Syllabus

M. Sc Course in Remote Sensing & Geographic Information System

REVISED IN MARCH 2022: TO BE EFFECTIVE FROM THE ACADEMIC SESSION 2021-2022

P.G. DEPARTMENT OF RS &GIS
MAHARAJA SRIRAM CHANDRA BHANJA DEO UNIVERSITY
Mayurbhanj, Takatpur, Baripada, Odisha
PIN – 757003

M.Sc. (RS & GIS) EXAMINATION
(Choice Based Credit System)
(Semester Pattern)

1. The course is of two years duration comprising of four semesters of theory, software and field works.
2. There are two supportive papers one in semester-II (RS-402) and other in semester-III (RS-501). These are open for the students of other departments.

3.Each student has to carry out project work from Semester-III and submit a dissertation before the commencement of Semester-IV theory examination.

4. The student can opt one elective course comprising of two papers in the 2nd year of PG programme.

5. The examination system for each theory paper consists of one IAE of 20 marks and one semester exam of 80 marks. The IAE shall be one hour duration and shall cover at least two units. The semester examination shall be 3 hour duration and the question paper shall be of unit pattern with two alternatives from each unit having equal weight. However, in practical paper semester examination shall be 100 marks and of 6 hours duration.

6. A candidate must secure at least 40% marks in practical and 30% marks in individual theory paper to pass the semester examination.

7. A student securing cumulative Grade Point Average (CGPA) 5.5 shall be declared as pass in the Post-Graduation Examination.

8. Formula for conversion of CGPA to Percentage is:

9. Candidate securing at least 6.75 CGPA (minimum 60% marks in aggregate) shall be declared as First Class..

10. If the candidate passes all the four semester examinations he/she will be declared to have passed the M.Sc. examination in Remote Sensing & GIS. Further, under no circumstance a candidate shall be allowed to appear any Semester Examination after completion of the twice the duration of the course.

11.The student has to secure at least 75% of attendance to be eligible to appear at the University examination.

Programme Outcome:

• The students will acquire advanced conceptual knowledge and comprehensive understanding of the fundamental principles in Remote sensing, Geographical Information System (GIS), Global Positioning System (GPS), Digital Image processing (DIP), Geo-Science and their different filed applications

• They will be prepared to take up challenges as globally competitive Geo Scientists/researchers in diverse areas of theoretical as well as experimental GIS.

• They will be equipped with enough technical and analytical skilled to pursue their further studies and develop continuous learning through their professional career.

• They will be trained to appear national level tests like UGC-CSIR NET, GATE, etc., successfully.

• They will acquire the sense of academic and social ethics.

P.G. DEPARTMENT OF RS &GIS
MAHARAJA SRIRAM CHANDRA BHANJA DEO UNIVERSITY
M.Sc. SYLLABUS-*2021-2022*

SEMESTER - I

Code	Title	Credit	Marks		Total
			Internal	Semester	
RS-401	**F**undamental of Optical Thermal & Microwave Remote Sensing	05	20	80	100
RS-403	Remote Sensing – II	05	20	80	100
RS-405	Application Of Remote Sensing	05	20	80	100
RS-407	Cartography	05	20	80	100
RS-409	Practical On Photogrammetry & Image Interpretation	06		100	100
	Total	**26**	**80**	**420**	**500**

SEMESTER - II

Code	Title	Credit	Marks		Total
			Internal	Semester	
RS-402	Aerial Photography & Photogrammetry	05	20	80	100
RS-404	IT In RS&GIS	05	20	80	100
RS-406	Digital Image Processing (DIP)	05	20	80	100
RS-408	Earth System Science	05	20	80	100
Rs-410	Practical On DIP (P.P) + Field Tour Survey Report	06	20	80	100
OERS-412	Basic Of Remote Sensing & Geographical Information system	05		80	100
	Total	**31**	**100**	**520**	**600**
	Summer Training One Week (Provide Certificate)				

SEMESTER - III

Code	Title	Credit	Marks		Total
			Internal	Semester	
RS-501	Research & Methodology	05	20	80	100
RS-503	GPS & Surveying	05	20	80	100
RS-505	Geographical Information System	05	20	80	100
RS-507	Advanced GIS – 1	05	20	80	100
RS-509	Practical on Geographic Information System (I)	06		100	100
RS-511	Practical On Geographic Information System-II	06		100	100
	Total	**32**	**100**	**520**	**600**

SEMESTER - IV

Code	Title	Credit	Marks		Total
			Internal	Semester	
RS-502	Dissertation	06		200	200
RS-504	Practical on Geo Informatics	05		100	100
	Total	**11**		**300**	**300**
	GRAND TOTAL	**100**			**2000**

SEMESTER - I
Fundamental of Optical Thermal & Microwave Remote Sensing

Internal=20 & external=80(20+80=100)

(Paper code-RS-401) **Marks-100(20+80)**

OBJECTIVES: This Chapter is designed to fulfil the following objectives

1. To provide exposure to students in gaining knowledge on concepts and applications leading to modelling of earth resources management using Remote Sensing
2. To acquire skills in storing, managing digital data for planning and development.
3. To acquire skills in advance techniques such as Optical, Thermal & Microwave Remote Sensing for mapping, modelling and monitoring.

Unit-I (Fundamental of Remote sensing)

Definition and Overview of Remote Sensing, History and Evolution of Remote Sensing , Remote Sensing Systems. Remote sensing Art or Science process. Energy: Sources of energy, Energy radiation principle, Energy interaction in the atmosphere , Energy interactions with earth surface feature, Recording energy by sensor transmission, Reception processing, Interpretation & Analysis. Advantages of Remote sensing, limitation of Remote sensing, Ideal and Real Remote sensing.

Unit-II (Fundamental of Satellite remote sensing-I)

Orbital characteristics of Remote sensing satellite, Concept of platforms and sensors, Remote Sensing systems , Types of sensors, Resolution of sensors—spatial, spectral, radiometric and temporal, Different application with respect to earth surface feature

Unit-IV (Thermal Remote sensing)

Fundamental of Thermal Remote Sensing, Thermal infrared radiation properties.Atmospheric effect of thermal remote sensors, Interaction of thermal radiation with terrain element, Thermal scanners, interpreting thermal scanner imagery, Geometric characteristics of thermal imagery, Temperature mapping with thermal scanner data.

Unit-V (Microwave Remote sensing)

Microwave Remote sensing : Fundamental of microwave remote sensing , SLAR: system components, spatial resolution , Synthetic Aperture Radar (SAR), Geometric characteristics of SLAR imagery , Earth surface features influencing radar returns, Interpretation of SLAR imagery. Microwave satellite in operation: Seasat, Radarsat , Shuttle, Imaging Radar (SIR) , ERS :Elements of Passive microwave remote sensing , Passive microwave scanner , application of passive microwave remote sensing .

COURSE OUTCOMES:

1. On completion of this course, the student shall be able to
2. Understand concepts of passive and active microwave system

3. Gain knowledge in the principles of Microwave image analysis and interpretation
4. Understand the various application domains of microwave satellite data
5. Acquire skills in analysing Thermal and Hyperspectral Remote Sensing data for various thematic mapping and its applications.
6. Provides employability opportunity in space organization.

REFERENCE BOOKS:

Remote Sensing and Image interpretation: Thomas Lille sand & R.W. Keifer, John Wiley and Sons (3rd Ed.).
Text Book of Remote Sensing & Cartography Kalyani Publication, D. Nandi, T. Chattrejee..
Remote Sensing: Principles and Interpretation: F. Sabins, Freeman Publication.
Remote Sensing of the Environment by J.R. Jensen, Pearson Publication

SEMESTER - I
REMOTE SENSING-II

Internal=20 & external=80(20+80=100)

(Paper code-RS-403) **Marks-100(20+80)**

OBJECTIVES:

This Chapter is designed to fulfil the following objectives

1.To introduce the student to the physical Advanced Satellite of Remote Sensing, Hyperspectral Remote Sensing, LIDAR Remote Sensing and their different application in terrestrial and vegetation mapping.

2. Acquire skills in handling instruments, tools, techniques and modelling while using Remote Sensing Technology

Unit-I (Advanced Satellite remote sensing)

Satellite and its classification. Sun synchronous orbit and geostationary orbit, Remote sensing satellites in operation:LANDSAT,SPOT,IRS,INSAT,GEOSAT,IKONOS,QUICK BIRD,NOAA, TERRA their sensor characteristics and application.

Unit-II (Hyper spectral remote sensing)

Hyper spectral Remote Sensing Hyper spectral image analysis: Atmospheric correction, Analysis technique of hyper spectral remote sensing, Biophysical modelling, Image transmission & compression. Spectroscopy, Image cube, Hyperian/HYSI, Spectral matching, Digital Spectral Data, Libraries, Application of Hyper spectral data, MODIS

Unit-III (LIDAR Remote Sensing)

Fundamental of LIDAR remote sensing, LIDAR Data Processing, LIDAR Data Management And Applications,(Topographic Mapping,flood inundation analysis, line-of-sight analysis, Forestry,

various types of LIDAR sensors-, vegetation metric calculations, Corridor mapping system,) Terrestrial And Bathymetric Laser Scanner

Unit-IV Ground Truth Data

Ground truth data collection - use of radiometers, and spectrophotometers, etc Spectral Reflectance, Physical basis of spectral signatures of the objects and Spectral, Signature for Vegetation, Soil, Water and Snow. Thermal Image and Interpretation, Interpretation of SAR data (from Satellite) for Landusestudies .

COURSE OUTCOMES:

On completion of this course, the student shall be able to

1. get knowledge to the advanced Satellite of Remote Sensing, Hyperspectral Remote Sensing, LIDAR Remote Sensing and their different application in terrestrial and vegetation mapping.
2. acquire skills in handling instruments, tools, techniques and modelling while using Remote Sensing Technology.
3. get familiarized about various image enhancement and image processing techniques.
4. get opportunity of employability opportunity in space organization.

REFERENCE BOOKS:

1. Remote Sensing and Image interpretation: Thomas Lille sand & R.W. Keifer, John Wiley and Sons (3rd Ed.).
2. Text Book of Remote Sensing & Cartography Kalyani Publication, D. Nandi, T. Chattrejee.
3. Remote Sensing: Principles and Interpretation: F. Sabins, Freeman Publication.
4. Remote Sensing of the Environment by J.R. Jensen, Pearson Publication
5. Lidar: Range-Resolved Optical Remote Sensing of the Atmosphere, edited by Claus Weitkamp.
6. Manual of Airborne T opographicLidar by Michael S. Renslow.
7. Lidar T echniques and Remote Sensing in the Atmosphere: Understanding the Use of Laser Light in the Atmosphere by Francis Emmanuel Mensah.

SEMESTER - I
APPLICATION OF REMOTE SENSING
Internal=20 & external=80(20+80=100

(Paper code-RS-405) **Marks-100(20+80)**

OBJECTIVES:

This Chapter is designed to fulfil the following objectives

1. The content of this course enable the students to understand the application potentialities of remote sensing data for Agriculture and Forestry.
2. The objective of the course is to impart knowledge about the various geological structures and Geomorphic Landforms.
3. The students will be exposed to various Remote Sensing Applications to earth Sciences.
4. To introduce the concepts of urban and regional planning.
5. To explore the use of the geospatial technology in advanced analysis in planning.

Unit-I (Remote Sensing In Environmental Mapping)

Rocks types, forms, Minerals and their field characteristics, Image interpretation for delineation of lithology (Rocks) and minerals, Geological structures - Folds, Faults and Joints and their field characteristics, Various important land forms, Image characteristics of geological structures and major land forms

Unit-II (Cultural Geo Science)

Field Application:Urban Planning and management, Application of Archeology,Application in Agriculture. Application in Disaster management, wet land management, Wildlife management, Forest management

Unit-III (Remote Sensing Application)

Hyperspectral RS and its application; Microwave RS and its application; Thermal RS and its application; Optical RS and its application

Unit-IV (Remote Sensing Software)

P.C .I Geometica, Tacit ViewTNTmips, ERDAS, ENVI,Opticks,Dragon,IDRISI, USGS Global Visualization Viewer (GloVis), NASA Earth Observation (NEO), USGS Earth,Explorer, ESA's Sentinel data, NOAA, IPPMUS Terra, LANCE, VITO Vision, Bhuvan,MOSDAC, India- WRIS .

COURSE OUTCOMES

1. On completion of this course, the student shall be able to understand the application potentialities of remote sensing data separately and in combination with GIS techniques for Agriculture, Forestry, Impart knowledge about the various geological structures and Geomorphic Landforms.

2. The students will be exposed to various Remote Sensing Applications to earth Sciences, urban and regional planning.
3. The students will understand the concepts involved in mapping of crop acreage and yield estimation, crop damage assessment.
4. The students will understand mapping lithological and structural features. Understand the concepts involved in Geomorphic Mapping.
5. It provides employability opportunity in space organization and survey of India.

REFERENCE BOOKS:

1. Remote Sensing and Image interpretation: Thomas Lille sand & R.W. Keifer, John Wiley and Sons (3rd Ed.).
2. Manual of Remote Sensing, Vol. 1, American Society of Photogrammetry.
3. Remote Sensing: Principles and Interpretation: F. Sabins, Freeman Publication.
4. Remote Sensing of the Environment by J.R. Jensen, Pearson Publication

SEMESTER - I
CARTOGRAPHY

Internal=20 & external=80(20+80=100)

(Paper code-RS-407) **Marks- 100**

OBJECTIVES

This Chapter is designed to fulfil the following objective.

1. Expose the students with concepts of cartography as major components of input and output related to cartography.
2. To expose the basic concept of cartography, projection, elements of cartography and Interpretation of topo graphical and Geological map.

Unit-I (Basic of Cartography)

Evolution of cartography, Roll of technology in the development of cartography. Types of map, element of cartography, coordinate system, cartography data and its measurement (ordinal, nominal, interval, ratio), Map designing and lay out ,cartography variable, types of symbolization-use of point, line and area symbols. Map compilation

Unit-II (Map projection)

History of map projection.Types of map projection, Fundamental properties of map projection, Elementary idea on zenithal projection. Conical projection, and cylindrical projection.

Unit-III (Element of Cartography)

Datum,Ellipsoid,Geodesy,geoid,scale,areameasurement,latitude , l,ongitude, parallel, meridian, grid,UTM.Maplettering.Cartographic coverage of the world,

Unit- IV (Topo Graphical & Geological Map)

Interpretation of topographical (Relief, Drainage, Natural vegetation, communication ,settelement)& geological maps(Uniclinal, unconformity), interpretation of statical data, mapping the terrain.Base map .Map enlargement and reduction, Map reproduction, Graph and Diagrams, Chorochromatic maps, isopleths and choropleth maps. Relief maps, Climate maps, Economic maps and diagrams, Population map and diagrams, Settlement map and Diagram, Mapping the Weather and Climatic data, Mapping socio-economic data, Thematic and Complex mapping constructing maps.

COURSEOUTCOME

On completion of this course, the student shall be able to

1. Familiarize with concepts of choosing map projections, 2D transformation.

2. Understand the data models and data structures used for spatial data.

3. Perform geospatial analysis and network analysis.

4. To understand the web based GIS architecture and concepts of Map server.

5. get job in survey of India.

REFERENCE BOOKS:

1. Robinson A., Morrison, J.L., Muehrcke P.C., Guptil S.C. 2002: Elements of Cartography. John Wiley
2. Rampal K.K. 1993: Mapping and compilation. Concept publication
3. Taylor,D.R.F. 1985: Education and Training in contemporary cartography, John Willey
4. Mishra R.P and Ramesh A. 1989: Fundamentals of Cartography. Concept publishing company

SEMESTER - I
PRACTICAL ON PHOTOGRAMMETRY & IMAGE INTERPRTETATION

(Paper code-RS-409) **Marks-100**

OBJECTIVES

1. To introduce the student to the toposheet and satellite image interpretation and photogrammetry as a tool for mapping.
2. To inform him of the different tools of ERDAS and Arc GIS, Quantum GIS software.
3. Understand the concept of stereoscopy and its use to determine height by parallax measurements.

Content:

1. Border information of satellite image.
2. Study of survey of India topo sheets (Base Map, Relief Map, Drainage Map, Natural vegetation, Communication settlement)
3. True colour and false colour image.
4. Satellite image Interpretation (Land use land cover, forest, Soil, Geomorphology, Surface water, Geology)
5. DEM & DTM image.
6. Interpretation of tools of ERDAS and Arc GIS, Quantum GIS
7. Download Microwave data
8. Download of LIDAR data
9. Layer stacking
10. Field Exercises for ground data collection for data Validation for satellite image interpretation.

COURSEOUTCOME

On completion of this course, the student shall be able to

1. Understand the concept of stereoscopy and its use to determine height by parallax measurements.
2. Perform orientations using analogue, semi-analytical and digital photogrammetric workstations.
3. To obtain spectral signature of various objects using spectro radiometer.
4. To visually interpret satellite imagery for generation of various thematic maps
5. get employability in space organization.

SEMESTER-II

AERIAL PHOTOGRAPHY AND PHOTOGRAMMETRY

Internal=20 & external=80(20+80=100)

(Paper code-RS-402) **Marks-100**

OBJECTIVES

1. To introduce the student to the physical principles of Remote Sensing and image interpretation as a tool for mapping.

2. To provide exposure to fundamental data models and data structures in GIS

3. To introduced principle of GPS, its components, signal structure, and working procedure.

Unit-I

Early history of aerial photography, Aerial platform, The simple camera, Camera systems, Filters,Films, Vantage point, Ideal time, Atmosphere for Aerial Remote sensing. Basic negative to positive photographic sequence ,Spectral sensitivity of black &white films, Colour film ,Processing of colour films, colour infrared films, Filters & their signification in Remote sensing .

Unit-II

Aerial camera and types, Types of aerial photographs, Geometry of aerial photographs, Scale of aerial photographs, Taking of vertical aerial photographs, Ground coverage of aerial photographs, Area measurement, Photo mosaics, flight planning

Unit-III

Photogrammetry: Relief displacement, Fundamental of human stereoscopy, Stereoscopy as applied to aerial photography, Image parallax, Parallax measurement, Stereoscope, Ortho photos.

Unit- IV

Development of photogrammetry, Photogrammetric process Orientation &Triangulation DTM/DEM generation, Ortho rectification, Contour map generation, Limitation of photogrammetry

COURSE OUTCOME

On completion of this course students shall be able to understand the principles of Remote Sensing andimage interpretation

1. Understand the fundamental of GIS, GPS,its component signal and applications.
2. The skill of managing aerial photography provides opportunity in getting job in space organization.

REFERENCE BOOKS:

1. Moffitt, F.H. and Mikhail, E.M., 1980. Photogrammetry, Harper and Row,
2. Paine, D.P.,1981: Aerial Photography and Image Interpretation for Resource Management. John Wiley.
3. Pandey, S.N.,1987: Principles and Applications of Photo geology. Wiley Eastern,.
4. Rampal K.K. 1999: Hand book of aerial photography and interpretation. Concept publication

SEMESTER-II
IT IN RS&GIS
Internal=20 & external=80(20+80=100)

(Paper code-RS-404) **Marks-100**

OBJECTIVES

1. To study and understand the concepts of Statistical methods and its applications in Engineering.

2. To study the effect of estimation theory, testing of hypothesis, correlation and regression, randomized Design, and multivariate analysis.

Unit I

Introduction of Hardware, software & data, DBMS, Communication system. Wire and wireless communication, Communication type LAN, WAN, MAN, Web server, client Web Browser, IP address.Topology

Unit II

Classification of computer, Input and Output peripherals of a computer memory — concept and types , Programming languages- types , Characteristics and application , Operating system — meaning types and function.

Unit III

Basic computer organization: Number system —Binary, Octal, and Decimal and their inter conversion, Computer arithmetic, Data representation —ASCII& EBDIC: their basic concepts.

Unit IV

Software, Data processing, Data storage, Standard method of organizing Data file management System, Database management system. Internet: Definition, History, Basic Services, Browsers, User of the internet, Advantages of internet Disadvantages of internet Client & server concepts Multimedia .

COURSEOUTCOME

1. On completion of this course the students will be able to solve various problems in the field of engineering employing probability and statistical methods.
2. It is used for data mining, data compression, artificial intelligence, network and traffic modelling, vision and image analysis.
3. The skill of applied statistics and analysis provides opportunity in getting job in space organization.

REFERENCE BOOKS:

1. Paul L. Meyer: Introductory Probability and statistical Applications, Adsion Wesley.
2. C.E. Balaguruswamy: Programming in ANSIC, Tata McGraw Hill Publishing Co. Ltd.
3. Gottrfriield, B.S.: Programming with C, Tata McGraw Hill Publishing Co. Ltd.
4. Introduction to Data Structure (Array, Stack, Linked List, Q)
5. Gupta .S.C and Kapoor .V.K, "Fundamentals of Mathematical Statistics", Sultan Chand and sons, Reprint 2003.
6. Gupta .S.C, and Kapoor, V.K, "Fundamentals of Applied Statistics", Sultan Chand and sons, 2003.
7. Veerarajan.T, "Probability Statistics and Random Processes", TMH, First reprint, 2004

SEMESTER-II
DIGITAL IMAGE PROCESSING
Internal=20 & external=80(20+80=100)

(Paper code: RS-406) **Marks-100**

OBJECTIVES:

1. To study the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image enhancement techniques
3. To study image restoration procedures.
4. To study the image compression procedures.

Unit I (Basics of Digital image)

Introduction to Digital image, Digital Image processing, Categorization of Image processing, Image processing system , Digital image ,Media for Digital Data Recording storage & distribution, Display of Digital image .

Unit II (Digital Image data processing)

Remote sensing data acquisition: Densitometer, Digital data formats, Basic features of digital images B/W hardcopy image display and FCC. Image Rectification and Restoration: Geometric correction, radiometric correction and Noise removal

Unit III (Manipulation and enhancement)

Contrast manipulation: Gray level slicing, contrast stretching. Spatial feature manipulation: Spatial filtering, Convolution, Edge enhancement. Filtering techniques, Image smoothing

Unit IV (Classification)

Multi image manipulation; Band rationing, Principal component analysis, Types of Vegetation component analysis (DVI, NDVI), Intensity-hue —Saturation transformation. Image classification: Supervised and unsupervised classification.

COURSEOUTCOME:

On completion of this course, the student shall be able to

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques.
5. Interpret Image compression standards.
6. Interpret image segmentation and representation techniques.
7. Have opportunity of getting job in all organizations involving Image processing.

REFERENCE BOOKS:

1. Introductory Digital Image Processing: J.R. Jensen.
2. Jensen, J.R. 2000: Remote Sensing of the Environment: An Earth resource Perspective. Prentice Hall.
3. Lillesand, T.M., and Kieffer, R.M., 1987: Remote Sensing and Image Interpretation, John Wiley. N
4. Sabbins, F.F., 1985: Remote sensing Principles and interpretation. W.H. Freeman and company

SEMESTER-II

EARTH SYSTEM SCIENCE

Internal=20 & external=80(20+80=100)

(Paper code: RS -408) **Marks -100**

OBJECTIVE

The objective of the course is to impart knowledge about the various geological structures and Geomorphic Landforms.

The students will be exposed to various Remote Sensing Applications to earth Sciences.

Unit - I: Spectral Properties of Rocks and Minerals

Reflectance Properties of Rocks, minerals in visible, NIR, MIR, SWIR, TIR and Microwave regions Laboratory spectroscopy - laboratory and field spectral data comparative studies, Spectral reflection curves for important Rocks, Minerals.

Unit - II: Geological Structure and Applications

Significance of Geological structures, Role of aerial photographs, Photo interpretation characters of photographs and satellite images, structural mapping, Fold, fault, Lineaments, Direction circular features. Intrusive rocks, rock exposure, Fractures and Joints, Rose diagram.Digital image processing for structural mapping.

Unit - III: Lithological Mapping

Introduction on Igneous rocks, sedimentary rocks, metamorphic rocks, mapping of regional scale lithological units, Image Characters of igneous rocks, sedimentary and metamorphic rocks, examples. Digital image processing of various rock types, resolution and Scale of lithological mapping and advantages.

Unit - IV: Geological & Geomorphological Mapping

Significance of landform, Geomoprphological guide, interpretation and image/photo characters, Tectonic landforms, Fluvial landforms, Denudational landforms, Volcanic landforms- Aeolian landforms, Coastal landforms. Importance of ground truth and geological field data collection. Geophysical survey, surface investigation, subsurface investigation .

COURSEOUTCOME

On completion of this course, the student shall be able to

1. Understand mapping lithological and structural features.
2. Understand the concepts involved in Geomorphic Mapping.
3. Understand the geophysical / geomagnetic surveys for subsurface exploration.
4. Get exposed to various earth sciences applications which helps them in getting job

REFERENCE BOOKS:

1. John J. Qu , Wei Gao, MenasKafatos , Robert E. Murphy, Vincent V. Salomonson, "Earth Science Satellite Remote Sensing", Springer 2007.
2. Gupta .R.P, "Remote sensing Geology", Springer, 2003.
3. Drury .S.A, "Image interpretation in Geology", Chapman and Hall, London. 1993.
4. Pandey .S.N, "Principles and Applications of Photogeology", Wiley eastern. 1987.

SEMESTER-II
PRACTICAL ON DIGITAL IMAGE PROCESSING

(Paper Code: RS-410) **Marks- 100**

OBJECTIVE:

This course will facilitate the students to have hands on experience on different steps of satellite image processing using ERDAS software.

Content

1. Photogrammetry
a. Stereo Test
b. Mirror Stereoscopes
c. Stereo model
d. Measurements/ Parallax
2. Image loading and display/registration
a. Image to topo
b. Image to registered image
c. Image with known points
3. Image masking
a. Vector boundary generation
b. Vector polygon topology building
c. Vector to raster conversion
d. Masking image with mask raster
4. Image mosaicking
a. Registration of all adjacent images in the same coordinate system
b. Image mosaicking
5. Sub set image registration
a. Image cutting with given boundary
6. Image enhancement
a. Linear Contrast stretching
b. Non-linear contrast stretching
7. Principal component generation
8. Band rationing and NDVI analysis
9. Spatial filtering and Edge enhancement
10. Image classification

a. Supervised classification
b. Non-supervised classification

COURSEOUTCOME

1. On completion of this course, the student shall be able to acquire skills to carry out the Lab Exercises independently on various Visual and digital Image processing techniques.
2. This helps in getting employability in space organization.

REFERENCE BOOK:

EARDAS Manual

SEMESTER-II
BASIC OF REMOTE SENSING &GEOGRAPHICAL INFORMATION SYSTEM
Internal=20 & external=80(20+80=100)

(Paper code-OE-RS-412) **Marks-100**

OBJECTIVES:

1. To introduce the student to the physical principles of Remote Sensing and image interpretation as a tool for mapping.

2. To provide exposure to fundamental data models and data structures in GIS

3. To introduced principle of GPS , It's components, signal structure, and working procedure.

Unit -I (Fundamental of Remote Sensing)

Concept and foundations of remote sensing: Basics of Remote sensing, remote sensing Art or Science process. Energy: Sources of energy, Energy radiation principle, Energy interaction in the atmosphere , Energy interactions with earth surface feature, Recording energy by sensor transmission, Reception processing, Interpretation & Analysis.

Unit -II (Fundamental of Image interpretation)

Satellite imagery interpretation, Elements of image interpretation, image interpretation strategies, interpretation keys, temporal aspect of image interpretation, interpretation techniques, methods of search in image interpretation.Steps of Image interpretation.

Unit -III (Fundamental of G.I.S)

Evolution of Geographical Information system, Concept of Geographic information systems: Introduction, Definition of GIS, Key components of GIS, Data Conceptual model of spatial

information: Spatial Information and data models conceptual models of spatial information- raster and models vector data models, advantages and disadvantages of raster and vector data models.

Unit -IV (Fundamental of GPS)

Global positioning system (GPS): Concept of Global positioning system (GPS) and its architecture. Working procedure of GPS, Different types of Errors in GPS, Kinds of GPS, application of GPS in different applications.

COURSEOUTCOME

On completion of this course students shall be able to

1. understand the principles of Remote Sensing and image interpretation
2. Understand the fundamental of GIS, GPS,its component signal and applications which helps them in getting job in space organization

The Department of Wildlife & Biodiversity Conservation, Zoology, Botany, Master in Computer Application and Master in Computer science students are able to take this paper

REFERENCE BOOKS

1. Remote Sensing and Image interpretation: Thomas Lille sand & R.W. Keifer, John Wiley and Sons
2. Manual of Remote Sensing, Vol. 1, American Society of Photogrammetry.
3. Remote Sensing: Principles and Interpretation: F. Sabins, Freeman Publication.
4. Remote Sensing of the Environment by J.R. Jensen, Pearson Publication

SUMMER TRAINING

SEMESTER - III

RESEARCH METHODOLOGY (Supportive)

Internal=20 & external=80(20+80=100)

(Paper Code- RS-501) **Marks-100**

OBJECTIVES

1. To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as exploratory or formulative research studies).
2. To portray accurately the characteristics of a particular individual, situation or a group (studies with this object in view are known as descriptive research studies).
3. To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as diagnostic research studies).
4. To test a hypothesis of a causal relationship between variables (such studies are known as hypothesis-testing research studies).

Unit 1(Research Methodology)

An IntroductionMeaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process.

Unit 2 (Developing a Research Proposal)

Format of research proposal-Individual research proposal-Institutional proposal-Hypothesis: Meaning-Types of hypothesis.
Sampling: Sampling and Population, Techniques sampling selection, Characteristics of a good sample, Sampling errors and how to reduce them.

Unit 3 (Tools and Techniques of Data Collection)

Checklist, Data schedule, Observation, Opinionative, Interview, Sociometric techniques, Questionnaire, Rating scales, Interview schedules.

Unit 4

Research Report: Format of the Research Report, Style of writing the report, References and Bibliography, Evaluation of Research: Criteria of evaluation.

COURSEOUTCOME:

The outcome that the research seeks to achieve is the entire reason for the research, so it should guide each step of the process.

The knowledge of research methodology in this area makes students competent to work in space organization

REFERENCE BOOK

1. DebashisPati, Marketing Research, University Press
2. Marketing research by N.Malhotra, Pearson Education
3. Cooper, Donald R and Pamela S schindler, Business Research Methods, Tata McGraw-Hill
4. Research Methodology. Methods & Techniques: Kothari, C.R.
5. Tests, Measurements and Research Methods in Behavioural Sciences. Singh, A

SEMESTER - III

GPS & Surveying

Internal=20 & external=80(20+80=100)

(Paper code-RS-503) **Marks-100**

OBJECTIVE

1. To understand the working of Total Station and GPS equipment and solve the surveying problems.

Unit I

Introduction of Global Positioning System, Satellite constellation, GPS signals and data,Geo-positioning-Basic Concepts. Discussion on NAVSTAR,GLONASS, GALLILEO, COMPASS etc.

Unit II

Basic geodesy, Geoid /datum/ Ellipsoid- definition and basic concepts, Coordinate Systems, Special Referencing system, Map Scale, Scale factors, Indian geodetic System, Segments of GPS: Control Segment, Space Segments, User Segment - operations of GPS,

Unit III

GPS Errors and Biases, GPS ephemeris errors, Selective availability, Satellite and receiver clock errors, Multipath error, Antenna-phase-center variation, Receiver measurement noise ,Ionospheric delay. GPS Positioning Modes.

Unit IV

Application of GPS: GPS in Natural Resource Management, GPS in Surveying and Mapping, GPS in Navigation, GPS Application in Crustal Mapping, GPS Application in Agriculture, GPS Application in Military Operations, GPS in Urban Utilities and Services.

COURSEOUTCOME

On completion of this course students shall be able to

1. Understanding the concepts of Electromagnetic waves and impact of RI
2. Work with Electro optical and microwave Total Station and understand error sources.
3. Understand the advantages of electronic surveying over conventional surveying methods
4. Understand the working principle of GPS ,its components, signal structure, and error sources
5. Understand various GPS surveying methods and processing techniques used in GPS observations
6. Familiarise various areas of GPS applications and new developments.
7. Get opportunity in getting job in survey work.

REFERENCE BOOK

1. Ahmed El-Rabbany, Introduction to GPS The Global Positioning System, Artech House Boston London 2002
2. Rueger, J.M., Electronic distance Measurement, Springer - Verlag, Berlin, 1990
3. Laurila, S.H., Electronic Surveying in Practice, John Wiley & Sons, Inc, 1983
4. Soastamoinen, J.J., Surveyor's Guide to electro-magnetic pistance Measurement, Adam Hilger Ltd., 1967
5. SantheeshGopi., Global Positioning System - Principles and Applications, Tata McGraw- Hill Publishing Company Limited, New Delhi, 2005
6. Seeber, G., Satellite Geodesy, Walter de Gruyter, Berlin, 1993
7. Alfred Leick, GPS Satellite surveying, John Wiley and Sons, 1995
8. Hofmann Wellenhof, B. Lichtenegger, H. and Collins, J., Global Positioning System, SorinQer - Verlag, New York, 199

SEMESTER - III

GEOGRAPHIC INFORMATION SYSTEM (GIS)

Internal=20 & external=80(20+80=100)

(Paper Code- RS-505) **Marks-100**

OBJECTIVE

1. To provide exposure to data models and data structures in GIS and to introduce various Raster and Vector Analysis capabilities.
2. To expose the concept of quality and design of cartographic outputs in open GIS environment.

Unit-I Concept of Geographic information systems:

A brief history ofGeographical Information system, Objectives of Geographical Information systems, Components and elements of GIS. coordinate system and map projection GIS- An information of Spatial & Attribute Information, GIS- Three views of information system, GIS- A knowledge Hub, GIS- A set of interrelated subsystems, GIS- An information Infrastructure

Unit- II Conceptual model of spatial information:

Spatial Information and data models conceptual models of spatial information- raster and models vector data models, advantages and disadvantages of raster and vector data models.

Unit- III Conceptual model of Non- spatial information:

Non spatial information and concept of database, Database management systems, Database structures- hierarchical, Network and relational, Important features of relational database structures- primary and foreign keys, Relational joins, Normal forms, object oriented database.

Unit-IV Data input, Verification, Storage and output:

Sources of geographical data, Geographical data collectors and providers, Acquisition of digital data from data suppliers, Creating dataset by manual input, Data editing- error detection and correction, Rms error, TIC match tolerance, fuzzy/node snap weed-grain tolerances, dangle length, Creation of topology-connectivity, containment and contiguity.

COURSEOUTCOME

On completion of this course, the student shall be able to

1. Understand the data models and data structures used for spatial data
2. Perform geospatial analysis and network analysis
3. To understand the web based GIS architecture and concepts of Map server
4. Have knowledge of geography information provides opportunity of getting job in various survey related organization

REFERENCE BOOK

1. Principles of GIS: P. A. Burrough and Rachel A.M. McDonnel, Oxford.
2. Concepts and Techniques of GIS by C.P. Lo and A.K.W. Y eung, Prentice Hall.
3. An Introduction to GIS by Heywood, Cornelius and Carver, Pearson Education

SEMESTER - III

ADVANCED G.I.S TECHNOLOGY

Internal=20 & external=80 (20+80=100)

(Paper Code- RS-507) **Marks-100**

OBJECTIVE

1. To provide exposure to data models and data structures in GIS and to introduce various Raster and Vector Analysis capabilities.
2. To expose the concept of quality and design of cartographic outputs in open GIS environment.

Unit- I Data quality and errors in GIS:

Nature of geographic data, Sources of errors in GIS database, Data quality parameters, Handling error in GIS, Error propagation in GIS. Human and Organizational issues: The issue of GIS applications and users, Justifying the investment in GIS. Choosing and implementation of GIS, Organizational changes due to GIS. GIS project design and management: Problem identification, designing a data model, Project management, Implementation problem, Project evaluation.

Unit-II Internet GIS:

Principles of computer network, Network type, Client server computing concept, Application of internet services to GIS software. Issues in GIS and trends: Development of computer method for handling spatial data, Web Page Basics, Web Mapping, Geospatial Web Services, Application of Internet services to GIS, Internet GIS software

Unit-III Spatial analysis-

Digital Terrain Modeling and other raster analysis, Vector overlay analysis, TIN. View shed analysis and its application. Watershed analysis and its application

Unit- IV Network Analysis:

Link and link impedance, Node and turn impedance, Overpass and underpass. Network applications: Shortest path analysis, closest facility allocation, Location allocation.

COURSEOUTCOME

On completion of this course, the student shall be able to

1. Have knowledge in Botanical GIS where integration of plant distributions and local plant locations, ethological studies of animal movement, landscape ecological studies of vegetation blocks, ecological studies of spatial population dynamics, and the study of Bio-geography
2. Analysis Epidemiology on disease mapping with research on mapping the spread of disease and with location studies for health care delivery.

3. Have Spatial Visualisation – basically converting all statistics into spatial maps and visualisation Spatial Econometrics.
4. Know image Analytics – to determine changes in multi-date images automatically and characterise the changes into morphometric and clustering analysis.
5. Have Fractals and scale invariance analysis so that scientific modelling provides a useful framework for new approaches.
6. Have opportunity in getting job in various survey related organization

REFERENCE BOOK

1. Principles of GIS: P.A. Burrough and Rachel A.M. McDonnel, Oxford.
2. Concepts and Techniques of GIS by C.P. Lo and A.K.W. Yeung, Prentice Hall.
3. An Introduction to GIS by Heywood, Cornelius and Carver, Pearson Education
4. Pinde Fu and JiulinSun,Web GIS: "Principles and Applications", ISBN:9781589482456,ESRI, 2010.

SEMESTER-III

PRACTICAL ON GEOGRAPHIC INFORMATION SYSTEM-I

(Paper Code: RS- 509) **Marks-100**

OBJECTIVES

1. Maximize the efficiency of decision making and planning.
2. Provide efficient means for data distribution and handling.
3. Elimination of redundant database-minimize duplication.

Contents

Hands on training on Arc- GIS software/ Quantum GIS

1.Introduction and Basic commands

2.Digitizing using digitizer.

3.Construction of topology, Error identification, error correction and reconstruction of topology.

4.Entry of non- spatial data.

5.Linking of spatial and non- spatial data.

6.Transformation of coordinates/ projections.

7.Buffer analysis.

8.Overlay analysis.

9.Network analysis.

10.Digital elevation model generation via point interpolation techniques and interpolation of contour lines .

COURSEOUTCOME:

1. Spatial search tools.
2. Crime Analysis using GIS.
3. Facility Siting Spatial Analytics tools
4. Land Analytics for real estate
5. Forecasting Land use Change
6. The practical application helps in getting job in various survey related organization

REFERENCE BOOK:

ARC GIS MANUAL

SEMESTER-III
PRACTICAL ON GEOGRAPHIC INFORMATION SYSTEM-II

(Paper code-RS-511) **Marks-100**

OBJECTIVES:

1. Capacity to integrate information from many sources.
2. Complex analysis/queries involving geographical reference data to generate new information.
3. Update data quickly and cheaply.

Content

Lab 1: Familiarization with the GIS software

Lab 2: Georeferencing of spatial data in GIS software

Lab 3: Geodatabase creation and Digitization of point line and polygon features

Lab 4: Creation of Spatial data from Non-spatial data

Lab 5: Topology creation of spatial data

Lab 6 Removing topological error

Lab 7 Attribute data Integration with spatial data

Lab 8 Map Designing (layout creation)

Lab 9 Thematic Map creation

Lab 10 Performing vector analysis; Atrribute query, buffering, overlay

Lab-11 Putting GPS data In Arc-GIS and Create IDW and Kiging model

Lab 12 Generation of Digital Elevation Model from spot height

Lab 13 Performing raster analysis

Lab-14 Understanding formats of satellite images and how to practically exchange them

Lab 15 On screen image interpretation: Comparision of images displayed on RGB and IHS display system

Lab 16 for LU/LC and Vegetation mapping Interpretation of Images with typical natural features

Lab 17 Image characteristics of geological structures and major land forms

Lab 18 Hydrological Analysis

Lab 19 Ground water Potential

COURSE OUTCOME

1. Demographic Projection Analysis
2. Environmental Impact Analysis
3. Optimal Routing Tools
4. Aviation Analytics
5. Traffic Analytics tools
6. Generic Spatial Decision Support tools
7. The practical application of geography information helps in getting job in various survey related organization

DISSERTATION

(Paper Code: RS- 502) **Marks-100**

OBJECTIVES

Dissertation are an important method of demonstrating that identify a topic of concern to the field , and read , understand and incorporate the relevant literature into a new research question to be investigated .

Duration: Dissertation and Seminar Six months.

M.Sc. projects should be socially relevant and research oriented ones. Each student is expected to do an individual project. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project.Student will be allowed to appear in the final viva voce examination only if he / she has submitted his / her project work in the form of paper for

presentation / publication in a conference / journal and produced the proof of acknowledgement of receipt of paper from the organizers / publishers.

COURSE OUTCOME:

1. Research skills develop
2. Problem solving skills develop
3. Communication skill develop
4. Specialist information
5. Numerical skills develop
6. Project management skills develop in different applications

Practical on Geo Informatics

(Paper Code 504) **Marks 100**

OBJECTIVES

1. Capacity to integrate information from many sources.
2. Complex analysis/queries involving geographical reference data to generate new information.
3.Update data quickly and cheaply.

Content

Application of Multi-sensor RS and GIS in generation of

a. Land information system
b. Soil information System
c. Forest Information System
d. Marine Information System

COURSE OUTCOME

1.Demographic Projection Analysis
2.Environmental Impact Analysis
3.Optimal Routing Tools
4.Aviation Analytics
5.Traffic Analytics tools
6.Generic Spatial Decision Support tools
7. The practical application helps in getting job in various survey related organization