on plant growth and nutrient availability and its reclamation techniques.

Practical : Measurement of soil pH, EC, Organic C, water holding capacity in soil, determination of soil nutrients, determination of major soluble cations and anions in soil and water.

SWC 553 Land Use Planning, Soil Survey, Mapping and Interpretation (2+1)

Definition and objectives, land use survey and classification, land capability survey – land capability class, sub-class and units. Irrigability survey, soil and land irrigability classes. Sub-class and units. Land suitability classification, sediment yield index. Soil survey- purpose, objectives and types. Taxonomic and mapping units for different types of survey – cartography. Soil classification based on depth, permeability, slopes and erosion. Land classification for gullies and ravine lands. Ratings of land capability classification.

Practical : In-situ soil profile study and interpretation.

SWC 554 Agricultural Hydrology (2+1)

Scope and development of hydrology, hydrologic cycle. Analysis of frequency, intensity, duration and probability of rainfall. Average precipitation, arithmetic mean, isohyetal, theissen polygon etc. Runoff – definition, runoff cycle, runoff rate, volume, methods of estimation of rate and volume, rainfall-runoff relationships. Ground water hydrology- occurrence, distribution and retention; hydrograph analysis – S-hydrograph. Infiltration – definition, factors affecting infiltration, cumulative infiltration, infiltration capacity. Estimation of infiltration – Kostikov's equation, Phillip's equation. Measurement of infiltration. Hydraulic conductivity and infiltration characteristics in soil, soil moisture characteristics, soil moisture constants. Soil moisture diffusion. Open channel hydrology, Manning's co-efficient, wetted perimeter etc. Flow of water – V-notch, orifice, Parshell flume etc. Water stage recording. Concepts of open and close aquifers.

Practical : Measuring precipitation by different methods. Rainfall analysis – probability, intensity and duration, precipitation measurement by theissen polygon, isohyetal methods. Measurement of flow in open channel. Measurement of water discharge through open channel using V-notch, orifice, Parshell flume etc.

SWC 555 Soil Water Plant Relationship (2+1)

State of water in soil and its classification- gravimetric, capillary and hygroscopic moisture. Retention and drying characteristics of soil moisture. Energy concepts of soil water. Thermodynamic concept of soil water potential, significance and evaluation of total and its component potentials. Soil water retention and movement, field capacity, wilting point, water holding capacity and available water. Soil water storage and its depletion. Mechanism of soil moisture absorption by plants. Evapotranspiration and potential evapotranspiration. Soil moisture determination, soil moisture stress and plant growth. Estimation of water requirement by empirical formulae – Thornthwite equation, Pen man's equation, Blanney-Criddle equations. Critical analysis of the equations. Irrigation water quality in relation to soil and plant water. Measurement of soil water – lysimeter tensiometer, moisture meter, pressure plate etc.

Practical: Determination of soil moisture content, determination of water holding capacity, determination of field capacity and permanent wilting point, estimation of depth of irrigation water, water requirement of crop. Tensiometer, soil moisture determination by tensiometer.

SWC 556 Conservation of Natural Resources through Agro forestry System (2+1)

Agroforestry- History, objectives, importance, potential. Agro ecological zones, Multipurpose trees in agroforestry. Soil and water management in relation to agroforestry systems. Irrigation methods under agroforestry system, Optimization of water use in agroforestry systems and dry land farming. Role of trees in soil productivity and conservation. Tree root patterns. Soil fertility. Recycling of nutrients including organic matter decomposition, nutrients budgeting, physical conditions and soil productivity under different agroforestry systems.

Practical : Measurement of height of trees. measurement of girth or diameter of trees, estimation of the volume of logs or trees, study of canopy, volume of standing trees, calculation of water storage and fluxes in the soil. Determination of in-situ infiltration rate of soils in forest ecosystem, measurement and estimation of runoff, mineral nutrient analysis of soil and plants.

SWC-557 Rainwater Harvesting and Water Conservation (2+1)

Monsoon– types and behavior in India, rainfall – characteristics and distribution, onset and withdrawal of effective rains, dry spells and wet spells, critical dry spells, water loss from the soil, measurement and factors, hydrological cycle, Importance and issues relating water status. Rainwater harvesting– methods, classes, benefits, approach, water saving technologies, rainwater harvesting and draught mitigation, crop productivity and water security.

Practical: Measurement of rainfall, effective rainfall, measurement of runoff, peak rate of runoff, calculation of design criteria of water harvesting structure.

SWC 558 Micro-Irrigation in Agriculture (2+1)

Types of micro-irrigation systems – sprinkler, drip, sub-surface. Design criteria and suitability of different micro-irrigations. Operation and maintenance of micro-irrigation system. Feasibility and applicability of micro-irrigation systems under diverse soil – water - crop continuum. Dynamics of water and nutrient interaction in soils – water and nutrient use efficiency and savings. Economics of micro-irrigation systems in crop production.

Practical: Determination of uniformity coefficient and coefficient variations in drip, water and nutrient distribution in soil under different irrigation systems. Estimation of water and nutrients use efficiency.

SWC 601 Principles of Agricultural Drainage (2+1)

Irrigation and drainage relations, sources of excess water and salts in soil. Development of drainage problems in different crops and soils, agricultural drainage – waterlogging, surface drainage and subsurface drainage, impact of waterlogging and drainage, drainage requirement of crops, drainage coefficient. Biodrainage - drainage alternatives.

Practical : Measurement of depth of groundwater table, determination of hydraulic conductivity by Auger-hole method, percolation, seepage, surface flow measurement, estimation of drainage requirement and drainage coefficient, measurement of tile drainage, estimation of specific yields of tubewell.

SWC 602 Pedogenic Evolutions in Soil and Classification (2+1)

Soil as a natural body, soil evolution, soil morphology and methods of its study. Soil development, soil formation – factors and process, pedons and polypedons, soil taxonomy – epipedons, diagnostic subsurface horizons, soil moisture and temperature regimes, USDA classification systems : order, sub-order, great group, sub-group, family, series, types, phase, benchmark soils.

Practical: Determination of soil erodibility indices - suspension percentage, dispersion ratio, erosion ratio, clay ratio, clay/moisture equivalent ratio, Study of Munsen Colour Chart. Study of soil horizons.

SWC 603 Water Management and Crop Production (2+1)

Water and its physical, chemical and biological properties. Occurrence, distribution and use of water resources on the planet. Need for water. Occurrence and distribution of surface and subsurface water. Irrigation requirement; depth and time of irrigation for different crops. Scheduling of irrigation, IW/CPE. Methods of irrigation - surface, subsurface, sprinkler, drip and pitcher. Measurement of irrigation water, conveyance of irrigation water. Water lifting devices, Irrigation use efficiencies. Reducing water losses. Water balance equation. Effective rainfall. Water harvesting. Planning and design of irrigation system. Water use efficiencies. Water production function for different crops.

Practical : Measurement of hydraulic conductivity and infiltration rate, measurement of irrigation water, estimation of irrigation depth, estimation of crop water requirement, irrigation efficiencies, study and design parameters of different irrigation systems.

SWC 604 Soil Moisture Conservation in Rainfed Farming (2+1)

Concept of soil moisture conservation, use and methods, rainfall and temperature distribution in India and rainfed farming areas. Soil water relation in rainfed farming – infiltration and available moisture storage. Soil moisture conservation measures – tillage, mulches – their different kinds, effectiveness and economics, draught resistance in crop, mechanism for draught situation, shoot and root growth characteristics. Water harvesting and life saving irrigation. Moisture use efficiency and economics of conservation technique in low rainfall areas.

Practical : Studies on onset and withdrawal of rainy season, dry-spell and wet-spell, soil moisture tension relationship by tensiometer methods, moisture adequacy index, study of water balance, study and design of water harvesting tank and life saving irrigation, studies on tillage and mulch.

SWC 605 Principle and Applications of Remote Sensing in Soil and Water Conservation (2+0)

Basic concept of remote sensing, satellite remote sensing, satellite orbits, stages of remote sensing, band used in remote sensing, major components of remote sensing technology, various platforms and sensors, active and passive remote sensing. Characteristics of electromagnetic radiation and its interaction with matter; sensors in visible, infrared and microwave regions. Characteristics of Different satellites like IRS, INSAT, LANDSAT etc. Microwave remote sensing. Introduction to GIS and GPS. Software and hardware requirements in GIS. Application of remote sensing data in agriculture with special emphasis on soil and water conservation.

SWC 651 Soil and Water Resource Planning (2+0)

Soil and water resources availability, resource utilization, physiography, climate, natural vegetation and geological distribution in India, soil groups in India – distribution, characteristics, classification and management, soil in agro-ecological zones, hydrological cycle, precipitation in India, loss of water by different processes, influence of land use on water resource, water resource of the world, water resource in India, water budget in India, planning and optimum use of soil and water resources.

SWC 652 Pollution and Conservation of Natural Resources (2+0)

Soil and water pollution problems, their magnitude, sources, sinks and persistence, soil and water pollution through fertilizers, pesticides, detergents, industrial effluents, agricultural wastes, sediments radio nuclear, oil spills and their effects on soil and plant growth, roadside pollution with special reference to heavy metals, industrial pollution and hazards to human life.