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

### Basic supporting

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Name</th>
<th>L-T-P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS 711</td>
<td>Statistics –I</td>
<td>2-0-1</td>
<td>3</td>
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<tr>
<td>COMP 805</td>
<td>Computer Programming</td>
<td>2-0-1</td>
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### Core Courses

<table>
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<td>SWLE 724</td>
<td>Photogrammetry and Cartography</td>
<td>2-0-1</td>
<td>3</td>
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<tr>
<td>SWLE 725</td>
<td>Fundamentals of Remote Sensing, Image Interpretation and Advances in remote Sensing</td>
<td>2-0-1</td>
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<tr>
<td>SWLE 728</td>
<td>Geographical Information System</td>
<td>2-0-1</td>
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<tr>
<td>SWLE 729</td>
<td>Thematic application</td>
<td>2-0-1</td>
<td>3</td>
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<td>SWLE 780</td>
<td>Seminar -I</td>
<td>0-0-1</td>
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<td>SWLE 880</td>
<td>Seminar –II</td>
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<td>SWLE 899</td>
<td>Dissertation</td>
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### Specialized Courses (Land and Water Resource)

<table>
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<tr>
<td>SWLE 727</td>
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<td>2-0-1</td>
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<tr>
<td>SWLE 707</td>
<td>Advance Soil and Water Conservation Engineering</td>
<td>2-0-1</td>
<td>3</td>
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<tr>
<td>SWLE 715</td>
<td>Waste Land Development and Management</td>
<td>2-0-0</td>
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</tbody>
</table>
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 X2 , t, Z & F – Tests. (definition, applications &Problems based on these tests).

COMP 805  Computer Programming  3 (2-0-1)

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 sterosplotting 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 Theissen 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 bogy mapping, Hydrologic modeling using HEC -1model, 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.