Centurion
UNIVERSITY
Shaping Lives...
Empowering Communities...

Centurion University of Technology & Management, Odisha

M. Sc. Geoinformatics

(Two Years Programme)

School of Applied Sciences

2019

Overview

Several aspects of space technology have already touched the life of common people, e.g., Google Earth, GPS-enabled Mobiles and day-to-day navigation, using maps. All the technologies behind these services, when put in one basket, can be justifiably described as "Geoinformatics". This includes satellite remote sensing, airborne remote sensing, photogrammetry, geographical information system (GIS), Global Positioning System (GPS), electronic surveying, laser scanning, mobile mapping, image processing, algorithms, data structures and computer programming. Geoinformatics or Geospatial technology touches around 80% of human activities knowingly or unknowingly.

Geoinformatics have high potential for better management and monitoring of day-to-day activities and short-term and long-term physical processes that affect our living environment. Besides finding the use in the day-to-day life of people, these technologies are becoming essential for a large number of application domains, e.g., environmental sciences, civil engineering, urban development and management, water resource, geology, navigation, disaster management, forest, coastal zones, mining operations, entertainment, and many more. Geomatics encompasses the practices related to developing, managing, interpreting or analysing geographically referenced data and includes everything that is 'spatial' in its characteristic and content. Geospatial information empowers the nation to understand its topography, natural resources and human capital and allows it to develop the requisite industrial policies to harness its resources.

Objective:

The 2-year master degree course – M. Sc. Geoinformatics is an interdisciplinary course with an aim to meet the increasing demand for qualified manpower in this rapidly developing field encompassing both pure and applied sciences. Application of Remote Sensing techniques using Geographic Information System (GIS) and Global Positioning System (GPS) with advance surveying has its place in various activities such as resources monitoring and evaluation, environmental monitoring and land use/land cover mapping etc. RS data products are increasingly being used for designing of plan at all the levels of nation building. The department has a separate vision for this course in becoming a Centre of excellence in Geomatics education and research thus to match the needs of ever increasing requirement of trained manpower in these fields and to cater to the need of the human society. It is our mission to impart quality education to students

supported by large-scale hands- on-activity that could make them capable of handling challenges of modern technologies and also to maintain super specialized research facilities to go hand in hand with the world's leading universities and research institutions.

Eligibility:

Bachelor degree in Science with specialization in Agriculture, Forestry, Geology, Geography, Environmental Sciences, Information Technology, Electronics, Mathematics and Computer Sciences. Bachelor degree in engineering with any specialization.

Or

Master degree in Science with specialization in Agriculture, Forestry, Geology, Marine Sciences, Earth Sciences, Geography, Environmental Sciences, Information Technology, Electronics Mathematics and Computer Sciences.

Carrier Prospective:

- **Indian Space Research Organization (ISRO) -** [Space Application Centre (SAC), Indian Institute of Remote Sensing (IIRS), ISRO State application Centre, Orissa Space Application Centre (ORSAC)].
- Survey of India (SOI)
- Indian Rice Research Institute (IRRI)
- Defence Research & Development Organization (DRDO)
- Urban Authorities of India
- Forest department [Odisha Forest Sector Development Project (OFSDP)]
- Chilika Development Authority (CDA)
- Odisha PVTG Empowerment Livelihood Improvement Programme
- Odisha Tribal Empowerment & Livelihoods Programme Plus
- Odisha State Disaster Management Authority (OSDMA)
- Bhubaneswar Municipality Corporation (BMC)
- Indian Institute of Mineral and Material Technology (IMMT)
- AABSys
- Amsys Software Pvt Ltd

- Astronauts Services Pvt. Ltd
- Institute for Spatial Planning and Community E-services (I SPACE)
- Geo Spatial Solution
- Kripal Earth and Environmental Technology Pvt. Ltd.
- Raj Subha Tech. Solution Pvt. Ltd.

Award

After finishing the course, the student will be award as **"Master of Science in Geoinformatics"** in his / her certificate.

Semester - I

Code	Course Title	T-P-PJ	Credits
MSGM1101	Remote Sensing and Its Techniques	**2-2-0**	**4**
MSGM1102	Digital Image Processing and Techniques	**2-2-0**	**4**
DESP0402	Photogrammetry and Application	**2-2-0**	**4**
MSGM1103	Introduction to GIS	**2-2-0**	**4**
MSGM1104	Quantitative Methods	**4-0-0**	**4**
MSGM1105	Digital Cartography	**2-2-0**	**4**
	Total		**24**

Semester - II

Code	Course Title	T-P-PJ	Credits
MSGM1201	GIS Data Analysis	**2-2-0**	**4**
ENFC0414	Database Management Systems	**1-2-0**	**3**
DESP0201	Lidar Remote Sensing and Application	**0-3-0**	**3**
MSGM1202	GPS & Surveying	**2-2-2**	**6**
MSGM1203	Big Data Analysis	**3-1-0**	**4**
MSGM1204	Research Methodology	**4-0-0**	**4**
	Total		**24**

Semester – III

Code	Course Title	T-P-PJ	Credits
GMSE0401	Geological Remote Sensing and Technique	2-2-0	4
GMSE0402	Hyperspectral Remote Sensing and Applications	2-2-0	4
GMSE0403	Microwave Remote Sensing and Applications	2-2-0	4
GMSE0404	RS & GIS for Ocean Eng. & Coastal Management	2-2-0	4
GMSE0405	RS & GIS for Hydrology and Water Resources	2-2-0	4
GMSE0406	RS & GIS For Urban and Regional Planning	2-2-0	4
GMSE0407	RS & GIS for Agriculture and Forestry	2-2-0	4
GMSE0408	RS& GIS for Environmental Engineering	2-2-0	4
GMSE0409	RS & GIS for Disaster Management	2-2-0	4
GMSE0410	RS& GIS for Rural Development	2-2-0	4
GMSE0411	Web GIS	2-2-0	4
MSGM0301	Minor Project	0-0-4	4

Semester -IV

Code	Course Title	T-P-PJ	Credits
MSGM0302	Major Project	**0-0-24**	**24**
			24

Semester - I

Remote Sensing and its Techniques

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Remote Sensing and its Techniques	MSGM1101	Theory + Practice	2-2-0	Nil

Objective

- To understand the Basic Principles of Remote Sensing and Techniques.
- To understand the current remote sensing system, Digital Image processing and Integration.

Learning outcome

- Students will gather knowledge in concepts of remote sensing, aerial photography and photogrammetry, different satellites and its application, image format and extortion, image classification techniques, image analysis and interpretation.

Evaluation Systems

	Component	% of Marks	Method of Assessment
Internal Examination	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		100	

Course Outline

UNIT I - INTRODUCTION AND CONCEPTS

Introduction of Remote Sensing; Principles of RS-Types, Pixel, DN value, Energy sources and Radiation principles, Energy equation, EMR and Spectrum, EMR interaction with Atmosphere- scattering, Absorption, Atmospheric window, Black body radiation, EMR interaction with earth surface features; reflection, absorption, emission and transmission, Spectral signature, Interaction with vegetation, soil, water bodies , Advantage of RS over conventional method; Limitation, Ideal remote sensing.

Practice:

1. Installation of Image Processing software's
2. Layer stacking
3. LUT
4. Subset

Module – IIData acquisition

Procedure, Reflectance and Digital numbers; Intensity, Reference data, Ground truth, Analog to digital conversion, FCCs, TCC, Platforms and sensors; orbits, types, Resolutions; types, Image Interpretation; visual- Interpretation keys.

Practice:

5. FCCs and TCC
6. Resolution
7. Image Interpretation

Module – III SATELLITE AND ITS USE

Land observation satellites; characters and applications, PSLV, GSLV, LANDSAT series; IRS series; IKONOS Series; QUICKBIRD series; Weather/Meteorological satellites; INSAT series; NOAA, Applications; Marine observation satellites, OCEANSAT

Practice:

8. Download satellite data from GLOVIS / Earth Explorer / Bhuvan etc.
9. Mosaicking

Module – IV TYPES of REMOTE SENSING

Remote Sensing and its types; Active, Passive, Optical Remote sensing, visible, infrared, thermal, sensors and characters. Thermal RS, Microwave remote sensing Sensors; Concept of Microwave remote sensing, SLAR, SAR Scattrometers, Altimeter, Characteristics, Image interpretation characters.

Text Books

1. Remote sensing & Image interpretation, Thomas M. Lillesand And Ralph W. Kiefer, John Wiley & Sons, Inc. Publishers.
2. Remote sensing & GIS, B.Bhatta, Oxford University Press.
3. Remote Sensing principle & application, Floydif Sabins, W.H Freeman & Company, Newyork.

4. Fundamentals Of Digital Image Processing, Anil K Jain, Jain, Prentice Hall, New Delhi.
5. Digital Image Processing, Abhishek Yadav,Poonam Yadav, Oscar Publication, Delhi

Digital Image Processing and Techniques

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Digital Image Processing and Techniques	MSGM1102	Theory+ Practice	2-2-0	Nil

Objective

- To study the digital data, image format and extortion.
- To study various image distortion and rectification
- To study and apply various image enhancement techniques
- To understand image classification techniques

Learning outcome

- To understand the structure of spatial data including file associations, attribute tables, Metadata, coordinate systems, and projections.
- To develop software skills in programs used for map production in the modern cartographic workflow.

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module – IIMAGE ACQUISITION AND FORMAT

Digital Image Processing; Export and import, Data formats; BSQ, BIL, BIP, Run length encoding, Image Compression Data products.

Practice:

1. Export and Import
2. Histogram
3. Subset using AOI

Module – IIIIMAGE RECTIFICATION

Preprocessing and Post processing Geometric distortion; sources and causes for distortion, rectification, GCP, Resampling, Image registration, Radiometric distortion; sources and causes, atmospheric correction

Practice:

4. Geometric correction
5. Radiometric correction
6. Atmospheric correction

Module –III IMAGE CLASSIFICATION

Classification techniques; types, Supervised and Un-supervised, PCA, Image Enhancement, Accuracy assessment.

Practice

7. Supervised Classification
8. Un-supervised Classification
9. Image Enhancement
10. Accuracy Assessment

Model – IV REMOTE SENSING APPLICATION

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

Practice:

11. Application of Hyperspectral remote sensing and case study
12. Application of microwave remote sensing and case study
13. Application of thermal remote sensing and case study
14. Application of optical remote sensing and case study

Text 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. Jean-yvesscanvk, “Aerospatial Remote Sensing in Geology”, A.A. Balakarma, Netherlands, 1997.
4. Drury .S.A, “Image interpretation in Geology”, Chapman and Hall, London. 1993.
5. Pandey .S.N, “Principles and Applications of Photogeology”, Wiley eastern. 1987.

Photogrammetry and Application

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Photogrammetry and Application	DESP0402	Theory+Practice	2-2-0	Nil

Objective

- To introduce digital photogrammetry
- To study the data acquisition and components
- To study data conversion techniques
- To study digital photogrammetric applications

Learning outcome

- After completion of this course, students will be able to prepare DEM, TIN model.

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module -I: INTRODUCTION

Fundamentals of photogrammetry and aerial photography; History, aerial cameras, aerial films and processing. Types of aerial photos. Fundamentals and geometry of aerial photographs, Scale, Advantages and disadvantages of small scale and large-scale aerial photographs.

Practice:

1. Scale determination from aerial photo
2. Aerial photo Interpretation

Module - II: CONCEPT of PHOTOGRAMMETRY

Introduction,Terrestrial and Aerial photographs; vertical and oblique photographs, height determination contouring, photographic interpretations, stereoscopy, parallax bar, Flight Planning, Photo Interpretation, Applications of aerial Photos, Photo theodolite.

Practice:

3. Use of Parallax bar and determination of Height from stereo pair

4. Satellite DEM and ortho Image generation

Module - III: DIGITAL PHOTOGRAMMETRY & ITS COMPONENTS

Digital Cameras ; CCD Camera, Full frame CCD Frame transfer CCD, CCD cameras 1 with piezo shift, Interline transfer CCD, Time delay integration CCD sensor; Spectral Sensitivity of CCD sensor, Geometric problems of CCD images, line jitter, blooming, warm up effect, tailing, Typical CCD systems.

Practice:

5. Primary and additive colour creation

6. Stereo test

Module – IV: RELIEF AND TILT DISPLACEMENTS

Mosaics and types of mosaics, stereoscopic vision and stereoscopes, image displacement due to relief, concepts of stereo-photogrammetry, normal vision, depth perception and vertical exaggeration.

Practice:

7. Mosaic
8. Stereoscopic vision
9. Relief displacement

Module – V: DIGITAL CONVERSIONS

Analog to digital conversion; Scanner, flat bed, drum type, Sensor characteristics; Scanner resolutions, Scanner calibration, Video Cameras, Frame Grabber, Typical Scanner systems and Video cameras.

Practice:

10. Analog to digital conversion

11. Orientation of stereo model

12. Determination of Height

Module – VI: DRONE SURVEY

Aerial mapping and modelling using drone; types of mapping, types of mapping product, mapping for agriculture, mapping for Construction, Autonomous flight planning, Waypoints, collecting nadir imagery for 2D mapping, Collecting oblique imagery for 3d mapping, Volumetric measurements, map accuracy, ground truthing, ground control points.

Practice:

13. Aerial mapping using DRONE

14. Mosaicking of aerial Photo

15. Correction and rectification

Module – VII: DIGITAL PHOTOGRAMMETRIC APPLICATIONS

DTM generation; Image correlation, Image matching; Digital Ortho-photo generation, Automated aero triangulation, Link between GIS and Digital Photogrammetry.

Practice:

16. DTM generation

17. Image correction

18. Link between GIS and Digital Photogrammetry

19. Ortho Image generation

References Book

1. Krauss .J, "Photogrammetry", Vol. I IV Edition, Springier -Verlag Publishers, 1993.
2. "International Archieves of Photogrammetry and Remota Sensing", ISPRS, Volume XXIX, B5, Commission 5, 1995.
3. Proceedings of Annual Convention of ASPRS, 1993-96

Introduction to GIS

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Introduction to GIS	MSGM1103	Theory+Practice	2-2-0	Nil

Objective

- To study the basic concepts of GIS.
- To study the data structure in GIS
- To study data conversion in GIS and Meta data

Learning outcome

- To study and understand basic principles of GIS.

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module-I: BASIC CONCEPT

Introduction, concepts , Information system , components of GIS, History, Geospatial data architecture, Operations, Geographic co-ordinate systems, Map projections, concepts, Input data for GIS , display ,types of output products. GIS categories, Level and scale of Measurement, importance of data quality.

Module-II: VECTOR DATA & PROCESSING

GIS data types, data Representation, Data sources, typical GIS data sets, Data Acquisition, vector data model , topology, topology rules, Non topological vector data, object based vector data model, relationship between classes, data structure, data verification and editing spatial data models and errors – GIS database , attribute data input and management.

Module-III: RASTER DATA AND PROCESSING

Raster data – elements of data model, cell, value, data structure, cell by cell encoding, run length encoding, Quad tree, Header files, format, Types of raster data, data compression, Linking and integration of vector data, Registration.

Module-IV: DATA CONVERSION AND EDITING

Data format conversion, Medium conversion, Spatial interpolation, measurement and analysis methods, Data accuracy and standards, Attribute data input and Management- Relational mode- Data manipulation- l e classification techniques.

MODULE-V: META DATA AND GIS MODELLING

Meta data – data standard- OGC- open source GIS - GIS modelling, basic elements, classification, model processing, integration, Binary models, index model, regression models, linear regression model, logistic regression model, process model.

6. Text Books

1. Anji Reddy .M, "Textbook of Remote Sensing and Geographical Information Systems", BS Publications, Hyderabad. 2011. ISBN : 81-7800-112-8.
2. Kang tsung Chang , "Introduction to Geographical Information System", Tata McGraw Hill, 7th edition, 2010
3. Burrogh .P.A, "Principles of Geographical Information System for Land Resources Assessment", Oxford Publications, | ISBN-13: 978-0198545927, 1986.
4. Chandra .A.M and Ghosh .S.K, "Remote Sensing and Geographical Information System", Narosa Publishing House, New Delhi. 2006.
5. Paul A. Longley, Micheal F. Goodchild, David J. Magaine David J. Magaine, David W. Rhind, "Geographical Information System", Vol. I & II, John wiley& Sons.Inc1999.

Quantitative Methods

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Quantitative Methods	MSGM1104	Theory	4-0-0	Nil

Objective

- To acquaint the students with different application of quantitative techniques in business decision making.

Learning outcome

- Understand statistical inference in relation to international business decision-making
- Convey the results of quantitative analysis

Evaluation Systems

Internal Examination	Component	% of Marks	Method of Assessment
	Internal Theory	40 (30+5+5)	Written examination + Assignment + Attendance
	Internal Practice	50 (40+10)	Lab Work
	Internal Project	50	Project Work
External Examination	External Theory	60	Written examination
	External Practice	50	Lab Work
	External Project	50	Project Work + Report
Total		**300**	

Course outline

Unit: I Overview of Statistics

Nature, Scope and limitations of statistics; uses of statistics to business and industrial activities, Statistical Data –primary and secondary data, Collection of data, Classification and tabulation of data, Diagrammatic and graphic representation of data. Questionnaire –its characteristics and drafting.

Unit-II Measurement of Central Tendency & Dispersion

Data Measure of Central Tendency: Introduction, Meaning of quantitative technique, statistical Research, Measures of central tendency (Averages), Arithmetic mean, Weighted Mean, Median, Mode Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Coefficient of Variation.

Unit: III Probability

Probability: Basic concepts, Bayesian, Probability Distribution- Binomial, Poisson, Normal Distribution .

Unit-IV Sampling and Hypothesis test

Sampling: Introduction, why sampling, sampling methods, Sampling distribution, standard error, typeI and II error, Estimation, properties of good estimator, Type of estimation, Confidence limit. Hypothesis: Hypothesis testing, Z-test, t-test, Chi square test, F-test, ANOVA.

Unit-V Forecasting Technique

Correlation, Regression, Time series.

Text Book

1. Gupta .S.C and Kapoor .V.K, "Fundamentals of Mathematical Statistics", Sultan Chand and sons, Reprint 2003.
2. Gupta .S.C, and Kapoor, V.K, "Fundamentals of Applied Statistics", Sultan Chand and sons, 2003.
3. Veerarajan.T, "Probability Statistics and Random Processes", TMH, First reprint, 2004.

Digital Cartography

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Digital Cartography	MSGM1105	Theory + Practice	2-2-0	Nil

Course objectives

- To know the basics, importance, and methods of Cartography
- To study the various maps projection and co-ordinate systems.
- To study the different aspects of design in cartography.
- To learn the Generalization and designing aspects of cartography
- To learn the different techniques of Map production and Reproduction

Learning outcome

- To learn the fundamental concepts of Cartography and its advancements as Digital Cartography. The engineers will be enabling to different aspects of Map Making, Generalization, Map Production and Map Reproduction

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module I (Concept of Map)

History and development of Cartography, Definition, scope and concepts of cartography. Characteristics of Map. Categories or types of maps. Methods of mapping, relief maps, thematic maps. Trends in Cartography.

Module II (Geodesy)

Geodesy, Map projection, classification principles of construction of common projections, cylindrical, conical, azimuthal and globular projections. Properties & uses of projection. The spheroid, Map scale, and co-ordinate system. Plane co-ordinates in UTM system, projection used in Survey of India topographic sheets.

Module III (Data Structure)

Sources of Data-Ground Survey and positioning, Remote sensing, Census and sampling, Data processing-image processing, digital database, Geographic and cartographic database, basic Statistical processing, Design of color and pattern, typography and lettering the map.

Module IV (Processing of Data)

Processing and generalizing geographic data, Simplification and Classification, computer assisted cartographic processes, symbolization, mapping with point, line and area symbols-Portraying the land surface form. Map Compilation-Analog and Digital Compilation.

Module V (Map Composition)

Map reproduction. Methods of few copies and many copies. Map production: Form of Art Work-Construction Method-Output option- Digital cartography, Geographic Information System.

Text Book

1. Robinson .A. H, Morrison .J. L, Muehrcke .A. C, Kimerling .A. J and Guptill .S. C, "Elements of Cartography", 6th Edition, John Wiley and Sons, 1995.
2. Cromley .R.G, "Digital Cartography", Prentice-Hall of India, New Delhi, 1992.
3. Dent .B. D, "Cartography – Thematic Map Design", 5th Edition, W C B McGraw-Hill, Boston, 1999.
4. Muller, "Advances in Cartography", ISBN: 1851666036, Elsevier Science Publications.
5. Anson .R.W and Ormeling .F.J, "Basic Cartography for students and Technicians", Vol., I, II and III Elsevier Applied Science publishers 2nd Edition, 1995.
6. Rampal .K.K., "Mapping and Compilation", Concept Publishing Co., New Delhi, 1993.

Semester - II

GIS Data Analysis

Course Title	Code	Type of course	T-P-PJ	Prerequisite
GIS Data Analysis	MSGM1201	Theory +Practice	2-2-0	Nil

Course objectives

- To know the Different GIS software and their capabilities.
- To study the various Functions tools available and Perform query operations in GIS.
- To study the different analysis types in GIS.
- To learn MCE, Weightage and Ranking capabilities of GIS

Learning outcome

- To study and understand basic principles of GIS.

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module I (INTRODUCTION TO GIS SOFTWARE)

Defining GIS -introduction to Spatial Data File Formats - Basics of Arc Catalog and Arc Map, Tabular Data Design, Functions, pitfall and Reprocessing, Tables, Queries, and Basic Geoprocessing Tools, Data sources and data collection data files in ArcMap and Arc Pad, The Raster Data File Format-, Overview of MAP INFO, QGIS, ERDAS IMAGINE.

Module II (DATA ANALYSIS TOOL)

The Spatial Analyst Extension and Model Builder, Metadata -Georeferencing – Geocoding- Network Analyst, Interpolation and Surface Modelling ,Interpolation Methods , The Geodatabase , Building a Geodatabase, Cartographic Design .

Module III (SPATIAL DATA ANALYSIS)

Spatial interpolation, measurement and analysis methods, reclassification techniques, Buffer analysis, overlay analysis, Vector over lay analysis, Topological overlay, raster over lay analysis – measurement of length, perimeter and area – queries –2D to 3 D conversion- DTM and DEM, advantages and disadvantages, Network modelling.

Module IV (DATA MODELLING)

GIS modelling, basic elements – classification, model processing, integration, Binary models, index model, regression models – linear regression model, logistic regression model, process model, applications – problem identification– designing data model, project management and evaluation – implementation

Module V (APPLICATIONS)

GIS Applications in automated mapping (AM)/ Facility management (FM) Multi criteria evaluation using GIS - Techniques - case studies - use of knowledge based tools with GIS - Expert system. Object oriented GIS, web based GIS, and WEB based GIS Applications.

Text Books

1. Burrogh .P.A, "Principles of Geographical Information System for Land Resources Assessment", Oxford Publications, 1980.

2. Chandra .A.M and Ghosh .S.K , "Remote Sensing and GIS", Narosa Publishing House, New Delhi, 2000.

3. Paul A. Longley, Micheal F. Goodchild, David J. Magaine David J. Magaine, David W .Rhind, "Geographical Information System", Vol. I & II, John wiley& Sons. Inc., 1999.

4. Kang-tsung Chang, "Introduction to Geographical Information System", Fourth Edition, Tata McGraw Hill, 2008.

Data Base Management System

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Data Base Management System	ENFC0414	Theory + Practice	2-2-0	Nil

Course objectives

- To study the data, data models and database types
- To study the file organization and normalization
- To the database operations and integration with GIS

Learning outcome

- To study the data base management systems.

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module: I

General introduction to database systems; Database - DBMS distinction, approaches to building a database, data models, database management system, three-schema architecture of a database, challenges in building a DBMS, various components of a DBMS.

File Based Systems and Database Systems : File Based Approach, Database Systems, File-oriented Systems vs. Database Systems Database Approach : Database, Database Management System (DBMS), Components of DBMS Environment, Advantages and Disadvantages of DBMS Roles in Database Environment : Database Users, Database Administrators(DBA)

Module: II

Database System Architecture: Three Level Architecture, External Level, Conceptual Level, Internal Level, Schemas, Mappings, Instances, Data Independence, Data Abstraction

E/R Model - Conceptual data modeling - motivation, entities, entity types, various types of

attributes, relationships, relationship types, E/R diagram notation, examples.

Module: III

Relational Data Model: Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators: selection, projection, cross product, various types of joins, division, example queries, tuple relation calculus, domain relational calculus, converting the database specification in E/R notation to the relational schema.

Module: IV

Database installation procedure: Database table creation & insertion of values Database Languages: SQL - DDL, DML, TCL, DCL SQL - Introduction, data definition in SQL, table, key and foreign key definitions, update behaviors. Querying in SQL - basic select-from-where block and its semantics, nested queries - correlated and uncorrelated, notion of aggregation, aggregation functions group by and having clauses, embedded SQL. Data Definition Language: Creating a Database, Table Operations (Create, Alter, Drop, Truncate, Comment and Rename), Creating and Removing an Index Data Manipulation Language: Using different DML commands (Insert, Delete, Update, and Select), Sorting Results (Order By), Aggregate Functions, Join, Grouping Results (Group By) Data Control Language & Transaction Control Language: Using different DCL commands (Grant, Revoke) & using different TCL commands (Commit, Rollback and Save point).

Module: V

Dependencies and Normal forms - Importance of a good schema design, problems encountered with bad schema designs, motivation for normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, multi-valued dependencies and 4NF, join dependencies and definition of 5NF.

Module : VI

Data Storage and Indexes - file organizations, primary, secondary index structures, various index structures - hash-based, dynamic hashing techniques, multi-level indexes, B+ trees.

Terminologies of Relational Model : Relational Data Structure, Relational Keys, Representing Relational Database Schema Integrity Constrains and Views : Nulls, Entity Integrity, Referential Integrity, General Constraints, Views, Purpose of Views

Module: VII

Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods. PL/SQL : SQL vs PL/SQL, Practice different basic PL/SQL programs

Text Book

1. Remez Elmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, Fourth Edition, Published by Pearson Education (Singapore) Pvt. Ltd., 2004.
2. Bipin C. Desai, “An Introduction to Database Systems”, Galgotia Publications PVT LTD First edit 1993.
3. Michael Abbey and Michael J .Corey, “ORACLE 8 -A Beginner's Guide”, Tata Mc.Graw Hill, 1998.
4. Date .C.J, “An Introduction to Database Systems”, Addison Wesley, sixth edition, 1995.

LIDAR Remote Sensing and Application

Course Title	Code	Type of course	T-P-PJ	Prerequisite
LIDAR Remote Sensing and Application	DESP0201	Practice	0-3-0	Basic Survey

Objective

- Application of LIDAR technique for linear and elevation measurement for multiple use geospatial management and planning plans.
- Application of LIDAR technique to get 3D map and terrain information.
- To enable students to know about 3D Experience Platform and Catia.

Learning outcome

- Students will be able to know about LIDAR and its application.
- Students will be more skilled in CATIA Civil module

Evaluation Systems

Internal Examination	Component	% of Marks	Method of Assessment
	Internal Practice	50 (40+10)	Lab work + Learning Record
External Examination	External Practice	50	Lab work
Total		**100**	

Course Outline

Model – I: LIDAR SYSTEM DESIGN

1. Download of LIDAR data
2. Layer stacking
3. Data Validation

Module – II: GEOREFERENCING AND CALIBRATION OF LIDAR DATA

4. Georeferencing Technology
5. Boresight Calibration - Lidar Data Preprocessing
6. Project Coverage Verification - Review Lidar Data against Field Control
7. Lidar data errors and rectifications, - processes calibration of Lidar data - artifacts and anomalies - Lidar Error Budget.

Module – III: AUTOMATED CLASSIFICATION

8. Noise Removal and other sensor-related artifacts - Layer Extraction - Automated Filtering 9. Manual Editing and Product Generation – Surface Editing - Hydrologic Enforcement
10. DEM, DSM -TIN,
11. Breaklines, Contours, and Accuracy Assessment.

Module – IV: LIDAR APPLICATIONS

12. Topographic Mapping, , flood inundation analysis, line-of-sight analysis
13. Forestry, various types of lidar sensors-, vegetation metric calculations - specific application software.
14. Corridor mapping system, data processing and quality control procedures.
15. Modelling

Resources List

1. Lidar: Range-Resolved Optical Remote Sensing of the Atmosphere, edited by Claus Weitkamp.
2. Manual of Airborne Topographic Lidar by Michael S. Renslow.
3. Lidar Techniques and Remote Sensing in the Atmosphere: Understanding the Use of Laser Light in the Atmosphere by Francis Emmanuel Mensah.

GPS & Surveying

Course Title	Code	Type of course	T-P-PJ	Prerequisite
GPS & Surveying	MSGM1202	Theory + Practice+ Project	2-2-1	Nil

Course objectives

- To understand the basics, classifications, and Applications of Electronic Surveying.
- To study the EDMS and GPS surveying and its application
- To study the EDMS Instruments, GPS.

Learning outcome

- To study the basics and fieldwork of Electronic Surveying.

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module I

Introduction – GPS satellites – components – Satellite Ranging – codes - GPS – DGPS - GPS Receiver and its Features – Receiver selection –enhancement of receiver - GPS processor Software – GPS Data – Processing of GPS data and types.

Module II

GPS Field Survey techniques - advantages - Characteristics - Positioning modes - static surveying - kinematics surveying - Doppler effect and basic positioning concept - Dilution of Precision - Types - Multi-path effect - field practices.

Module III

Refractive index, factors affecting RI, computation of group refractive index for light and near infrared waves at standard conditions and ambient conditions.

Module IV

Electro-optical system, measuring principle, working principle, sources of errors, infrared EDM instruments, Laser EDM instruments and total station. Microwave system, measuring principle - field practices.

MODULE V

Introduction to surveying: Classification, Basic Principle, List of Instruments used in surveying. Linear measurement and chain survey: Use of various types of chains and tapes, measurement of correct length of lines, direct and indirect ranging, chaining along sloping ground. Obstacle in chaining, errors and their elimination. Compass surveying.

MODULE VI

Contouring: Characteristics, methods and types of contouring (topographical map study) Preparation of contours using auto level/Dumpy level through Surfer software. Total Station Surveying.

6. TEXT BOOK

1. Burnside, C.D., Electromagnetic distance measurement, Crosby Lock wood staples, U.K., 1971
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, 1994

Big Data Analysis

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Big Data Analysis	MSGM1203	Theory +Practice	3-1-0	

Objective

- To optimize business decisions and create competitive advantage with Big Data analytics
- To learn to analyse the big data using intelligent techniques

Learning outcome

- Students will be able to work with big data platform and explore the big data analytics techniques business applications.
- Understand the fundamentals of various big data analytics techniques

Evaluation Systems

Internal Examination (Theory)	Component	% of Marks	Method of Assessment
	Midterm Test	20	Written examination
	Assignment	0	Assignment
	Experiments	20	Course Contents/Case studies
	Quiz	10	Surprise/preannounced ones
External Examination		50	Written examination
Total		100	

Course Outline

Unit: I BASIC CONCEPTS

Spatial Data Analysis, Introduction, , Spatial Data Structures, Spatial Data in R, Data Coding and Quality, Methodological Challenges, Standard Methodologies for Spatial Data Analysis, Advanced Methodologies for Spatial Data Analysis, Evidence Driven Modeling.

Unit: II: BIG Data

Introduction to the course; General concept of big data; features of big data; big data remote sensing: opportunity and challenges, Big data remote sensing: data collection challenges and cyberinfrastructure and sensor web solutions, Computing power to handle big data: distributed and parallel computing

Unit: III Big data management

Remote sensing data archiving, cataloguing, and dissemination; Big data management services: data discovery (collection and granule level) and access, archiving, metadata, data format, data discovery, data access, Implementation examples of big data management systems for remote sensing: CWIC and GEOSS GCI.

Unit: IV: BIG DATA ANALYTICS

Big data analytics for remote sensing: concepts, algorithms, platforms, and standards, Algorithmic design considerations of big data analytics; Machine Learning and data mining on Geospatial Big Data. Examples of remote sensing applications of big data analytics, Big Data Challenges in Earth Sciences, Big data activities in ESRI, Challenge and opportunities in the Big Data Remote Sensing.

Unit: V DATA MINING

Mining data streams : Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.

6. TEXT BOOK:

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
2. Tom White “Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012.
4. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, CUP, 2012.
5. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley& sons, 2012.
6. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007.
7. Pete Warden, “Big Data Glossary”, O’Reilly, 2011.
8. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, 2 nd Edition, Elsevier, Reprinted 2008.
9. Da Ruan, Guoquing Chen, Etienne E.Kerre, Geert Wets, “Intelligent Data Mining”, Springer, 2007. 10.Paul Zikopoulos, Dirkde Roos, Krishnan Parasuraman, Thomas Deutsch, James

Giles , David Corrigan, “Harness the Power of Big Data The IBM Big Data Platform”, Tata McGraw Hill Publications, 2012.

10. Arshdeep Bahga, Vijay Madisetti, “Big Data Science & Analytics: A HandsOn Approach “,VPT, 2016 12. Bart Baesens “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)”, John Wiley & Sons,2014

Research Methodology

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Research Methodology	MSGM1204	Theory	4-0-0	

Objective

- To sensitize students with a appropriate research design and research technique
- To enable them to conduct investigation within and outside their organization by applying the concepts of Marketing research

Learning outcome

- The students will able to gather knowledge how to write research paper.

Evaluation Systems

	Component	% of Marks	Method of Assessment
Internal Examination	Internal Theory	30	Written examination
	Assignment	5	Report or Presentation + Learning Record
	Attendance	5	Based on class attended
External Examination	External Theory	60	Written examination
Total		**100**	

Course Outline

Unit: I

Introduction to Research: Nature and Scope of Research, Identification of Research problem, Research objective, **Research and application:** Importance, Interpretation & role in Strategy; Research **Problem:** Identification of research problem, research objective, types of research, research process

Unit: II

Research designs: Exploratory, descriptive, experimental and observational, planning andFormulation of research projects. **Research Brief:** Statement of Research Problem, Review of Literature, Hypotheses Formulation; **Tools of research:** Preparation of questionnaire and schedules, Sample questionnaire development; **Measurement:** Nature of measurement, Measurement problem & scaling techniques, Nominal, ordinal, interval, ratio Thurston Scale, Questionnaires using Item Analysis e.g. Likert Scale

Unit: III

Sampling: Probabilistic & Non Probabilistic sampling, methods of drawing samples, concepts of different sampling methods, Qualitative Vs Quantitative research methods, Qualitative techniques used in gathering raw primary data, Focus Group discussion; **Collection of data:** Primary and secondary data, Survey Design (including online survey) ,Social Science Research, Participatory Rural Appraisal.

Unit: IV

Data Analysis: Data entry, editing, coding, Data Tabulation, (USE OF SPSS); **Data analysis Techniques**: Crosstabs, Correlation, Goodness of fit, ANOVA, one way , two way, Demand Estimation, **Qualitative forecasting techniques:** Basic Concept ofDelphi Technique, Opinion Based method; **Non-parametric tests:** chi-square, Tukey Kramer, Kruskal Wallis, Wilcoxon signed rank test, Man-Whitney U test. Factor Analysis, Cluster Analysis; R**esearch Results**: Report preparation and presentation process, report format, report writing, guidelines for table and graph.

Text 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. C.R. Kothari, Marketing Research, New Age International
5. Zikmund, William G. , Business research methods by Cengage Learning

Semester – III

Electives

Geological Remote Sensing and Technique

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Geological Remote Sensing and Technique	GMSE0401	Theory +Practice	2-2-0	Nil

Objective

- To study the spectral characteristics of Rocks and Minerals.
- To study the remote sensing for geological structures mapping
- To study the remote sensing for Lithological mapping
- To understand geological survey techniques and GIS integration

Learning outcome

- To study the role of remote sensing and GIS Tools in Earth Sciences.

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module – 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.

Module – 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.

Module – 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.

Model – IV: 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.

Model – V: GEOLOGICAL SURVEY TECHNIQUES AND DATA INTEGRATION

Geophysical survey, surface investigation, subsurface investigation, Gravity survey, Seismic survey, refraction methods, reflection methods, applications, Magnetic survey and Electrical resistivity survey, self potential methods, potential drop methods, resistivity values, data interpretation, Curve fitting, GIS data generation , integration and analysis.

Text Book

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. Jean-yvesscanvk, “Aerospatial Remote Sensing in Geology”, A.A. Balakarma, Netherlands, 1997.
4. Drury .S.A, “Image interpretation in Geology”, Chapman and Hall, London. 1993.
5. Pandey .S.N, “Principles and Applications of Photogeology”, Wiley eastern. 1987.

Hyperspectral Remote Sensing and Applications

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Hyperspectral Remote Sensing and Applications	GMSE0402	Theory+Practice	2-2-0	Nil

Objective

- To understand the hyperspectral remote sensing and data products
- To study the sensors and hyperspectral image devices
- To study the pre-processing of hyperspectral data
- To study the hyperspectral data analysis
- To study and apply the hyperspectral remote sensing and applications

Learning outcome

- The purpose of this course is to study the state-of-the-art of hyperspectral remote sensing and applications

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module – I: INTRODUCTION

Multispectral and hyperspectral remote sensing, Comparison of Multispectral and Hyperspectral Image Data, Spectral Signatures and BRDF in the Visible, Near Infrared and Shortwave Infrared regions of EMR, Hyperspectral Issues.

Module – II: SENSORS AND HYPERSPECTRAL IMAGING DEVICES

Scanner types and characterization - specifications of various sensors Spectrographic imagers-hyperspectral sensors, Design tradeoffs. Data formats and systems, AVIRIS, CASI, NASA Terra Moderate Resolution Imaging Spectrometer (MODIS), Hyperion.

Module – III: PREPROCESSING OF HYPERSPECTRAL DATA

Hyperspectral Data Cube, Hyperspectral Profiles, Data Redundancy. Problems with Dimensionality, Principal Component, Minimum Noise Fraction (MNF), Atmospheric Correction, Atmospheric Correction Measures, Flat Field Correction, Empirical Line Calibration, Empirical Flat Field Optimized, Reflectance Transformation (EFFORT), Continuum Removal, Spectral Feature Fitting.

Model – IV: HYPERSPECTRAL DATA ANALYSIS

Derivative spectral analysis, techniques for analysis of hyperspectral data, first-order and second-order derivative spectra, Theoretical basis and relevance, Methods of generating derivative spectra, electronic, electro-mechanical, numerical techniques, case studies.

Model – V: APPLICATIONS

Applications of Hyperspectral Image Analysis Forestry to Mineral exploration, soil mapping, coastal water quality studies, quantification of biophysical parameters

TEXT BOOK

1. Schowengerdt .R.A, "Remote cS'en!!!wg -Models and Methods ,for Image Processing", Academic Press, London, 1997.
2. Jensen .J. R, "Introductory Digital Image Processing: A Remote Sensing Perspective", Prentice Hall, 2nd Edition, 1996.
3. Mather .P. M, "Computer Processing of Remotely Sensed Images- An Introduction", St. Edmundsbury Press Ltd, 1987.
4. Thomas M. Lillesand & Ralph W. Keifer, "Remote Sensing and Image Interpretation" (John Wiley & sons, Inc), 2000
5. Pramod K. Varshney and Manoj K. Arora, "Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data", Springer publication, 2004.

Microwave Remote Sensing and Applications

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Microwave Remote Sensing and Applications	GMSE0403	Theory+Practice	2-2-0	Nil

Objective

- To study basics of Microwave Remote Sensing
- To Understand parameters of radiometry and Antena functions
- To understand RADAR principles
- To learn Microwave data processing
- To study Microwave remote sensing Applications

Learning outcome

- To study the RS & GIS data for microwave and Remote Sensing.

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module – I: BASICS OF MICROWAVE REMOTESENSING

Fundamentals – EMR-Electromagnetic Spectrum - Microwave Band Designation Microwave interaction with atmospheric constituents, Earth's surface, vegetation, and ocean.

Module – II: RADIOMETRY & ANTENNA SYSTEMS

Basics - Theory of Radiometry - Sensors applications in atmosphere, ocean and land. Antenna – Types and Functions of different types of antenna.

Module – III: RADAR

Radar-Real and synthetic aperture radars, - Principles - different platforms and sensors, System parameters, Target parameters, Radar equation measurement and discrimination, Airborne Data products and selection procedure - SEASAT, SIRA, SIRB, ERS , JERS, RADARSAT missions.

Model – IV:RADAR DATA PROCESSING

Radar grammetry, Image processing, SAR Interferrometry – Polarimetry- Interpretation of microwave data - Physical mechanism and empirical models for scattering and emission, volume scattering.

Model – V: APPLICATIONS OF MICROWAVE REMOTE SENSING

Geological interpretation of RADAR –sites-default-files, Application in Agriculture -forestry, Hydrology - ice studies – land use mapping and ocean related studies.

TEXT BOOK

1. Charles Elachi and Jakob Van 2y, "Introduction to the Physics and Techniques of Remote Sensing", Wiley Interscience, A John Wiley and sons Inc., 2006.
2. Robert M. Haralick and Simmonett, "Image Processing for Remote Sensing", 1983
3. Robert N. Colwell, "Manual of Remote Sensing Volume 1", Americal Society of Photo - grammetry 1983.
4. Travett .J. W, "Imaging Radar for Resources Surveys", Chapman and Hall, London 1986.
5. Ulaby .F.T, Moore .R.K, Fung .A.K, "Microwave Remote Sensing; active and passive", Vol. 1,2 and 3, Addison – Wesley publication company 2001.

RS & GIS for Ocean Engg & Coastal Management

Course Title	Code	Type of course	T-P-PJ	Prerequisite
RS & GIS for Ocean Engg & Coastal Management	GMSE0404	Theory+Practice	2-2-0	Nil

Objective

- To study the coastal and ocean process
- To study the physical and chemical properties of ocean
- To study different satellites and sensors for coastal and ocean applications
- To understand remote sensing and GIS for coastal applications
- To understand remote sensing and GIS for ocean applications

Learning outcome

- To study the RS & GIS Tools in Ocean Engg. and Coastal zone Management

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module – I: OCEANS AND COASTS

Introduction- origin- ocean importance, boundaries, continental margins and ocean basin, shelves, slopes, canyon, and rises, deep ocean basins, ridges, seamounts, abyssal plain, sedimentation processes - Coastal processes-circulation, current Measurement, Waves, Surface waves, reflection, diffraction and refraction, wave generated currents, Tides, sediment drift

Module – II: SEAWATER PHYSICAL AND CHEMICAL PRPOERTIES

Chemical properties- Water molecules, salinity, components, sources, concentration, mixing, dissolved gases, acid –base balance, Study of physical properties of sea water and parameters – heat and temperature, thermostatic effects, density, ocean surface conditions- refraction, light and sound, –sea level rise – coastal zone

Module – III: SENSORS FOR COASTAL AND OCEAN APPLICATIONS

Use of Microwave data - SeaWiFS, OCR, CZCs studies -chlorophyll production index -sea surface temperature (SST) sensors -NIMBUS, RADARSAT, CASI - MESSR, OCTS ATSR - Sensors -OCEANSAT ATSR on ERS TOPEX/Poseidon satellite

Model – IV:RS AND GIS APPLICATIONS IN COASTAL STUDIES

Role of remote sensing, advantages, resolutions, scale parameters, regional studies, coastal regulation zone mapping, Issues, Coastal Hydrodynamic, Coastal erosion and protection, salt water intrusion studies, Estuaries and their impact on coastal process wetland mapping, Thematic data base generation in GIS and analysis, mangroves and coastal zone management

Model – V: RS AND GIS APPLICATIONS IN OCEAN STUDIES

Tsunami impact assessment, wave dynamics, ocean resources ocean circulation studies, seal level changes and impact, Tide dynamics, wave dynamics, Plankton and marine plant studies, Changes in marine communities, -open ocean, sea ice studies, Global warming applications Marine.

TEXT BOOK

1. Tang, Danling, "Remote Sensing of the Changing Ocean", Springer, 2011.
2. Seelye Martin, "An Introduction to Ocean Remote Sensing", University of Washington Cambridge, ISBN:9780521802802 2004.
3. Deepak .A, "Remote Sensing of Atmospheres and Oceans", Academic press, San Francisco, 1986.re (SST), - Mangroves coral reefs mapping
4. Michael Hord .R, "Remote Sensing Methods and Application", John Wiley and Sons, New York, 1986
5. Alasdair J. Edwards, "Remote Sensing Hand book for Tropical Coastal Management", UNESCO Publication 2000.

RS & GIS for Hydrology and Water Resources

Course Title	Code	Type of course	T-P-PJ	Prerequisite
RS & GIS for Hydrology and Water Resources	GMSE0405	Theory +Practice	2-2-0	Nil

Objective

- To study the basic knowledge of hydrologic data
- To study the watershed characters and applications
- To study the hydrological disaster and role of remote sensing & GIS
- To study the ground water resources mapping by remote sensing & GIS
- To study the surface water resources mapping by remote sensing & GIS

Learning outcome

- To **s**tudy and understand application of RS and GIS techniques for hydrology and water resources.

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module – I: HYDROLOGICAL COMPONENETS

Hydrological cycle, Estimation of various components of hydrological cycle, rainfall, runoff, evaporation, transpiration, evapotranspiration, crop evapotranspiration, depression and interception loss, infiltration and percolation losses.

Module – II: WATERSHED CHARECTERS

Watershed, types, divide, catchment , command area, stream types, influent, effluent, ephemeral, non perennial. Drainage network, different pattern, morphometric analysis, linear, area, relief aspects. GIS applications for watershed analysis

Module – III: HYDROLOGICAL STIDIES

Hydrological aspects- mapping and monitoring, management mapping of snow covered area and glacial outburst, soil moisture estimation, Optical and microwave remote sensing techniques, drought zonations, Agricultural, meteorological and hydrological, flood mapping pre and post flood area estimation and control measures –GIS applications for hydrological disaster studies

Model – IV: GROUNDWATER RESOURCES APPLICATIONS

Types of Aquifers formations confined and unconfined aquifers Assessment of Groundwater potential zones and Groundwater mapping. Site selection for recharge structures- Hydrogeological Mapping GIS applications to ground water studies

Model – V: SURFACE WATER RESOURCES APPLICATIONS

Surface water bodies, lakes, reservoirs, ponds, rivers, channels, mapping- change detection , Water harvesting structures, in-situ and Ex-situ , Mapping and monitoring of catchment and command area, Water logging and salt affected area mapping, Reservoir Sedimentation, sedimentation control. GIS applications to surface water studies

TEXT BOOK

1. Raghunath .H.M, "Hydrology – Principles – Analysis – Design", New Age International Publishers, New Delhi. 2006
2. Ramasamy .S.M, "Remote sensing in water resources", Rawat publications, New Delhi ,2005.
3. Murty.V.V.N, "Land and Water Management Engineering", Kalyani Publishers, New Delhi – 2002.
4. Agarwal C.S and Garg.P.K, "Text Book on Remote Sensing in Natural Resources, Monitoring and Management", Wheeler publishing Co & Ltd., New Delhi, 2010.

RS & GIS for Urban and Regional Planning

Course Title	Code	Type of course	T-P-PJ	Prerequisite
RS & GIS for Urban and Regional Planning	GMSE0406	Theory+Practice	2-2-0	Nil

Objective

- To study the RS & GIS data
- To study the Mapping for Urban and Regional areas
- To study GIS Tool in Urban Planning

Learning outcome

- The students will learn different tools using Urban planning.
- The students will handle different case study using image processing and GIS tools

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module – I: REQUIREMENTS FOR URBAN & REGIONAL PLANNING

Relevance of remotely sensed data for Urban & Regional Analysis and Planning - Identification of settlement features from aerospace images - Visual and digital analysis techniques - Scale and Resolution concepts - Scope and limitations.

Module – II: URBAN & REGIONAL MAPPING

Regional Mapping - City Mapping - Intra - city Mapping-Methodology - Base map preparation - Delineation of area - Change Detection and mapping - classification - Urban fringe - CBD - Urban sprawl - Case studies.

Module – III: SUSTAINABLE DEVELOPMENT PLANS

Regional plan - Master plan - Detailed Development plan - Objective and contents - Delineation of planning area - Methodology - Integrated plans - Case studies.

Model – IV: URBAN STUDIES

Urban growth analysis - Slum development - House typology - Site selection for urban development - Density analysis - Population estimation - Transportation network analysis - Case studies.

Model – V: GIS IN URBAN MODELLING

GIS - Data Input - Storage - Retrieval - Suitability of GIS software for urban analysis - Modelling with GIS - Decision support systems for urban studies.

TEXT BOOK

1. Brench .M.C, "City Planning & Aerial Information", Harvard University, Cambridge, 1971.

2. Margaret Roberts, "An Introduction to Town Planning Techniques", Hutchinson, London 1980.

3. Gautam N.C, "Urban land use Interpretation through Arial Photograph Interpretation", NRSA.

4. "IRS RS Applications to Urban Planning and Development", Institute of Remote Sensing.

RS & GIS for Agriculture and Forestry

Course Title	Code	Type of course	T-P-PJ	Prerequisite
RS & GIS for Agriculture and Forestry	GMSE0407	Theory +Practice	2-2-0	Nil

Objective

- To study the Spectral characteristics of Vegetation
- To study the integrated analysis of GIS in agriculture and forest development
- To study the biomass estimation and Leaf area Index.

Learning outcome

- The students will learn different indices, Biomass study using Image Processing
- The students will handle different case study using image processing and GIS tools

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module – I: SPECTRAL CHARACTERISTICS OF LEAF

Structure of leaf - Spectral behavior of leaf – Vegetation indices – NDVI, TVI, SVI, PCA – Vegetation classification and mapping - Estimation of Leaf area index, Biomass estimation – Estimation of terrestrial carbon assimilation in forests - case studies.

Module – II: FOREST MAPPING

Forest type and density mapping and forest stock mapping using RS technique -factors for degradation of forests – deforestation/afforestation/. Change detection in forests - case studies

Module – III: BIODIVERSITY CHARACTERIZATION MAPPING

Forestry – Forest taxonomy – Linnaeus classification - Biodiversity characterization – Forest fire risk zonation – wildlife habitats suitability analysis - case studies.

Model – IV:: AGRICULTURAL APPLICATIONS

Identification of crops -acreage estimation -production forecasting - pests and disease attacks through remote sensing -crop stress detection due to flood and drought - catchments and command area monitoring.

Model – V SOIL APPLICATIONS

Soil survey and land use classification - water logging - characters of saline, alkali soils - soil erosion – types – Estimation of soil loss from USLE using Remote sensing and GIS - Wasteland development.

TEXT BOOK

1. Steven .M.D and clark .J.A, "Applications of Remote Sensing in Agriculture", Butterworths, London 1990.
2. “Remote Sensing Applications Group”, Space Applications Centre, Crop Average and production Estimation (CAPE): An Anthology from January 1986 - June 1996. (Publications in Journals, Seminars I Symposium proceedings), Ahmedabad, August 1996.
3. Negi .S.S,” A Handbook of forestry. International Book distributors”, Dehradun, 1986. Space Applications Centre, Manual of procedure for Forest mapping and Damage Detection using satellite data, Ahmedabad, 1990.

RS & GIS for Environmental Engineering

Course Title	Code	Type of course	T-P-PJ	Prerequisite
RS & GIS for Environmental Engineering	GMSE0408	Theory +Practice	2-2-0	Nil

Objective

- To study the basic Environmental aspects and satellites
- To study the RS & GIS application in soil degradation
- To study the RS & GIS application in water pollution
- To study the RS & GIS application in Air quality
- To understand the RS & GIS application in Environmental management

Learning outcome

- Students will learn Environmental Impact assessment
- Students will handle different case study
- Students will put different pollutants in the GIS platform and prepare pollution map.

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module – I: BASICS

Resource development in remote areas-Impacts of anthropogenic activity- Solid Waste management- Carbon footprints and sinks, carbon trading, carbon credits and marketing using RS and GIS. , Indian and international status.

Module – II: SOIL DEGRADATION

Soil classification & mapping. Impact of agricultural and industrial activity on soil properties. soil salinity/alkalinity, erosion studies, Applications of GIS in assessing soil salinity, erosion productivity etc. Creation and maintaining water supply network, sewerage network using GIS.

Case studies. Aquifer Vulnerability Intrinsic and specific vulnerability. Remote Sensing technique to monitor, air pollution due to industrial activity, modeling using GIS case Studies.

Module – III: AIR QUALITY AND COASTAL STUDIES

Atmosphere: Chemicals, Particulate matters present in the atmosphere, allowable limits, Remote Sensing techniques - Monitoring atmosphere constituents- air pollution - industrial activity, modeling using GIS - Ecology studies- Coastal color monitoring- marine studies.

Model – IV:ENVIRONMENTAL MANAGEMENT

Revenue management-environment and ecological concerns- Resource development in remote areas-Impacts of anthropogenic activity- Solid Waste management- Forest classification Mapping – Biomass estimation - Carbon footprints and sinks, carbon trading, carbon credits and marketing, Indian and international status.

Model – V: Environmental law

The Environmental Protection Act, The water Act, The Air (Prevention & Control of pollution Act.), Motor Act, Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries.

TEXT BOOK

1. Larry Canter – Environmental Impact Assessment, McGraw-Hill Publications
2. Environmental Impact Assessment, Barthwal, R. R. New Age International Publications
3. Lilliesand .T.M and Kiefer .R.W, "Remote Sensing and Image Interpretation", John Wily and sons, 1994.
4. Burrough .P.A and McDonnell .R.A, "Principles of Geograj1JhicaJ Information Systems", Oxford University Press, 1988.
5. Lintz .J and Simonet, "Remote Sensing of Environment", Addison Wesley Publishing Company, 1994.

RS & GIS for Disaster Management

Course Title	Code	Type of course	T-P-PJ	Prerequisite
RS & GIS for Disaster Management	GMSE0409	Theory +Practice	2-2-0	Nil

Objective

- To study the Basic concepts and Principle of disaster and Mitigation measures
- To study the application of RS & GIS for hazard Evaluation

Learning outcome

- Understanding Disasters, man-made Hazards and Vulnerabilities
- Understanding disaster management mechanism
- Understanding capacity building concepts and planning of disaster managements

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module – I: HYDROLOGICAL & GEOLOGICAL DISASTERS

Basic concepts and principles - Hydrological and geological disasters, Role of Government administration, NGO's - International disaster assistance - Sharing techno - logy and technical expertise.

Module – II: PREDICTION & MITIGATION

Needs and approach towards prevention - Principles and components of mitigation - Disaster legislation and policy - Cost effective analysis - Utilisation of resources - Training - Education - Public awareness - Roles of media.

Module – III: CYCLONES & FLOODS

Dams, Bridges, Hospitals, Industrial structures, Disaster resistant structures - Low cost housing for disaster prone areas - Cyclone shelter projects and their implications - Reconstruction after disasters.

Model – IV:REMOTE SENSING MONITORING & ANALYSIS

Remote Sensing Application - Risk assessment - Damage assessment - Land use planning and regulation for sustainable development - Use of Internet - Communication Network -Warning system - Post disaster review - Case studies.

Model – V: ROLE OF GIS IN DISASTERS

Vulnerability analysis of infrastructure and settlements - Pre-disaster and post disaster planning for relief operations - Potential of GIS application in development planning and Disaster management plan - Case studies.

TEXT BOOK

1. Bell .F.G, "Geological Hazards: Their assessment", avoidance and mitigation. E & FN SPON Routledge, London. 1999.
2. David Alexander, "Natural Disasters", UCL Press, London, Research Press, New Delhi, 1993.
3. Nick Carter .W, "Disaster Management -A Disaster Manager's Handbook", Asian Development Bank, Philippines. 1999.
4. Mitigating Natural Disasters, Phenomena, Effects and options, "A Manual for Policy makers and Planners', United Nations. New York, 1991.
5. George G. Penelis and Andras J. Kappos, "Earthquake Resistant Concrete Structures" E & FN SPAN, London, 1997.

RS & GIS for Rural Development

Course Title	Code	Type of course	T-P-PJ	Prerequisite
RS & GIS for Rural Development	GMSE0410	Theory+Practice	2-2-0	Nil

Objective

- To study the Basic concepts of Rural Development
- To study the application of RS & GIS for Rural Development, Model Village, Village GIS etc.

Learning outcome

- Evaluate the contribution of sectors, policies and services for rural development
- Evaluate the contribution of sectors, policies and services for rural development
- Plan and design the rural infrastructure
- Apply the geospatial concepts for rural governance

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module – I:

Concepts of Rural Area and Rural Development; Causes of Rural Backwardness, Need for Rural Development, Levels of Living of Rural People Poverty indicators.

Module – II:

Organizational Aspects of Agriculture, Alternative Occupations in Rural Areas, Assessment of Rural Energy Supply and Demand, Planning for Rural Development, Definition and Characteristics of Village Communities – Concept and Importance of Rural Industrialization.

Module – III:
Engineering aspects of rural infrastructure development - Education - Housing – Health - Drinking Water Supply Road Network, PURA model, Study of poverty alleviation programmes implementation.

Model – IV:
Governance of Rural Information and Communication Technology: Opportunities and Challenges; GIS and Governance in Development in India: Trends and Strategy for Implementation; ICT Infrastructure for Rural Development: Issues and Priority for Application.

Model – V:
Geospatial techniques for mapping of rural resources. Spatial technologies in rural planning management administration and development.

TEXT BOOK

1. Jain S.C. Indigenous Resources for Rural Development, Concept Publishers, 2005.
2. N.I.R.D. Facets of Rural Development,
3. Technologies for Rural Development; http://en.wikibooks.org/wiki/ Technologies for_Rural_Development, 2010.
4. HarekrishnaMisra (ed.), Governance of Rural Information and Communication Technologies, Opportunities and Challenges, Academic Foundation, 2009.

Web GIS

Subject Name	Code	Type of course	T-P-PJ	Prerequisite
Web GIS	GMSE0411	Theory+Practice	2-2-0	Nil

Objective

- To understand of the Open Geospatial Consortium (OGC) web mapping standards
- To learn the concepts of Internet and Web GIS
- Explain the types of client that can be used for web mapping
- Deploy a working client server for an example data set

Learning outcome

- To familiarize with different GIS Software and functionalities. To let the student learn the versatile application capabilities of different GIS analysis techniques.

Evaluation Systems

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal Theory	20	Written examination
	Internal Practice	30(20+10)	Lab work + Learning Record
External Examination	External Theory	30	Written examination
	External Practice	20	Lab work
Total		*100*	

Course outline

Module – I: INTRODUCTION TO OPEN WEB MAPPING

Web Page Basics, Web Mapping, Geospatial Web Services, OGC-framework of open web mapping, importance of open web mapping, international open web standards as published by the Open Geospatial Consortium, explain the importance of international open standards to developers, users and businesses.

Module – II: INTERNET CONCEPTS & WEB GIS

Overview of Internet concepts & features: Internet protocol, Domain Name System, Internet services, www, Web servers, Web clients. CGI,The web and GIS, Web GIS origin and Evolution, -concept-Applications.

Module – III: WEB GIS TECHNICAL BASICS

Fundamentals-principles-architecture-components-ThinVSthik Client architecture-design development. Geospatial web services- Website to web service-geospatial webservice function-service types-interoperability and web service standard.

Model – IV: GEOSPATIAL MASHUPS

Evolution-Impact-web content-function and interfaces –Mashup design and implementation-challenges and prospects-uses and benefits-supporting technology-solution and production.

Model – V: GEOPORTALS

Concept-uses-functions-architectures-geoportal applications-challenges and prospects.Web page design principles, HTML, XML, data formats, helper applications, Java, databases and the Web. Application of Internet services to GIS, Internet GIS software, interoperability issues &OpenGIS-GSDI and NSDI, Applications-e-business, e-government.

TEXT BOOK

1. Burrogh .P.A, "Principles of Geographical Information System for Land Resources Assessment", Oxford Publications, 1980.
2. Kang-tsungChang , "Introduction to Geographical Information System", Fourth Edition, Tata McGraw Hill,2008.
3. Pinde Fu and JiulinSun,Web GIS: "Principles and Applications", ISBN:9781589482456,ESRI, 2010.

Minor Project

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Minor Project	MSGM0301	Project	0-0-4	Nil

2. Objective

A student is required to do one mini projects independently under the guidance of any faculty member of the institute or professionals from Industry. This facilitates the student to get familiarize with the latest research and development trends in the field. At the end of the semester, the student is required to submit a report of the mini project and give an oral presentation of the mini project carried out by him/her.

The project report and the oral presentation will be evaluated by three members committee comprising of the faculty members of the institute including the project guide. The project report and the oral presentation carry 100 marks each.

Semester IV

Major Project

Course Title	Code	Type of course	T-P-PJ	Prerequisite
Major Project	MSGM0302	Project	0-0-4	Nil

Objective

- The student shall be capable of identifying a problem related to the program of study and carry out wholesome research on it leading to findings, which will facilitate development of a new/improved product, process for the benefit of the society.

Learning outcome

- To undertake research in an area related to the program of stud

Course outline

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.