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**

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

First year- 2nd Semester

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

Second year- 3rd Semester

Course No.	Subjects	Marks	Credit hours
GT.E. 511	Elective (any one of the following)	100	4 CH

Elective　　a.　Application of Geographic Information Systems in Geological Science

　　　　　　b.　Application of Geographic Information Systems   in Geography/ Human settlement/ archeology

　　　　　　c.　Application of Geographic Information Systems in Environmental studies

　　　　　　d.　Application of Geographic Information Systems in Geotecnical engineering/ Engineering Geology

　　　　　e. Application of Geographic Information Systems in Natural resource management

　　　　　f.　Application of Geographic Information Systems in surface and subsurface water resources

　　　　　　g.　Application of Geographic Information Systems in Oceanic studies and fishery

　　　　　　h.　Application of Geographic Information Systems in Agriculture and Forestry

Course No.	Subjects	Marks	Credit hours
GT.C. 512	(Training in a reputed institute on Digital Image Processing,/GIS or GPS) Report on field Training	300	12 CH
GT.C. 513	Seminar (at least 4)	100	4 CH

Second year- 4th Semester

Course No.	Subjects	Marks	Credit hours
GT.C. 521	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.	500	20CH

DETAILED SYLLABUS FIRST SEMESTER Course- GT.C. 411   100 marks (4CH) Basic Principles ofGeospatial 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   (4 CH) 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 SensingPlatforms; 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; Streoscopic 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,

Sensors of LANDSAT, IRS, SPOT sensor system. Data transmission from sensor to ground station. Satellite RS data products and their characteristic features. Principles of Microwave remote sensing, Response of vegetation, water, urban structure to microwave; Microwave remote sensing instruments (Radiometer, Scatterometer, Altimeter, SLR, SAR), Radar image characteristics. Interpretation and application of radar images. Thermal infrared radiation properties, Thermal infrared radiation windows,

Thermal radiation laws, Thermal properties of terrains, Thermal infrared multispectral scanner, Interpretation and application of Thermal infrared images.

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.   40marks

 Field/ Lab. Visit report   10 marks

Course - GT.C. 416   50marks (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 trothing 30 marks Practical Record, Viva and Term paper   20 marks

Books recommended for course GT.C. 411- 414:

1) Miller, V.C. and Miller, F. J. :Photogeology.

2) Von Bandat, H. F.: Aerogeologv

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 7) Eardley, A. J. : Aerial photographs : their use and interpretation. 8) American Soc. of Photogrammetry; Manual of photogrammetry 9) Hart, C. A.: Air photography applied to surveying.

10) Jensen, J. R. : Remote Sensing of the Environment

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

15) Johannsen. C. J. and Sanders, J. L. : Remote sensing for resource Management

16) Mekel, J. F. M. : The use of Aerial photographs and other images in geological mapping

17) Sabins, F. F.: Remote sensing principles and Interpretation

18) Colwell, R. N. (Ed): The manual of Remote sensing

19) American. Soc. of Photogrammetry: Manual of Remote sensing 20) Fisch, J. P. Synthetic Aperture Radar, New York, Springer Verlag.

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.   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.   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,

Digital Image, Radiometric and Geometric errors in digital images and their correction, image analysis and pattern recognisation, Image enhancement, reduction and magnification, contrast enhancement. Rationing, spatial filtering, Edge enhancement. Band rationing, Special transformations; Thematic information extraction. Classification scheme, training site selection, supervised classification, Map accuracy assessment.

Course - GT.C. 424   100 marks (4CH)

Dgital 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.

4) Chandpr, A.: The Penguin dictionary of Computers. 5)   Sanjay Saxena : A first course in Computers 6)   Bingham, J. : Mastering Data Processing.

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

11) Hord. R. M.: Digital picture Processing of Remotely sensed data

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

16) Nagao. M. and Matsuyama, T.: Computer graphics and image processing 17) MacDaugalI, E.B. : Computer programming for spatial problems

18) Swain, P. H, and Davis, S M : Remote sensing; the quantitative approach

19) Lileesand, T. M., Kiefer, R. W., and Chipman, J. W.,: Remote Sensing and Image Interpretation

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.
a. Geological Science, b. Geography/ Human settlement/ archeology, c. Landuse studies, d. Environmental studies, e. Geotecnical engineering/ Engineering Geology, f. Natural resource management, g. Surface and subsurface water resources, h. Oceanic studies and fishery

Course - GT.E. 512　　　　　　　　　　　　　**300marks(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)** 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.

P. G. Dip. in Remote Sensing and Geographic Information System
Theory Papers: 4   Practical and Dissertation: 1

Course No.		Marks
Paper- I	Fundamentals and Basic principles of Remote Sensing	100
Paper- II	Aerial photography and Satellite Remote Sensing	100
Paper- III	Digital Image Processing	100
Paper- IV	Geographic Information System	100
Paper- V	Practical and dissertation	100

Details of the course Paper - I

	Fundamentals and Basic principles of Remote Sensing
Unit- IA:	History of Remote Sensing, Benefits of Remote Sensing over conventional methods of resource survey, Uses of Remote Sensing.
Unit-IB:	Nature of Remote Sensing; Components of Remote Sensing System: Terrestrial System, Aerial System, Spatial System
Unit- IIA:	Electro-magnetic Radiation (EMR)- The nature of radiation; Radiation at source; Radiation in propagation; Radiations at its target; Radiation from sun; Radiation from the earth.
Unit- IIB:	Properties of EMR; Atmospheric windows; Perturbing effects of the atmosphere.
Unit- IIIA:	EMR properties; Reflection, Emission, Absorption, Transmission, Scattering
Unit- IIIB:	Characteristics of objects; Interaction of EMR with rocks, minerals, vegetation, water, urban areas, soil etc.
Unit- IVA:	Platforms: Role of Platform in Remote Sensing; Manned Earth Resource Satellite; Unmanned Earth Resource Satellite, Meteorological Satellite.
Unit- IVB	Types of platforms; Ground borne Platforms- Cherry arm configuration; Airborne Platforms- balloons, aircrafts; Space borne Platforms- satellites.
Unit- VA:	Fundamental properties of sensors; types of sensors- Passive and active sensors; Optical scanner, thermal scanner; Multispectral scanner.
Unit- VB:	Basic features of different types of sensors in use

Paper - 2

Paper- 2	**Aerial photography and Satellite Remote Sensing**
Unit- IA:	Fundamentals of aerial photography; Acquisition of photographs- Terrestrial System and Aerial System
Unit-IB:	Uses of aerial photographs in different fields of science (geology, geography, forestry, natural hazard assessment) and for the earth features.
Unit- IIA:	Aerial photography- photographic instruments; photographic configuration; types of photography.
Unit- IIB:	Types of aerial photographs; B&W panchromatic photographs, Coloured photographs, False coloured infrared photographs, Ultraviolet photographs, Multiband photographs. photographs
Unit- IIIA:	Characteristic features of aerial photographs
Unit- IIIB:	Geometric characteristic of aerial photographs- scale, overlap, sidelap, vertical exaggeration, and geometric resolution.
Unit- IVA:	Photo features- Form, shape, texture, tone, contrast, colour, drainage pattern, structure, relief displacement.
Unit- IVB	Stereoscopic perception, conditions for stereoscopic vision.
Unit- VA:	Remote Sensing data acquisition system; Sensors in the visible wave length; Sensors outside the visible wave length; Active and passive sensors; Opticalmechanical sensors.

Unit- VB:	Remote Sensing data products; Satellite mageries, FCC, CCT etc. Role of manual data analysis and interpretation, Methods of data interpretation.

Paper - 3

	Digital Image Processing
Unit- IA:	Image processing system characteristics, C. P. U., Arithmetic coprocessor, RAM
Unit-IB:	Operating system and compiler. Operating system and compiler.
Unit- IIA:	Basic features of digital images, Image display system- Black and white image interpretation and display.
Unit- IIB:	Video image display. Transforming video displays to hard copy displays. Verification.
Unit- IIIA:	Data input, verification, correction and storage, data quality and errors.
Unit- IIIB:	Image analysis and pattern recognisation, Image enhancement- reduction and magnification, contrast enhancement
Unit- IVA:	Rationing, spatial filtering, Edge enhancement.
Unit- IVB	Special transformations, Thematic information extraction,
Unit- VA:	Classification scheme, supervised classification, training site selection, Statistics extraction, Classification algorithm.
Unit- VB:	Unsupervised classification, Cluster building, assignment of pixels to one of the clusters using minimum distance classification logic.

Paper - 4

Paper- IV	Geographic Information System
Unit- IA:	Components of Geographic information system (GIS). GIS softwares module; Organisational aspects of GIS; Future trends in GIS.
Unit-IB:	Definition of map; map and spatial information; Computer assisted mapping and map analysis.
Unit- IIA:	Data organization in computer; Files and data excess; Data structure of GIS; Points, lines and area; Geographical data in computer; Perceived structures and computer representation of geographical data.
Unit- IIB:	Raster data system, Vector data structure for thematic maps, Choice of vector or raster data; Advantages and disadvantages of vector methods.
Unit- IIIA:	Data encoding; Data base structure; computer representation of data.
Unit- IIIB:	Data manipulation; the need of numerical data manipulation; Operational, automatic decision, / classification techniques.
Unit- IVA:	Definition of database; data analysis; -simple data retrieval.
Unit- IVB	Spatial modelling-cartographic modelling, map overlay.
Unit- VA:	Data quality, Errors- Errors resulting from rasterizing a vector map; errors associated with digitizing a map or with geocoding; errors associated with overlaying two or more polygon network.
Unit- VB:	Data interpretation and application for- Forest resource inventory, landuselandcover study; crop estimation; Draught monitoring; soil and salinity mapping; geological study; geomorphological study; environment management; oceanographic studies; natural hazard management.
Paper- V	Practical and dissertation
	Study of Aerial photographs, B & W satellite imageries and FCC; Mosaic and planimetric map preparation; Ground truthing. Dissertation on aerial photograph/ satellite imagery based study.