### Courses of Studies

**M. Tech in Geospatial Technology**  
Duration: 2 years

| No. of Theory papers - 9 | No. of Practical Papers: 4 |

#### First year- 1st Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subjects</th>
<th>Marks</th>
<th>Credit hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GT.C. 411</td>
<td>Basic Principles of Geospatial Technology, Survey, Thematic Mapping and Cartography</td>
<td>100</td>
<td>4CH</td>
</tr>
<tr>
<td>GT.C. 412</td>
<td>Earth features and phenomena, Earth Resources and Resource Management</td>
<td>100</td>
<td>4CH</td>
</tr>
<tr>
<td>GT.C. 413</td>
<td>Principles of Aerial Remote Sensing and Photogrammetry</td>
<td>100</td>
<td>4CH</td>
</tr>
<tr>
<td>GT.C. 414</td>
<td>Satellite, Microwave and thermal infrared Remote Sensing</td>
<td>100</td>
<td>4CH</td>
</tr>
<tr>
<td>GT.C. 415</td>
<td>Practical on Survey and Cartography, Report on Lab/ Field Visits</td>
<td>50</td>
<td>2CH</td>
</tr>
<tr>
<td>GT.C. 416</td>
<td>Practical on Aerial Photographs, satellite images, Term paper</td>
<td>50</td>
<td>2CH</td>
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#### First year- 2nd Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subjects</th>
<th>Marks</th>
<th>Credit hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GT.C. 421</td>
<td>Statistical data analysis and Spatial statistics</td>
<td>100</td>
<td>4CH</td>
</tr>
<tr>
<td>GT.C. 422</td>
<td>Computer Programming and Database Management</td>
<td>100</td>
<td>4CH</td>
</tr>
<tr>
<td>GT.C. 423</td>
<td>Digital Image Processing, Correction and Interpretation</td>
<td>100</td>
<td>4CH</td>
</tr>
<tr>
<td>GT.C. 424</td>
<td>Digital Elevation Modelling and Global Positioning System</td>
<td>100</td>
<td>4CH</td>
</tr>
<tr>
<td>GT.C. 425</td>
<td>Practical on Statistical data analysis, Computer Programming, and Digital image processing</td>
<td>50</td>
<td>2CH</td>
</tr>
<tr>
<td>GT.C. 426</td>
<td>Report on Field Visits / Seminar</td>
<td>50</td>
<td>2CH</td>
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</table>

#### Second year- 3rd Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subjects</th>
<th>Marks</th>
<th>Credit hours</th>
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</thead>
<tbody>
<tr>
<td>GT.E. 511</td>
<td>Elective (any one of the following)</td>
<td>100</td>
<td>4 CH</td>
</tr>
<tr>
<td>a.</td>
<td>Application of Geographic Information Systems in Geological Science</td>
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<tr>
<td>b.</td>
<td>Application of Geographic Information Systems in Geography/ Human settlement/ archeology</td>
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<td>c.</td>
<td>Application of Geographic Information Systems in Environmental studies</td>
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<tr>
<td>d.</td>
<td>Application of Geographic Information Systems in Geotechnical engineering/ Engineering Geology</td>
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<td>e.</td>
<td>Application of Geographic Information Systems in Natural resource management</td>
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<tr>
<td>f.</td>
<td>Application of Geographic Information Systems in surface and subsurface water resources</td>
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<td>g.</td>
<td>Application of Geographic Information Systems in Oceanic studies and fishery</td>
<td></td>
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<tr>
<td>h.</td>
<td>Application of Geographic Information Systems in Agriculture and Forestry</td>
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<tr>
<td>GT.C. 512</td>
<td>(Training in a reputed institute on Digital Image Processing,/GIS or GPS) Report on field Training</td>
<td>300</td>
<td>12 CH</td>
</tr>
<tr>
<td>GT.C. 513</td>
<td>Seminar (at least 4)</td>
<td>100</td>
<td>4 CH</td>
</tr>
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</table>

#### Second year- 4th Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subjects</th>
<th>Marks</th>
<th>Credit hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GT.C. 521</td>
<td>Dissertation on any topic on Remote Sensing, GIS/ GPS Global positioning system under the guidance of a faculty of the Dept./ Scientist of a RS- GIS Institute/ company.</td>
<td>500</td>
<td>20 CH</td>
</tr>
</tbody>
</table>
DETAILED SYLLABUS
FIRST SEMESTER

Course- GT.C. 411 100 marks (4CH)
Basic Principles of Geospatial Technology, Survey, Thematic Mapping and Cartography

Introduction to Geospatial Technology; Components of Geospatial Technology and their relationship. Basic principles of Remote Sensing. Benefits of Remote Sensing over conventional method of resource survey. Electromagnetic energy and its generation; Division of EMR; Radiation principles- wave model, particle mode; Black body and Real body radiation; Contrast and illumination effect on human vision; Measurement of radiation; Energy matter interaction- Refraction, scattering, absorption, reflectance. Effects of atmosphere on EMR; EMR and their interaction with rocks, minerals, vegetation, water, soil etc.

Geographic data, their nature and acquisition methods. Topography. Terrestrial Survey Methods - chain and compass, plane table, prismatic compass, theodolite. Maps and their classification. Map characteristics and features; Thematic symbolization; positioning of objects on map. Properties of map projection; projection types; Extrinsic and Intrinsic problems; Map reference system- latitude, longitude and other systems. Basic principles of cartography. Cartographic communication process.

Course- GT.C. 412 100 marks (4CH)
Earth features and phenomena, Earth Resources and Management

Natural agents and their role in shaping the earth. Action of river, wind, glaciers; Depositional, erosional and structural land form and their characteristic features; Development of valleys and drainage system; Slope and drainage analysis; Geomorphic divisions of India; Water bodies, their shape, size, depth and water property; Soil formation and soil type.

Earth resources- renewable and no renewable (forest, water, soil, minerals etc.); Population dynamics; Consumption of natural resources; Resource evaluation methods; Environmental problems due to earth resources utilisation. Resources survey and damage estimation.

Course - GT.C. 413 100 marks (4CH)
Principles of Aerial Remote Sensing and Photogrammetry

Fundamentals of aerial photography. Aerial Remote Sensing Platforms; Instruments used for aerial photography; Aerial vehicles; cameras, films and filters; Types of aerial photographs, Characteristic features of aerial photographs - scale, overlap, sidelap, vertical exaggeration etc. Photo features - form, shape, texture, tone, drainage pattern etc., Stereoscopic perception, conditions for stereoscopic vision. Instruments for study of aerial photography - Viewing instruments.,

Measuring instruments, stereoscope, Stereometer (Paralex bar), contour finder, template, Kelsh plotter, sketch master. Scale and height measurement on single vertical aerial photographs; Height measurement based on relief displacement; Stereoscopic measurement of object height. Measurement of absolute and differential parallax; Area measurement; Measurement on Satellite images and their limitations; Softcopy photogrammetry.

Course - GT.C. 414 100 marks (4CH)
Satellite Microwave and thermal infrared Remote Sensing

Satellites and ther types; Satellites launched by India for Remote Sensing data acquisition; Optical mechanical scanner; Satellite photographic system; Space shuttle photography; Return beam vidicon camera; Sensors- MSS and TM sensors,

Course - GT.C. 415 50 marks (2CH)
Practical on Survey, cartography, Field/ Lab. Visit report
Chain and compass survey, plane table survey, prismatic compass survey, theodolite survey. Cartography. 40 marks
Field/ Lab. Visit report 10 marks

Course - GT.C. 416 50 marks (2CH)
Practical on Aerial photographs and Satellite Images
Measurement of distances; Determination of scale and height; Identification of various geomorphic features; Mosaic and planimetric map preparation; Contouring; Study of Aerial photographs and Satellite Images for geomorphological, geological, geographical and other purposes. Ground truthing. 30 marks
Practical Record, Viva and Term paper 20 marks

Books recommended for course GT.C. 411-414:
2) Von Bandat, H. F.: Aerogeology
3) Allum, J. A. F.: Photogeology and regional mapping
4) Leuder, P. R.: Aerial photographic interpretation- principles and applications
5) Bagley, J. W.: Aerophotography and Aero surveying
6) Avery, T. E. and Berlin, G. L.: Interpretation of Aerial photographs
8) American Soc. of Photogrammetry ; Manual of photogrammetry
11) American Soc. of Photogrammetry : Manual of photographic interpretation
12) Kraak, M., and Ormeling, F.,: Cartography
13) Panda, B. C.: Remote Sensing - Principles and Application
14) Rao, D. P.: Remote sensing for earth resources
17) Sabins, F. F.: Remote sensing principles and Interpretation
18) Colwell, R. N. (Ed): The manual of Remote sensing
SECOND SEMESTER

Course - GT.C. 421 100 marks (4 CH)
Statistical data analysis and Spatial statistics
   Basic statistics, Characteristic of statistical data, Limitation of statistics, Primary and secondary data, Organisation of data, Measurements- Arithmetic mean, Median, Mode, Mean deviation, standard deviation, Correlation, Methods of measuring correlation, Regression, Multivariate analysis. Topology.

Course - GT.C. 422 100 marks (4CH)
Computer Programming and Database Management
Image processing system characteristics; CPU, Arithmetic, coprocessor, RAM, Operating system and compiler. Storage devices, input and output devices, Scan, display and processing unit, interactive graphics. Data representation in computers, Programming, Computer language (C++), Visual basic.

Course - GT.C. 423 100 marks (4CH)
Digital Image Processing, Correction and Interpretation
   Digital data; Digital image data storage; Mass storage. Display resolution, Colour resolution software; Statistical data extraction. Univariate and multivariate statistics computed from remotely sensed data; Histograms and .its significance to digital image processing, image display system, Black and white image display, Video image display. Transforming video displays to hard copy displays. Image enhancement techniques. Data input, verification, correction and storage, data quality and errors,

Course - GT.C. 424 100 marks (4CH)
Digital elevation Modelling and Global positioning System
   Baics of Digital Elevation Model; Terrain visualization. Methods of representing DEM; Image methods, Point models; Data sources and sampling methods for DEMs; Data registration and geo-coding; Volume estimation in cut and fill problems; Contour maps; Line of sight maps; Shaded relief maps; Automated landform delineation from DEMs.
   Global positioning system (GPS)- basic concepts; Characteristic of GPS Satellite; GPS signals, GPS receivers; Observation principles, Types of GPS positioning, Measures of accuracy, Determination of orthographic heights using GPS; Heights and geoid, GPS procedures, applications and limitations .

Course - GT.C. 425 50 marks (2CH)
Practicals on statistical data analysis, Computer programming 30 marks
Practical Record and Viva 10 marks
Seminar 10 marks

Course - GT.C. 426 50 marks (2CH)
Report on Field Visits 40marks
Seminar 10 marks
Books Recommended for course GTC. 521-524
1) Snedcor, G. W., and W. G. Kohran,: Statistical Method
2) Till, R., :Statistical Methods for Earth Scientists
3) N. Subramanian : Introduction to Computers.
5) Sanjay Saxena : A first course in Computers
7) Jenson, J. R. -.Introductory Digital Image Processing
8) Gonzalez, R.C, & Wins, P. ; Digital Image Processing
9) Castleman, K, B.: Digital Image processing
10) Rosenfeld, A. & Kak, A.: Digital picture Processing
12) Pavlidis, T.: Algorithms for graphics and Image Processing
13) Duda, R. and Hart, P.: Pattern classification and scene
14) Sabins; F. F.: Remote sensing principles and interpretation
15) Schowengerdt, R. A.: Techniques for image processing and classification in Remote sensing
17) MacDaugall, E.B. : Computer programming for spatial problems
18) Swain, P. H, and Davis, S M : Remote sensing; the quantitative approach

THIRD SEMESTER
Course - GT.E. 511 100 marks (4CH)
Geographic Information Systems
Introduction to Geographic information system. History of GIS; Components of GIS, Advantages of GIS, Data models, Layers and coverages, Database structure of GIS; Raster and Vector data for geographical entities. Data encoding. Data manipulation, Data analysis and spatial modelling, Data quality, Errors and natural variation, interpretation; Data output; Selection of a GIS, Integrated Multidisciplinary Geoinvestigations, Advantages and limitations of combining multidata,

Application of Geographic Information Systems in any one aspect. 

Course - GT.E. 512 300 marks (12CH)
Training
Training in a reputed institute on Digital Image Processing/GIS or GPS. Report on field Training

Course - GT.E. 513 Seminar 100 marks (4CH)
Seminar (at least 4)

FOURTH SEMESTER
Course - GT.C. 521 500 marks (20 CH)