

# Syllabus for M. Sc Course in Remote Sensing & Geographic Information System

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REVISED IN JANUARY 2014: TO BE EFFECTIVE FROM THE ACADEMIC SESSION 2014-2015



**Department of Remote Sensing & GIS**  
**Vidyasagar University,**  
**West Medinipur, West Bengal**  
**PIN – 721 102**

## DIVISION OF MARKS

Total Marks : 1200  
 SEM I Marks : 300  
 SEM II Marks : 300  
 SEM III Marks : 300  
 SEM IV Marks : 300

Theoretical Marks : 600 (SEM I: 200, SEM II: 200, SEM III : 200)

Practical Marks : 300 (SEM I: 100, SEM II: 100, SEM III : 100)

Dissertation : 200 marks (SEM IV)

Grand Viva : 100 marks (SEM IV)

## STRUCTURE OF THE SYLLABUS (SEM-I)

Typ e	Name of Paper	Paper /Module No.	Subject	Marks	Exam Time	
<b>THEORETICAL</b>	FUNDAMENTALS OF REMOTE SENSING	<b>RSG 101</b>	<b>Gr. A</b>	Fundamentals & Physics of Remote Sensing	20	2 hours
			<b>Gr. B</b>	Platforms and Sensors	20	
				Internal Assessment	10	
	FUNDAMENTALS OF GIS & DIGITAL CARTOGRAPHY	<b>RSG 102</b>	<b>Gr. A</b>	Fundamentals of Geographic Information System	20	2 hours
			<b>Gr. B</b>	Digital Cartography	20	
				Internal Assessment	10	
	PHOTOGRAMMETRY, SURVEYING AND GPS	<b>RSG 103</b>	<b>Gr. A</b>	Photogrammetry	20	2 hours
			<b>Gr. B</b>	Surveying and Global Positioning System	20	
				Internal Assessment	10	
	COMPUTER FUNDAMENTALS & PROGRAMMING	<b>RSG 104</b>	<b>Gr. A</b>	Computer Basics	20	2 hours
			<b>Gr. B</b>	Programming languages	20	
				Internal Assessment	10	

<b>PRACTICAL</b>	<b>RSG 105</b>	Image Interpretation	25	4 hours
	<b>RSG 106</b>	Fundamentals of GIS	25	4 hours
	<b>RSG 107</b>	Photogrammetry, Surveying & GPS	25	4 hours
	<b>RSG 108</b>	Computer Fundamentals & Programming	25	4 hours

## STRUCTURE OF THE SYLLABUS (SEM-II)

<b>Type</b>	<b>Name of Paper</b>	<b>Paper /Module No.</b>	<b>Subject</b>	<b>Marks</b>	<b>Exam Time</b>	
<b>THEORETICAL</b>	DIGITAL IMAGE PROCESSING AND INFORMATION EXTRACTION	<b>RSG 201</b>	<b>Gr. A</b>	Digital Image Processing	20	2 hours
			<b>Gr. B</b>	Information Extraction from Satellite Images	20	
				Internal Assessment	10	
	ADVANCE REMOTE SENSING	<b>RSG 202</b>	<b>Gr. A</b>	Thermal and Microwave Remote Sensing	20	2 hours
			<b>Gr. B</b>	Hyperspectral Remote Sensing and Lidar	20	
				Internal Assessment	10	
	ADVANCE GEOGRAPHIC INFORMATION SYSTEM	<b>RSG 203</b>	<b>Gr. A</b>	GIS Data Analysis	20	2 hours
			<b>Gr. B</b>	Geodesy	20	
				Internal Assessment	10	
	FUNDAMENTAL STATISTICAL CONCEPTS & GEO-STATISTICS	<b>RSG 204</b>	<b>Gr. A</b>	Fundamental Statistical Concepts	20	2 hours
			<b>Gr. B</b>	Geo-statistics & Statistical applications in GIS	20	
				Internal Assessment	10	

<b>PRACTICAL</b>	<b>RSG 205</b>	Digital Image Processing (DIP)	25	4 hours
	<b>RSG 206</b>	Advance Remote Sensing: Data Processing & Applications	25	4 hours
	<b>RSG 207</b>	Advance Geographic Information System & Geodesy	25	4 hours
	<b>RSG 208</b>	Fundamental Statistical Concepts & Geo-Statistics	25	4 hours

## STRUCTURE OF THE SYLLABUS (SEM-III)

<b>Ty pe</b>	<b>Name of Paper</b>	<b>Paper /Module No.</b>	<b>Subject</b>	<b>Marks</b>	<b>Exam Time</b>	
<b>THEORETICAL</b>	APPLICATION OF GEOINFORMATICS & SPATIAL DECISION SUPPORT SYSTEM	<b>RSG 301</b>	<b>Gr. A</b>	Application of Geo-informatics	20	2 hours
			<b>Gr. B</b>	Spatial decision support system	20	
		Internal Assessment			10	
	RESEARCH METHODOLOGY & PROJECT MANAGEMENT	<b>RSG 302</b>	<b>Gr. A</b>	Fundamental of Research	20	2 hours
			<b>Gr. B</b>	Research Methodology and Project Management	20	
		Internal Assessment			10	
	ELECTIVE PAPER	<b>RSG 303</b>	<b>Gr. A</b>	<i>Elective Special paper</i>	20	2 hours
			<b>Gr. B</b>	<i>Elective Special paper</i>	20	
		Internal Assessment			10	
	ELECTIVE PAPER	<b>RSG 304</b>	<b>Gr. A</b>	<i>Elective Special paper</i>	20	2 hours
			<b>Gr. B</b>	<i>Elective Special paper</i>	20	
		Internal Assessment			10	

<b>PRACTICAL</b>	<b>RSG 305</b>	Application of Geo-Informatics and Spatial Decision Support System	25	4 hours
	<b>RSG 306</b>	Generation of Case Studies (Compulsory Field study)	25	4 hours
	<b>RSG 307</b>	<i>Elective Special paper</i>	25	4 hours
	<b>RSG 308</b>	<i>Elective Special paper</i>	25	4 hours

## STRUCTURE OF THE SYLLABUS (SEM-IV)

<b>Type</b>	<b>Name of Paper</b>	<b>Paper /Module No.</b>	<b>Subject</b>	<b>Marks</b>	<b>Exam Time</b>
<b>THEORETICAL</b>	<b>DISSERTATION</b>	<b>RSG 401</b>	<b>Gr. A</b>	Dissertation (Examination)	100
			<b>Gr. B</b>	Dissertation (Viva)	100
		<b>RSG 402</b>		Grand Viva	100

**The students have to select any two of following subjects, likely to be offered as elective special papers:**

1. Advance Photogrammetry (Only For Those Having Mathematics In Graduation)
2. Geoinformatics In Coastal Management
3. Geoinformatics In Watershed Management
4. Geoinformatics In Earth Sciences
5. Geoinformatics In Forest Management
6. Geoinformatics In Disaster Management
7. Geoinformatics In Agriculture
8. Geoinformatics In Urban, Rural Development & Regional Planning
9. Geoinformatics In Environmental Science & Management
10. Geoinformatics In Resource Management
11. Geoinformatics In Transport Network Analysis
12. Geoinformatics In Utility Management

### **Important Note:**

- ❖ **Total intake capacity of the Department (SEM-I) every year is 45 candidates at present.**
- ❖ **The intake capacity of each special paper (SEM-III) will be decided by the Departmental Committee before commencement of SEM-III classes.**
- ❖ **First class 60 %, Second Class 50 %, No third class. Min marks for passing Theory 20, Practical 13.**
- ❖ **Internal assessment will be based on class attendance and class performance.**
- ❖ **Field work is compulsory for Students of semester - III**
- ❖ **Students will get maximum 5 months to complete his/her dissertation work in semester-IV.**
- ❖ **Students may visit their field of study during dissertation work at their own expenses.**
- ❖ **Students may have to carry out Dissertation works in an outstation institution at their own expenses.**
- ❖ **Grand viva will be based on the overall understanding of the subject.**

# SEM I PAPERS

## SEM -I THEORY

### **/// RSG-101: (EXAMINATION TIME: 2 HOURS)**

#### **FUNDAMENTALS OF REMOTE SENSING (50marks)**

*Full Marks: 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

#### **RSG-101**

##### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35*

##### **Fundamentals & Physics of Remote Sensing:**

- i. *Concept and Scope of Remote Sensing:* Definitions, Process and Characteristics of Remote Sensing System, Advantages and limitations.
- ii. *Concept of Electromagnetic Radiation (EMR):* Wavelength-frequency-energy relationship of EMR, EMR Spectrum and its properties, EMR wavelength regions and their applications, Atmospheric windows, Interaction of EMR with matter, Spectral signatures.
- iii. *Fundamental laws governing the science:* Sources of Energy, Radiation laws: Stefan-Boltzman law, Wien's law, Kirchhoff's law etc., Black body and Real body, Radiant temperature & Kinetic temperature (**Numerical problems of all above**)
- iv. *Energy Interaction in the atmosphere:* Scattering, absorption, transmission, atmospheric windows
- v. *Energy Interactions with Earth Surface Features:* Spectral Reflectance Curve, Concept of signatures
- vi. Remote Sensing Scenario in Indian Context

##### **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35*

##### **Platforms and Sensors:**

- i. *Introduction:* Sensor materials, Sensor System - Framing and Scanning System, Whiskbroom scanners, Push-broom scanners, Side Looking scanner
- ii. *Types and Characteristics of Sensor:* Imaging and non-imaging sensors, Active and passive sensors, Resolution of Sensors - Spectral, Spatial, Radiometric & Temporal, Scale, Mapping unit, Multi-band concepts and False Colour Composites
- iii. *Remote Sensor Platforms and Satellite Orbits:* Ground, Airborne and Space borne Platforms, Orbital Characteristics – Coverage, Passes, Pointing Accuracy, Geostationary, sun synchronous, shuttle orbit. Semisynchronous orbit (Molniya orbit) and Quasi-zenith satellite orbit
- iv. *Satellite Basics:* Kepler's laws, Major-Semimajor axis & Eccentricity, Velocity, Period (Numerical problems), Historical development, Launch Vehicle, Escape Velocity

- Payload.
- v. *Space Imaging Satellites:* Early history of space imaging; Multispectral and Hyperspectral sensors, Radar, Lidar; Specification of some popular satellites – IRS, Landsat and SPOT series; High resolution satellites – IKONOS, Cartosat, Quickbird, OrbView, GeoEye, Pléiades, WorldView; Other latest earth resource satellites.

### ***Internal Assessment (10)***

### ***/// RSG-102: (EXAMINATION TIME: 2 HOURS)***

#### **FUNDAMENTALS OF GIS & DIGITAL CARTOGRAPHY (50 marks)**

*Full Marks: 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

#### **RSG-102**

##### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35*

##### **Fundamentals of Geographic Information System:**

- i. *Basic Concepts:* definition of GIS, Components of GIS, Variables - points, lines, polygon, Functionality of GIS, Areas of GIS application, Advantage and Limitation of GIS
- ii. *GIS Data:* Spatial and Attribute Data, Information Organization and Data Structures - Raster and Vector data structures, Data file and database
- iii. *Creating GIS Database:* GIS Softwares, file organization and formats, Geo-database, Rectification, Digitization and Map Composition
- iv. *GIS Data Input:* Nature and Source of data, Method of spatial data capture - Primary and Secondary, digitization and scanning method, Techniques and procedure for digitizing, Errors of Digitization, Attribute data capture
- v. *Data Editing:* Detecting and correcting errors, Re-projection, Transformation and Generalization, Edge matching and Rubber sheeting, Topology, Conversion from Other Digital Sources

##### **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35*

##### **Digital Cartography:**

- i. *GIS and Digital Cartography:* Concept of Digital Cartography, Advantages and Disadvantages of Digital Cartography
- ii. *Concept of Map Scales:* Defining Map, Projection Systems, Categories of maps, Map Scales
- iii. *Measurement of Geographic Variables:* Nominal, Ordinal, Interval and Ratio Scales, Qualitative vs. Quantitative data, Discrete vs. Continuous data
- iv. *Digital Mapping:* Cartographic Design Issues, Concept of Visual Variables, Map Lettering, Map Compilation, Generalization, Map Composition, Multivariate and Dynamic Mapping, Map Production
- v. Visualization of geospatial data- 2D and 3D visualization

## **Internal Assessment (10)**

### **/// RSG-103: (EXAMINATION TIME: 2 HOURS)**

#### **PHOTOGRAMMETRY, SURVEYING AND GPS: (50marks)**

*Full Marks: 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

#### **RSG-103**

##### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35*

##### **Photogrammetry:**

- i. *Introduction:* Historical Development and Fundamentals of aerial photography, Vertical and Oblique aerial photography, Classification of Aerial Film Cameras, Digital cameras Components of aerial Cameras, Camera Calibration, Photogrammetric Applications and Products
- ii. Scale, Geometry and Ground Coverage of Aerial Photographs, Area calculation & Flight Planning.
- iii. Binocular and Stereoscopic vision, Conditions for Stereovision, Photographic overlap Image Parallax, Height determination from stereo pairs - Parallax Equation, Ground Control.
- iv. Co-ordinate Systems used in Photogrammetry, Relief distortion and Tilt distortions, Rectification, Ortho Rectification, Height determination from single photograph, Planimetric map compilation, Digital Elevation Model (DEM), Digital orthophotos.
- v. *Principles of digital photogrammetry:* Hardware & software requirements, Image measurement, Orientation procedure, Epipolar geometry, Aerotriangulation, Block adjustment, Mosaics of DTM & ortho images.

##### **Group B**

*Full Marks: 20 Number of lectures to be delivered for each module is 35.*

##### **Surveying and Global Positioning System:**

- i. *Validation of Data:* Importance of Field Survey, Collection of Ground Truth.
- ii. *Introduction to conventional field survey techniques:* Plane and Geodetic Surveying (Traversing, Triangulation and Levelling), Topographic, Cadastral, Engineering and Hydrographic surveys.
- iii. *Surveying Instruments:* Principles of using Plane Table, Principles of Prismatic Compass, Theodolite traversing, Utility of Total Station
- iv. *Global Positioning System:* Introduction, Satellite constellation, GPS signals and data, Geopositioning-Basic Concepts. NAVSTAR, GLONASS, Indian Regional Navigational Satellite System (IRNSS), Control Segment, Space Segments, User Segment, GPS Positioning Types- Absolute Positioning, Differential positioning
- v. *GPS Surveying Methods and Accuracy:* Methods-Static & Rapid Static, Kinematic-Real Time Kinematic Survey- DGPS-GPS Data Processing and Accuracy, Factors Affecting GPS Accuracy
- vi. *Reference Station:* Selection of Reference Station, Reference Station Equipment: GPS receiver, GPS antenna. Radio and its types, Radio Antenna

- vii. *Mobile Mapping and GPS Applications*: Mobile Mapping basic concepts and Applications , GPS Application in Surveying and Mapping

**Internal Assessment (10)**

**/// RSG-104: (EXAMINATION TIME: 2 HOURS)**

**COMPUTER FUNDAMENTALS AND PROGRAMMING (50marks)**

*Full Marks*50. *Number of lectures to be delivered for this paper is 70. Pattern of setting questions:* Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.

**RSG-104**

**Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35*

**Computer Basics:**

- i. Introduction to Computers, Data representation, Conversion of data. Memory organization, Different secondary storage devices and Magnetic media devices.
- ii. *Data Representation*: Representation of Characters in Computers, Representation of Integers, Representation of Fractions, Hexadecimal Representation of Numbers, Decimal to Binary Conversion, Error Detecting Codes.
- iii. *Information Technology and Operating System*: Information Technology Infrastructure Hardware, software and Data related issues, Systems Application software, Enterprise software, Operating System Concepts, Structures, Files, Directories, Process and Memory management

**Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

**Programming Language:**

- i. *Introduction to Programming*: Basic concepts, program constructions – flowcharts, algorithms, pseudo codes, data structures – stacks, queues, linked lists etc., approaches to programming – top-down, bottom-up approach, divide & conquer, modular programming
- ii. *C programming*: Preliminaries, Constants & Variables, Arithmetic Expressions, Input-Output statements, Control Statements, Do-Statements, C-Preprocessor, Do-While statement, if-else statement, Array, Pointer. Elementary Format Specifications, Logical Statements & Decision Tables, Function & Subroutines
- iii. *Data Arrangement and access*: Basic of Data Arrangement and access, file Environment, Relational database system, DBMS (Oracle), Data Flow Diagrams Logical Data model, Data Warehouses, Meta Data and Global Databases, Spatial Databases available for natural resources and Terrain.

**Internal Assessment (10)**

## SEM -I PRACTICAL

### **/// RSG-105 (PRACTICAL)**

#### **IMAGE INTERPRETATION (25 marks)**

*Full Marks: 25. At least even number of periods to be assigned (preferably in batches). Examination Time: 2hours. Pattern of setting questions:20 marks compulsory questions are to be set. 5 marks are to be allocated for Evaluation of Practical Notebook and Viva-voce. Right hand side parentheses indicate lecture / demonstration hours.*

Topic to be covered	*Software to be used	PG	EV	AG	ED	Oth
File export import/ translation, Conversion of file formats		•	•	•	•	•
false colour composite and visual identification		•	•			•
Image registration / Geo coding, Projection, Creating Region of Interest		•	•			•
File sub setting /clipping Mosaic Air photo and Images		•	•	•	•	•
Feature identification and signature curve generation		•	•		•	•
Image Statistics, Histogram		•	•		•	•

- i. Familiarization with hard copy and soft copy images, Introduction to different GIS and RS software, Concept of bands and channels, True colour, false colour and standard false colour composite, Physical and cultural Features identification from imageries, Ground based observation equipments -Radiometer, Spectrophotometer, Use of spectrometer for ground truth.

(20)

Practical Notebook and Viva Voce

(5)

### **/// RSG-106 (PRACTICAL)**

#### **FUNDAMENTALS OF GIS (25 marks)**

*Full Marks: 25. At least even number of periods to be assigned (preferably in batches). Examination Time: 2hours. Pattern of setting questions:20 marks compulsory questions are to be set. 5 marks are to be allocated for Evaluation of Practical Notebook and Viva-voce. Right hand side parentheses indicate lecture / demonstration hours.*

Topic to be covered	*Software to be used	PG	EV	AG	MI	Oth
Visualization Tools Blend, Swipe, Flicker, Conversion: Raster ↔ Vector ↔ ASCII and others		•	•			
Managing Geo-database, geometric measurements tools & Changing Projection			•	•	•	
Digitization: Point, Line, Polygon		•		•	•	•
Managing attribute table and thematic mapping		•		•	•	
Map composition and representation		•	•	•	•	

(20)

Practical Notebook and Viva Voce

(5)

## **/// RSG-107 (PRACTICAL)**

### **PHOTOGRAMMETRY, SURVEYING AND GPS (25 marks)**

*Full Marks: 25. At least even number of periods to be assigned (preferably in batches). Examination Time: 2 hours. Pattern of setting questions: 20 marks compulsory questions are to be set. 5 marks are to be allocated for Evaluation of Practical Notebook and Viva-voce . Right hand side parentheses indicate lecture / demonstration hours.*

- i. Scale measurement of aerial photographs, Distance and area measurement of themes, Aerial-photo Interpretation for Terrain Evaluation and thematic mapping, Object height measurements by Parallax bar, Aerial photo mosaicking, Stereo plotting with photogrammetric Instruments, Aerial triangulation and photo control.
- ii. Ortho rectification of Air photos [orthobase] Stereo analysis & Anaglyph generation (10)
- iii. Calculation of distance & area on plane surface, spherical surface and ellipsoidal surface. Coordinate transformation. Determination of orbital period of a satellite, its velocity and distance from the earth's centre.
- iv. Preparation of Base map from Survey of India Toposheets, Use of India topographical sheets for delineation of different features.
- v. Plane table survey for cadastral and large scale Mapping, Theodolite traverse and triangulation, Spirit Leveling, use of Dumpy level, Prismatic Compass, and preparation of a road map
- vi. Introduction to a GPS and initial setting ,Creating codes and attribute table for GPS receiver, Point Data collection using GPS with different datum, Line data collection using GPS and measurements, GPS data collection for area calculation, Post processing of the GPS data, Creating attribute table in GPS pro software and Export functions, GPS and GIS integrations output preparation

Practical Notebook and Viva Voce (5) (10)

## **/// RSG-108 (PRACTICAL)**

### **COMPUTER FUNDAMENTALS & PROGRAMMING (25 marks)**

*Full Marks: 25. At least even number of periods to be assigned (preferably in batches). Examination Time: 2 hours. Pattern of setting questions: 20 marks compulsory questions are to be set. 5 marks are to be allocated for Evaluation of Practical Notebook and Viva-voce . Right hand side parentheses indicate lecture / demonstration hours.*

- i. Operating System: Windows XP, MSDOS Commands, Windows 7
- ii. Office Application: Microsoft PowerPoint
- iii. Web Designing: CSS tags and JAVA script
- iv. Image Management: Scanning, Image format, Export and Import
- v. C Programming Language: Basics, Statements, Loop, Array, String, Pointer
- vi. DBMS: Database Generation, Database Management, Quarry in Oracle (20)

Practical Notebook and Viva Voce (5)

# SEM II PAPERS

## SEM -II THEORY

### **/// RSG-201: (EXAMINATION TIME: 2 HOURS)**

#### **DIGITAL IMAGE PROCESSING & INFORMATION EXTRACTION (50marks)**

*Full Marks: 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

#### **RSG-201**

##### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35*

##### **Digital Image Processing:**

- i. *Introduction:* Definition of digital image, Source of Data, Data Formats, Hardware and Software Consideration for Digital Image Processing, Data loading, Image Restoration, Image Reduction and Magnification
- ii. *Image Pre-processing:* Sources of Error in image data, Image Rectification and Registration, Resampling Techniques, Radiometric corrections
- iii. *Contrast Manipulation:* Gray Level Thresholding, Level Slicing; Contrast Stretching – Linear and Non-linear
- iv. *Spatial Texture Manipulation:* Spatial filtering – Linear, High Boost, Directional and Gradient Filters; Edge Enhancement and Fourier Analysis
- v. *Multi-image Manipulation:* Band Ratioing and Differencing, Principal and Canonical Components, Vegetation Components, Image Fusion
- vi. *Initial Statistics Extraction:* Univariate & Multivariate Image Statistics, Band Correlation, Statistical Evaluation of Image Quality Parameters

##### **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

##### **Information Extraction from Satellite Images:**

- i. *Ground Truthing:* Ground Truth Collection for Image Classification, Spectral Signature, Data Calibration, Interpretation of target Properties, Training, Verification.
- ii. *Thematic Image Classification:* Spectral Pattern Recognition, Spatial Pattern Recognition, Temporal Pattern Recognition, Parametric and Non-Parametric classifiers, Hard and Soft Classification System, Advantage and Disadvantages of Different Classifiers
- iii. *Unsupervised Classification:* Isodata, K-mean
- iv. *Supervised Classification System:* Minimum Distance to Mean, Parallelepiped, Maximum Likelihood, Mahalanobis Distance

- v. *Advanced Classification Techniques:* Hybrid Classification, ANN, Spectral Mixture Analysis, Fuzzy Classifiers, Spectral Angle Mapper, Decision Tree, Support Vector Machine
- vi. *Accuracy Assessment:* Reference Data, Sampling techniques, Error of Commission and Omission, Error Matrix, Kappa Statistics
- vii. *Change Detection Analysis*

### ***Internal Assessment (10)***

### **/// RSG-202: (EXAMINATION TIME: 2 HOURS)**

#### **ADVANCE REMOTE SENSING (50marks)**

*Full Marks 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

### **RSG-202**

#### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

#### **Thermal and Microwave Remote Sensing:**

- i. *Thermal Remote Sensing:* Basic Principles, Physical Laws, Blackbodies and Emissivity, Thermal Infrared Radiation Properties, Thermal Infrared Atmospheric Windows, Interaction of Thermal Radiation with Terrain Elements
- ii. *Thermal Data Processing:* Thermal Energy Detectors, Thermal Radiometers, Thermal Scanners, Interpreting Thermal Scanner imagery, Geometric Characteristics of Thermal Scanner Imagery, Geometric and Radiometric Calibration of Thermal data, Applications
- iii. *Microwave Remote Sensing:* Basic Principles, Radar Operation, Polarization, Spatial Resolution, Radar Image Geometry, Relief Displacement, Shadows and Speckle effect, Side Looking Radar System (SLAR) Operation, Synthetic Aperture Radar (SAR), Radar Interferometry
- iv. *RADAR Environmental Considerations:* Surface Roughness Characteristics, Electrical Characteristics, Vegetation and Water response to Microwave energy
- v. *Microwave Remote Sensing and its advantages, Active and Passive Microwave Systems, Attenuation of Microwave, Surface Scattering, Volume Scattering, Types of Antenna, Platforms and sensors, Applications*

#### **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

#### **Hyperspectral Remote Sensing and Lidar:**

- i. *Hyperspectral Remote Sensing:* Basic principles of Spectroscopy, Advantages, Hyperspectral sensors and platforms, Sensor specifications
- ii. *Hyperspectral Data Processing:* Geometric and Atmospheric Corrections, Endmember Collection, Image Classification, Spectro-radiometer
- iii. *Application of Hyperspectral Data:* Application in Agriculture, Water, Soil and Mining
- iv. *LIDAR:* Basic Principles and advantages, Laser and Scanning System, Laser Location, Lidar Antenna Attitude, Types of Lidar returns, Lidar post processing of multiple returns,

- Accuracy of Lidar measurements, The Laser Vegetation Imaging Sensor, Lidar types based on Platforms
- v. *LIDAR Applications*: Lidar derived Vegetation and Urban Information, Applications in Vegetation, Urban and Coastal mapping

### ***Internal Assessment (10)***

## **/// RSG-203: (EXAMINATION TIME: 2 HOURS)**

### **ADVANCE GEOGRAPHIC INFORMATION SYSTEM (50marks)**

*Full Marks: 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

## **RSG-203**

### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35*

#### **GIS Data Analysis:**

- i. *Data Storage*: Vector and Raster data model, Digital coding and storing of Point, Line and Polygon, Spaghetti Model, Topological Model, Quadtree, Conversion between Raster and Vector
- ii. *Database Modelling*: Hierarchical Model, Network Model, Relational Model
- iii. *Spatial Database Management*: Concept of Spatial Database, Database Management System, Basic Concepts of Entity, Relationship and Primary Key, Database Structure
- iv. *Data Organization*: Chain Coding, Run-length Coding, Block Coding
- v. *Spatial Analysis*: Types of Spatial Analysis, Measurement in GIS, Query – Query by Attributes, Spatial Queries, Attribute Based Operation, Neighbourhood Analysis, Connectivity Analysis, Overlay and Coverage Rebuilding
- vi. *Data Quality and Errors in GIS*: Errors and Uncertainty in GIS data, Positional and Attribute Accuracy
- vii. *Web GIS, Mobile GIS*

### **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

#### **Geodesy:**

- i. The Planet Earth, Geoids, Concept of Spherical Geometry and Geodesy, Reference Spheroid and Mean Sea Level
- ii. Introduction to different spheroid / ellipsoid systems with special reference to Everest and WGS-84 - Geometric Constants, Indian Geodetic Datum; Rectangular and Geographical Co-ordinate System - Conversion of latitudes and longitudes to linear distances, Co-ordinate Transformations, Geoidal parameters and their relationship.
- iii. Dimensions of some well-known Spheroids, Definition and Determination of Geoid Undulation, Coordinate System used in Geodesy, Coordinate System used by Survey of India ( $\phi$ ,  $\lambda$ , H), Redefinition of Horizontal and Vertical Datum in India, Indian Mean Sea Level Datum;
- iv. Satellite Geodesy: Early satellites, Interferometry, Doppler, Point Positioning, Translocation, Observational systems, New Satellite gravity missions,

- v. Modern Views on determination of figure of the Earth: Gravimetric Methods, Astrogeodetic methods.

### **Internal Assessment (10)**

## **/// RSG-204: (EXAMINATION TIME: 2 HOURS)**

### **FUNDAMENTAL STATISTICAL CONCEPTS & GEO-STATISTICS (50marks)**

*Full Marks: 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

### **RSG-204**

#### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

#### **Fundamental Statistical Concepts:**

- i. Meaning, Scope and Importance of Statistics, Collection of data - sampling methods; random and systematic method; source of data - primary and secondary
- ii. Organization of data - array, frequency, class intervals, histograms, and distribution, Presentation of Data: Tables, Diagrams
- iii. Grouped data and ungrouped data, Geographical data: discrete and continuous series, scales of measurement, Measures of Central Tendency - mean, median, mode, quartiles
- iv. Moments, Skewness, Kurtosis, Measures of Dispersion – absolute dispersion, relative dispersion
- v. Correlation: meaning, scatter diagram, standard deviation, variance, Measures of correlation – Karl Pearson's method (two variables ungrouped data), Spearman's rank correlation methods.

#### **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

#### **Geo-statistics & Statistical applications in GIS:**

- i. Mean centre of population and temporal shift, Bi-variate & Multiple correlation and regression, Correlation analysis Scatter Diagram & Residual mapping, T-test, Z-Score, Root Mean Square Error, Principal Component analysis
- ii. *Surface Modelling:* Spatial autocorrelation, Role of Interpolation, Methods of Interpolation – Global and Local Deterministic Methods, Moving Averages, Inverse Distance Interpolation, Optimal Interpolation using Geostatistics
- iii. Variogram and its use for Interpolation, Interpolation by Kriging – Ordinary Kriging, Block Kriging, Non-Linear Kriging, Stratified Kriging, Co-Kriging, Universal Kriging, Probabilistic Kriging
- iv. Factor and cluster analysis.

### **Internal Assessment (10)**

## SEM -II PRACTICAL

### **/// RSG-205 (PRACTICAL)**

#### **DIGITAL IMAGE PROCESSING (25 marks)**

*Full Marks: 25. At least even number of periods to be assigned (preferably in batches). Examination Time: 2 hours. Pattern of setting questions: 20 marks compulsory questions are to be set. 5 marks are to be allocated for Evaluation of Practical Notebook and Viva-voce. Right hand side parentheses indicate lecture / demonstration hours.*

Topic to be covered to be used	*Software	PG	EV	ED	Oth
Atmospheric Correction, Image enhancement and filtering of multispectral optical data		•	•	•	
Image classification (Unsupervised, Supervised)		•	•	•	
Accuracy assessment, Class separability & contingency Matrix			•	•	
Stereo-SAR DEM generation, Rader image interpretation: Speckle suppression, Texture analysis, Texture & Object based classification.		•	•	•	

(20)

Practical Notebook and Viva Voce

(5)

### **/// RSG-206 (PRACTICAL)**

#### **ADVANCE REMOTE SENSING: DATA PROCESSING & APPLICATIONS (25 marks)**

*Full Marks: 25. At least even number of periods to be assigned (preferably in batches). Examination Time: 2 hours. Pattern of setting questions: 20 marks compulsory questions are to be set. 5 marks are to be allocated for Evaluation of Practical Notebook and Viva-voce . Right hand side parentheses indicate lecture / demonstration hours.*

Topic to be covered	*Software to be used	PG	EV	ED	Oth
Geometric and Atmospheric Correction		•	•	•	
Image enhancement and filtering		•	•	•	
Advanced classification techniques			•	•	
Accuracy assessment, ground truthing with spectroradiometer		•	•	•	
Algorithm Liberation, Raster calculation, Modeling.		•	•	•	

(20)

Practical Notebook and Viva-Voce

(5)

## **/// RSG-207 (PRACTICAL)**

### **ADVANCE GIS AND GEODESY (25 marks)**

*Full Marks: 25. At least even number of periods to be assigned (preferably in batches).*

*Examination Time: 2 hours. Pattern of setting questions: 20 marks compulsory questions are to be set. 5 marks are to be allocated for Evaluation of Practical Notebook and Viva-voce. Right hand side parentheses indicate lecture / demonstration hours.*

<b>Topic to be covered</b>	<b>*Software to be used</b>	<b>PG</b>	<b>AG</b>	<b>MI</b>	<b>Oth</b>
Vector Editing, Data base creation, Managing Attribute Table, Thematic Maps		•			
Charts and Diagrams generation Select and Query in vector layers, Use of SQL, GIS based models.		•	•	•	
Network, Neighborhood, Buffer, Proximity [ thiesen polygon], Overlay, Intersection, & Union		•	•	•	
Topographic & Morphometric analysis: TIN, DEM, Contour & Isopleth generation.		•			

(10)

i. Geodesy

(10)

Practical Notebook and Viva Voce

(5)

## **/// RSG-208 (PRACTICAL)**

### **FUNDAMENTAL STATISTICAL CONCEPTS & GEO-STATISTICS (25 marks)**

*Full Marks: 25. At least even number of periods to be assigned (preferably in batches).*

*Examination Time: 2 hours. Pattern of setting questions: 20 marks compulsory questions are to be set. 5 marks are to be allocated for Evaluation of Practical Notebook and Viva-voce . Right hand side parentheses indicate lecture / demonstration hours.*

- i. Introduction of Statistical Software: Time series, Charts, Scatter plot with regression line, Histogram, Z-Score, T-test, Correlation, Neighborhood analysis
- ii. Principal Component analysis, Spatial autocorrelation.
- iii. IDW and Krigging through GIS softwares
- iv. Extraction of image statistics

(20)

Practical Notebook and Viva-Voce

(5)

# SEM III PAPERS

## SEM -III THEORY

### **/// RSG-301: (EXAMINATION TIME: 2 HOURS)**

#### **APPLICATION OF GEO-INFORMATICS AND SPATIAL DATABASE MANAGEMENT (50marks)**

*Full Marks: 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

#### **RSG-301**

##### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

##### **Application of Geo-Informatics:**

- i. *Introduction:* Emergence of Geoinformatics technology in different application areas, Indian satellite missions with focused applications
- ii. *Areas of Applications:* Application in Disaster Management, Water, Soil, Urban Planning, Landuse/ Landcover, Environmental Management
- iii. Remote Sensing in Water resource evaluation and Watershed Management, Runoff & Soil Loss estimation based on empirical models, Remote Sensing in hydro-geomorphological studies for ground water targeting.

##### **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

##### **Spatial Decision Support System:**

- i. *GIS and Decision Support Systems:* Concept and characteristics of Decision Support Systems (DSS), Spatial Decision Support Systems (SDSS) and GIS
- ii. *Multicriteria Decision Analysis(MCDA):* Elements and Structure of MCDA, Multiobjective and Multiattribute analysis
- iii. *Spatial Multicriteria Decision Analysis (SMDA):* Framework of SMDA, Evaluation Criteria and GIS, Decision Alternatives and Constraints
- iv. *Criterion Weighting and Decision Rules:* Estimation of Weights- Ranking, Rating, Pairwise Comparison and Trade-off analysis method; Decision Rules-Simple Additive Weighting method and Analytic Hierarchy Process

##### **Internal Assessment (10)**

## **/// RSG-302: (EXAMINATION TIME: 2 HOURS)**

### **RESEARCH METHODOLOGY & PROJECT MANAGEMENT (50marks)**

*Full Marks 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

### **RSG-302**

#### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

#### **Fundamental of Research:**

- i. Basic concept of research, Objectives, Motivation and Significance of research, Types of Research, Deductive and Inductive Approach, Levels of Certainty: Facts, Hypotheses, Theories and Laws, Criteria of good research
- ii. *Research Problem:* Identification and Techniques of defining a research problem, significance of literature review
- iii. *Research Design:* Research design for Exploratory, Descriptive and Hypothesis-testing research studies.
- iv. *Sampling Design:* Steps in Sampling Design, Types of Sampling and their applications in research, Collection of Spatial and Temporal data.
- v. Problems encountered by researchers in India

#### **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

#### **Research Methodology and Project Management:**

- i. *Statistical Inference for Research:* Concepts and Procedure concerning testing of Hypothesis, Chi-square Test, Variance and Co-variance analysis, Concept of Standard Error
- ii. Model Calibration and Validation
- iii. Preparation of research projects and writing of reports, Critical Writing, Ethical Issues in Research.
- iv. *Project:* Definition and Characteristics of Project, Project Objectives and Functions, Classification of projects, Project Life Cycle
- v. *Project Management :* Definition and elements of Project management, Techniques of Project Management, Roles and attributes for project manager

#### **Internal Assessment (10)**

## **ELECTIVE SPECIAL PAPER THEORY: (Any two)**

**/// RSG-303:** (EXAMINATION TIME: 2 HOURS)

**/// RSG-304:** (EXAMINATION TIME: 2 HOURS)

1. Advance Photogrammetry (Only For Those Having Mathematics In Graduation)
2. Geoinformatics In Coastal Management
3. Geoinformatics In Watershed Management
4. Geoinformatics In Earth Sciences
5. Geoinformatics In Forest Management
6. Geoinformatics In Disaster Management
7. Geoinformatics In Agriculture
8. Geoinformatics In Urban, Rural Development & Regional Planning
9. Geoinformatics In Environmental Science & Management
10. Geoinformatics In Resource Management
11. Geoinformatics In Transport Network Analysis
12. Geoinformatics In Utility Management

### **Option-1 ADVANCED PHOTOGRAMMETRY (only for those having Mathematics in Graduation)**

*Full Marks 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

#### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

##### **Analytical Photogrammetry:**

- i. Comparators and Photo co-ordinates, Sources of error
- ii. Analytical orientations (collinearity and coplanarity conditions)
- iii. Space resection and intersection techniques, Analytical Plotters.

#### **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

##### **Digital Photogrammetry:**

- i. The concept of Digital Images, Photogrammetric Scanners, Soft copy photogrammetric work stations, Digital orthophotos and Digital Elevation Models (DEM)
- ii. *Satellite Photogrammetry:* Celestial mechanics, modeling of satellite based stereoscopic data.

##### **Internal Assessment (10)**

## **Option-2 GEOINFORMATICS IN COASTAL MANAGEMENT**

*Full Marks 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

#### **Theoretical Considerations**

- i. Coastal morphodynamics: Micro, macro and biogenic forms. Systems of change in coasts: cyclical and progressive. Classification of coasts based on processes and sediment characteristics.
- ii. Coastal biogeography with special reference to sea weeds, mangroves, dune vegetation and corals, Coastal pollution: Sources, impacts and management, Integrated Coastal Management: Concepts, techniques and applications.
- iii. Natural coastal hazards and their management: Sea level rise, erosion, sedimentation and tropical cyclones, Coastal engineering and its impacts: Ports and harbours, measures for prevention of erosion and sedimentation.
- iv. Techniques of monitoring changes in coastal processes and landforms.
- v. Human utilisation of coasts, environmental impacts and management: Navigation, mining, fishing and fish-processing, off-shore oil exploitation, reclamation and tourism.

### **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

#### **Potential Application areas of RS /GIS**

- i. Indian coast: Major environmental issues, problems and their management
- ii. Application of Remote Sensing with special reference to Coastal Zone Management
- iii. Monitoring Surface waters in Coastal Regulatory Zone (CRZ)
- iv. Study of Suspended mineral in water
- v. Study of Chlorophyll in water
- vi. Measurement of Sea Surface Temperature (SST)

### **Internal Assessment (10)**

## **Option-3 GEOINFORMATICS IN WATERSHED MANAGEMENT**

*Full Marks 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

#### **Water Resources and Watershed Management:**

- i. Surface water-ground water, water deciphering

- ii. Quality inventory and monitoring, quantity assessment – Parametric watershed modeling – dimensional consideration of basic dynamics – evaluation of hydrologic parameters
- iii. Concept of watershed, Morphometric Analysis
- iv. Hydro-morphogeologic interpretation techniques for targeting ground water potential zones in alluvial, sedimentary and hard rock areas, location of aquifer
- v. Watershed management, techniques of soil and water conservation.

## **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

### **Remote Sensing in Water resource Evaluation:**

- i. Drought & flood Assessment, flood plain mapping, soil moisture, water quality, snow & cloud mapping.
- ii. Estimation of Aquatic biodiversity, Runoff and soil loss estimation.
- iii. Site location for storage and diversion projects, dam site selection, tunnel and canal alignment
- iv. Case Studies.

## **Internal Assessment (10)**

### **Option-4 GEOINFORMATICS IN EARTH SCIENCES**

*Full Marks: 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

## **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

### **Fundamentals of Earth System:**

- i. *The Earth System:* Concept of Earth System, lithosphere, biosphere, hydrosphere & atmosphere, plate tectonic theory and its relationship to earthquakes, and volcanic activity.
- ii. *Rock Types:* igneous, sedimentary and metamorphic rocks, their characteristics, types and forms, delineation on satellite images.
- iii. *Rock Structures:* Folds, faults, joints and lineaments, field characteristics, delineation on satellite images and analysis.
- iv. *Geomorphology:* Fundamental concepts, geomorphic agents and processes, drainage patterns, classification of landforms. Image characteristics of major landforms.

## **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

### **Application of Geo-informatics in Earth Science:**

- i. *Visual/ Digital Satellite Image Interpretation:* Elements of image interpretation, Digital image enhancement techniques for lithological discrimination. Application of Remote Sensing in Geological Mapping (both Lithological and Structural)
- ii. Geo-technical Engineering & Environmental Management, Digital terrain models for selection of dam site, road, and canal construction.
- iii. *Multivariate data modelling:* Concept and application in geosciences: Disaster

- Management, Landslide hazard zonation, mineral targeting. Rock Information System. GIS based multivariate analysis in mineral targeting.
- iv. *Case Studies:* GPS in plate tectonic studies in Himalayas, Predicting seismicity in peninsular region through lineament studies, Study of hydro-geomorphology in West Bengal

### ***Internal Assessment (10)***

#### **Option-5 GEOINFORMATICS IN FOREST MANAGEMENT**

*Full Marks*50. *Number of lectures to be delivered for this paper is 70. Pattern of setting questions:* Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.

#### **Group A**

*Full Marks:* 20. *Number of lectures to be delivered for each module is 35.*

##### **Fundamentals of Forest Resources:**

- i. Introduction of conventional classification Inventory of forest land Temperate and Tropical zones, Forest resources of India, state wise status of forests
- ii. Forest Classification, Sensor Requirements, Forest mapping needs and remote sensing – national, regional and local level
- iii. Forest inventorying through remote sensing – techniques, processes and methods, Visual and digital analysis (5)

#### **Group B**

*Full Marks:* 20. *Number of lectures to be delivered for each module is 35.*

##### **Application of Geo-informatics in Forest:**

- i. Forest management, Damage assessment Fire Identification and control Disease detection storm damage - role of geoinformatics
- ii. Forest planning, information generation and updation through geoinformatics
- iii. Forest and Wildlife Management, Forest resources and wildlife habitat assessment, Wild life management Case Study of India and abroad, Forest recreation
- iv. Mapping of forest density and type using optical and microwave remote sensing, issues in forest management

### ***Internal Assessment (10)***

#### **Option-6 GEOINFORMATICS IN DISASTER MANAGEMENT**

*Full Marks*50. *Number of lectures to be delivered for this paper is 70. Pattern of setting questions:* Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.

#### **Group A**

*Full Marks:* 20. *Number of lectures to be delivered for each module is 35.*

##### **Fundamental concepts of hazards and disasters:**

- i. *Introduction:* Types of hazards and disasters, characterization, zonation of hazards, natural and human induced disasters.
- ii. Disaster and National losses, historical perspective of disasters in India.
- iii. *Disaster Management:* Fundamental concept of Disaster Management, government, NGOs and peoples participation disaster management. Existing organization structure for managing disasters in India.
- iv. Geoinformatics in disaster mitigation.

## Group B

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

### **Application of Geo-informatics in Hazards and Disasters Management:**

- i. *Geological Hazards:* Landslide, Earthquake, Mining hazards (subsidence, flooding etc.), Volcanic hazards, Groundwater hazards, Glacial hazards
- ii. *Hydro meteorological Hazards:* Flash floods, River floods, Dam burst, Cloud burst, Cyclones, Coastal hazards and Drought
- iii. *Environmental hazards:* Forest hazards (Deforestation, Degradation and Forest fire), Land, soil degradation, desertification and Pollution (Water, air and soil)
- iv. *Geoinformatics Applications:* Geoinformatics models in managing forest fires, floods, landslides, cyclone and earthquake, multiple hazard mapping.
- v. *Case Studies:* Earthquakes in India, Floods in Indo Gangetic plains, Landslides in Himalayan region, Drought in Indian plateau regions.

### **Internal Assessment (10)**

## **Option-7 GEOINFORMATICS IN AGRICULTURE**

*Full Marks 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

## Group A

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

### **Fundamental concepts of Agricultural Science:**

- i. Crops, Introduction – Yield parameters- spectral properties of crops- identification of crops and acreage estimation
- ii. Vegetation indices production forecasting through digital analysis monitoring and condition assessment – case studies.
- iii. Soils, Introduction –Soil Survey methods- soil Classification – land Evaluation- Saline, alkaline soils- mapping using RS data

## Group B

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

### **Application of Geo-informatics in Agriculture:**

- i. Problems soil identification and mapping – Soil sedimentation and erosion- Soil conservation case studies.
- ii. Damage assessment, Detection of pest and diseases- damages due to droughts and floods –water-logging and salinity- stress detection.

- iii. Integrated surveys, Integrated surveys for sustainable development – watershed approach –Agriculture and forest development,
- iv. GIS for drawing out action plans- case studies and recent development in Agro- climatic modelling –watershed planning.

### ***Internal Assessment (10)***

## **Option-8 GEOINFORMATICS IN URBAN, RURAL DEVELOPMENT & REGIONAL PLANNING**

Full Marks50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.

### **Group A**

Full Marks: 20. Number of lectures to be delivered for each module is 35.

#### **Theoretical Considerations:**

- i. Concepts and definitions: urban, urbanization and urbanism,
- ii. Origin & growth of urban settlements; bases & process of urbanisation
- iii. Urbanization in India: a historical perspective
- iv. Features of metropolitan development (with special reference to India), Urban Environmental Problems in West Bengal
- v. Theoretical framework of rural development and geographical perspective: Rural economy under different production systems – experiences of developed and developing world with examples.
- vi. Growth Pole theories and the developing world, Regional Environmental Issues.

### **Group B**

Full Marks: 20. Number of lectures to be delivered for each module is 35.

#### **Potential Application areas of RS / GIS:**

- i. Analysis of rural settlement: Cause and effect associations, distribution of rural settlement with special reference to size and spacing; Rural service centres – Nodal settlement of market centres and growth centres – Studies on rural urban continuum.
- ii. Brief introduction of Remote Sensing applications on Urban landscape
- iii. Population estimates, housing quality studies, site selection processes, traffic and parking studies,
- iv. Urban & rural change detection studies, Remote sensing applications in Biological systems.

### ***Internal Assessment (10)***

## **Option-9 GEOINFORMATICS IN ENVIRONMENTAL SCIENCE & MANAGEMENT**

Full Marks50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two

questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.

## **Group A**

Full Marks: 20. Number of lectures to be delivered for each module is 35.

### **Theoretical Considerations:**

- i. Water and the environment, R.S. of fluorescence- water quality- water pollution- pollution sources- water runoff, Remote Sensing and Water quality management –snow surface cover- flood prediction
- ii. Soils and land forms- insects and disease- soil erosion- salinity- flood damage- soil limitation –soil degradation using Remote Sensing and GIS.
- iii. Urban environment, General consideration rural structure- urban areas- Impact of industrial pollution- chemical effluents, land reclamation- disposal of solid waste- mining pollution

## **Group B**

Full Marks: 20. Number of lectures to be delivered for each module is 35.

### **Application of Remote Sensing and GIS:**

- i. Ecology and ecosystem, Conservation and resource management – spectral reflectance from vegetated surface- Stress monitoring- forest conservation- wild life studies- GIS for monitoring non print source pollution.
- ii. Marine environment, Sensors for environmental monitoring sensors – visible and outside visible wave length – absorption spectrometers – selection of ground truth sites- sea truth observations –Radar techniques for sensing ocean surfaces- thermal measurements – application of sensing, mapping oil slicks – Chlorophyll detection- Fisheries resources- Coastal marine studies- determination of temperature and sea state.
- iii. Air pollution and global climatology, R.S. technique for Air quality monitoring- case studies- weather forecasting and climatology- emissivity characteristics.
- iv. Measurement of atmospheric temperature- composition- constituent distribution and concentration- composition- constituent distribution and concentration- wind flows and air circulation- Hurricane tracking – meteorological satellite systems.

## **Internal Assessment (10)**

### **Option-10 GEOINFORMATICS IN RESOURCE MANAGEMENT**

Full Marks:50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.

## **Group A**

Full Marks: 20. Number of lectures to be delivered for each module is 35.

### **Concepts in Resources:**

- i. Resources classification systems, natural and cultural resources, renewable and non-renewable resources.
- ii. Resource Conservation: Remote sensing based Land use- Land cover mapping for resource monitoring and management Sustainable development of natural resources.
- iii. Land Resources: Introduction to soil, mineral resources, remote sensing in mapping soil

degradation, impact of surface mining on land resources,

## **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

### **Application of Remote Sensing and GIS in Resource Management:**

- i. Bio-Resources: Remote sensing application in agriculture, forest resources and wildlife habitat assessment. Mapping of forest density and type, issues in forest management.
- ii. Water Resources: Remote sensing application in surface and sub surface water resources evaluation, water mining and pollution, issues in water resources management.
- iii. Energy Resources: Coal, oil and nuclear energy, non conventional energy resources, future potential and requirement of energy resources. GIS in energy resources management.
- iv. Geoinformatics Models in Resource Management: Forest Fire Modeling, Wild Life Habitat Assessment Modeling, Soil Erosion Modeling, Land Resources Development Prioritization Modeling.

### **Internal Assessment (10)**

## **Option-11 GEOINFORMATICS IN TRANSPORT NETWORK ANALYSIS**

*Full Marks 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

## **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

### **Concepts in Transportation:**

- i. Introduction to Transportation Planning, Behavioral Issues in Transportation Studies, Public Transportation Operations and Technology
- ii. Transportation Systems: Mass Transportation Systems, Traffic Studies and Capacity, Transportation Economics and Finance, Traffic Safety and Control
- iii. Network Analysis and Transportation: Concept of networks and Network models, Network analysis, Important applications, utilities and transportation, using network model in GIS, Multi-modal Freight Transportation Systems Analysis

## **Group B**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

### **Application of Remote Sensing and GIS in Transportation:**

- i. Transportation Modelling: Transportation Models, Simulation Analysis , Discrete Choice Modeling for Travel Demand Forecasting
- ii. Intelligent Transportation Systems: Urban Transportation Networks , Geometric Design of Transportation Facilities, Transportation Design
- iii. Planning and Execution: Airport Design and Planning , Port Design and Planning , Urban Transport planning
- iv. Applications and Case studies

## ***Internal Assessment (10)***

### **Option-12 GEOINFORMATICS IN UTILITY MANAGEMENT**

*Full Marks: 50. Number of lectures to be delivered for this paper is 70. Pattern of setting questions: Four questions of 10 marks (Group A) and four questions of 10 marks (Group B) are to be set. Two questions of 10 marks and two questions of 10 marks from each of the module are to be answered. Each question is to have at least two parts in Group A & Group B.*

#### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

##### **Concepts of Utility Management:**

- i. Utility, Description of all essential services and utilities, Database development and Data Acquisition, Acquiring and integrating geospatial data, Spatial Data Bases
- ii. Spatial Data Manipulation and Analysis, Geospatial system analysis and design, Geospatial technology project , management ,Query Processor and Visualization
- iii. Applications and Problem solving with GIS Electricity, Gas, Water supply, Sewerage system

#### **Group A**

*Full Marks: 20. Number of lectures to be delivered for each module is 35.*

##### **Application of Remote Sensing and GIS in Utility Management:**

- i. Solid waste disposal, Telecommunication, Public health and safety, Crime analysis
- ii. Modelling in utility applications, Infrastructure aims and objectives, Environmental law and regulations governing infrastructure utilities, Modern infrastructure tools
- iii. Case study

## ***Internal Assessment (10)***

## SEM -III PRACTICAL

### **/// RSG-305 (PRACTICAL)**

#### **APPLICATION OF GEO-INFORMATICS AND SPATIAL DECISION SUPPORT SYSTEM (25 marks)**

*Full Marks: 25. At least even number of periods to be assigned (preferably in batches). Examination Time: 2 hours. Pattern of setting questions: 20marks compulsory questions are to be set. 5 marks are to be allocated for Evaluation of Practical Notebook and Viva-voce . Right hand side parentheses indicate lecture / demonstration hours.*

- i. Application of Geo-informatics in Environmental issues, Measurement of Canopy Cover through Leaf Area Index (LAI) Meter
- ii. Morphometric analysis of terrain, satellite image based hydro-geomorphological interpretation for ground water targeting.
- iii. Runoff & Soil Loss estimation based on empirical models.
- iv. Digital terrain models for selection of dam site, road, and canal construction, Cut & Fill analysis using DEM
- v. Spatial decision support system

(20)

Practical Notebook Viva-voce

(5)

### **/// RSG-306 (PRACTICAL)**

#### **GENERATION OF CASE STUDIES (COMPULSARY FIELD STUDY) (25 marks)**

*Full Marks: 25. At least even number of periods to be assigned (preferably in batches). Examination Time: 2 hours. Pattern of setting questions: 20marks compulsory questions are to be set. 5 marks are to be allocated for Evaluation of Practical Notebook and Viva-voce . Right hand side parentheses indicate lecture / demonstration hours.*

- i. Based on primary or secondary data based on the field studies to be generated on respective themes, Validation of the output based on post field data
- ii. Output generation – finalization of Field Report and Viva-Voce

(25)

### **/// RSG-307 AND RSG-308 (PRACTICAL)**

#### **PRACTICAL ON ELECTIVE SPECIAL PAPER (Any two) (25+25 marks)**

1. Advance Photogrammetry (Only For Those Having Mathematics In Graduation)
2. Geoinformatics In Coastal Management
3. Geoinformatics In Watershed Management
4. Geoinformatics In Earth Sciences
5. Geoinformatics In Forest Management
6. Geoinformatics In Disaster Management
7. Geoinformatics In Agriculture

8. Geoinformatics In Urban, Rural Development & Regional Planning
9. Geoinformatics In Environmental Science & Management
10. Geoinformatics In Resource Management
11. Geoinformatics In Transport Network Analysis
12. Geoinformatics In Utility Management

*Full Marks: 25. At least even number of periods to be assigned (preferably in batches). Examination Time: 2 hours. Pattern of setting questions: 20 marks compulsory questions are to be set. 5 marks are to be allocated for Evaluation of Practical Notebook and Viva-voce. Right hand side parentheses indicate lecture / demonstration hours.*

### **Generation of Case Studies**

Based on primary or secondary data case studies to be generated on respective themes, Validation of the output based on post field data, Output generation – finalization

**(20)**

Practical Notebook and Viva-Voce

**(5)**

# SEM IV

## **/// RSG-401**

**M.Sc. RESEARCH DISSERTATION\_(200marks)**

**RSG-401 (GROUP A & B)**

**GROUP A (Dissertation Examination 100) + GROUP B (Dissertation Viva-Voce 100)**

- Dissertation consisting of relevance of the problem to be studied and its aims and objectives, Methodology adopted to study such problem
- Chapter Scheme
  - Problem Definition
  - Objective
  - Review of Literature
  - Database and Methodology
  - Result and Discussion
- Presentation

ON SATISFACTORY COMPLETION OF THE TAUGHT COMPONENT OF THE COURSE, STUDENTS WILL NORMALLY PROCEED TO THE M.SC. RESEARCH DISSERTATION WHICH MUST BE COMPLETED BY THE END OF FOURTH SEMESTER. THIS SHOULD BE A SUBSTANTIAL PIECE OF RESEARCH WORK, WHICH BOTH REINFORCES THE SKILLS LEARNED IN THE TAUGHT COMPONENT OF THE COURSE AND PROVIDES A GENUINE OPPORTUNITY TO UNDERTAKE VALUABLE RESEARCH. EACH STUDENT IS REQUIRED TO DEFEND HIS / HER THESIS THROUGH A PRESENTATION IN FRONT OF AN EXTERNAL EXPERT AND FACULTY AND STUDENTS.

## **/// RSG-402**

**GRAND VIVA\_(100marks)**

**Grand viva will be based on the overall understanding of the subject in front of external and internal examiner**

## ***LIST OF REFERENCES:***

### **RSG-101: FUNDAMENTALS OF REMOTE SENSING**

#### **TEXT BOOKS:**

1. Jensen, J.R., 2000. Remote sensing of the environment: An earth resource perspective, Prentice Hall, Upper saddle river, NJ,
2. Joseph, George, (2003), Fundamental of Remote Sensing, University Press (India) Pvt. Ltd, Orient Longman Pte. Ltd., Hyderabad, India
3. Lillesand, T.M. and Kieffer, R.W., 2003. Remote Sensing and Image Interpretation, 5<sup>th</sup> Edition., Wiley, New York
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#### **REFERENCE BOOKS:**

1. Avery, T.E., and G.L. Berlin, Fundamental of remote sensing and airphoto interpretation, 5<sup>th</sup> ed, Macmillan, New York, 1992
2. Barrett, E.C., and L.F. Curtis, Introduction to environmental remote sensing, 3<sup>rd</sup> ed, Chapman and Hall, New York, 1992
3. Campbell J.B. (2002) Introduction to Remote Sensing, 3rd ed., The Guilford Press.
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### **RSG-102: FUNDAMENTALS OF GIS & DIGITAL CARTOGRAPHY**

#### **TEXT BOOKS:**

1. Anson, R.W. & Ormeling, F.J. (1993), Basic Cartography, Vol. 1, 2<sup>nd</sup> ed., Elsevier Applied Science Publishers, London.
2. Burrough, Peter A. and Rachael McDonnell, 1998, ‘ Principles of Geographical Information Systems’ Oxford University Press, New York.

3. C.P.Lo and Albert K.W.Yeung 2005 “Concepts and Techniques of Geographic Information Systems” Prentice Hall of India, New Delhi.
4. Chakraborty and Sahoo, 2008, Fundamentals of Geographic Information Systems, Viva Books Private Limited, India
5. Magwire, D. J., Goodchild, M.F. and Rhind, D. M. Ed. 1991, ‘Geographical Information Systems: Principles and Applications’, Longman Group, U.K.
6. Robinson A.H. & Morrison J.L, (1995) Elements of Cartography, John Wiley & Sons

#### REFERENCE BOOKS:

1. Chaisman, N. 1992: Exploring Geographical Information Systems, John Wiley and Sons Inc., New York: 198p.
2. Chrisman, N.R. (1997) Exploring Geographic Information Systems. John Wiley and Sons.
3. DeMers, M.N., Fundamentals of geographic information system, Wiley, New York, 1997
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### **RSG-103: PHOTOGRAMMETRY, SURVEYING AND GPS**

#### **TEXT BOOKS:**

1. Hussain, S.K. and Nagaraj, M.S. 1992 :Text Book of Surveying, S. Chand & Co. Ltd., New Delhi:
2. Joseph, George, (2003), Fundamental of Remote Sensing, University Press (India) Pvt. Ltd, Orient Longman Pte. Ltd., Hyderabad, India
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1. Alvi, Z. 1995 : Statistical Geography: Methods and Applications, Rawat Pub. New Delhi: 194p.
2. American society of photogrammetry (ASP), Manual of remote sensing, second edition, ASP, Falls church, VA, 1983
3. Burnside C.D. (1985) Mapping from Aerial Photography, 2nd Ed, Collins.
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25. Principles of GNSS, Inertial, and Multi-sensor Integrated Navigation Systems by Paul D. Groves, ARTECH House.
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#### **RSG-104: COMPUTER FUNDAMENTALS & PROGRAMMING**

**TEXT BOOKS:**

1. E Balaguruswamy “ Programming in ANSI C ” TMH 2<sup>nd</sup> Edition 2000
2. Evangelos Petroustos “Mastering Visual Basic 6.0” , BPB Publications, Edition 1998
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2. Pal, S.K. 1999 : Statistics for Geoscientists, Concept publishing Company, New Delhi: 423p.
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**RSG-201: DIGITAL IMAGE PROCESSING AND INFORMATION EXTRACTION****TEXT BOOKS:**

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2. Jensen J.R. (2007) Remote Sensing of the Environment: An Earth Resource Perspective, 2nd ed., Prentice Hall.
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### **RSG-202: ADVANCE REMOTE SENSING**

#### **TEXT BOOKS:**

1. Jensen J.R. (2005) Digital Image Processing: A Remote Sensing Perspective, 3rd ed., Prentice Hall.
2. Jensen J.R. (2007) Remote Sensing of the Environment: An Earth Resource Perspective, 2nd ed., Prentice Hall.
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5. Hyperspectral Data Exploitation: Theory and Applications by Chein-I Chang, Wiley & Sons Ltd.
6. Hyperspectral Remote Sensing of Tropical and Subtropical Forests by Margaret Kalacska and G. Arturo Sanchez- Azofeifa., CRC Press.
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9. Imaging with Synthetic Aperture Radar by Didier Massonnet, Jean-Claude Souyris, CRC Press, 2008.
10. Introduction to Microwave Remote Sensing by Iain H. Woodhouse, CRC, 2004.
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14. Skolnik and Merrill I. Introduction to Radar Systems, McGraw-Hill (1st ed., 1962; 2nd ed., 1980; 3rd ed., 2001).
15. Techniques and Applications of Hyperspectral Image Analysis by Hans F. Grahn and Paul Geladi, Wiley & Sons Ltd.

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### **RSG-203: ADVANCE GEOGRAPHIC INFORMATION SYSTEM**

#### **TEXT BOOKS:**

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## **RSG-204: FUNDAMENTAL STATISTICAL CONCEPTS & GEO- STATISTICS**

### **TEXT BOOKS:**

1. Alvi, Z. 1995 : Statistical Geography: Methods and Applications, Rawat Pub. New Delhi
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18. Walford N. (2011) Practical Statistics for Geographers and Earth Scientists, John Wiley & Sons, New Jersey, USA.
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### **RSG-301: APPLICATION OF GEOINFORMATICS & SPATIAL DECISION SUPPORT SYSTEMa**

#### **TEXT BOOKS:**

1. An Introduction to Database Systems by C.J.Date, A. Kannan S. Swamynathan (8th Ed.), Pearson Education, 2009.
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