

**M. TECH. IN GEOSPATIAL TECHNOLOGY
DEPT. OF EARTH SCIENCES**

- 1. Minimum eligibility:** Master degree in any General Science subject or +3 Science graduate with P. G. Dip. in Remote Sensing & GIS or any B.E / B. Tech degree in any branch with a minimum of 45% marks.

The Form for admission can be downloaded from Sambalpur University website www.suniv.ac.in.

- 2. Selection criteria:** Career- 30 marks, written- 60 marks and Viva Voce- 10 marks (Total 100) with the following distribution

For general M. Sc. Student	First Division	Second Division	Third Division/ Pass
H.S.C. E.	5.0	4.0	3.0
+2	5.0	4.0	3.0
+3 (Hons)	6.0	4.0	2
Distinction	1.0	1.0	1.0
P. G. Diploma in RS & GIS	4	2	1.0
M. Sc.	9.0	7.0	5.0
For professional degree student	First class Hons	First class	Second class
B. Tech/ B. E. degree holder (after +2)	20.0	15.0	10.0

(When the number of applications is less than the sanctioned strength, merit list will be prepared on the basis of Career marks only)

3. Course Structure:

First year- 1st Semester		
Course No.	Course Name	Credit hours
GT. 411	Basic Principles of Geospatial Technology, Survey, Thematic Mapping and Cartography	4CH
GT. 412	Earth features and phenomena, Earth Resources and Resource Management	4CH
GT. 413	Principles of Aerial Remote Sensing and Photogrammetry	4CH
GT. 414	Satellite, Microwave and thermal infrared Remote Sensing	4CH
GT. 415	Practical on Survey and Cartography, Report on Lab./ Field Visits	2CH
GT. 416	Practical on Aerial Photographs, satellite images, Term paper	2CH
First year- 2nd Semester		
Course No.	Subjects	Credit hours
GT.421	Statistical data analysis and Spatial statistics	4CH
GT.422	Computer Programming and Database Management	4CH
GT.423	Digital Image Processing, Correction and Interpretation	4CH
GT.424	Digital Elevation Modelling and Global Positioning System	4CH
GT.425	Practical on Statistical data analysis, Computer Programming, and Digital image processing	2CH
GT. 426	Report on Field Visits / Seminar	2CH
Second year- 3rd Semester		
Course No.	Subjects	Credit hours
GT.511	Elective (any one of the following)	4 CH

- a. Application of Geographic Information Systems in Geology, Geotechnical Engineering and Engineering Geology
- b. Application of Geographic Information Systems in Geography, Human settlement, Land use studies and Archeology
- c. Application of Geographic Information Systems in Environmental studies and Natural Resource Management
- d. Application of Geographic Information Systems in surface and subsurface water resources, Oceanic studies, Fishery and Meteorology
- e. Application of Geographic Information Systems in Ecology, Agriculture and Forestry

GT.512	(Training in a reputed institute on Digital Image Processing,/GIS or GPS) Report on field Training	12 CH
GT.513	Seminar (at least 4)	4 CH
Second year- 4th Semester		
GT.521	Dissertation on any topic on Remote Sensing, Geographical Information System(GIS)/ Global Positioning System (GPS) under the guidance of a faculty of the Dept./ Scientist of a RS-GIS Institute/ Company (*12 CH Dissertation, 4 CH Viva Voce on Dissertation, 4 CH Seminar on Dissertation)	20 CH*

DETAILED SYLLABUS FIRST SEMESTER

Course- GT. 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. 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. 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. 414

100 marks (4CH)

Satellite Microwave and thermal infrared Remote Sensing

Satellites and their 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. 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. 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

SECOND SEMESTER**Course - GT. 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. 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. 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 recognition, 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. 424**100 marks (4CH)****Digital elevation Modelling and Global positioning System**

Basics 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. 425**50 marks (2CH)**

Practicals on statistical data analysis, Computer programming

30 marks

Practical Record and Viva

10 marks

Seminar

10 marks

Course - GT. 426**50 marks (2CH)**

Report on Field Visits
Seminar

40 marks
10 marks

THIRD SEMESTER

Any one of the following:

Course - GT. 511. A

100 marks (4CH)

Application of Geographic Information Systems in Geology, Geotechnical Engineering and Engineering Geology

Unit 1

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.

Unit 2

Basic principles of geology, Concept of non-renewable natural resources, Various land forms developed in different rock types, Preparation of lithotectonic maps and their integration with existing geological maps; Plotting of field data on computer generated lithotectonic maps; Thematic map generation; Slope map construction; Integration of toposheet with satellite images, Digital elevation map preparation and their Integration with geological maps, linear features and Lineament mapping and their analysis, reservoir site selection, water holding capacity assessment, flood zone mapping. Application of GIS in site selection for dams, bridges, tunnels and detection of landslide prone areas, earthquake and tsunami studies.

Course - GT. 511. B

100 marks (4CH)

Application of Geographic Information Systems in Geography, Human settlement, Land use studies and Archeology

Unit 1

Same as that of Course - GT. 511. A

Unit 2

Basic principles of geography, Concept of natural resources, Classification of land and soil; Land potentiality study, Preparation of land use- landcover maps and their integration with existing geographical maps; wetland and wasteland mapping using RS & GIS, Study of topography/ geomorphology using remote sensing data products, contouring; Cadastral mapping. Generation of Digital elevation models and contouring; Application of GIS in urban planning, road communication, traffic control. Supervised and unsupervised classification of digital maps for soil erosion mapping, study of agriculture, crop yield prediction, hazard zone mapping.

Course - GT. 511. C

100 marks (4CH)

Application of Geographic Information Systems in Environmental studies and Natural Resource Management

Unit 1

Same as that of Course - GT. 511. A

Unit 2

Basic principles of ecology and ecosystem, natural resources and their assessment, Human consumption of natural resources and its impact on environment, Concept of development, Industrialisation and its impact, Concept of Natural and anthropogenic hazards, Application of RS & GIS for Classification of land and soil, water bodies, forests; Preparation of land use- landcover maps and their integration with existing geographical maps; wetland and wasteland mapping using RS & GIS, Generation of Digital elevation models related to environmental studies, flood zone mapping, draught area detection; Application of GIS in site selection for industries, towns, mining, water resource projects. Supervised and unsupervised classification of digital maps for soil erosion mapping, study of agriculture, crop yield prediction, hazard zone mapping. Application of RS and GIS in Environmental Impact Assessment studies (baseline data generation, DEM generation).

Course - GT. 511. D

100 marks (4CH)

Application of Geographic Information Systems in Surface and subsurface water resources, Oceanic studies and Fishery

Unit 1

Same as that of Course - GT. 511. A

Unit 2

Importance of surface and subsurface water resources; Human use and misuse of water resources and its impact on environment; vertical zonation of ground water; water quality parameters; Basic principles of water flow and their measurement; various sources of water pollution. Concept of watershed and their management; Depth zonation of oceans, marine processes and resources; Sources of marine pollution and their detection using RS data products; RS & GIS methods of Turbidity, temperature, phytoplankton studies; RS & GIS methods of subsurface water resources assessment, RS & GIS methods used in Fishery. RS and GIS applications in Water flow modeling, Reservoir routing etc. and DEM generation.

Course - GT. 511. E

100 marks (4CH)

Application of Geographic Information Systems in Ecology, Agriculture, Forestry and Meteorology

Unit 1

Same as that of Course - GT. 511. A

Unit 2

Basic principles of ecology and ecosystem, Renewable resources and their assessment, Human consumption of forest and natural resources and its impact on environment, Concept of Natural and anthropogenic hazards like flood, cyclone, draught, forest fire etc, Application of RS & GIS for Classification of soil, forests; Preparation of land use- landcover maps, flood zone mapping, draught area detection; Application of GIS in soil conservation, afforestation, damage estimation due to urbanisation, mining, water resource projects, road and rail links. Application of RS & GIS in meteorology. Supervised and unsupervised classification of digital maps for soil erosion mapping, study of agriculture, crop yield prediction, hazard zone mapping.

Course - GT.E. 512**300 marks (12CH)****Training**

Training in a reputed institute on Digital Image Processing,/GIS or GPS. Report on field Training (50 days)

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

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.

4. Course Faculty:

Core Faculty	
1. Prof. Ashutosh Naik (Dept. of Earth Sciences)	2. Mr. Duryadhan Behera (Dept. of Earth Sciences)
3. Prof. P. C. Mishra (Dept. of Environmental Sciences)	4. Dr. Sanjaya Kumar Pattanayak (Dept. of Environmental Sciences)
5. Prof. Niranjana Behera (School of Life Sciences)	6. Dr. C. Tripathy (Dept. of Statistics)
7. Prof. Biswajit Satapathy (Dept. of Business Administration)	8. Dr. D. K. Mahalik (Dept. of Business Administration)
9. Mr. C. S. Panda (Dept. of Computer Science)	
Visiting Faculty	
1. Prof. Gopal Krushna Panda (Dept. of Geography, Utkal University)	2. Prof. N. Patel (Birla Institute of Technology, Mesra, Ranchi)
3. Prof. P. K. Verma (Dept. of Geology, Vikram Uni., Ujjain)	4. Dr. S. B. Chaudhury (National Remote Sensing Centre, Hyderabad)
5. Dr. Kalicharan Sahoo (Dept. of Marine Sciences, Berhampur Uni.)	6. Dr. Jadish Tripathy (Dept. of Geology, Ravenshaw University)
7. S. N. Mohapatra (Dept. of Geology, Jiwaji University, Gwalior)	8. A. S. Jasrotia (Dept. of Geology, Jammu University, Jammu)
9. Dr. Dipti Ranjan Satapathy Scientist -B, IMMT, Bhubaneswar	10. Dr. Rabi Samal Scientist, CDA, Bhubaneswar
11. Dr. B. Mishra, GIS Specialist, OSDMA, Bhubaneswar	12. Dr. Jayanta Kumar Jena Reliance
13. Mr. Ranjan Kumar Mallik, GIS Specialist, Geospatial Solutions	14. Mr. Rajat Satapathy GIS Specialist
15. Ms. Trushna Dash Miss Subhra Dash	16. Miss Subhra Dash

5. No. of seats : 16 (Minimum to run the course 10)**6. Course Fee:** Rs. 20,000/- per Semester for regular students and Rs. 25,000/- per Semester for sponsored students in addition to the fee prescribed at in the admission prospectus.

7. Other special features

a. About the M. Tec. Programme

The M. Tech. in Geospatial Technology is first of its kind in the state. It is a four semester course approved by Sambalpur University. It has theoretical, practical and research project / training component. It is a regular course but keeping the requirements of employed persons pursuing the course, the teaching shall be imparted in the after noon/ evening hours on all working days and from 10.00 AM to 5.00 PM on Sundays and other holidays. Advance topics in the fields of Remote Sensing, Cartography, Digital Image processing, GIS, GPS and DEM have been included to meet the requirements of employers. The admitted students will be sent to leading GIS companies for training/ project work in the second year.

b. About the host Department:

The Dept. of Earth Sciences of Sambalpur University was established with the approval of University Grants Commission in 1984. It is the only Department in the state to offer M. Sc. Applied Geology and M. Phil. Applied Geology in the state. The Dept. also offers a P. G. Diploma course in Remote Sensing and GIS in Distance Education mode.

Remote Sensing, Digital Image processing and GIS has been taught as an integral part of M. Sc. and M. Phil. Applied Geology courses since the inception of these programmes. Taking into consideration the importance of the subject and job opportunity in the coming years the Dept. decided to offer the Geospatial Technology course for the first time in Odisha. The Dept. has all the basic laboratory facilities needed for the subject. However, there is lot of scope for further upgradation of the facilities in the RS & GIS Laboratories and shall be done as per the requirement of the students.

The Department has organized fourteen National level seminars/ conferences/ workshops and refresher courses since its inception. Those related to RS & GIS are-

1. Workshop on Application of Remote sensing Data (22nd March, 1993)
2. National level workshop on Geospatial Technology for Earth Resources and Environmental Management (17th-18th, February, 2007).
3. Workshop on Remote Sensing Application in Mineral Exploration (13th-14th December, 2010)
4. Refresher course on Remote Sensing and GIS Application (24th January, 2011 - 13th February, 2011)

For further Information, contact:

Prof. Ashutosh Naik

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