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

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 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 (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 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; 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. 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:

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. 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,

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) MacDaugall, 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 spatital 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 **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)**

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.