ಮಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

MANGALORE UNIVERSITY

(Accredited by NAAC Grade)

ಕ್ರಮಾಂಕ/No. : MU/ACC/CR.16/2025-26/A2

ಕುಲಸಚಿವರಕಛೇರಿ
ಮಂಗಳಗಂಗೋತ್ರಿ – 574 199
Office of the Registrar
Mangalagangothri – 574 199
ದಿನಾಂಕ/Date:31.07.2025

NOTIFICATION

Sub: Revised syllabus of M.Sc. in Geoinformatics Programme.

Ref: Academic Council approval vide agenda No.:ಎಸಿಸಿ:ಶೈ.ಮ.ಸಾ.ಸ.1:1 (2025-26) dtd 18.07.2025.

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The revised syllabus of M.Sc. in Geoinformatics programme which has been approved by the Academic Council at its meeting held on 18.07.2025 is hereby notified for implementation with effect from the academic year 2025-26 and onwards.

Copy of the Syllabus shall be downloaded from the University Website (www.mangaloreuniversity.ac.in)

REGISTRAR

To,

1. The Registrar (Evaluation), Mangalore University.
2. The Chairman, PG Board of Studies in Geoinformatics, Dept. of Marine Geology, Mangalore University.
3. The Chairman, Dept. of Marine Geology, Mangalore University.
4. The Asst. Registrar (ACC), O/o the Registrar, Mangalore University.
5. The Director, DUIMS, Mangalore University – with a request to publish in the website.
6. Guard File.

Mangalore University

Department of Marine Geology

Mangalagangothri-574199

Revised syllabus for **M.Sc. Geoinformatics** (Choice Based Credit System) with effect from Academic Year 2025-26

PREAMBLE

In response to the No.MU/REG/SYN(S3)/12/2025-97261 dated:15-04-2025, the syllabus prepared during 2024 has been modified during the annual BoS meeting held on 04th June 2025 by introducing few new contents and modifying some content. The main objective of this revision is to update and revise the syllabus according to the current scenario.

Programme learning outcomes

Geoinformatics is one of the interdisciplinary branches of Science and Technology that deals with acquisition, processing and production of geospatial data. This course programme also comprises of remote sensing, geographic information system (GIS), global positioning system (GPS), earth, atmospheric, ocean sciences including socio-economic related aspects in first three semesters, followed by intense field study and visit to RS and GIS organizations, R & D laboratories/institutions related to the prescribed curriculum and carry out dissertation in the IV semester. The main intension of the revisiting this program is to increase student's ability to work independently and pursue higher education such as M.Tech. and Ph.D. degrees. Based on the learning experience, students are capable to join reputed institutions to work as consultants in the field of geospatial technology in solving various issues related to earth and environmental sciences. In the view of the recent developments, the outcomes of M.Sc. in Geoinformatics programme are listed as follows:

PO1: Acquire advanced knowledge in the field of Remote Sensing, Photogrammetry, GIS, Cartography, GPS, Earth, Atmosphere and Ocean Sciences.

PO2: Enhance skills of learning software such as ArcGIS, QGIS, ERDAS Imagine, SPSS.

PO3: Acquisition of primary and secondary data from different sources including those from satellites.

PO4: Geoinformatics tools for monitoring, mapping and management of land, water, marine resources, urban planning, evaluation of natural disasters and geological and geomorphological studies.

PO5: Visit to R & D institutions, private GIS companies and geological sites. Project/dissertation pertaining to applications of RS and GIS in various fields.

Programme specific outcomes

Students after gaining the knowledge in the field of Geoinformatics, they can utilize theoretical and practical knowledge, which are useful for teaching, research, employability and entrepreneurship. The qualified students can develop ability of professional ethics and accountability to work as a

geoinformatician in government and private organizations. Nevertheless, students can start their own entrepreneurship/startups.

The mapping of course outcomes (COs) and the program-specific outcomes (POs) is given in the following Table:

Course No.	Course Title	POs as spelt out in the syllabus				
	COs as spelt out in the syllabus	1	2	3	4	5
1	Remote Sensing and Photogrammetry	✓	✓	✓		✓
2	GIS and GPS	✓	✓	✓		✓
3	Fundamentals of Earth Science and Oceanography	✓	✓		✓	✓
4	Cartography	✓				✓
5	Remote Sensing and Photogrammetry (Lab, Hard core)		✓	✓		✓
6	Earth Science (Lab, Soft core)	✓				✓
7	Advanced GIS		✓		✓	✓
8	Digital Image Processing	✓		✓		✓
9	DBMS and Spatial Statistics	✓	✓	✓		✓
10	Applied Geomorphology and Geoenvironmental Science			✓	✓	
11	Geomorphology and Geostatistics (Lab, Soft core)				✓	✓
12	GIS (Lab, Hard core)		✓		✓	✓
13	Geoinformatics (Open Elective)	✓	✓			
14	RS and GIS in Marine Resources and Coastal Zone Management	✓		✓	✓	✓
15	RS and GIS in Land and Water Resources	✓	✓		✓	✓
16	RS and GIS in Urban Planning and Disaster Management	✓		✓	✓	✓
17	RS and GIS in Agriculture and Forestry	✓		✓	✓	✓
18	DIP and GPS Survey (Lab, Soft core)	✓	✓			✓
19	RS and GIS in Water and Marine Resources (Lab, Hard core)	✓	✓	✓		✓
20	Geological Field Work and Field Report (Lab, Hard core)	✓	✓	✓	✓	✓
21	Geoinformatics of Coastal Environments (Open Elective)	✓	✓			
22	Dissertation and Viva-Voce		✓	✓	✓	✓

Mangalore University

DEPARTMENT OF MARINE GEOLOGY

M.Sc. GEOINFORMATICS SYLLABUS (Choice Based Credit System)

with effect from Academic Year 2025 - 26

Structure of the M.Sc. Geoinformatics Programme

Semester	Course (Theory and Practical)	Theory/ Practical	Duration of Exam (hrs)	Marks			Credits
				IA	Exam	Total	
I Semester - 3 Hard core (T), 1 Soft core (T), 1 Hard core (P) and 1 Soft core (P)							
GIH-101	Remote Sensing and Photogrammetry	4	3	30	70	100	4
GIH-102	GIS and GPS	4	3	30	70	100	4
GIH-103	Fundamentals of Earth Science and Oceanography	4	3	30	70	100	4
GIS-104	Cartography	3	3	30	70	100	3
GIP-105	Remote Sensing and Photogrammetry (Lab, Hard core)	8	4	30	70	100	4
GIP-106	Earth Science (Lab, Soft core)	6	3	30	70	100	3
I Semester Total		**29**	**19**	**180**	**420**	**600**	**22**
II Semester - 2 Hard core (T), 2 Soft core (T), 1 Soft core (P), 1 Hard core (P) and 1 Open Elective (E)							
GIH-151	Advanced GIS	4	3	30	70	100	4
GIH-152	Digital Image Processing	4	3	30	70	100	4
GIS-153	DBMS and Spatial Statistics	3	3	30	70	100	3
GIS-154	Applied Geomorphology and Geoenvironmental Science	3	3	30	70	100	3
GIP-155	Geomorphology and Geostatistics (Lab, Soft core)	6	4	30	70	100	3
GIP-156	GIS (Lab, Hard core)	8	4	30	70	100	4
GIE-157	Geoinformatics (Open Elective)	3	3	30	70	100	3
II Semester Total		**31**	**23**	**210**	**490**	**700**	**24**

III Semester - 2 Hard core (T), 2 Soft core (T), 1 Soft core (P), 2 Hard core (P) and 1 Open Elective (E)							
GIH-201	RS and GIS in Marine Resources and Coastal Zone Management	4	3	30	70	100	4
GIH-202	RS and GIS in Land and Water Resources	4	3	30	70	100	4
GIS-203	RS and GIS in Urban Planning and Disaster Management	3	3	30	70	100	3
GIS-204	RS and GIS in Agriculture and Forestry	3	3	30	70	100	3
GIP-205	DIP and GPS Survey (Lab, Soft core)	6	3	30	70	100	3
GIP-206	RS and GIS in Water and Marine Resources (Lab, Hard core)	8	3	30	70	100	4
GIP-207	Geological Field Work and Field Report (Lab, Hard core)	8	4	30	70	100	4
GIE-208	Geoinformatics of Coastal Environments (Open Elective)	3	3	30	70	100	3
III Semester Total		**39**	**25**	**240**	**560**	**800**	**28**
IV Semester							
GIP-251	Dissertation and Viva-Voce	32	-	100 Dissertation=200 Viva-Voce=100	300	400	16
IV Semester Total		**32**	**-**	**100**	**300**	**400**	**16**
Grand Total						**2500**	**90**

Note: **GI -** Geoinformatics, **H**-Hardcore, **S**-Softcore, **P**-Practical/Project Work, and **E**-elective

Course/Credit Pattern: **Semester Credits**	**Hard Core (H)**	**Soft Core (S)**	**Elective (E)**	**Practical/ Project Work (P)**	**Total Credits**
I - 3 Hard core (T), 1 Soft core (T), 1 Hard core (P) and 1 Soft core (P)	3 x 4= 12	1 x 3= 3	--	4(H), 3(S)	22
II - 2 Hard core (T), 2 Soft core (T), 1 Soft core (P), 1 Hard core (P) and 1 Open Elective (E)	2 x 4= 8	2 x 3= 6	3	4(H), 3(S)	24
III - 2 Hard core (T), 2 Soft core (T), 1 Soft core (P), 2 Hard core (P) and 1 Open Elective (E)	2 x 4= 8	2 x 3= 6	3	8(H), 3(S)	28
IV - Project work	--	--	--	16(H)	16
Total	**28**	**15**	**6***	**32(H)+ 9(S)**	**90**

Total Credits from all the Four Semesters = 22+24+28+16 = 90
Total Hard Core Credits =7x4=28(T) + 4x4= 16(P) +16(Project) =60 = 67%
Total Soft Core Credits = 5x3=15(T) + 3x3= 9(P) +2x3=6(E) = 30 = 33%

FIRST SEMESTER

GIH 101: Remote sensing and photogrammetry

Students will be able to:
CO1: Understand the fundamental principles of remote sensing and energy interactions.
CO2: Describe and differentiate various remote sensing technologies and their applications.
CO3: Apply basic image interpretation and processing techniques.
CO4: Comprehend the fundamentals and geometry of aerial photography.
CO5: Utilize photogrammetric concepts for image interpretation and digital mapping.

Skills, employability and entrepreneurship: This course helps students understand how different sensors collect geospatial data and the physics behind it. Also it is useful to draw meaningful conclusions about the Earth's surface and features derived from satellite images. The skills learned from this course are useful to become geospatial analysts, remote sensing scientist in organizations, such as ISRO, NRSC, IIRS, KSRSAC, INCOIS etc., photogrammetrist in different organizations and MNCs. Students can also start their entrepreneurship.

Remote Sensing		52 hrs
Unit 1	Introduction: History and concept of Remote Sensing, Electromagnetic Spectrum, Energy Interaction with atmosphere and earth surface features. Basic concepts of visible, Optical, Thermal (Infrared), and Microwave Remote Sensing. Platforms and Sensors. Optical Remote Sensing: Principles of Optical Remote Sensing, spectral reflectance of earth's features indifferent wave length regions, multispectral concepts of remote sensing, scanners, applications of optical Remote Sensing, Indian Remote Sensing Program and important Indian Satellites.	8 hrs
Unit 2	Thermal Remote Sensing: Principles of thermal remote sensing, black body, radiant temperature, radiation from Earth's objects, thermal conductivity, thermal capacity, thermal inertia, thermal diffusivity, thermal radiometers, scanners, calibration of scanners, mapping with thermal scanners, Imaging Spectrometer, Applications of Thermal Remote Sensing.	8 hrs
Unit 3	Hyper Spectral Remote Sensing: Introduction to Hyperspectral Remote Sensing, Sensors/Imaging Spectrometers, Hyperspectral Satellite Systems, Hyperspectral Image Analysis Techniques including Correction.	6 hrs
Unit 4	Microwave Remote Sensing & RADAR Remote Sensing*:* Concept and principles of Microwave Remote Sensing, SLAR, SAR and Scaterometer, Application of Microwave Remote Sensing. Outlines of Radar Image Interpretations. Image Interpretation: Visual and Digital Interpretation techniques-Basic concepts of visual interpretation, tone, color, texture, pattern, shape and contextual features. Basic Principles of Digital Image Processing. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	8 hrs
Photogrammetry		
Unit 5	Principles of Aerial photography; Geometry of aerial photography:	

	Fundamentals of photogrammetry and aerial photography: History, aerial cameras, aerial films and processing. Types of aerial photos. Fundamentals and geometry of aerial photographs, Scale, Advantages and disadvantages of small scale and large scale aerial photographs.	6 hrs
Unit 6	Relief and tilt displacements, mosaics and types of mosaics, stereoscopic vision and stereoscopes, image displacement due to relief, concepts of stereo-photogrammetry, normal vision, depth perception and vertical exaggeration. Planning for aerial photographs, flight procedures, planning and execution of photographic flights, radiometric characteristics. Elements of aerial photo interpretation: tone, color, texture, pattern, shape, size and associated features, geotechnical analysis and convergence of evidence.	6 hrs
Unit 7	Principles and Applications of Aerial Photography: Aerial photo interpretation in resource evaluation–geology, delineation of geological structures, mineral exploration, geomorphology, geological structure.	6 hrs
Unit 8	Digital photogrametry and interpretation techniques: definition, creation of digital images, automatic measurements, automatic surface modeling, aerial triangulations, digital photogrammetric workstation. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	4 hrs

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GIH 102: GIS and GPS

Students will be able to:
CO1: Understand the foundational concepts, history, and components of Geographic Information Systems.
CO2: Comprehend different spatial data models and their characteristics.
CO3: Apply various GIS functionalities for spatial data management and manipulation.
CO4: Perform diverse spatial analysis operations using GIS software.
CO5: Utilize GIS for advanced geospatial modeling and real-world applications, including GPS integration.

Skills, employability and entrepreneurship: This course paper is an advanced type in terms of not only studying the entire earth science in general, but also all aspects of spatio-temporal data of any discipline in particular. With the help of advanced software, massive data collected over time can be analyzed to determine complex future trends. There is a good scope of this course for students who can work as Geoinformaticians in various organizations related to human resource development and private organizations and MNCs. Students can also open up their own start-up company

Geographical Information System (GIS)		52 hrs
Unit 1	**Basics of Geographic Information System**: Definition, components, packages, capabilities and purpose of GIS. History of Geographic Information System, Development of GIS as information and decision- making system, Overview of GIS Architecture.	6 hrs
Unit 2	**Definition**: Maps and spatial information, Components of GIS, maps and spatial data. Thematic characteristics of spatial data, other sources of spatial data-sensors, survey data, air photos, satellite images and field data.	6 hrs
Unit 3	Functions and Advantages of GIS: Introduction, Functions of GIS, application areas of GIS, Advantages of GIS, Uses and limitations of GIS.	4 hrs
Unit 4	GIS Data Models: Introduction, Spatial, Thematic, and Temporal Dimensions of Geographic Data. Spatial entity Spatial data Models: Introduction and types, Spatial Resolution. Raster Data Models: Raster Data Formats – netCDF4, HDF, Geo TIFF, ESRI grid, IMG. Raster data structure - Cell-by-cell raster encoding, Run-length raster encoding, Quad-tree raster encoding. Advantages/Disadvantages of the Raster data Model.	8 hrs
Unit 5	Vector Data Models: Definition, basic types of vector data model – Point, Line and Polygon. Vector Data Models Structures: Spaghetti Data Model, topological data model. Spatial Analysis: Types of analysis- point data, line data and polygon data. Data Extract – Clip, Select, Split and Table select. Overlay analysis – Erase, Identify, Intersect, Spatial join, Union etc. Proximity analysis – Buffer, Multiple Buffers, Thiessen Polygon, point distance. Conversion from vector to raster data. Advantages / Disadvantages of the Vector Model. Vector Data Formats – shape file, AutoCAD DXF, Geo Media, GML and DLG.	8 hrs
Unit 6	Concepts of 3D models: Digital Elevation and Terrain Models (DEM & DTM), Generation and structure of DEM/DTM and their applications. Geospatial Triangulated Irregular Network (TIN) model, slope, aspect, hill shade. Digitization: Editing and Structuring of Map Data. Mode of digitization, editing, topology creation and structuring map data. Data Quality and Sources of Errors. Nature of geographic data, sources of errors in GIS data base, data quality parameters, handling errors in GIS.	8 hrs

Unit 7	Fundamentals of GPS: Introduction, space segments, user segments and control segments. Observation principle and signal structure, accuracy of GPS measurements, point position in gang relative positioning, methods of surveying with GPS, Static and Kinematic positioning, navigation with GPS, differential GPS, navigational receivers.	6 hrs
Unit 8	Applications of GIS in India: Outlines of Applications in Facility and Utility Management, Natural Resource Management, Natural Disaster Management, Coastal Zone Management, Hydrology, Atmosphere, Health and energy. Application of Open source GIS, Bhuvan, Google Earth, Geo-server and Map-server. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	6 hrs

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2. Bonham – Carter G.F., Geographic Information System for Geoscientists, Pergamon Press, Tarrytown, New York, 1994.
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GIH 103: Fundamentals of Earth Science and Oceanography

GIH 103: Fundamentals of Earth Science and Oceanography

Students will be able to:

CO1: Describe the fundamental composition and structure of the Earth and its major rock types.

CO2: Understand the principles of structural geology and plate tectonics.

CO3: Comprehend key physical oceanographic processes.

CO4: Analyze the chemical and geological aspects of the ocean.

CO5: Identify the factors influencing marine life and oceanographic parameters.

Skills, employability and entrepreneurship: Students admitted from different disciplines are provided with a broad range of basics/fundamentals of Earth Sciences. Students learn about the formation and properties of minerals and rocks as well as oceans. Students who exit this course have the skills to work in industries related to earth resources, agricultural and soil survey and public works. They will be exposed to start their entrepreneurship. This course may also be helpful in various government exams, including NET, SET, GATE, and other similar tests.

Fundamentals of Earth Science		**52 hrs**
Unit 1	Introduction**:** Formation of the earth, composition of earth crust, mantle and core.	4 hrs
Unit 2	Mineralogy: Introduction to important Rock forming Minerals. Igneous Petrology: Intrusive and Extrusive igneous rocks, granite, gabbro, dolerite, basalt, pumice, rhyolite, scoria and tuff etc.	8 hrs
Unit 3	Sedimentary Petrology: Origin of sediments. Formation of sedimentary rocks. Conglomerate, sandstone, limestone. Morphology and origin of laterites. Metamorphic Petrology: types, grade and facies of metamorphism. Gneiss, Schist, quartzite, marble.	8 hrs
Unit 4	Structural Geology: importance of textures and structures of various rocks. Folds, faults, joints and unconformities. Introduction to plate tectonics.	6 hrs
Fundamentals of Oceanography		
Unit 5	Introduction to physical oceanography: Introduction, waves and their characteristics, tides and tidal currents in shallow seas and estuaries. Wave action on sediment movement; rip currents. Major currents of the oceans. Currents in Indian Ocean – Periodical currents (Summer (SW) and Winter (NE) monsoon currents). The global wind system. El Nino and La Nina; monsoonal winds and currents over the North Indian Ocean.	8 hrs
Unit 6	Chemical oceanography: Classification of elements and their distribution in sea water. Chemical exchanges across river-sea.	4 hrs
Unit 7	Geological oceanography: classification of coasts, description of beaches: sea stacks, sea stump, sea caves and notches. Ocean floor morphology: continental shelf, slope, rise and abyssal plains, mid-oceanic ridge, trenches, canyons. Tsunami. Demarcation of various zones : Exclusive Economic Zone (EEZ) and Coastal Regulation Zones (CRZ). Concept of Coastal Regulation Zones. Classification of CRZ.	8 hrs
Unit 8	Biological oceanography: Physico-chemical factors affecting marine life – light, temperature, salinity, pressure, nutrients, dissolved gases. Harmful algal blooms. Introduction to chlorophyll, dissolved oxygen, total suspended matter, Sea Surface Temperature (SST) and salinity. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	6 hrs

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GIS 104: Cartography

Students will be able to:
CO1: Understand the fundamental principles and evolution of cartography.
CO2: Differentiate and interpret various types of maps and their thematic content.
CO3: Apply cartographic models and design principles for map creation.
CO4: Create and analyze thematic maps for diverse geographical phenomena.

Skills, employability, and entrepreneurship: This course enables students to learn about creating topographical maps/base maps. This is particularly useful to generate different kinds of thematic maps of land and water resources. Students who qualify for this course have opportunities to work as cartographers in the field of surveying, both in government and private organizations.

Cartography		42 hrs
Unit 1	Introduction to Cartography and Ancient Cartography: Evolution of Cartography, Modern Cartography and Applications, Definition of Maps. Outlines of Map Projections.	6 hrs
Unit 2	Cartographic Themes and Types of Maps: Introduction to Cartographic themes. Cadastral and Chorographical maps. Representation of Choroschematic maps, and Chorochromatic maps. Introduction to Population diffusion and the importance of Dot and Multi Dot maps. Map Scale and Types.	6 hrs
Unit 3	Topographic Maps: Introduction to Topographic maps. Identification of Symbols and Interpretation of Central Themes. Spatial Information and Marginal Information of Topographic maps. Recovery of Spatial Information from Topographic maps. Concept of 'Central Theme' and examples. Retrieval of Secondary Data. Hydrographic Charts: Introduction to Hydrographic Charts. Recovery of Spatial Information from Hydrographic	8 hrs

	Charts.	
Unit 4	Cartographic models: Inductive and Deductive Models, Model Flow Charting, Model Implementation and Verification. Principles of Design and GIS Output, GIS Project design and Management. Remote Sensing Satellites used for Cartography. Digital Cartography: Web Cartography, 3D Simulation and Visualization	8 hrs
Unit 5	Thematic Mapping: Geomorphology, Slope, Elevation, Stream Network, Drainage Patterns, Resources and Bathymetry. Representation of Thematic Data: Application of Histograms, Pie Charts, Wind Roses, Ray Diagrams. Contour Maps. Choroschematic mapping.	8 hrs
Unit 6	Population Density: Grid pattern distribution of population, Dot mapping, Multi Dot mapping and Settlement Mapping. Multi-dated Thematic Mapping: shoreline changes, forest cover changes, population diffusion/urban growth mapping. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	6hrs

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GIP 105: Remote sensing and Photogrammetry (Lab- Hard core)

Students will be able to:

CO1: Perform fundamental aerial photo processing and analysis.
CO2: Interpret spatial data using visual and basic digital image analysis techniques.
CO3: Apply basic remote sensing and photogrammetric software for image interpretation and analysis.

Skills, employability and entrepreneurship: These courses are useful for students to study of aerial photographs and the interpretation of satellite images. Preparation of aerial photo index, photo base determination and numerical problems on aerial photographs and satellite images. Students who learn the fundamental concepts of remote sensing and photogrammetry have good opportunities as well they can start their entrepreneurship.

1.	Aerial mosaics, compilation, annotation, scaling and preparation of the Photo index, Photo base determination.
2	Numerical problems on aerial photographs.
3	Spectral reflectance: Plotting of Spectral Reflectance Curves, Rocks, Soil, Vegetation and Water.
4	Visual Analysis: Study of aerial photographs under pocket and mirror stereoscopes and interpretation of satellite images (Black & White and FCC images). Generation of thematic maps.
5	Interpretation of satellite data products (visual image interpretation and digital image analysis). Handling Image Processing Software Packages like: ERDAS, ENVI etc.
6	Elements of Aerial Photo: Study of Stereo pairs of aerial Photos. Flight planning, Determination of scale and slope. Outlines of parallax measurement.

GIP 106: Earth Science (Lab - Soft core)

Students will be able to:
CO1: Identify different types of rocks.
CO2: Differentiate between various rock structures and textures.

Skills, employability and entrepreneurship: Students from different disciplines are provided with the fundamental processes which are leading to the formation of minerals and rocks. Students can enhance their skills to work in quarrying, mining, rock polishing, ceramic and refractory industries. They can start their entrepreneurship

1.	Megascopic study of common rock forming minerals.
2.	Identification of igneous, sedimentary and metamorphic rocks (hand specimen).
3.	Study of mega structures, textures and mineralogy of igneous rocks.
4.	Study of mega structures, textures and mineralogy of sedimentary rocks.
5.	Study of mega structures, textures and mineralogy of metamorphic rocks.

SECOND SEMESTER

GIH 151: Advanced GIS

Students will be able to:
CO1: Apply advanced spatial analysis techniques for complex geographical problems.
CO2: Develop and implement spatial models for decision support and surface/network analysis.
CO3: Understand and apply topological concepts and spatial statistical modeling.
CO4: Explore concepts of Web GIS, Decision Support Systems, and open-source GIS platforms.

Skills, employability and entrepreneurship: This is the most important course for students to study advanced with the help of advanced GIS software. There is a good scope of this course for students who can work as geoinformaticians, GIS engineers in government organizations like ISRO, IIRS, KSRSAC, INCOIS etc., and in private institutions such as disaster management organizations and MNCs. Students can also open their own start-up companies.

Advanced GIS		52 hrs
Unit 1	GIS Data and Analysis: Spatial Analysis:-Classification, Overlay analysis, Proximity Analysis, Polygon Neighborhoods, Data analyzing operations in GIS, Buffering and neighboring functions, integrated data, raster and vector overly method, problems of vector and raster overlay, spatial interpolation GIS for surface analysis and network analysis.	6 hrs
Unit 2	Introduction to modeling in ArcGIS Concepts of 3D models: Suitable Site selection – Simple overlay analysis, multi-criteria analysis, View shed analysis, Flood analysis, Sun shadow volume analysis, Using Model Builder. Grid based spatial analysis – local, focal, zonal, and global function (Neighborhood analysis).	8 hrs
Unit 3	Topology and network analysis: Topology – Types of errors, editing and error rectification, types of topology, modeling topological relationships, network connectivity rules, finding shortest route, creating geometric network, creating and building a network dataset. Applications of network analysis. Geovisualization; GIS classification methods, Image Classification.	6 hrs
Unit 4	Spatial Statistical Modeling: Identification of Central feature, directional distribution, mean center, median center, linear directional mean, standard distance, hot-spot analysis, correlation, raster calculator and Boolean operation. Geostatistics - Pattern Analysis, Measures of Arrangements and dispersion, Spatial Auto Correlation, Kriging.	6 hrs
Unit 5	Decision Support Systems (DSS): Concepts of decision making, systems and modeling, Need for DSS. Concepts of multicriteria decision making.	6 hrs
Unit 6	Web GIS: Definition, concept and history of Web GIS, components of web and internet GIS, advantages and limitations of web GIS. Web mapping: Static and interactive web mapping, open GIS web map server. Geographic Markup Language - principles and characteristics, commercial web mapping programs. Functions of Web GIS: Display of general information for the public, display of planning information, interactive display of spatial information, sharing and distribution of spatial data as well as management of spatial data.	8 hrs

Unit 7	Open source GIS and its components. GIS platforms, software, Libraries - GRASS GIS, Cloud GIS, QGIS, Application of Open source GIS, ArcGIS.	6 hrs
Unit 8	Applications of GIS in various fields of Geoinformatics Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	6 hrs

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GIH 152: Digital Image Processing

Students will be able to:
CO1: Understand the fundamentals of digital images and image pre-processing.
CO2: Apply various image enhancement techniques for visual interpretation.
CO3: Comprehend advanced image manipulation techniques and indices.
CO4: Execute and evaluate digital image classification methods.
CO5: Analyze image characteristics and apply advanced signal processing concepts.

Skills, employability and entrepreneurship: Students have good opportunity to learn this course for manipulating and analyzing digital images by using specialized software to enhance quality of images and create new applications. DIP provides a foundation for the artificial intelligence (AI) and machine learning to perform advanced image analysis. Students who qualify in this course have opportunities to work as image processors in both government and private organizations and companies.

GIH 152: Digital Image Processing		52 hrs
Unit 1	Introduction: Digital images, Sources of errors; Image Pre-processing- Atmospheric, Geometric and Radiometric corrections, Noise removal, Resampling techniques.	6 hrs

Unit 2	Image Enhancement Techniques. Contrast enhancement: Linear and Non-Linear Logarithmic contrast enhancement, Edge enhancement, Density slicing, Principal Component Analysis; IHS Transformation, Spatial filtering, Low and high frequency band ratioing and band combination.	8 hrs
Unit 3	Image and Digital Images: types of images and acquisition, simple image model, Sampling and reconstruction, uniform sampling and quantization. Digital Image Analysis: Digital data, Image File formats, Image Rectification and Restoration.	8 hrs
Unit 4	Image enhancement techniques: Raw, Processed Images, Contrast Manipulation, Spatial feature Manipulation, Multi-Image Manipulation.	4 hrs
Unit 5	Contrast Manipulation: Grey Level Thresholding, Level Slicing, Contrast Stretching- Concept of Digital Number.	4 hrs
Unit 6	Spatial feature Manipulation: Convolution, Edge Enhancement, Concept and Use of Fourier Analysis in Digital Image Analysis.	6 hrs
Unit 7	Multi-Image Manipulation: Spectral Ratioing, Principle and Canonicle Components, Vegetation Components/Indices - Infrared Index, Simple Ratio, Perpendicular Vegetation Index (PVI), Moisture Stress Index (MSI), EVI (enhanced vegetation index), transformed Vegetation Indices (TVI), NDVI and NDWI.	8 hrs
Unit 8	Digital Image Classification: Classification scheme; Supervised classification, Training sites selection and statistical information extraction; Discriminant functions; Maximum Likelihood classifier, Euclidian distance, Mahalanobis distance; Unsupervised classification, classification accuracy assessment, Error Matrix. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	8 hrs

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GIS 153: DBMS and Spatial Statistics

Students will be able to:

CO1: Understand the fundamental concepts of Database Management Systems (DBMS) and data organization.

CO2: Apply core measures of central tendency and correlation to spatial data.

CO3: Perform and interpret cluster and factor analysis for spatial datasets.

CO4: Utilize statistical software packages for spatial data analysis and visualization.

Skills, employability and entrepreneurship: This course provides the basic knowledge of DBMS and SQL framework which are necessary to understand storing, accessing, and managing geo-spatial data. Integrating SQL with GIS software allows for the visualization of queried data which are useful for decision-making process. The skills learn out of this course enable students to try for various employment across various private organizations. The spatial statistics of different type's data such as environmental science, urban planning, public health, and ecology is useful for decision-making policies.

DBMS and Spatial Statistics		42 hrs
Unit 1	Data Base Management Systems (DBMS): Data and data base, organization of data base and components of DBMS, files: key, file directories and file storage. Data retrieval and Data Security, Basics of Database models: Entity-relationship model, flat file system.	8 hrs
Unit 2	Network Data model. Concept of Data Mining and Data Warehousing. DBMS applications in GIS.	4 hrs
Unit 3	Spatial Statistics: Measures of Central Tendency: Mean, Median and Mode and their applications in GIS and Remotely Sensed Data interpretation. Correlation Co-efficient and its application to GIS and Remotely Sensed Data.	8 hrs
Unit 4	Cluster Analysis: Introduction to Cluster Analysis. Interpretation of Q-mode and R- mode Clusters with reference to Spatial Data. Application of Cluster Analysis to Spatial Data.	8 hrs
Unit 5	Factor Analysis: Outlines of Factor Analysis. Interpretation of Factors for Spatial data.	6 hrs
Unit 6	Statistical Packages: Introduction to Statistical Packages. Introduction to SPSS Package. Functions of SPSS. Graphic out-put of processed data using SPSS. Application of SPSS to Geoinformatics. Case studies using SPSS. Use of SPSS in spatial data analysis. Designing of Cluster Analysis and Dendrograms related to Geoinformatics data. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	8 hrs

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GIS 154: Applied Geomorphology and Geoenvironmental Science

Students will be able to:
CO1: Understand core concepts of modern geomorphology and its applications in natural resource management.
CO2: Analyze diverse geomorphic environments and their evolutionary controls.
CO3: Evaluate the role of geomorphology in groundwater resources and waste management.
CO4: Assess natural and anthropogenic environmental hazards and apply management strategies.

Skills, employability and entrepreneurship: The applied geomorphology course provides a comprehensive understanding of the processes of Earth leading to the formation of landforms, including the formation of continents and oceans. Whereas, the geo-environmental science course is an interdisciplinary science connected with chemistry, physics, life science, geoscience, and computer science, especially instrumental for assessing human impacts on the natural environment. Students who qualify this course have promising careers in geomorphology, and environmental research laboratories of private and government sectors.

Applied geomorphology and geoenvironmental science		42 hrs
Unit 1	Concepts of modern geomorphology: Geomorphology and its applications in natural resources inventory. Geomorphology and its applications to Geoinformatics.	6 hrs
Unit 2	Geomorphic Environments: The Fluvial systems, Coastal and Marine geomorphology. Fluvial, Aeolian, Glacial, Karst and Dune Environments. Mid Oceanic. Ridges, Ocean Floor Topography. Geomorphology and GIS in exploration of the natural environment. Impact of Slope, Badlands, Pediments, Streams in Geomorphic Evolution.	8 hrs
Unit 3	Geomorphic controls on the groundwater resources of Coastal, Island and Hinter land terrains. Geomorphological factors to be considered while selecting the solid waste disposal sites and Solid waste management.	6 hrs
Unit 4	Natural and anthropogenic environmental hazards, environmental pollutant, environmental pollution, environment handling, hazardous substance.	6 hrs
Unit 5	Environment Impact Assessment Act: Definition, use and implementation for specific areas such as marine environments, ports, harbours, recreation, noise standards. Environment Management Plan: Concepts and use of EMP in coastal and marine environments.	8 hrs
Unit 6	Natural and anthropogenic environmental hazard and management: use of high-resolution satellite data and other digital data products in assessing and mapping of damages due to natural hazards (landslide, earthquakes, forest fires, flood). Impacts of open-cast mining and monitoring through multi-dated Remote Sensing and GIS techniques. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	8 hrs

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GIP 155: GEOMORPHOLOGY AND GEOSTATISTICS (Lab - Soft core)

Students will be able to:
CO1: Analyze and interpret drainage basin characteristics and prepare derivative maps from DEMs.
CO2: Interpret and map various geomorphological landforms.
CO3: Apply descriptive and inferential statistical methods to geospatial data.
CO4: Utilize statistical software for regression analysis and hypothesis testing on geospatial data.

Skills, employability and entrepreneurship: Studying these courses will help to students learn to analyze and create thematic maps about landforms, geomorphological maps. The SPSS software is helpful to create and model for geospatial databases. Students learning these courses develop skills which are useful to work in geomorphological and environmental research laboratories of both private and government sectors.

GEOMORPHOLOGY	
1.	Morphometry of drainage basins. Analysis of drainage patterns and orientation structure.
2.	Preparation of DEM from topographical maps, ASTER and SRTM data.
3.	Preparation of Aspect, Shaded relief, and Slope maps from DEM.
4.	Interpretation of longitudinal and cross-valley profiles.
5.	Generation of geomorphologic maps showing fluvial, coastal/marine, denudational, volcanic and glacial land forms.

GEOSTATISTICS	
1.	Quartiles, Deciles and Percentages for geospatial data
2.	Measures of Dispersion
3.	Skewness and Kurtosis for geospatial data
4.	Students T test
5.	Regression and Multiple linear regression
6.	Applications of SPSS in creating database, correlation co-efficient, linear regression. modeling and p rediction.

GIP 156: GIS (Lab - Hard core)

Students will be able to:
CO1: Perform fundamental geospatial data pre-processing and digitization.
CO2: Integrate and extract thematic information from diverse geospatial datasets.
CO3: Apply core spatial analysis and visualization techniques using GIS software.

Skills, employability and entrepreneurship: This course provides students with knowledge about creating the number of basic and thematic maps. There is a good scope of this course where students can work as geoinformaticians and as well as data operators in disaster management sectors, government institutions, various organizations, research institutes and MNCs. Students can also open their own start-up company.

1.	Geo-referencing – image rectification based on co-ordinate system.
2.	Onscreen digitization. Edge matching/spatial adjustment.
3.	GIS and Remote Sensing data integration: Integration of vector and raster data (linking of spatial and non-spatial data)
4.	Extraction of Thematic maps: preparation of thematic layers-on screen from toposheets, images - road, settlement, drainage, LU/LC etc.
5.	Map composition and presentation of results. Overlay and proximity analysis- clip, erase, merge, intersect, union, buffer.
6.	Calculation of area, perimeter and distance using GIS software.
7.	Creation of 3D maps: TIN, hill shade, slope, and aspect.

GIE 157: Geoinformatics (Open Elective)

Students will be able to:
CO1: Understand the foundational concepts of spatial data and remote sensing
CO2: Comprehend map concepts and different map projections.
CO3: Grasp the core components, data models, and functionalities of Geographic Information Systems (GIS).
CO4: Explain the principles of Global Positioning Systems (GPS) and the diverse applications of Geoinformatics.

Skills, employability and entrepreneurship: This course is open to other disciplines such as chemistry, physics, life sciences, statistics and computer sciences. Currently, remote sensing and GIS technology are being used in various disciplines. However, students can perform better in their career if they know some knowledge about this subject for interdisciplinary science. Students have employability opportunities in many branches of science in various government organizations and MNCs.

Geoinformatics (Open Elective)		42 hrs
Unit 1	Definition: of data and information, historical evolution and need for information, Basic Concepts of Spatial Data and aspatial data, spatial information. Sources of spatial data-survey data, air photos, satellite images and field data.	4 hrs
Unit 2	Scope and Importance: of Geoinformatics; Basic concepts of Remote Sensing; aerial photography and satellite remote sensing. Indian Space Program and Indian Remote Sensing Satellites.	4 hrs
Unit 3	Principles of Thermal and Microwave Remote Sensing: Introduction, Black body Radiation, Temperature Radiations from the earth's surface and Applications of thermal remote sensing. Basic concepts of micro wave remote sensing, Real Aperture Radars and Synthetic Aperture Radars, Microwave sensors. Applications of Microwave Remote Sensing. Visual and digital image analysis techniques.	6 hrs
Unit 4	Map Concept: Map features, scale, resolution, accuracy, projection and data base extent. Map Projection and parameters: Geographical co-ordinate system, spheroid and spheres. Types of projection and parameters. Indian geodetic system and Everest spheroid, world geodeticsystem-084(WGS- 084).	4 hrs
Unit 5	Geographic Information System: Definition, components, packages, capabilities and purpose of GIS. Spatial and non-spatial databases. Data models: Vector and raster models. Application and limitations of GIS.	6 hrs
Unit 6	Fundamentals of GPS: Introduction, space segments, user segments and control segments, observation principle and signal structure, accuracy of GPS measurements, point positioning and relative positioning, methods of surveying with GPS, Static and Kinematic positioning, navigation with GPS, differential GPS, navigational receivers.	6 hrs
Unit 7	Geoinformatics and other Information Sciences: Geoinformatics – Spatialand Non-spatial data Management. Spatial information technology.	6 hrs
Unit 8	Applications of Geoinformatics: Geoinformatics technologies. Applications in Natural Resource Management, Agriculture, Solid Waste Management, Natural Disaster Management, Coastal Zone Management. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	6 hrs

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THIRD SEMESTER

GIH 201: RS and GIS in marine resources and coastal zone management

Students will be able to:
CO1: Understand the fundamental characteristics of coastal and marine environments and their resources.
CO2: Analyze the regulatory frameworks and energy potential of coastal and marine zones.
CO3: Apply Remote Sensing techniques for the acquisition and retrieval of oceanic parameters.
CO4: Utilize GIS and Cartography for mapping, management, and resource assessment in marine and coasta areas.

Skills, employability and entrepreneurship: Remote sensing and GIS play a crucial role in the evaluation of marine resources and coastal zone management. Students learn about modeling and mapping coastal vulnerability to understand the natural and anthropogenic impacts by using spatial planning techniques to attain sustainable development. Students who study in this course have opportunities to work in government organizations like NIO, NCPOR, INCOIS, GSI etc., and several private companies and research institutes. Students can start their own entrepreneurship.

RS and GIS in marine resources and coastal zone management		52 hrs
Unit 1	Introduction and Classification to Coastal and Marine Environments. Historical Review of Oceanography: HMS Challenger Expedition. Fundamentals of Marine ecology, Bio Resource, coastal bathymetry, properties of seawater.	6 hrs
Unit 2	Marine resources: Hydrothermal sulfide deposits including black and white smokers. Poly metallic nodules, oil and natural gas, gas hydrates, marine heavy minerals resources.	6 hrs

Unit 3	Marine Environment: Mangrove Environments, Island Environments, Tidal Flat Environments, Intertidal Environments, Estuarine Environments.	6 hrs
Unit 4	Coastal Regulation Zones (CRZ): Concept of coastal Regulation Zones. Classification of Zones, Criteria of Zonation and Evolution of CRZ norms. Exclusive Economic zone (EEZ).	6 hrs
Unit 5	Marine energy resources: tidal energy, wave energy, wind energy, ocean thermal energy conversion (OTEC).	4 hrs
Unit 6	Remote Sensing and GIS applications in oceanography: Data products and their acquisition, satellites and their payloads useful for ocean related studies. Satellite Oceanography: History of Oceanographic Satellites. Satellites and their payloads for the retrieval of various coastal parameters. Technical characteristics of MODIS-Aqua, Oceansat I and II - OCM/MSMR payloads.	8 hrs
Unit 7	Retrieval of oceanic parameters using RS and GIS (chlorophyll-a, Dissolved organic substances, total suspended matter, Sea Surface Temperature (SST), wind speed, sea surface currents, salinity). Instruments used for collecting and analysis of the marine samples. Concepts of biophysical coupling.	8 hrs
Unit 8	Applied Oceanography: Satellite Oceanography and Satellite data products required to generate Potential Fishing Zones. Use of GIS and cartography to map morpho-eco systems of the coast. Use of Cartography, GIS and satellite oceanography in site selection of major and minor ports and beach recreational environments. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	8 hrs

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GIH 202: RS and GIS in Land and Water Resources

Students will be able to:
CO1: Understand the principles of land resources and apply remote sensing/GIS for land resource investigations.
CO2: Analyze surface water resources and apply hydrogeomorphic concepts in water resource studies.
CO3: Explain groundwater concepts, properties, and resources, with a focus on India.
CO4: Apply Darcy's law and geospatial techniques for groundwater potential assessment and management.
CO5: Evaluate groundwater quality, contamination, and advanced water resource management strategies.

Skills, employability and entrepreneurship: This course provides students with knowledge about RS and GIS applications in land and water resource management. This paper describes the technical aspects of land and water resource assessment using a geospatial platform. The course provides employability in GSI, CGWB, Mines and Geology departments of various public, private organizations and international companies. Students have opportunities to work as consultants for analyzing groundwater resources. Students also can start their own entrepreneurship.

RS and GIS in land and water resources		52 hrs
Unit 1	Land as a natural resource: rocks, minerals, soils, oil and gas, coal. Agriculture land and forest.	6 hrs
Unit 2	Remote sensing and GIS in land resources: visual and digital techniques in land resources investigations. Selection of appropriate software and data products useful in land resources. Site selection for mining.	4 hrs
Unit 3	Water Resources: concepts of surface water, hydrological cycle. World water distribution, watershed management.	6 hrs
Unit 4	Hydrogeomorphic studies in water resources: theory of geomorphic controls of water resources, concept of basin network analysis. surface run off, slope analysis, applications of DEM in water resources, quantitative studies of drainage basins.	8 hrs
Unit 5	Groundwater: Concepts of groundwater, vertical distribution of groundwater, types of aquifers, rock properties affecting ground water resources, lineament studies in water resources, groundwater resources of India with special reference to Karnataka.	6 hrs
Unit 6	Theory of groundwater flow: Darcy's law and its applications. Groundwater potential zone assessment, groundwater prospect zones mapping and groundwater information system. Groundwater provinces in India.	6 hrs
Unit 7	Groundwater development and management: planning and management of groundwater. Methods of artificial groundwater recharge; rainwater harvesting, problems of over-exploitation of groundwater; salt water intrusion, water management in rural and urban areas, geological and geophysical methods of groundwater exploration. Water quality-physical and chemical properties of groundwater, quality criteria for different uses, surface and groundwater contamination.	8 hrs

Unit 8	Water resources and watershed management: concept of river basin management, GIS applications in water resources development and management. Concept of natural recharge, concepts in artificial recharge, and use of DEM in artificial recharge. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	8 hrs

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7. Thomas G. Lane, 2000. Arc View 3D Analyst, ESRI, Press, 12-43.

GIS 203: RS and GIS in urban planning and disaster management

Students will be able to:

CO1: Understand the fundamental concepts of urban and regional planning and apply geospatial technologies to urban studies.
CO2: Evaluate the application of RS and GIS in rural development and planning initiatives.
CO3: Identify and assess various types of natural disasters and their vulnerabilities.
CO4: Formulate and analyze disaster preparedness and mitigation strategies using geospatial tools.
CO5: Comprehend post-disaster management, rehabilitation, and the coordination of support functions.

Skills, employability and entrepreneurship: This course provides geospatial technique abilities for tracking changes in urban environment over time and space, which is also useful for planning for sustainable urban growth. It imparts technical skills related to disaster management using geospatial tools. This course has good opportunities for students in government institutions, particularly in the disaster management cells (state and district levels), smart city development organizations and research institutes. Students can start their entrepreneurship in the form of consultancy/ company.

RS and GIS in Urban Planning		42 hrs
Unit 1	Concepts: urban, urbanism, urbanization, regional concept and types of planning process, presentation and preparation Origin and Growth of urbanization in the world urban problems: pollution, slum, housing, social wellbeing.	6 hrs
Unit 2	Application of GIS, GPS and RS: in Urban and Regional Planning Research Methods in Urban and Regional Studies. Applications of RS and GIS in socio-economic information analysis, land holdings–irrigation, land use, land reforms. Urban sprawl.	6 hrs

Unit 3	RS and GIS Applications: concept of rural development–globalization and its impact on rural development.	4 hrs
Unit 4	Application of RS and GIS: in rural problem solving situation–Village Information System and planning. Planning in India–Development policies (Five Year Plans). Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	6 hrs
RS and GIS in Disaster Management		
Unit 5	Disaster Management: principles of disaster management (cyclone, flood and drought, landslide, land subsidence, volcanism, and earthquake), hazards, and vulnerabilities. Issues and concern for various causes of disasters.	6 hrs
Unit 6	Assessment of disaster: Vulnerability of allocation and vulnerable groups. Preparedness and mitigation measures for various disasters. Preparedness of disaster management plans.	4 hrs
Unit 7	Issues in Environmental Health, Water and Sanitation, Mitigation of natural calamities (cyclone, flood and drought, landslide, land subsidence, volcanism and earthquake). Post-disaster relief and logistics management. Role of remote sensing as a decision making tool in disaster management.	6 hrs
Unit 8	Rehabilitation programs: Voluntary agencies and community participation at various stages of disaster management. Role of military and paramilitary forces during disaster. Emergency Support: functions and their coordination mechanism. Management of Relief Camp. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	4 hrs

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GIS 204: RS and GIS in Agriculture and Forestry

Students will be able to:
CO1: Understand the fundamentals of agriculture and apply geospatial techniques for crop inventory and monitoring.
CO2: Explain and apply the principles of precision agriculture.
CO3: Utilize remote sensing and GIS for sustainable agriculture and damage assessment.
CO4: Comprehend forest characteristics and apply geospatial methods for forest classification and management.
CO5: Analyze forest hazards and apply advanced remote sensing techniques for forest ecosystem monitoring.

Skills, employability and entrepreneurship: This course provides technical skills for implementing RS and GIS techniques in agricultural and forest monitoring and management operations and in identifying forest disasters. There are employment opportunities for students in department of Forestry and Agriculture, research institutes, agricultural universities and NGOs. Students can start their own business as a consultancy to help farmers.

GIS in Agriculture		42 hrs
Unit 1	Introduction to Agriculture: Types of agriculture - Shifting, Subsistence, Extensive, Intensive agriculture, Plantation, Mixed Farming, Commercial Farming, Dry land farming, Wet land farming. Challenges posed to agriculture: Climate Change - Patterns of Temperature and Rainfall, Resource Constraint. Concepts of Agrometeorology: Agro-meteorological stations and automated weather stations.	6 hrs
Unit 2	Spectral Characteristics of Crop. Crop Inventory and assessment: Spectral characteristics of crops and Spectral Vegetation Indices; Crop yield modeling and condition assessment. Crop Management: Plant signatures and vitality indicators: Imaging spectroscopy, chlorophyll fluorescence. Cropping pattern & cropping indices analysis, Crop condition and stress assessment, Crop water management. Crop Monitoring: Crop area estimation, Crop growth monitoring and Condition Assessment, Crop yield prediction, crop stress detection, Disease identification, Phenological studies.	6 hrs
Unit 3	Precision agriculture: Definition, Importance, Components, prospects in Indian agriculture. GPS role in Precision Agriculture. Technologies used in Precision agriculture – Robots, Self-steering tractors, Drones and satellite imagery, Internet of things. Soil Nutrient Management for Precision Agriculture. Irrigation Systems in Agriculture.	5 hrs
Unit 4	Concept of sustainable Agriculture: Agricultural Land Use /Land Cover mapping – Visual analysis of satellite data. LULC Mapping and change detection using Remote Sensing Techniques. Site suitability for agricultural and horticulture crops. RS and GIS in crop damage assessment due to cyclone, drought and flood. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	5 hrs

GIS in Forestry		
Unit5	Geographical distribution, types, extent and status of vegetation of the World, Asia- Pacific and India. Spectral properties of vegetation and factors affecting spectral reflectance. Spectral vegetation indices, phenology as discriminant for vegetation differentiation and growth.	5 hrs
Unit 6	Forest/Vegetation classification and mapping, Forest inventory and sampling techniques, Growing stock estimation, Biomass estimation, forest management, Fire risk zonation, Land evaluation of forestry, Landscape analysis, Wildlife habitat suitability analysis.	5 hrs
Unit 7	Forest hazards (Deforestation, Degradation and Forest fire), Land and soil degradation, desertification and Pollution (Water, air and soil).	4 hrs
Unit 8	Remote sensing of forest ecosystem: Forest change detection using time-series data. Hyperspectral Remote Sensing for species/community delineation, Microwave remote sensing in forestry, LiDAR remote sensing for tree height determination, Biophysical spectral response-based forest canopy density (FCD) mapping. Use of RS and GIS in Forest fire and wildlife habitat assessment and mapping. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	6 hrs

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1. Application of Remote Sensing in Forestry by A.G. Koppad and Anup Kumar Das.
2. Book of Remote Sensing and Geographical Information Systems by M Anji Reddy.
3. Forester's Perspective: Remote Sensing & Geographic Information System by Avichal Tripathi.
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8. Remote sensing and Geographic Information System in Forestry by Girish B Shahapurmath, A. G. Koppad.
9. Remote Sensing For Sustainable Forest Management by Steven E. Franklin.
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GIP 205: DIP and GPS Survey (Lab - Soft core)

Students will be able to:
CO1: Perform essential image pre-processing operations for data quality improvement.
CO2: Apply and evaluate image enhancement and transformation techniques.
CO3: Execute image classification and change detection, and calculate spectral indices.

Skills, employability and entrepreneurship: In this course, students become proficient in the laboratory by using remote sensing software which are commonly used in spatial analysis, modeling, mapping applications, and integrating GIS functions into web-based platforms. There are employment opportunities in private firms, MNCs

and private companies. Students can start their own entrepreneurship. GPS Survey will help the students to acquire skills in the field of surveying and mapping.

1.	Noise removal
2.	Geometric Correction
3.	Radiometric correction
4.	Histogram construction for digital data
5.	Outputs of linear and non-linear stretch
6.	Filtered outputs
7.	Ratio images
8.	Change detection analysis
9.	Image classification based on digital values
10.	Unsupervised and Supervised classifications.
11.	Calculation of various indices - NDVI, NDWI etc.
12.	GPS field survey and mapping.

GIP 206: RS and GIS in Water and Marine Resources (Lab - Hard core)

Students will be able to:
CO1: Apply RS and GIS for quantitative analysis and mapping of surface water resources.
CO2: Utilize RS and GIS for groundwater potential mapping and rainfall analysis. CO3: Implement RS and GIS techniques for marine resource assessment and coastal zone management.

Skills, employability and entrepreneurship: In this course, students gain knowledge about river basins, their catchments, geomorphology and coastal management and modelling. Students will become experts in mapping and monitoring of water resources and monitoring of coastal and marine environment in a sustainable manner using remote sensing and GIS techniques. Students who qualify this course will get opportunities to work in government organizations, several private companies and research institutes. Students can start their entrepreneurship.

RS and GIS in Water Resources (Lab)	
1.	Delineation of river catchments on satellite image. Quantification of Lakes/Reservoirs, Water Bodies from satellite data and top sheets.
2.	Evaluation of various drainage morphometric parameters for watershed characterization. Identification of Drainage Patterns, Computation of Stream Density, Stream Frequency, Ruggedness Number etc.
3.	Creation of flow direction, flow length, flow accumulation in a watershed based on contours using Arc GIS.
4.	Generation of Groundwater potential zone mapping, Isohyetal map generation and interpretation, Generation of Theissen polygons, Precipitation contours.

RS and GIS in Marine Resources (Lab)	
1.	Instrumentation in In-situ collection of Oceanographic Data: Secchi Disc, Water Samplers, Grab Samplers, Anemometers, D. O., Salinity, pH meter.
2.	Construction of Chlorophyll-a, SST, Depth, Salinity, Biomass, Total /Suspended matter, using interpolation techniques in GIS software.
3.	CRZ mapping using topographic sheets, Hydrographic charts, Arial photographs, Digital data products.
4.	Mapping of coastal features like riverine, beach, tidal flat, rocky and sandy shore environments from satellite images, topo-sheets and hydrographic charts.

GIP 207: Geological Field Work and Field Report (Lab - Hard core)

Students will be able to:
CO1: Execute independent and collaborative fieldwork or participate in professional expeditions.
CO2: Apply observational and analytical skills in diverse real-world settings.
CO3: Produce a comprehensive and scientifically sound field report based on practical experience.

Skills, employability and entrepreneurship: it is completely devoted to geological field work, sample collection and visit to various national organizations and sister departments, research institutes, geological survey of India, mining and ocean related R & D Labs, and educational institutions.

Field Work: All students must do detailed geological field work/participate in the ocean expedition/visit RS and GIS related organizations under the guidance of faculty members. The faculty members will continuously evaluate the performance of the students during field work/ocean expedition.

Field Report: A detailed report must be submitted immediately after the field work/ocean expedition. The report will be evaluated.

GIE 208: Geoinformatics of Coastal Environments (Open Elective)

Students will be able to:
CO1: Understand the fundamental concepts of Geoinformatics and its application to coastal environments.
CO2: Identify and characterize key Indian and international satellite systems and their data products relevant to coastal studies.
CO3: Analyze the geomorphology of coastal environments and apply spatial analysis techniques.
CO4: Comprehend coastal regulations and apply Geoinformatics in coastal zone management and development

Skills, employability and entrepreneurship: This course is open to other disciplines such as chemistry, physics, life sciences, statistics and computer sciences. Students who study this course will learn about the monitoring of coastal and marine environments by using remote sensing and GIS techniques. Therefore, students can perform better in their careers if they study this course thereby utilizing their skills of the interdisciplinary science. Students have employability in government organizations and private companies including MNCs.

Geoinformatics of Coastal Environments (Open Elective)		42 hrs
Unit 1	Introduction: Concepts of Geoinformatics. Outlines of Remote Sensing, arial photo interpretation, and Geographic Information System. Arial photos and remote sensing of coastal environment.	4 hrs
Unit 2	Outlines of Indian Satellites: Indian space Program, Scientific Pay loads from India and abroad, Bhuvan: Description of 3D Satellite Mapping. IRS- P4, Ocean Sat-II: Description and Payloads. IRS-IC/D.A brief note on Hyper-spectral Remote Sensing. Resource sat, Cartosat - I & II etc.	6 hrs
Unit 3	Data and Data products: List of Data and Data Models. Digital Data Products, Topographic Sheets and Theme Analysis, Hydrographic Sheets, Outlines of the I.H.O. Bathymetric measurements and outlines of Echo- sounders and Multibeam unit.	6 hrs
Unit 4	Coastal Environments: Geomorphology of Coasts. Classification of Coastal Environments. Relevance Geology and Geotectonic to the genesis of coasts.	4 hrs
Unit 5	Spatial Analysis of Coastal Environments: Collection of Spatial Data from Coastal Environments. Data Interpretation and use of GIS in modeling studies.	6 hrs
Unit 6	Coastal Regulations and Zones: Outlines of CRZ-I, CRZ-II, CRZ-III and CRZ-IV. Amendments to the CRZ norms.	4 hrs
Unit 7	Coastal Development: Definition and Description of Ports and Harbours. Application of EIA and CRZ to development Ports and Harbours. EIA Norms and Criteria for Recreation and Water sports.	6 hrs
Unit 8	Coastal Information System: Concepts of a Coastal Information System. Use of GIS in developing a Coastal Information System. Use of RS and GIS in developing coastal information system. Interactive sessions of teaching to enhance students-teacher interactions through hands-on demonstrations and exercises in the recent advancement of the subject related to the curriculum.	6 hrs

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FOURTH SEMESTER

GIP 251: Dissertation and Viva-Voce

Students will be able to:
CO1: Independently design and execute a comprehensive research project in Geoinformatics.
CO2: Apply advanced Geoinformatics methodologies to solve real-world problems.
CO3: Critically analyze, interpret, and synthesize complex geospatial data and research findings.
CO4: Produce a high-quality, scientifically rigorous dissertation and adhere to academic standards.
CO5: Effectively communicate and defend research findings orally to a panel of experts.

Skills, employability and entrepreneurship: This semester is most important for students to visit different geological sites, government organizations and private companies including MNCs institutions. Students work as a researcher in the chosen areas of the dissertation which may be related to all branches of earth, atmosphere, ocean and space science including societal aspects by using RS and GIS applications. Students learn skills to work with the public, private sectors, universities and research institutions generally outside the university to provide a better exposure related to remote sensing, GIS, earth, atmosphere and ocean science at national and international levels. Students who qualify MSc in Geoinformatics with dissertation have opportunities to teach in degree and engineering colleges, and have employment opportunities in many government agencies like ISRO, IIRS, NRSA, many private companies of GIS and WIPRO, etc., and overseas fellowships/employment.

Dissertation	
Project work and dissertation: Each student is required to undertake a project work under the supervision of a faculty member. It shall consist of 36 hours of Project work per week and include the entire fourth semester and the students shall carry out their project work either in a software company, GIS application company, Remote Sensing company or any research institution such as NIO, INCIOS, CESS, C-GIST, NCAOR, etc. In-house project work with an affiliation of an external company or research institution with an external guide will also be considered for project work in the last (fourth) semester. The project work will be used to provide a dissertation that shall be submitted to the Chairman BoE. For evaluation as per the regulations for Geo- informatics. A viva-voce shall be mandatory as provided in the regulations for Geo-informatics M.Sc. course. After the dissertation work is completed, students shall submit dissertation/thesis based on the results obtained. The dissertation is evaluated by internal and external examiners. The total of the fourth semester shall be of 16 credits only.	200 marks
Viva-Voce	
Dissertation viva –voce: Each student has to present the dissertation work carried out by him/her in front of the examination committee that comprising of Guide, Chairman of the department and the external examiner(s).	100 marks

MODEL QUESTION PAPER

------Semester M. Sc. in Geoinformatics Degree Examination, Month---Year---
(CBCS system)

Subject code ----- : Title of the paper-----

Time: 3 Hours Max. Marks: 70

Instructions: Answer all the questions

I. Define/state any **FIVE** the following: **5x 2= 10**

1)

2)

3)

4)

5)

6)

7)

II. Write short notes on any **FIVE** of the following: **5 x 6 = 30**

8)
9)
10)
11)
12)
13)
14)

III. Answer any **THREE** of the following: **3 x 10 = 30**

15)
16)
17)
18)

Note to the question paper setter: give equal weightage to all the units.

Dr. Mohandas Chadaga Member	Dr. R Nirmala Member
Smt. Yamuna S M Member	Dr. Govindaraju Member
	Dr. Priya K Chairperson