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)

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

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

STRUCTURE OF THE SYLLABUS (SEM-II)

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

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

STRUCTURE OF THE SYLLABUS (SEM-III)

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

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

STRUCTURE OF THE SYLLABUS (SEM-IV)

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

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 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.

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 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.

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 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.

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 (10)

Practical Notebook and Viva Voce (5)

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 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.

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 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.

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 imaginary, Geometric Characteristics of Thermal Scanner Imaginary, 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 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.

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 (φ, λ, 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 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.

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, Skew ness, 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. 5marks 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
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: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.

Topic to be covered *Software to be used	PG	AG	MI	Oth
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 [thiessen 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: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. 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 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.

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 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.

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 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.

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 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. 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 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.

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 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.

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 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.

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 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.

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 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.

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 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.

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. Geoinformtics 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 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.

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 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.

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 GISElectricity, 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: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.

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 REFRENCES:

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3. Lillesand, T.M. and Kieffer, R.W., 2003. Remote Sensing and Image Interpretation, 5th Edition., Wiley, New York
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3. Campbell J.B. (2002) Introduction to Remote Sensing, 3rd ed., The Guilford Press.
4. Canada Center for Remote Sensing, Remote Sensing Tutorial
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6. Curran, P.J. (1980) Mulltispectral remote sensing of vegetation amount, Progress in Physical Geography, 4:315
7. Curran, P.J. (1988) Principles of Remote Sensing, ELBS Edn. Longman Group UK Ltd.
8. Guha, P.K. (2003) Remote Sensing for the Beginner, Affiliated East-West Press Pvt. Ltd., New Delhi
9. Jensen J.R. (2005) Digital Image Processing: A Remote Sensing Perspective, 3rd ed., Prentice Hall.
10. Jensen J.R. (2007) Remote Sensing of the Environment: An Earth Resource Perspective, 2nd ed., Prentice Hall.
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RSG-102: FUNDAMENTALS OF GIS & DIGITAL CARTOGRAPHY

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RSG-103: PHOTOGRAMMETRY, SURVEYING AND GPS

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RSG-104: COMPUTER FUNDAMENTALS & PROGRAMMING

TEXT BOOKS:

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RSG-202: ADVANCE REMOTE SENSING

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RSG-203: ADVANCE GEOGRAPHIC INFORMATION SYSTEM

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RSG-204: FUNDAMENTAL STATISTICAL CONCEPTS & GEO- STATISTICS

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RSG-301: APPLICATION OF GEOINFORMATICS & SPATIAL DECISION SUPPORT SYSTEMa

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1. An Introduction to Database Systems by C.J.Date, A. Kannan S. Swamynathan (8th Ed.), Pearson Education, 2009.
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RSG-302: RESEARCH METHODOLOGY & PROJECT MANAGEMENT

TEXT BOOKS:

1. Kothari, C. R., 1985. Research Methodology: Methods and Techniques, New Age International Pvt. Ltd.
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RSG-303 AND 304: SPECIAL PAPERS

GEOINFORMATICS IN COASTAL MANAGEMENT

1. Carter, R. W. G., 1989. Coastal Environments: An Introduction to Physical, Ecological and Cultural Systems of Coastlines, Academic Press Ltd.
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GEOINFORMATICS IN EARTH SCIENCES

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GEOINFORMATICS IN URBAN, RURAL DEVELOPMENT & REGIONAL PLANNING

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GEOINFORMATICS IN FOREST MANAGEMENT

2. Baretl, E.C. and Culis I.F. Introduction to Environmental Remote Sensing, Second edition, Chapman and Hall, New York, 1993.
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GEOINFORMATICS IN TRANSPORT NETWORK ANALYSIS

1. Network Analysis in Geography. St Martin's Press Haggett P, Chorley R J
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