

- **M-Tech in Remote Sensing and Geographic Information System (GIS)**

Basic supporting

Course code	Course Name	L-T-P	Credit
MAS 711	Statistics –I	2-0-1	3
COMP 805	Computer Programming	2-0-1	3

Core Courses

Course code	Course Name	L-T-P	Credit
SWLE 724	Photogrammetry and Cartography	2-0-1	3
SWLE 725	Fundamentals of Remote Sensing, Image Interpretation and Advances in remote Sensing	2-0-1	3
SWLE 726	Digital Image Processing	2-0-1	3
SWLE 728	Geographical Information System	2-0-1	3
SWLE 729	Thematic application	2-0-1	3
SWLE 780	Seminar -I	0-0-1	1
SWLE 880	Seminar –II	0-0-1	1
SWLE 899	Dissertation	0-0-15	15

Specialized Courses (Land and Water Resource)

Course code	Course Name	L-T-P	Credit
SWLE 727	Advance Image Processing Techniques	2-0-1	3
SWLE 824	Water Resource Assessment	2-0-1	3
SWLE 825	Watershed Characterization	2-0-1	3
SWLE 826	Water Resource Management	2-0-1	3
SWLE 827	Water Resources Development	2-0-1	3
SWLE 707	Advance Soil and Water Conservation Engineering	2-0-1	3
SWLE 715	Waste Land Development and Management	2-0-0	2

Basic supporting

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 724 - Photogrammetry and Cartography

3(2-0-1)

Aerial photography – terms and definitions; Geometry of aerial photographs; Flight planning; Aerial camera; film and filter combinations; Film processing; printing & procurement of aerial photos; Stereoscopy and types of stereoscopes; Use of parallax bar; Height and slope measurement; Photogrammetry; Stereo plotters and mapping instruments; Orientation concepts on stereo plotters; Control extension & Aerial triangulation; Basics of Analytical & Digital photogrammetry; Photogrammetric mapping & mapping accuracy; Cartography – terms and definitions; Map projections and reference spheroids; Map numbering systems; Base maps and thematic maps; Map legend symbols & border information; Design and layout of maps.

Practicals - Stereo Test; Orientation of Stereo model under mirror stereoscope; Determination of photo / imagery scale; Use of parallax bar; determination of heights; Preparation of photo / imagery line index; Preparation of grid; plotting of control points; Checking and updating existing maps; Preparation of map / use of Kargle Reflection Projector; Use of steroplotting instruments B8S; Use of planimeter and Dot/square Grid for area calculation.

SWLE 725- Fundamentals of Remote Sensing, Image Interpretation and Advances in Remote Sensing

3(2-0-1)

Physics of Remote Sensing – terms and definitions; Electromagnetic spectrum; Black body radiation & radiation laws; Scattering; Reflection; Absorption and Transmission; Platforms and sensors in Remote Sensing; Orbit of satellite for Remote Sensing; Types of sensors used in R S and their geometry; Remote sensing data products; Ground truth data in remote sensing; Instruments for ground truth data collection; Spectral signatures of different objects in R S; Interpretation of MSS; Thermal and Microwave images; Aerial photo-interpretation – objectives & definitions; Factors affecting image interpretation; Elements of image interpretation; Use of image interpretation keys;

Image interpretation techniques and methods of analysis; Artificial intelligence; Radar interferometer; Laser altimetry.

Practicals - Study of satellite imagery, border information and marking reference system; Study of infrared radiometer; Collection of radiant temperature and Drawing of its graph of diurnal variation; Use of spectro-radiometer – production and analysis of spectral reflectance curves; Use and analysis of Densitometric data for a given image; Identification of features on single aerial photograph; Study of a given area in B/W; B/W IR; Colour and IR colour photographs; Study of multi spectral photographs using additive colour viewer; Study of satellite imagery (B/W) in different bands and visual interpretation; Study of thermal image interpretation of various features and drawing of isotherms; Study of Radar (microwave) imagery and interpretation of features; Interpretation of cultural details from IRS and SPOT imagery; Preparation of LANDSAT Map using satellite imager FCC.

SWLE 726- Digital Image Processing

3(2-0-1)

Digital Images – terms and definitions; Digital image Data formats; Computer Hardware for digital image processing; Analog – Digital conversion and display of digital images; Basic Statistics used in DIP; Radiometric & Geometric Errors and Corrections in DIP; Image enhancement; Contrast enhancement; Band Ratioing in Digital Image Processing; Filtering Techniques in DIP; Principal component analysis; Supervised and Un-Supervised Techniques; Accuracy assessment of Classified Data; Fuzzy logic classifier; Hyper-spectral Image processing; Image Fusion;

Practicals - To load data from CCT; To convert image data to ERDAS format; Build statistics for the newly loaded data; Loading of data from disk to VDU; Histogram Display; Histogram Equalization; Ratioing Transformation; Principal component analysis; Image filtering; Un-Supervised classification; Supervised classification; Programming on C++/ JAVA

SWLE 728 Geographical Information System

3(2-0-1)

Computer hardware and its components; Data storage & handling in computer data types modern computers; Main frame; Workstation and personal computers; Components of GIS; Basic terms and definitions; Data handling in GIS; Input Storage; Processing and output data;

Geographical data types; Database structures in GIS; Raster and Vector data in GIS; Topology in GIS database; Spatial data Analysis; Overlay operations; Network analysis; Internet GIS; Global positioning system-Introduction and definition; GPs satellites and constellation; GPs segments – space segments; Control segments; User segments; GPS signals and codes; GPS receivers; Different mode of measurement and post processing of data; Accuracy of GPS measurement; Microsoft Access; Oracle

Practicals - Familiarization with GIS software; Data input; Data editing and Topology creation; Not spatial data entry; Practical exercise on ORACLE & ACCESS; Data Analysis; Output map generation; Demonstration on GPS; Provision of Ground Control by GPS in different mode.

SWLE 729- Thematic Applications
3(2-0-1)

Hydrological cycle-precipitation-types of precipitation; analysis of precipitation data; Thiessen polygon method of estimating average rainfall using GIS; interception Evapotranspiration; runoff; Runoff estimation using modified SCS method; Advantages of water balance study; water balance components; methods of estimating Evapotranspiration soil moisture; water balance computation using Thornwait and Mather model; Types of erosion, transpiration and deposition of sediment; soil loss estimation methods; Concept of watershed management; watershed work plans; watershed management programmes; cost benefit studies; role of remote sensing and GIS in watershed management.

Practicals - Land use analysis; Physiographic analysis; Photo / image sample study for understanding fundamental elements of interpretation in Geosciences; Remote Sensing data study for identification and delineation of various land forms and their significance; Identification and delineation of various rock type structures; Interpretation and identification of urban features; Interpretation and urban land use mapping; Application of Remote Sensing data for retrieval of water quality parameters; Application of RS data for identification of coastal habitat; Generation of Thiessen Polygon using conventional and GIS techniques

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 (Land and Water Resource)

SWLE 727- Advanced Image Processing Techniques **3(2-0-1)**

Radiometric & Geometric Errors and their Corrections in DIP; Image enhancement; Contrast enhancement, Histogram Equilization; Band Ratioing in Digital Image Processing; Filtering Techniques in DIP; Principal component analysis; Supervised and Un-Supervised Techniques; Accuracy assessment of Classified Data; Fuzzy logic classifier; Hyper-spectral Image processing; Image Fusion;

Practicals – Fuzzy logic classifier, Hyper spectral Image processing, Image Fusion.

SWLE 824 -Water Resource Assessment**3(2-0-1)**

Hydrological Cycle Elements and Quantification through Remote Sensing; Rainfall–Runoff Modeling (SCS Method); Water Quality; Causes of Water Pollution and Water Quality Parameters; Remote Sensing Techniques in Water Quality Monitoring; Climatic Water Balance; Evapotranspiration; Role of Remote Sensing in Evapotranspiration.

Practicals – Surface water body mapping, Hydrologic modeling using HEC -1 model, water quality estimation using remote sensing, calculation of water balance components.

SWLE 825- Watershed Characterization**3(2-0-1)**

Watershed Characterization and Morphometric Analysis; Watershed Hydrology and Physical Processes in Watershed; Applications of Digital Elevation Models in Water Resources; Erosion, Erodibility & Sediment Yield Modeling; Watershed Prioritisation; Watershed Conservation Planning and Management.

Practicals – Temporal satellite data analysis for vegetation condition, crop water requirement calculation , Crop average estimation using multi temporal satellite data, Database creation and indentifying suitable sites for WHS , Ground water modeling.

SWLE 826- Water Resource Management**3(2-0-1)**

Flood Risk Zone Mapping and Flood Damage Assessment; Flood Frequency Analysis; Drought Monitoring; Tools for drought analysis; Satellite Based Drought Information; Irrigation Water Management; Mapping and Evaluation of Irrigation Command; Site suitability analysis for Water Harvesting Structure.

Practicals – Delineation of Watershed, DEM generation: slope, Aspect, flow direction, Flow accumulation, Drainage, network & morphometric analysis, Erosion mapping using aerial and satellite Data, water prioritization, integration of watershed data base, Soil and water conservation planning using RS &GIS

SWLE 827 -Water Resources Development**3(2-0-1)**

Reservoir Sedimentation; Impact of River Valley Project on Environment; Water Logging and Drainage; Water Resources Project Planning using Remote Sensing & GIS; Familiarization of Remote Sensing Data Products and Data Ordering; Watershed Conservation Planning and Management.

Practicals - Monitoring and management of waterlogged areas using RS & GIS, Water Resources project planning, Performance evaluation of irrigation command area using RS & GIS.

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 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.