Vidyasagar University
Midnapore-721102, West Bengal

The SYLLABUS for
POST-GRADUATE Programme
in

REMOTE SENSING & GEOGRAPHIC INFORMATION SYSTEM (RS & GIS)

Under Choice Based Credit System (CBCS)
(Semester Programme)

[w.e.f. 2022-23]

Brief history

Remote Sensing and GIS has been developed as a powerful technology for mapping and analyzing earth resources. Although it has been widely used as a mapping tool and well-known for its application in various fields of earth sciences, but it has emerged as a new subject with immense potentiality and opportunity in recent days. The Department of Remote Sensing and Geographical Information System was established in 2003 with the view to cater the increasing demand of qualified and skilled manpower in this rapid growing field. It is one of the first Remote Sensing & GIS departments in West Bengal to start the course of Remote Sensing and GIS at Post Graduate and Doctoral levels. The Alumni of this Department have occupied responsible positions in India and abroad. Our students have unique opportunity to undertake their dissertation collaboratively with renowned state and central government agencies and research institutes and they are encouraged to carry out innovative research during their project period. Several Remote Sensing and GIS related Research and Consultancy Projects have been undertaken by the faculty members of the Department.

Program Outcomes (POs)

The Master of Science (M.Sc.) degree is designed to produce postgraduate students who are highly skilled, knowledgeable, and responsive to the demands of their respective fields. The core program outcomes (POs) for M.Sc. graduates are as follows:

- Advanced Knowledge: Graduates gain an in-depth understanding of their specific field of study, including theoretical foundations, practical applications, and current trends.
- Research Skills: Students develop robust research skills, enabling them to formulate, design, and conduct scientific research. This includes proficiency in using modern research methodologies, critical analysis, and data interpretation.
- Technical Proficiency: They are trained in the use of advanced tools and technologies relevant to their discipline, enhancing their analytical and problem-solving capabilities.
- Communication Skills: M.Sc. graduates are equipped with the skills to effectively communicate complex information in a clear and concise manner, both in writing and verbally, to both specialist and non-specialist audiences.
- Ethical Practices: Students are instilled with a strong sense of ethical responsibility, ensuring that their professional activities are conducted with integrity and adhere to applicable standards and regulations.
- Professional Competence: Graduates demonstrate the ability to work independently and as part of a team, managing projects efficiently and making informed decisions that reflect expert knowledge and judgment.
- Innovation and Creativity: The program encourages innovation and critical thinking, enabling graduates to contribute novel solutions to problems in their fields.
- Lifelong Learning: Graduates are prepared to engage in continuous learning, adapting to changes and pursuing further educational opportunities to remain relevant in their professions.

These outcomes prepare graduates not only to excel in their immediate roles but also to contribute effectively to the advancement of their fields and to address broader societal challenges.

Programme Specific Outcomes

The Master of Science (M.Sc.) degree in Remote Sensing and Geographic Information Systems (GIS) equips students with a comprehensive skillset and knowledge base that prepares them for diverse professional roles and further research in the field. The specific program outcomes include:

- Technical Proficiency: Graduates will demonstrate advanced proficiency in the principles and applications of remote sensing and GIS. This includes competency in data acquisition, processing, analysis, and interpretation.
- Analytical Skills: Students will develop strong analytical skills, enabling them to tackle complex spatial problems using geospatial technologies. They learn to integrate multiple data sources and apply quantitative and qualitative analysis techniques.
- Problem-Solving Abilities: The curriculum fosters the ability to design and implement GIS projects and remote sensing campaigns that address real-world issues, emphasizing strategic problem-solving and decision-making skills.
- Research Capability: Graduates will be capable of conducting independent research, utilizing advanced tools and methodologies in remote sensing and GIS. This includes designing research proposals, managing projects, and synthesizing findings coherently.
- Technological Adaptability: Keeping pace with rapid technological advancements in the field, students will gain proficiency in the latest remote sensing software and GIS tools, ensuring they remain adaptable and industry-relevant.
- Communication Skills: Effective communication is pivotal, and graduates will be adept at presenting complex geospatial information to diverse audiences, including scientists, policymakers, and the general public.
- Professional Development: The program prepares students for a professional career in various sectors, including government, academia, private industry, and non-profit organizations, by inculcating a strong ethos of ethical practice and continuous professional development.
- Collaborative Experience: Through collaborative dissertations and projects with state and central government agencies, as well as renowned research institutes, students gain valuable teamwork and leadership experience.

These outcomes ensure that graduates not only enter the workforce as highly qualified GIS and remote sensing professionals but also contribute innovatively to their fields of expertise.

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)

M. Sc in RS & GIS

SEMESTER	COURSE CODE	COURSE TITLES		Full Marks	No of Lectures (hours)	CREDIT (Lecture – Tutorial - Practical) (L-T-P)
I	RSG 101	FUNDAMENTALS OF REMOTE SENSING		50	40	4(3-1-0)
		RSG 101.1	FUNDAMENTALS & PHYSICS OF REMOTE SENSING	25		
		RSG 101.2	PLATFORMS AND SENSORS	25		
	RSG 102	FUNDAMENTALS OF GIS AND DIGITAL CARTOGRAPHY		50	40	4(3-1-0)
		RSG 102.1	FUNDAMENTALS OF GEOGRAPHIC INFORMATION SYSTEM	25		
		RSG 102.2	DIGITAL CARTOGRAPHY	25		
	RSG 103	PHOTOGRAMMETRY, GEODESY, SURVEYING AND NAVIGATIONAL SATELLITE SYSTEM		50	40	4(3-1-0)
		RSG 103.1	PHOTOGRAMMETRY AND GEODESY	25		
		RSG 103.2	SURVEYING AND NAVIGATIONAL SATELLITE SYSTEM	25		
	RSG 104	COMPUTER BASICS AND PROGRAMMING		50	40	4(3-1-0)
		RSG 104.1	COMPUTER BASICS	25		
		RSG 104.2	PROGRAMMING LANGUAGES	25		
	RSG 195	PHOTOGRAMETRY, GEODESY AND IMAGE INTERPRETATION (practical)		25	40	2(0-0-4)
	RSG 196	FUNDAMENTALS OF GIS (practical)		25	40	2(0-0-4)
	RSG 197	COMPULSORY FIELD SURVEY (practical)		25	40	2(0-0-4)
	RSG 198	COMPUTER FUNDAMENTALS AND PROGRAMMING (practical)		25	40	2(0-0-4)
		TOTAL		300	320	24
II	RSG 201	DIGITAL IMAGE PROCESSING AND INFORMATION EXTRACTION		50	40	4(3-1-0)
		RSG 201.1	DIGITAL IMAGE PROCESSING	25		
		RSG 201.2	INFORMATION EXTRACTION FROM SATELLITE IMAGES	25		
	RSG 202	ADVANCED REMOTE SENSING		50	40	4(3-1-0)
		RSG 202.1	THERMAL AND MICROWAVE REMOTE SENSING	25		
		RSG 202.2	HYPERSPECTRAL REMOTE SENSING AND LIDAR	25		
	RSG 203	ADVANCED GEOGRAPHIC INFORMATION SYSTEM		50	40	4(3-1-0)
		RSG 203.1	GIS DATA ANALYSIS	25		
		RSG 203.2	MODELING SPATIAL DATABASE AND ANALYSIS	25		
	C-RSG 204	FUNDAMENTALS OF GEOSPATIAL TECHNOLOGY(CBCS)		50	40	4(3-1-0)
		C-RSG 204.1	FUNDAMENTALS OF REMOTE SENSING AND PHOTOGRAMMETRY	25		
		C-RSG 204.2	FUNDAMENTS OF GEOGRAPHIC INFORMATION SYSTEM AND NAVIGATIONAL SATELLITE SYSTEM	25		
	RSG 295	DIGITAL IMAGE PROCESSING (practical)		25	40	2(0-0-4)
	RSG 296	ADVANCED REMOTE SENSING: DATA PROCESSING AND APPLICATION (practical)		25	40	2(0-0-4)
	RSG 297	ADVANCED GEOGRAPHIC INFORMATION SYSTEM (practical)		25	40	2(0-0-4)
	RSG 298	MODELING SPATIAL DATABASE AND ANALYSIS (practical)		25	40	2(0-0-4)
		TOTAL		300	320	24
III	RSG 301	APPLICATION OF GEO-INFORMATICS, SPATIAL DATA SCIENCE AND SDSS		50	40	4(3-1-0)
		RSG 301.1	APPLICATION OF GEO-INFORMATICS	25		
		RSG 301.2	SPATIAL DATA SCIENCE AND SDSS	25		
	RSG 302	FUNDAMENTAL OF RESEARCH AND GEOSTATISTICS		50	40	4(3-1-0)
		RSG 302.1	FUNDAMENTAL OF RESEARCH AND GEOSPATIAL PROJECT MANAGEMENT	25		
		RSG 302.2	GEOSTATISTICS	25		

SEMESTER	COURSE CODE	COURSE TITLES		Full Marks	No of Lectures (hours)	CREDIT (Lecture – Tutorial - Practical) (L-T-P)
	SPECIAL PAPER					
	RSG 303	RSG 303A	GEO-INFORMATICS IN COASTAL MANAGEMENT	50	40	4(3-1-0)
			RSG 303A. 1 THEORETICAL CONSIDERATIONS	25		
			RSG 303A.2 POTENTIAL APPLICATION AREAS OF RS /GIS	25		
		RSG 303B	GEO-INFORMATICS IN WATERSHED MANAGEMENT			
			RSG 303B.1 WATER RESOURCES AND WATERSHED MANAGEMENT			
			RSG 303B.2 REMOTE SENSING IN WATER RESOURCE EVALUATION			
		RSG 303C	GEO-INFORMATICS IN EARTH SCIENCES			
			RSG 303C.1 FUNDAMENTALS OF EARTH SYSTEM			
			RSG 303C.2 APPLICATION OF GEO-INFORMATICS IN EARTH SCIENCE			
		RSG 303D	GEO-INFORMATICS IN DISASTER MANAGEMENT			
			RSG 303D.1 FUNDAMENTAL CONCEPTS OF HAZARDS AND DISASTERS			
			RSG 303D.2 APPLICATION OF GEO-INFORMATICS IN HAZARDS AND DISASTERS MANAGEMENT			
		RSG 303E	GEO-INFORMATICS IN SOIL AND AGRICULTURE			
			RSG 303E.1 FUNDAMENTAL CONCEPTS OF SOIL AND AGRICULTURAL SCIENCE			
			RSG 303E.2 APPLICATION OF GEO-INFORMATICS IN SOIL AND AGRICULTURE			
		RSG 303F	GEO-INFORMATICS IN URBAN, RURAL DEVELOPMENT & REGIONAL PLANNING			
			RSG 303F.1 THEORETICAL CONSIDERATIONS			
			RSG303F.2 POTENTIAL APPLICATION AREAS OF RS / GIS			
		RSG 303G	GEO-INFORMATICS IN EVIRONMENTAL SCIENCE AND MANAGEMENT			
			RSG 303G.1 THEORETICAL CONSIDERATIONS			
			RSG 303G.2 APPLICATION OF REMOTE SENSING AND GIS			
		RSG 303H	GEO-INFORMATICS IN RESOURCE MANAGEMENT			
			RSG 303H.1 CONCEPTS IN RESOURCES			
			RSG 303H.2 APPLICATION OF REMOTE SENSING AND GIS IN RESOURCE MANAGEMENT			
		RSG 303I	GEO-INFORMATICS IN TRANSPORT NETWORK ANALYSIS			
			RSG 303I.1 CONCEPTS IN TRANSPORTATION			
			RSG 303I.2 APPLICATION OF REMOTE SENSING AND GIS IN TRANSPORTATION			
		RSG 303J	GEO-INFORMATICS IN UTILITY MANAGEMENT			
			RSG 303J.1 CONCEPTS OF UTILITY MANAGEMENT			

			RSG 303J.2	APPLICATION OF REMOTE SENSING AND GIS IN UTILITY MANAGEMENT		40	
	C-RSG 304	*ADVANCED* REMOTE *SENSING AND AREAS OF APPLICATIONS (CBCS)*			50		4(3-1-0)
		C-RSG 304.2	*ADVANCED REMOTE SENSING* TECHNIQUES		25		
		C-RSG 304.2	*APPLICATIONS* OF GEO-INFORMATICS		25		
	RSG 395	APPLICATION OF GEO-INFORMATICS AND SPATIAL DECISSION SUPPORT SYSTEM			25	40	2(0-0-4)
	RSG 396	GENERATION OF CASE STUDIES			25	40	2(0-0-4)
	RSG 397	GEOSTATISTICS			25	40	2(0-0-4)
	RSG 398	PRACTICAL (based on Spl. Paper) (RSG 398A, RSG 398B, RSG 398C, RSG 398D, RSG 398E, RSG 398F, RSG 398G, RSG 398H, RSG 398I, RSG 398J)			25	40	2(0-0-4)
	TOTAL				300	320	24
IV	RSG 401	DISSERTATION AND VIVA					
		RSG 401.1	DISSERTATION EXAMINATION		100	80	8(0-0-8)
		RSG 401.2	DISSERTATION-VIVA		100	80	8(0-0-8)
	RSG 402	GRAND -VIVA			100	80	8(0-0-8)
	TOTAL				300	240	24
	GRAND TOTAL				**1200**	**1200**	**96**

The total credit for the course is 96 and the total mark is 1200.

Distinctive features of course content:

- **Value-added course: RSG 104, 198**
- **Employability / entrepreneurship/ skill development: RSG 101.1; 102; 202; 301.2; 195; 196; 296; 297; 298; 395; 401; 402**
- **Ethics, environment & sustainability: RSG 301.1; 302.1; 304.2**
- **The new course introduced: RSG 204; 304**
- **Field Survey (academic excursion): RSG 197, 396**
- **Internship (optional): RSG 401**

STRUCTURE OF THE SYLLABUS (SEM-I)

Type	Name of Paper	Paper /Module No.		Subject	Marks	Credits	Exam Time
THEORETICAL	FUNDAMENTALS OF REMOTE SENSING	**RSG 101**	RSG 101.1	Fundamentals & Physics of Remote Sensing	20	4	2 hrs
			RSG 101.2	Platforms and Sensors	20		
				Internal Assessment	10		
	FUNDAMENTALS OF GIS &DIGITAL CARTOGRAPHY	**RSG 102**	RSG 102.1	Fundamentals of Geographic Information System	20	4	2 hrs
			RSG 102.2	Digital Cartography	20		
				Internal Assessment	10		
	PHOTOGRAMMETRY, GEODESY, SURVEYING AND NAVIGATIONAL SATELLITE SYSTEM	**RSG 103**	RSG 103.1	Photogrammetry and Geodesy	20	4	2 hrs
			RSG 103.2	Surveying and Navigational Satellite System	20		
				Internal Assessment	10		
	COMPUTER BASICS AND PROGRAMMING	**RSG 104**	RSG 104.1	Computer Basics	20	4	2 hrs
			RSG 104.2	Programming languages	20		
				Internal Assessment	10		
PRACTICAL		**RSG 195**		Photogrammetry, Geodesy and Image Interpretation	25	2	4 hrs
		RSG 196		Fundamentals of GIS	25	2	4 hrs
		RSG 197		Compulsory Field Survey	25	2	4 hrs
		RSG 198		Computer Programming and Statistics	25	2	4 hrs

STRUCTURE OF THE SYLLABUS (SEM-II)

Type	Name of Paper	Paper /Module No.		Subject	Marks	Credits	Exam Time
THEORETICAL	DIGITAL IMAGE PROCESSING AND INFORMATION EXTRACTION	**RSG 201**	RSG 201.1	Digital Image Processing	20	4	2 hrs
			RSG 201.2	Information Extraction from Satellite Images	20		
				Internal Assessment	10		
	ADVANCED REMOTE SENSING	**RSG 202**	RSG 202.1	Thermal and Microwave Remote Sensing	20	4	2 hrs
			RSG 202.2	Hyperspectral Remote Sensing and LIDAR	20		
				Internal Assessment	10		
	ADVANCED GEOGRAPHIC INFORMATION SYSTEM	**RSG 203**	RSG 203.1	GIS Data Analysis	20	4	2hrs
			RSG 203.2	Modeling Spatial Database and Analysis	20		
				Internal Assessment	10		
	CBCS I: FUNDAMENTALS OF GEOSPATIAL TECHNOLOGY	**C-RSG 204**	C-RSG 204.1	Fundamentals of Remote Sensing & Photogrammetry	20	4	2 hrs
			C-RSG 204.2	Fundamentals of Geographic Information System & Navigational Satellite System	20		
				Internal Assessment	10		
PRACTICAL		**RSG 295**		Digital Image Processing	25	2	4 hrs
		RSG 296		Advanced Remote Sensing: Data Processing & Applications	25	2	4 hrs
		RSG 297		Advanced Geographic Information System	25	2	4 hrs
		RSG 298		Modeling Spatial Database and Analysis	25	2	4 hrs

STRUCTURE OF THE SYLLABUS (SEM-III)

Type	Name of Paper	Paper /Module No.		Subject	Marks	Credits	Exam Time
THEORETICAL	APPLICATION OF GEOINFORMATICS, SPATIAL DATA SCIENCE & SDSS	**RSG 301**	**RSG 301.1**	Application of Geo-informatics	20	4	2 hrs
			RSG 301.2	Spatial Data Science and SDSS	20		
			Internal Assessment		10		
	FUNDAMENTAL OF RESEARCH &GEOSTATISTICS	**RSG 302**	**RSG 302.1**	Fundamental of Research and Geospatial Project Management	20	4	2 hrs
			RSG 302.2	Geostatistics	20		
			Internal Assessment		10		
	ELECTIVE PAPER	**RSG 303**	**RSG 303.1**	*Elective Special paper*	20	4	2 hrs
			RSG 303.2	*Elective Special paper*	20		
			Internal Assessment		10		
	CBCS II: ADVANCED REMOTE SENSING AND AREAS OFAPPLICATIONS	**RSG 304**	**RSG 304.1**	Advanced Remote Sensing Techniques	20	4	2 hrs
			RSG 304.2	Application of Geo-Informatics	20		
			Internal Assessment		10		
PRACTICAL		**RSG 395**		Application of Geo-Informatics and Spatial Decision Support System	25	2	4 hrs
		RSG 396		Generation of Case Studies (Compulsory Field study)	25	2	4 hrs
		RSG 397		Geostatistics	25	2	4 hrs
		RSG 398		*Elective Special paper*	25	2	4 hrs

STRUCTURE OF THE SYLLABUS (SEM-IV)

Type	Name of Paper	Paper /Module No.		Subject	Marks	Credit	Exam Time
THEORETICAL	DISSERTATION	RSG 401	RSG 401.1	Dissertation (Examination)	100	8	
			RSG 401.2	Dissertation (Viva)	100	8	
		RSG 402		Grand Viva	100	8	

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

RSG 303A: Geoinformatics in Coastal Management

RSG 303B: Geoinformatics in Watershed Management

RSG 303C: Geo-informatics in Earth Sciences

RSG 303D: Geo-informatics in Disaster Management

RSG 303E: Geoinformatics in Soil and Agriculture

RSG 303F: Geoinformatics in Urban, Rural Development & Regional Planning

RSG 303G: Geoinformatics in Environmental Science & Management

RSG 303H: Geoinformatics in Resource Management

RSG 303I: Geoinformatics in Transport Management

RSG 303J: 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.**
- **Field work is compulsory for Students of semester – I and III**
- **Internal assessment will be based on seminar presentation, class tests, quiz and assignments.**
- **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 40. 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.

Course Outcome: Students will understand the various sources of energy, their properties, interaction mechanisms, and use in remote sensing studies. They will be able to discuss the broad application areas of remote sensing technology. They will understand the forces involved in maintaining the satellite orbits. They will able to solve related numeric problems. They will understand the differences in satellite types, payloads/ sensors, their working principles, data capturing, storing and transmission processes. They will understand the properties and use of different satellite data.

RSG 101.1:
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

RSG 101.2:
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. Semi synchronous 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 40. 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.

Course Outcome: Students will be able to differentiate the spatial and non-spatial data, data format and types, data capturing, storing and processing steps, application, advantages and disadvantages of GIS. They will be able to explain the digital cartography system, application and components, projection systems, digital mapping units; and generate digital surface.

RSG 102.1:

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

Fundamentals of Geographic Information System:

i. *Basic Concepts:* definition of GIS, Components of GIS, Areas of GIS application, Advantage and Limitation of GIS

ii. *GIS Data:* Spatial and Attribute Data, Analog vs. Digital data, Spatial/Graphical elements of GIS

iii. *Information Organization and Data Structures:* Raster and Vector data structures, advantages and disadvantages

iv. Nature and Source of data in GIS: Spatial and Attribute data capture and linking

v. *Creating GIS Database:* GIS Software, file organization and formats, Rectification; Methods of Data Input: Keyboard entry, Manual digitizing, Semi-automatic digitizing, Automatic digitizing, Geocoding, Map Composition

vi. *Data Editing:* Detecting and correcting errors, Re-projection, Transformation and Generalization, Edge matching and Rubber sheeting, Topology

vii. *Modern Trends in GIS:* 3D GIS, Web GIS and Mobile GIS

RSG 102.2:

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

Digital Cartography:

i. *GIS and Digital Cartography*: Concept of Digital Cartography, Advantages and Disadvantages of Digital Cartography

ii. *Concept of Map:* Defining Map, Classification of maps, Map Scales, Coordinate System and Projections, Lambert Conformal Conic (LCC) and Universal Transverse Mercator (UTM) projection

iii. *Measurement of Geographic Variables:* Nominal, Ordinal, Interval and Ratio Scales

iv. *Types of data*: Qualitative vs. Quantitative data, Discrete vs. Continuous data, Absolute vs. Derived data

v. *Digital Mapping:* Cartographic Design, Concept of Visual Variables (Shape, Size, Orientation, Hue, Value, Chroma, Pattern), RGB colour model, Symbols, Map Lettering, Map Compilation, Map Generalization (Classification, Simplification, Exaggeration, Symbolization, Induction)

vi. Mapping Statistical Surface: Dot map, Choroplethic and Isarithmic Mapping, Dasymetric

Mapping, Multivariate and Dynamic Mapping

Internal Assessment (10)

RSG 103: (*Examination Time: 2 hours)*
PHOTOGRAMMETRY, GEODESY, SURVEYING AND GPS: (50marks)

Full Marks50. Number of lectures to be delivered for this paper is 40. 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.

Course Outcome: Students will understand the basics of old and modern photographic systems, aerial photography, the principles and measurement procedures, 3-D mapping, height estimation, flight planning etc. They will be able to generate traditional, modern digital, and Satellite Navigational System surveying data using high end equipment and devices; and they will be able to analyse such data using powerful computer systems. They will also learn the uses and limitations of such systems.

RSG 103.1:

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

Photogrammetry and Geodesy:

i. *Introduction:* Historical Development and Fundamentals of aerial photography, Scale, Geometry and Ground Coverage of Aerial Photographs, Area calculation & Flight Planning.
ii. Binocular and Stereoscopic vision, Conditions for Stereovision, Photographic overlap Image Parallax, Height determination from stereo pairs - Parallax Equation.
iii. Rectification, Ortho Rectification, Digital Elevation Model (DEM), Digital orthophotos. Unmanned aerial vehicles (UAV).
iv. The Planet Earth, Geoids, Concept of Spherical Geometry and Geodesy, Reference Spheroid and Mean Sea Level
v. Introduction to different spheroid / ellipsoid systems with special reference to Everest and WGS-84 - Geometric Constants

RSG 103.2:

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

Surveying and Navigational Satellite 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; Total Station
iii. *Global Navigational Satellite System:* Introduction, Satellite constellation, GPS signals and data, Geopositioning-Basic Concepts. GPS, NAVSTAR, GLONASS, Indian Regional Navigational Satellite System (IRNSS), Control Segment, Space Segments, User Segment, GPS Positioning Types- Absolute Positioning, Differential positioning
iv. *GPS Surveying Methods and Accuracy:* Methods, DGPS-GPS Data Processing and Accuracy, Factors Affecting GPS Accuracy
v. *Reference Station:* Selection of Reference Station, Reference Station Equipment: GPS receiver, GPS antenna. Radio and its types, Radio Antenna.

Internal Assessment (10)

RSG 104: (*Examination Time: 2 hours)*

COMPUTER PROGRAMMING AND STATISTICS (50marks)

Full Marks50. Number of lectures to be delivered for thispaper is 60. 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 t o have at least two parts in Group A& Group B.

Course Outcome: Students will learn the basics traditional, modern digital surveying methods, and satellite navigational system using high end equipment, devices and powerful computer systems. They will also learn the uses and limitations of such systems. They will be able to analyse the data using basic and advanced statistical methods, distribution functions. They will be able to apply the mathematical functions in geospatial data, and to derive important information from it.

RSG 104.1:

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

Computer Basics:

i. Introduction to Computers, Data representation, Conversion of data. Memory organization, Different secondary storage devices and media devices

ii. *Data Representation*: Representation of Characters in Computers, Representation of Integers, Fractions, Hexadecimal Representation of Numbers, Decimal to Binary and vice-versa conversion.

iii. *Information Technology and Operating System:* Information Technology Infrastructure Hardware, software, Systems Application software, Enterprise software, Operating System Concepts, Files, Directories, Process and Memory management.

RSG 104.2:

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

Programming Language:

i. *Introduction to Programming:* Basic concepts, program constructions – flowcharts, algorithms, pseudo codes, data structures – array, stacks, queues, etc., approaches to programming – top-down, bottom-up approach, divide & conquer, modular programming.

ii. *Object oriented programming:* Concept of objects and class, functions, Constants & Variables

iii. *Programming in Python:* Introduction to Python programming language, basic functions and keywords of Python, arithmetic operations using Python, Input-Output statements, Data types in Python, convert between different data types. Variables, reference to variables. Functions in detail, definition, passing parameters, and return information. Concepts of code reuse, code style, and refactoring complex code, effectively using code comments. Equality and logical operators, complex branching scripts using if statements. Loops in programming.

iv. *Advanced data types:* lists, tuples, and dictionaries. Storing, referencing, and manipulating data in these structures, combining them to store complex data structures.

v. Using libraries in Python, Formatting input and output, plotting, Reading and writing text and image files, accessing Spatial Databases available for natural resources and Terrain.

Internal Assessment (10)

SEM -I PRACTICAL

RSG 195 (Practical)

PHOTOGRAMETRY AND 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.

Course Outcome: Students will be able to process satellite image, aerial photographs, basic GIS data, and digital survey data using multiple image processing and GIS software. They will be able to solve the problems applying statistics in advance statistical and programming platform in the modern computer systems.

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. (5)

ii. 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 equipment -Radiometer, Spectrophotometer, Use of spectro-radiometer for ground truth.

Topic to be covered	
File export import/ translation, Conversion of file formats	**Available Software's**
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	

(15)

Practical Notebook and Viva Voce (5)

RSG 196 (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	
Creating Geo-Database: Import, Export, subset	**Available Software's**
Managing Geo-Database, Geo-referencing & Changing Projection	
Digitization: Point, Line, Polygon	
Managing attribute table and thematic mapping	
Map composition and representation	

(20)

Practical Notebook and Viva Voce

(5)

RSG 197 (Practical)

COMPULSORY FIELD SURVEY (25 marks)

Full Marks: 25. Compulsory field survey

Field survey and field report preparation (compulsory) using following methods

i. Preparation of Base map from Survey of India Toposheets, Use of India topographical sheets for delineation of different features.
ii. 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
iii. Field validation of satellite imagery. (20)
iv. Viva voce and Report presentation (5)

RSG 198 (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: MSDOS Commands, Windows 7
ii. Office Application: Word, Spreadsheet and Slides
iii. Image Management: Scanning, Image format, Export and Import
iv. Python: Basics, Statements, Data types, logical operator, branching, Looping, functions, plotting, reading and writing files. (20)

Practical Notebook and Viva Voce (5)

SEM II PAPERS

SEM -II THEORY

RSG 201: (*Examination Time: 2 hours)*
DIGITAL IMAGE PROCESSING & INFORMATION EXTRACTION (50 marks)

Full Marks50. Number of lectures to be delivered for this paper is 40. 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.

Course Outcome: Students will be able to access the satellite image data, can apply preprocessing tools. They will learn the background algorithms, applications of such algorithms in data processing, and image analysis. They will be able to access and analyse the satellite and ground data. They will be able to apply basic and advance image classification algorithm to generate various information from the satellite data.

RSG 201.1:

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

Digital Image Processing:

i. *Introduction:* Definition of digital image, Source of Data, 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; Initial Statistics Extraction: Univariate& Multivariate Image Statistics, Band Correlation, Statistical Evaluation of Image Quality Parameters

RSG 201.2:

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

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, Object Based Classification. *Accuracy Assessment:* Reference Data, Sampling techniques, Error of Commission and Omission, Error Matrix, Kappa Statistics and Change Detection Analysis

Internal Assessment (10)

RSG 202: (*Examination Time: 2 hours)*

ADVANCED REMOTE SENSING (50 marks)

Full Marks50. Number of lectures to be delivered for this paper is 40. 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.

Course Outcome: Students will be able to explain the energy-matter interaction mechanisms in thermal and microwave region of the EM spectrum, the information acquires using such imaging systems, the properties of such image data, and their data processing methodology. They will be able to differentiate the multispectral from hyperspectral imaging systems, their advance capability of information generation, the methods and tools for analysing the hyperspectral data, their application areas and limitations.

RSG 202.1:

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

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, Microwave Remote Sensing and its advantages, Active and Passive Microwave Systems

iv. Attenuation of Microwave, Surface Scattering, Volume Scattering, Types of Antenna, Platforms and sensors, RADAR Environmental Considerations: Surface Roughness Characteristics, Electrical Characteristics, Vegetation and Water response to Microwave energy

v. Radar Operation, Polarization, Spatial Resolution, Radar Image Geometry, Relief Displacement, Shadows and Speckle effect, Side Looking Airborne Radar (SLAR) Operation, Synthetic Aperture Radar (SAR), Differential Interferometry, Applications

RSG 202.2:

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

Hyperspectral Remote Sensing and LIDAR:

i. *Hyperspectral Remote Sensing:* Basic Concept, Advantages and Disadvantages, Multispectral vs. Hyperspectral Remote Sensing, Basic principles of Spectroscopy, Hyperspectral sensors and platforms, Sensor specifications

ii. *Hyperspectral Data Processing and Information Extraction:* Atmospheric Corrections-Empirical and Physics based Approaches, Bad band and Bad line removal; Information extraction: Endmember collection, Minimum Noise Fraction, Pixel Purity Index, N-D visualizer, ground truthing through Spectro-radiometer, Image Classification techniques

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

v. *Applications of LIDAR Data:* Areas of Applications with special reference to Vegetation and Urban Infrastructure

Internal Assessment (10)

RSG 203: (*Examination Time: 2 hours)*

ADVANCED GEOGRAPHIC INFORMATION SYSTEM (50 marks)

Full Marks 50. Number of lectures to be delivered for this paper is 40. 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.

Course Outcome: Students will be familiar with advance GIS data analysis, identifying the sources of errors in such data, and various approaches to minimize the data shortcoming. They will be able to understand the concept of spatial database management, spatial analysis and overlay operations in GIS.

RSG 203.1:

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

GIS Data Analysis:

i. *Data Storage:* Spaghetti Model, Topological Model, Quadtree
ii. *Database Modelling:* Hierarchical Model, Network Model, Relational Model
iii. *Data Organization:* Chain Coding, Run-length Coding, Block Coding
iv. *Data Quality in GIS:* Uncertainty in GIS data, Positional and Attribute Accuracy, Logical consistency, Completeness Lineage,
v. *Errors in GIS:* Sources of Errors in GIS data base: Obvious sources from natural variations & original measurements, Errors through processing, errors associated with overlaying of polygons, Data Quality parameters

RSG 203.2:

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

MODELING SPATIAL DATABASE AND ANALYSIS

i. Role of databases in GIS, Methods of GIS analysis, Selection of GIS applications, Basics of the Geodatabase Model Geodatabase concepts.
ii. Database Structure, Types of Geo-database used in GIS
iii. *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
iv. Data Manipulation Techniques, Overlay Operations and Buffering, Neighbourhood functions, Interpolation methods, Methods of Spatial analysis.
v. Introduction to Modeling & Flowcharting, Map Algebra - Operators & Operations, Functional Operations, Modeling Essentials

Internal Assessment (10)

RSG 204: (*Examination Time: 2 hours)*

CBCS- I: FUNDAMENTALS OF GEOSPATIAL TECHNOLOGY (50marks)

Full Marks: 50. Number of lectures to be delivered for this paper is 40. 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

Course Outcome: Students will have the concept of satellite data collection, use of such system in mapping and monitoring of various earth surface processes, uses in planning, management and policy making processes. They will be able to understand the variables used in GIS, their sources, their processing or analysing and representation methods. They will also learn the principles, uses, and limitations of satellite navigational system.

RSG 204.1:

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

Fundamentals of Remote Sensing & Photogrammetry:

i. *Concept and Scope of Remote Sensing:* Definitions, Process and Characteristics of Remote Sensing System, Advantages and limitations. Concept of Electromagnetic Radiation (EMR)
ii. *Sensor System* - Framing and Scanning System, Whiskbroom scanners, Push-broom scanners, Platforms and Sensors,
iii. Concept of False Colour Composites. Orbits and Orbital Characteristics
iv. *Introduction:* Historical Development and Fundamentals of aerial photography, Scale, Geometry and Ground Coverage of Aerial Photographs, Area calculation & Flight Planning.
v. Binocular and Stereoscopic vision, Conditions for Stereovision, Photographic overlap Image, Ortho Rectification

RSG 204.2:

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

Fundamentals of Geographic Information System &Navigational Satellite System:

i. *Basic Concepts:* Definition and Components of GIS, application, Advantages and Limitations of GIS
ii. *GIS Data:* Spatial and Attribute Data, Raster and Vector data structures
iii. *Creating GIS Database:* Sources of Data in GIS, GIS Data Input, Rectification, Methods of Digitization, Map Composition
iv. *Global Navigational Satellite System:* Introduction, Satellite constellation, GPS signals and data, Basic Concepts of NAVSTAR, GLONASS, IRNSS)
v. *Applications:* Mobile Mapping basic concepts and Applications, GNSS Application in Surveying and Mapping

Internal Assessment (10)

SEM -II PRACTICAL

Course Outcome: Students will be able to analyse the advanced satellite and other geospatial data. They will be also able to solve various problems in a geospatial environment using various data processing platforms in modern computer systems.

RSG 295 (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	
Geometric and Atmospheric Correction	**Available Software's**
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 296 (Practical)
ADVANCED 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	
Atmospheric and Radiometric Correction, Image enhancement and filtering of multispectral optical data	**Available Software's**
Hyperspectral data processing, Bad band and bad line removal, FLAASH model, Endmember collection, MNF, PPI	
Image classification (Unsupervised, Supervised and advanced)	
Accuracy assessment, Class separability & contingency Matrix	
Stereo-SAR DEM generation, Rader image interpretation: Speckle suppression, Interferogram generation, Texture analysis, Texture& Object based classification.	

(20)

Practical Notebook and Viva-Voce (5)

RSG 297 (Practical)
ADVANCED GIS (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	
Vector data Export, Vector Editing, Managing Attribute Table, Thematic Maps	
Charts and Diagrams generation Select and Query in vector layers, Use of SQL,	

Network, Neighbourhood, Buffer, Proximity [Thiessen polygon]	**Available Software's**
Topographic & Morphometric analysis: Contours & Isopleths generation.	

(20)

Practical Notebook and Viva Voce (5)

RSG 298 (Practical)

MODELING SPATIAL DATABASE AND ANALYSIS (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	
Image to Image Geo-referencing, Creation of Different types of Geo-Data base, Topology building	**Available Software's**
Errors Inspections, Corrections of errors in spatial database, Data manipulation techniques	
GIS based models: DEM, DTM, TIN etc.	
Different environmental modelling: NDVI, NDBI, SAVI, NDWI, TWI etc.	

(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 DECISION SUPPORT SYSTEM (50marks)

Full Marks50. Number of lectures to be delivered for this paper is 40. 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.

Course Outcome: Students will be able to access various geospatial data, and they will learn the integration of various data for their meaningful analysis to solve various spatial problems or to generate various information layers. They will be able to analyse and interpret the obtained results and to prescribe important inputs in management and policy making processes. The students will also learn suitability analysis and recent trends in spatial data science.

RSG 301.1:

Group A

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

Application of Geo-Informatics:

i. *Natural hazards and disasters:* Application of geospatial techniques in mapping and modeling Earthquake, Landslide, Flood, Drought, Forest fires, Cyclone
ii. *Agriculture and soils:* Crop inventory mapping, crop type identification, environmental factors for aquaculture development, mapping and monitoring soil quality
iii. *Water resources:* Surface and sub-surface water resource evaluation, different hydrological modeling for water resource management
iv. *Forestry:* Identification of forest type, canopy cover and height estimation, biomass estimation
v. *Urban studies:* Mapping built-up area and expansion, urban planning, urban green space dynamics, urban climate

RSG 301.2:

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

Spatial Data Science and SDSS:

i. *Introduction to Spatial Data Science:* Basic concept and application areas, Key Elements and types of Machine Learning (ML) techniques, predictive analysis through ML, Deep Learning (DL) methods and application areas, Challenges in ML and DL
ii. *Advanced Trends in Spatial Data Science:* Geospatial Artificial Intelligence, concept of Big Data, Potentialities of Big Data in GIS
iii. *GIS and Spatial Decision Support Systems:* Concept and characteristics of Spatial Decision Support Systems (SDSS), Types of Decision Problems, Phases of Decision- Making Process, Spatial Decision Support Systems (SDSS) and GIS, Elements and

Structure of Multicriteria Decision Analysis (MCDA)

iv. *Analytic Hierarchy Process:* Standardization of Criterion Maps, Criterion Weighting through Pairwise Comparison method, Decision Rules-Simple Additive Weighting method

Internal Assessment (10)

RSG 302: (*Examination Time: 2 hours)*

RESEARCH METHODOLOGY, PROJECT MANAGEMENT & GEOSTATISTICS (50marks)

Full Marks50. Number of lectures to be delivered for this paper is 40. 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.

Course Outcome: Students will be able to identify the research problems in the field of geoinformatics. They will learn to develop or prescribe a research approach or project management structure starting from input data, techniques, with expected outcome. They will be able to perform statistical analysis of the geospatial problems. They will be able demonstrate the working principles of various data interpolation methods.

RSG 302.1:

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

Fundamental of Research and Geospatial Project Management

i. *Research Problem:* Identification and Techniques of defining a research problem, significance of literature review
ii. *Statistical Inference for Research:* Concepts and Procedure concerning testing of Hypothesis, Model Calibration and Validation
iii. *Sampling Design:* Steps in Sampling Design, Types of Sampling and their applications in research, Collection of Spatial and Temporal data.
iv. *Project Management* : Definition and elements of Project management, Techniques of Project Management, Roles and attributes for project manager
v. *Research Ethics*: Fundamental ethical practices in research, Types of Plagiarism, Research ethics and artificial intelligence (AI)

RSG 302.2:

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

Geostatistics

i. Mean centre of population & settlement and their temporal shift, Neighbourhood Analysis, Z-Score
ii. Scatter Diagram, Bi-variate& Multiple correlation, Linear regression & Residual mapping
iii. Standard Error of Estimate, Significance Test, RMSE.
iv. *Surface Modelling***:** Spatial autocorrelation, Variogram and its use for Interpolation
v. Role of Interpolation, Methods of Interpolation – Global and Local Deterministic Methods, Moving Averages, Inverse Distance Interpolation, Optimal Interpolation using Geostatistics
vi. Interpolation by Kriging – different types of Kriging
vii. R programming: regression analysis

Internal Assessment (10)

◢RSG 303: (*EXAMINATION TIME: 2 HOURS)*

ELECTIVE SPECIAL PAPER THEORY: (Any One)

Course Outcome: Students will be able to analyse various tasks to solve the problems in a specified domain.

RSG 303A: Geoinformatics in Coastal Management

RSG 303B: Geoinformatics in Watershed Management

RSG 303C: Geo-informatics in Earth Sciences

RSG 303D: Geo-informatics in Disaster Management

RSG 303E: Geoinformatics in Soil and Agriculture

RSG 303F: Geoinformatics in Urban, Rural Development & Regional Planning

RSG 303G: Geoinformatics in Environmental Science & Management

RSG 303H: Geoinformatics in Resource Management

RSG 303I: Geoinformatics in Transport Management

RSG 303J: Geoinformatics in Utility Management

RSG 303A: GEOINFORMATICS IN COASTAL MANAGEMENT

Full Marks50. Number of lectures to be delivered for this paper is 40. 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 303A.1

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

Theoretical Considerations

i. Coastal morpho dynamics: 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.

RSG 303A.2

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

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)

RSG 303B: GEOINFORMATICS IN WATERSHED MANAGEMENT

Full Marks50. Number of lectures to be delivered for this paper is 40. 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 303B.1

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

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.

RSG 303B.2

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

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)

RSG 303C: 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.

RSG 303C.1

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.

RSG 303C.2

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
iv. *Mineral targeting:* Rock Information System, GIS based multivariate analysis in mineral targeting.

Internal Assessment (10)

RSG 303D: GEOINFORMATICS IN DISASTER MANAGEMENT

Full Marks50. Number of lectures to be delivered for this paper is 40. 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 303D.1:

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

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.

RSG 303D.2:

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. *Geospatial Applications:* Monitoring and hazard zonation mapping, early warning of natural hazard

Internal Assessment (10)

RSG 303E: GEOINFORMATICS IN SOIL AND AGRICULTURE

Full Marks50. Number of lectures to be delivered for this paper is 40. 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 303E.1:

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

Fundamental concepts of Soil and 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

RSG 303E.2:

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

Application of Geo-informatics in Soil and 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)

RSG 303F: Option-6GEOINFORMATICS IN URBAN, RURAL DEVELOPMENT & REGIONAL PLANNING

Full Marks50. Number of lectures to be delivered for this paper is 40. 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 303F.1:

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

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.

RSG 303F.2

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

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)

RSG 303G: GEOINFORMATICS IN ENVIRONMENTAL SCIENCE & MANAGEMENT

Full Marks50. Number of lectures to be delivered for this paper is 40. 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 303G.1:

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

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

RSG 303G.2:

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

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)

RSG 303H: GEOINFORMATICS IN RESOURCE MANAGEMENT

Full Marks50. Number of lectures to be delivered for this paper is 40. 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 303H.1:

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

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,

RSG 303H.2:

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

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)

RSG 303I: Option-9GEOINFORMATICS IN TRANSPORT NETWORK ANALYSIS

Full Marks50. Number of lectures to be delivered for this paper is 40. 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 303I.1

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

Concepts in Transportation:

i. Introduction to Transportation Planning, Behavioural 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

RSG 303I.2:

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

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. Applicationsand case studies

Internal Assessment (10)

RSG 303J: GEOINFORMATICS IN UTILITY MANAGEMENT

Full Marks50. Number of lectures to be delivered for this paper is 40. 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 303J.1:

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

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

RSG 303J.2:

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

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)

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

CBCS- II: ADVANCED REMOTE SENSING AND AREAS OF APPLICATIONS (50 Marks)

Full Marks: 50. Number of lectures to be delivered for this paper is 40. 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

Course Outcome: Students will have the concept of advance satellite sensors, working principles, data acquisition and processing techniques. They will be able to demonstrate or develop research methodology in solving geospatial problems.

RSG 304.1:

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

Advanced Remote Sensing Techniques

i. *Introduction:* Definition of digital image, Source of Data, Data Formats, Ground Truthing: Ground Truth Collection for Image Classification, *Image Classification techniques*, Spectral Signature
ii. *Thermal Remote Sensing:* Basic Principles and 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)
iv. *Hyperspectral Remote Sensing:* Basic Concept, Advantages and Disadvantages, Multispectral vs. Hyperspectral Remote Sensing, Hyperspectral sensors and platforms, Hyperspectral Data Processing, Applications of Hyperspectral Data
v. *LIDAR:* Basic Principles, DSM and DTM, Areas of Applications

RSG 304.2:

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

Application of Geo-Informatics:

i. *The Earth System:* Concept of Earth System, lithosphere, biosphere, hydrosphere & atmosphere.
ii. *Geomorphology:* Fundamental concepts, geomorphic agents and processes, drainage patterns, classification of landforms
iii. *Visual/ Digital Satellite Image Interpretation:* Elements of image interpretation
iv. *Areas of Applications:* Application in Disaster Management, Earth resources and Environmental Management

SEM -III PRACTICAL

Course Outcome: Students will be able perform integration of various data sources. They became capable to performing geostatistical analysis using various commercial or open source software or platform. The students will be able to solve numbers of problems in few particular domains. In addition, few live-projects are assigned to students to make them more research oriented. With the faculty advisors, they visit the field to study available natural resources, environmental issues, societal problems through collecting several datasets, calibration and validation of the models, and to compare with the satellite based observations.

RSG 395 (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. Morphometric analysis of terrain, satellite image-based hydro-geomorphological interpretation for ground water targeting.
ii. Runoff & Soil Loss estimation based on empirical models.
iii. Digital terrain models for selection of dam site, road, and canal construction, Cut & Fill analysis using DEM
iv. Generating Criterion Maps, Linear Transformation Methods for Standardization of Criterion Maps
v. Estimation of Weights: Ranking, Rating, Pairwise Comparison and Trade-off analysis method; Decision Rules-Simple Additive Weighting method
vi. Application of Spatial Decision Support System in Site Suitability Analysis

(20)

Practical Notebook Viva-voce (5)

RSG 396 (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. Generation of pre-field theme maps using multi-seasonal image of an area – ground truthing and field data collection -- Validation of the output based on post field data
ii. Output generation – finalization of Field Report and Viva-Voce

(25)

RSG 397 (Practical)

Geostatistics (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.

iii. Introduction of Statistical Software: Time series, Charts, Scatter plot with regression line, Bi-

variate and Multiple Correlation, Significance test, Mean Centre of Population, Z-Score

iv. Principal Component analysis

v. IDW and Krigging through GIS softwares

vi. Extraction of image statistics and regression analysis using R

(20)

Practical Notebook and Viva-Voce (5)

RSG 398 (Practical)

ELECTIVE SPECIAL PAPER THEORY: (Any One)

RSG 398A: Geoinformatics in Coastal Management

RSG 398B: Geoinformatics in Watershed Management

RSG 398C: Geo-informatics in Earth Sciences

RSG 398D: Geo-informatics in Disaster Management

RSG 398E: Geoinformatics in Soil and Agriculture

RSG 398F: Geoinformatics in Urban, Rural Development & Regional Planning

RSG 398G: Geoinformatics in Environmental Science & Management

RSG 398H: Geoinformatics in Resource Management

RSG 398I: Geoinformatics in Transport Management

RSG 398J: 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: RESEARCH DISSERTATION (200marks)

Course Outcome: The individual student will be able to identify a small research problem, and try to generate a geospatial solution of the problem.

RSG 401 (GROUP A & B)
RSG 401.1: *Dissertation Examination 100* + RSG 401.2: *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., Hyd
3. erabad, India
4. Lillesand, T.M. and Kieffer, R.W., 2003. Remote Sensing and Image Interpretation, 5th Edition., Wiley, New York
5. Panda, B. C., 2008. Remote Sensing: Principles and Applications, Viva Books Private Limited, India

REFERENCE BOOKS:

1. Avery, T.E., and G.L.Berlin, Fundamental of remote sensing and airphoto interpretation,5thed, Macmillan, New York,1992
2. Barrett,E.C., and L.F.Curtis, Introduction to environmental remote sensing, 3rded, Chapman and Hall, New York,1992
3. Campbell J.B. (2002) Introduction to Remote Sensing, 3rd ed., The Guilford Press.
4. Canada Center for Remote Sensing, Remote Sensing Tutorial
5. Cracknelll, A.P., and L.W.B.Hayes, Introduction to remote sensing, Taylor and Francis, Washington, DC,1991
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.
11. John, R. J., Introductory Digital Image Processing – A Remote Sensing Perspective, Prentice Hall Series
12. Muralikrishna V., Geographical Information Systems and Remote Sensing Applications, Allied Publishers Private Limited.
13. Nag P. and Kudrat M., Digital Remote Sensing, New Delhi, Concept Publishing.
14. Reeves, Robert G., “Manual of Remote Sensing, Vol. I, American Society of Photogrammetry and Remote Sensing, Falls Church, Virginia, USA
15. Richards J.A. and Jia X. (2006) Remote Sensing Digital Image Analysis: An Introduction, 4th ed., Springer

RSG 102: FUNDAMENTALS OF GIS &DIGITAL CARTOGRAPHY

TEXT BOOKS:

1. Anson, R.W. &Ormeling, F.J. (1993), Basic Cartography, Vol. 1, 2nd 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 andSons.
3. DeMers, M.N.,Fundamentals of geographic information system, Wiley, New York, 1997
4. ESRI (2004) ESRI Cartography: Capabilities and Trends, Redlands, CA, White Paper.
5. Foresman,T.W.(ed)History of GIS, Prentice-Hall, Upper saddle river, NJ,1998
6. Harvey, F. 2008, A Primer of GIS: Fundamental Geographic and Cartographic Concepts, The Guilford Press, New York.
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8. Ian Masser& Michael Blakemore., 1991, Handling Geographical Information: Methodology and Potential Applications, Ed.
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15. Menno-Jan Kraak&FerojanOrmeling, 2003, Cartography – Visualisation of Geospatial data, 2ndEdn, , Pearson Education Ltd.
16. Mishra, R.P. and. A. Ramesh, Fundamentals of Cartography , Concept Publishing House, New Delhi – 110059
17. Monkhouse F.J. and Wilkinson, H.R. 1971. : Maps and Diagrams: Their Compilation and Construction, B.I. Publications Private Limited, New Delhi: 527p.
18. Muralikrishna V., Geographical Information Systems and Remote Sensing Applications, Allied Publishers Private Limited.
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20. Peuquet, D.J. and Marble, D.F. (eds.) (1990) Introductory Readings in Geographic Information Systems. London, Taylor and Francis.
21. Ramesh, P. A. (2000): Fundamentals of Cartography, Concept Publishing Co., New Delhi.
22. Rampal, K.K. (1993): Mapping and Compilation, Concept Publishing Co.,New Delhi.
23. Slocum T. (2003) Thematic Cartography and Geographic Visualization, Upper Saddle River, New Jersey: Prentice Hall.
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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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5. Panda, B. C., 2008. Remote Sensing: Principles and Applications, Viva Books Private Limited, India
6. Terry-Karen Steede, 2002, Integrating GIS and the Global Positioning System, ESRI Press
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1. Alvi, Z. 1995: Statistical Geography: Methods and Applications, Rawat Pub. New Delhi: 194p.
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6. Digital Photogrammetry, Theory and Application, Eilifried Linder, Springer, 2003.
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10. Global Navigation Satellite Systems: Insights into GPS, GLONASS, Galileo, Compass and Others by BasudebBhatta, CRC Press.
11. GNSS – Global Navigation Satellite Systems, GPS, GLONASS, Galileo, and more by Hofmann-Wellenhof, Bernhard, Lichtenegger, Herbert, Wasle, Elmar, SPRINGER.
12. GPS: Theory, Algorithms and Applications by GuochangXu, Artech House, 2009.
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14. Introduction to Modern Photogrammetry by Edward M.Mikhail, JananS.Bethel& Chris McGlone, Wiley & Sons Inc,2000.

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RSG 104: COMPUTER FUNDAMENTALS & PROGRAMMING

TEXT BOOKS:

1. E Balaguruswamy " Programming in ANSI C " TMH 2nd Edition 2000
2. EvangelosPetroutsos "Mastering Visual Basic 6.0" , BPB Publications, Edition 1998
3. MohmmedAzam"Programming with VB 6.0 ",Vikash Publishing House Pvt. Ltd.
4. Rajaraman Y., "Fundamentals of Computers", Prentice Hall of India, New Delhi, 1999.

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1. Mano, M., Digital Logic and Computer Design
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:

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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RSG 304: CBCS II: ADVANCED REMOTE SENSING AND AREAS OF APPLICATIONS

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