Mangalore University
Accredited by the NAAC
Department of Marine Geology
Geoinformatics Programme
Mangalagangothri-574199

Revised syllabus for M.Sc. Geoinformatics (Choice Based Credit System) with effect from Academic Year 2024-25

Preamble

In response to the IQAC letter No. MU/IQAC/2023-24/67, dtd., 17/07/2023, the syllabus prepared during 2023 has been modified during the annual BoS Meeting held on 11th July 2024 by including **Course Outcomes (Cos) with relevance to the Programme Outcomes (POs)** format provided by the IQAC. The main objective of this revision is to provide more insights of the syllabus to students to enhance their knowledge not only to update the current status of programme, but also skills, employability and entrepreneurship.

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, GIS, Photogrammetry, Cartography, GPS, Earth, Atmosphere and Ocean Sciences.

PO2: Enhance skills of learning software such as ArcGIS, QGIS, ERDAS Imagine, SPSS, programming languages like Java, Python, SQL and C++.

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 and 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 **programme specific outcomes 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
CO 1	Cartography	✓	✓			✓
CO 2	Remote Sensing and Photogrammetry	✓		✓		✓
CO 3	Geographical Information System (GIS)	✓	✓			✓
CO 4	Fundamentals of Earth Sciences	✓				✓
CO 5	RS and Photogrammetry (L)		✓	✓		✓
CO 6	Earth Science (L)		✓			✓
CO 7	DBMS and Spatial Statistics		✓	✓		
CO 8	Digital Image Processing		✓	✓		✓
CO 9	Advanced GIS	✓	✓	✓	✓	
CO 10	Applied Geomorphology and Geo- Environmental Science			✓	✓	

CO 11	Geomorphology and Geostatistics (L)		✓		✓	✓
CO 12	GIS and DBMS (L)		✓		✓	
CO 13	Geoinformatics (Elective)	✓			✓	✓
CO 14	RS & GIS in Marine Resources and Coastal Zone Management	✓	✓		✓	
CO 15	RS & GIS in Land and Water Resources	✓			✓	✓
CO 16	RS & GIS in Urban Planning and Disaster Management	✓		✓	✓	
CO 17	RS & GIS in Agriculture and Forestry	✓		✓	✓	
CO 18	Computer Programming	✓	✓			✓
CO 19	DIP and computer Programming (L)		✓		✓	
CO 20	RS & GIS in Water and Marine Resources (L)		✓		✓	
CO 21	Geoinformatics of Coastal Environments (Elective)	✓				
CO 22	Field Work, Dissertation		✓	✓	✓	✓

MANGALORE UNIVERSITY

DEPARTMENT OF MARINE GEOLOGY

MASTER OF SCIENCE IN GEOINFORMATICS

STRUCTURE OF THE PROGRAMME

Semester	Paper Theory/Lab	Instruction hrs/Week Lectures/ Practicals	Dura-tion of Exams (hrs)	Marks			Credits
				IA	Exam	Total	
First Semester: Five Hard Cores and One Soft Core							
GIH 401	Cartography	4	3	30	70	100	4
GIH 402	Remote Sensing and Photogrammetry	4	3	30	70	100	4
GIH 403	Geographical Inf. System (GIS)	4	3	30	70	100	4
GIS 404	Fundamentals of Earth Sciences	3	3	30	70	100	3
GIP 405	RS and Photogrammetry(L)	8	4	30	70	100	4
GIP 406	Earth Science (L)	8	4	30	70	100	4
Semester Total		**31**	**20**	**180**	**420**	**600**	**23**
Second Semester: Two Hard Cores, Four Soft Cores and One Open Elective							
GIH 451	DBMS and SpatialStatistics	4	3	30	70	100	4
GIH 452	Digital Image Processing	4	3	30	70	100	4
GIS 453	Advanced GIS	3	3	30	70	100	3
GIS 454	Applied Geomorphology and Geo- Environmental Science	3	3	30	70	100	3
GIP 455	Geomorphology and Geostatistics (L)	6	3	30	70	100	3
GIP 456	GIS and DBMS (L)	6	3	30	70	100	3
GIE 457	Geoinformatics*	3	3	30	70	100	3
Semester Total		**29**	**21**	**210**	**490**	**700**	**23**
Third Semester: Two Hard Cores, Five Soft Cores and One Open Elective							
GIH 501	RS & GIS in Marine Resources and Coastal Zone Management	4	3	30	70	100	4
GIH 502	RS & GIS in Land and Water Resources	4	3	30	70	100	4
GIS 503	RS & GIS in Urban Planning and Disaster Management	3	3	30	70	100	3

GIS 504	RS & GIS in Agriculture and Forestry	3	3	30	70	100	3
GIS 505	Computer Programming	3	3	30	70	100	3
GIP 506	DIP and Computer Programming (L)	6	3	30	70	100	3
GIP 507	RS & GIS in Water and Marine Resources (L)	6	3	30	70	100	3
GIE 508	Geoinformatics of Coastal Environments*	3	3	30	70	100	3
Semester Total		**32**	**24**	**240**	**560**	**800**	**26**

Fourth Semester							
GIP 551	Field Work and Field Report				100	100	4
GIP 552	Dissertation				300	300	12
GIP 553	Viva-voce				100	100	4
Semester Total					**500**	**500**	**20**
Grand Total						**2600**	**92**

Note: GI = Geoinformatics, H = Hardcore, S = Soft core, P = Practical/Project Work, and E = Elective. *****Not included for CGPA calculation.

Total Credits from all the Four Semesters:

Semester Credits	Hard Core (H)	Soft Core (S)	Elective (E)	Practical/Project Work (P)	Total credits
First	12	03	--	8 (H)	23
Second	08	06	3*	6 (S)	23
Third	08	09	3*	6 (S)	26
Fourth	--	--	--	20(H)	20
Total	28	18	6*	28 (H) + 12 (S)	92

Total Credits from all the Four Semesters = 23 + 23 + 26 + 20 = 92

Total Hard Core Credits = 28 (T) + 8 (P) + 20 (Project) = 56 = 60.86%

Total Soft Core Credits = 18 (T) + 12 (P) = 30 = 32.60%

*Open Elective Credits = 6 = 6.52% (**Not to be considered for CGPA calculation**)

First Semester

GIH 401: CARTOGRAPHY

Skills, employability and entrepreneurship: This course provides 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 qualify this course have opportunities to work as cartographers in the field of surveying in both government and private organizations.

Unit 1	**Introduction to Cartography and Ancient Cartography:** Evolution of Cartography, Modern Cartography and Applications, Definition of Maps. Outlines of Map Projections.	06 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.	06 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.	06 hrs
Unit 4	**Hydrographic Charts**: Introduction to Hydrographic Charts. Marginal Information and Depth Information of Hydrographic Charts. Scales of Hydrographic Charts. Recovery of Spatial Information from Hydrographic Charts.	06 hrs
Unit 5	**Cartographic models**: Inductive and Deductive Models, Model Flow Charting, Model Implementation and Verification. Principles of Design and GIS Output, GIS Project design and Management.	06 hrs
Unit 6	**Remote Sensing Satellites used for Cartography.** **Digital Cartography:** Web Cartography, 3D Simulation and Visualization	06 hrs
Unit 7	**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.	06 hrs
Unit 8	**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.	06 hrs

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GIH 402: REMOTE SENSING AND PHOTOGRAMMETRY

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, IIRS, KSRSAC, INCOIS etc., photogrammetrist in different organizations and MNCs. Students can also start their entrepreneurship.

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 Programme and Important Indian Satellites.	06 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.	06 hrs
Unit 3	**Hyper Spectral Remote Sensing:** Introduction to Hyperspectral Remote Sensing, Sensors/Imaging Spectrometers, Hyperspectral Satellite Systems, Hyperspectral Image Analysis Techniques including Correction.	06 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.	06 hrs
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.	06 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 executionof photographic flights, radiometric characteristics. Elements of aerial photo interpretation: tone, color, texture, pattern, shape, size and associated features, geotechnical analysis and convergence of evidence.	06 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.	06 hrs

Unit 8	Digital photogrametry and interpretation techniques: definition, creation of digital images, automatic measurements, automatic surface modeling, aerial triangulations, digital photogrammetric workstation.	06 hrs

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GIH 403: GEOGRAPHICAL INFORMATION SYSTEM

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 specific. With the help of advanced software's and computer programs, massive data collected over time can be analyzed to determine the complex future trends. There is a good scope of this course for students who can work as Geoinformatician in various organizations related to human resource development and private organizations and MNCs. Students can also open up their own start-up company.

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.	06 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.	06 hrs
Unit 3	Functions and Advantages of GIS: Introduction, Functions of GIS, application areas of GIS, Advantages of GIS, Uses and limitations of GIS.	06 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.	06 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.	06 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.	06 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.	06 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.	06 hrs

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GIS 404: FUNDAMENTALS OF EARTHSCIENCES

Skills, employability and entrepreneurship: Students admitted from deferent disciplines are provided bride type of basics/fundamental of Earth Sciences. Students learn about the formation and properties of minerals and rocks. Therefore, tis course will help students to identify better quality materials for the constructions dimensional and decorative stones for major civil engineering structures. Students exit out of this course have skills to work in industries related to earth resources, agricultural and soil survey and public works. They will be exposed to start their own entrepreneurship. This course may also be helpful in various government exams, including NET, SET, GATE, and other similar tests.

Unit 1	Introduction**:** Formation of the earth, composition of earth crust, mantle and core. Plate tectonics, Major and Minor plates, continental drift and ocean floor spreading.	08 hrs
Unit 2	Mineralogy: Introduction to important Rock forming Minerals.	08 hrs
Unit 3	Outlines of Igneous Rocks: Intrusive and Extrusive igneous rocks, Granite, diorite, gabbro, pegmatite, peridotite, dolerite, basalt, andesite, dacite, obsidian, pumice, rhyolite, scoria and tuff etc.	08 hrs
Unit 4	Outlines of Metamorphic Rocks: Contact and regional matamorphism, Important metamorphic rocks: Gneiss, Schist, Quartzite, Granulites, Marble, Slate, etc.	08 hrs
Unit 5	Outlines of Sedimentary Rocks: Origin of sediments. Breccia, Conglom-erate, Sandstone, Limestone, Shale, Morphology & Origin of Laterites.	08 hrs
Unit 6	Structural Geology: Primary and Secondary Structures. Folds, Faults, Joints & Unconformities.	08 hrs

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GIP 405: REMOTESENSING AND PHOTOGRAMMETRY (LAB H)

Skills, employability and entrepreneurship: These courses are useful for students to study of aerial photographs and interpretation of satellite images. Preparation of aerial photo index, photo base determination and numerical problems on aerial photographs and satellite images. Students 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 Photo index, Photo base determination and numerical problems on aerial photographs.
2.	**Spectral reflectance:** Plotting of Spectral Reflectance Curves, Rocks, Soil, Vegetation and Water.
3.	**Visual Analysis:** Study of aerial photographs under pocket and mirror stereoscopes and interpretation of satellite images (Black & White and FCC images). Interpretation of satellite data products (visual image interpretation and digital image analysis). Handling Image Processing Software Packages like: ERDAS, ENVI etc. and Generation of thematic maps.
4.	**Elements of Aerial Photo:** Study of Stereo pairs of aerial Photos. Flight planning, Determination of scale and slope. Outlines of parallax measurement.

GIP 406: EARTH SCIENC (LAB H)

Skills, employability and entrepreneurship: Students from deferent 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 own entrepreneurship.

	Petrology
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 451: DATA BASE MANAGEMENT SYSTEM (DBMS) AND SPATIAL STATISTICS

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 provide students to try for various employment across various private organizations. The spatial statistics of different types data such as environmental science, urban planning, public health, and ecology is useful for decision-making policies.

Unit 1	**Data and data base**: Organization of data base, Components of Data Base Management Systems. Files: key, file directories and file storage. Data retrieval and Data Security, Basics of Database models: Entity-relationship model, Flat File system, Network Data model. Concept of Data Mining and Data Warehousing.	06 hrs
Unit 2	**Structured Query Language (SQL)** **Relational and Hierarchical Data Models:** Relational Algebra, Projection operators, Selection operators (Arithmetic & Logical operators), Set unions, Set differences, Cartesian product. Record Storage & primary File Organization, Buffering of Blocks, Hashing Techniques, Index Structures for Files. Transaction Processing Concepts, Data Base Recovery Techniques, Data Base Security Authorizations, Functional Dependencies and Normalization for Relation Data bases.	06 hrs
Unit 3	**C Programming:** Overview of C, Constants, Variables and Data types. Managing input and output operations. Decision Making Statements: Branching (simple if, else, nested if else, else if ladder) and looping statements (while, do while, for loops). Arrays: One-dimensional, Two-dimensional arrays, declaring and initializing arrays.	06 hrs
Unit 4	**Spatial Statistics:** Measures of Central Tendency: Mean, Median and Mode and theirApplications in GIS and Remotely Sensed Data interpretation.	06 hrs
Unit 5	**Correlation Co-efficient** and its application to GIS and Remotely Sensed Data.	06 hrs
Unit 6	**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.	06 hrs
Unit 7	**Factor Analysis:** Outlines of Factor Analysis. Interpretation of Factors for Spatialdata.	06 hrs
Unit 8	**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.	06 hrs

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GIH 452: DIGITAL IMAGE PROCESSING

Skills, employability and entrepreneurship: Students have good opportunity to learn this course for manipulating and analyzing digital images by using specialized softwares 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.

Unit 1	**Introduction**: Digital images, Sources of errors; Image Pre-processing- Atmospheric, Geometric and Radiometric corrections, Noise removal, Resampling techniques. 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.	06 hrs
Unit 2	**Image and Digital Images:** types of images and acquisition, simple image model, Sampling and reconstruction, uniform sampling and quantization.	06 hrs
Unit 3	**Digital Image Analysis:** Digital data, Image File formats, Image Rectification and Restoration.	06 hrs
Unit 4	**Image enhancement techniques:** Raw, Processed Images, Contrast Manipulation, Spatial feature Manipulation, Multi-Image Manipulation.	06 hrs
Unit 5	**Contrast Manipulation:** Grey Level Thresholding, Level Slicing, Contrast Stretching- Concept of Digital Number.	06 hrs
Unit 6	**Spatial feature Manipulation:** Convolution, Edge Enhancement, Concept and Use of Fourier Analysis in Digital Image Analysis.	06 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, TVI, NDVI and NDWI.	06 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.	06 hrs

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GIS 453: ADVANCED GIS

Skills, employability and entrepreneurship: This is the most important course for students to study advanced with the help of advanced software and computer programs. There is a good scope of this course for students who can work as geoinformatician, GIS engineer 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.

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.	06 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).	06 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.	06 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 & dispersion, Spatial Auto Correlation, Kriging.	06 hrs
Unit 5	**Decision Support Systems** (DSS): Concepts of decision making, systems and modeling, Need for DSS. Concepts of multicriteria decision making.	06 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. Open Source GIS and its components.	06 hrs
Unit 7	Open source GIS platforms, software, Libraries - GRASS GIS, Cloud GIS, QGIS, Application of Open source GIS, Arc GIS.	06 hrs
Unit 8	Applications of GIS in various fields of Geoinformatics.	06 hrs

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GIS 454: APPLIED GEOMORPHOLOGY AND GEOENVIRONMENTAL SCIENCE

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, environmental and environmental research laboratories of private and government sectors.

Unit 1	Concepts of modern Geomorphology: Geomorphology and its applications in natural resources inventory. Geomorphology and its applications to Geoinformatics.	06 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.	06 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. Solid waste management and its impaction on local and regional geomorphology. Geo-hazards and geomorphic controls. Application of Remote Sensing and GIS in quantitative and Quantitative interpretations of 'risk area mapping' including forest fires, floods, earthquakes and Tsunami effected terrains.	06 hrs
Unit 4	General Introduction: Definition of Environment, Environmental Pollutant, Environmental Pollution, Environment–Handling, Hazardous substance.	06 hrs
Unit 5	Environment Management Plan: Concepts and use of EMP in coastal and marine environments.	06 hrs
Unit 6	Environment Impact Assessment Act: Definition, use and implementation for specific areas such as Marine Environments, Ports, Harbours, Recreation, Water Quality Standards for class SW-I waters, SW-II, SW-III, SW-IV, SW-V.etc., Noise Standards.	06 hrs
Unit 7	Coastal Regulation Zones: Concept of coastal Regulation Zones. Classification of Zones, Criteria of Zonation and Evolution of CRZ norms. Application of cartography, Remote sensing and GIS in mapping of Coastal Regulation Zones.	06 hrs
Unit 8	Anthropogenic and Natural Environmental Hazards: Reconnaissance mapping of Landslides and use of DEM. Use of GIS and Remote sensing in detection of water– spread areas including monitoring flood scenarios. Use of high resolution satellite data (IKONOS) and other digital data products in assessing damage due to earthquakes, forest fires, flooding, etc. Impacts of Open-cast Mining and monitoring through multi-dated Remote Sensing and GIS techniques.	06 hrs

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GIP 455: GEOMORPHOLOGY AND GEOSTATISTICS (Lab S)

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.
6.	Exercises related to measurements of runoff dynamics and sediment dynamics.
Geostatistics	
1.	Quartiles, Deciles and Percentages
2.	Measures of Dispersion
3.	Skewness and Kurtosis
4.	Students T test
5.	Regression and Multiple linear regression
6.	**SPSS**: Introduction to SPSS. Use of SPSS in creating a database. Applications of SPSS in Correlation Co-efficient. Use of SPSS in Linear Regression. Modeling and Prediction. Application of SPSS in GIS data modeling.

GIP 456: GIS AND DBMS (Lab S):

Skills, employability and entrepreneurship: This course is provides students with knowledge about creating 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.

GIS	
1.	Geo-referencing – image rectification based on co-ordinate system. Onscreen digitization
2.	GIS and Remote Sensing data integration: Integration of vector and raster data (linking of spatial and non-spatial data)
3.	Extraction of Thematic maps: preparation of thematic layers-on screen from toposheets, images - Road, Settlement, Drainage, LU/LC etc.

4.	Map composition and presentation of results. Overlay and proximity analysis-clip, erase, intersect, union, buffer.
5.	Edge matching/spatial adjustment. Calculation of slope in degrees and percentages. Calculation of area, perimeter and distance using Arc GIS.
6.	Creation of 3D maps: TIN, Hill shade, Slope, and Aspect with Arc GIS.
DBMS	
1.	Outlines of DBMS and Applications of DBMS in Geoinformatics.
2.	Introduction to SQL and its application in GIS.SQL Queries (Alter, Insert, Update, Delete).
3.	Designing database: Creation of tables, inserting values in to the tables, updating the existing Value, modifying the structure of the database, Use of Drop and delete commands. Use of Numeric, Aggregate, Date, Conversion and character functions.
4.	C programming: Applications of C program in Geoinformatics.

GIE 457: GEOINFORMATICS (Open Elective)

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.

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 imagesand field data.	6 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.	6 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).	6 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.	6 hrs

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THIRD SEMESTER

GIH 501: RS AND GIS IN MARINE RESOURCES AND COASTAL ZONE MANAGEMENT

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.

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	**Ocean Floor Topography:** Continental margins – Active and Passive, Ocean basin floor, Mid oceanic ridge, Submarine Canyons, Waves, Ekman Spiral, Ekman Transport, Upwelling/Down welling Processes.	6 hrs
Unit 3	**Coastal Environment:** Concepts of Zonation, Rocky Shores, Sandy Shores, Cuspate Beaches, Spits and Beach Ridges, Back Shore Dune Environments.	6 hrs
Unit 4	**Marine Environment:** Mangrove Environments, Island Environments, Tidal Flat Environments, Intertidal Environments, Estuarine Environments.	6 hrs
Unit 5	**Major Currents of the Oceans**: Surface currents, Deep ocean currents, Subtropical gyres. Currents in Indian Ocean – Periodical currents (Summer (SW) and Winter (NE) monsoon currents).	6 hrs
Unit 6	**Remote Sensing and GIS:** Applications in Oceanography and Environmental studies. 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 & II - OCM/MSMR payloads.	6 hrs
Unit 7	**Retrieval of Oceanic Parameters:** Chlorophyll-a, Dissolved organic substances and Total Suspended Matter. Insitu recovery of Chlorophyll, SST, Wind Speed, Sea Surface Currents, Salinity, and TSM. Instruments used for collecting and analysis of the samples. Concepts of Biophysical Coupling. Prediction models of Sea Surface Temperature.	6 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.	6 hrs

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GIH 502: RS AND GIS IN LAND AND WATER RESOURCES

Skills, employability and entrepreneurship: This course provides students 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.

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 and Water Resources:** Application ofRemote Sensing and GIS in the study of Land and Water Resources. Visual and Digital Techniques in Land and Water Resources Investigations. Selection of appropriate software and data products useful in these resources.	6 hrs
Unit 3	**Water Resources:** Introduction, 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, Flood mapping, Quantitative studies of drainage basins.	6 hrs
Unit 5	**Groundwater:** Concepts of Groundwater, Vertical Distribution of Ground water, 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 assessment, ground water prospect zones mapping and ground water information system.	6 hrs
Unit 7	**Water Resources and Watershed Management:** Concept of River Basin Management, GIS applications in water resources development andmanagement. Concept of Natural Recharge, Concepts in Artificial Recharge, and use of DEM in Artificial Recharge.	6 hrs
Unit 8	**Groundwater development and management:** Planning and management of groundwater. Methods of artificial groundwater recharge; rainwater harvesting, problems of over-exploitation of groundwater; water management in rural and urban areas, geological and geophysical methods of groundwater exploration. **Water Quality** Physical and chemical properties of water, quality criteria for different uses, groundwater provinces of India, Groundwater contamination.	6 hrs

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

GIS 503: RS AND GIS IN URBAN PLANNING AND DISASTER MANAGEMENT

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.

GIS in Urban Planning		
Unit 1	**Concepts**: Urban, Urbanism, Urbanisation, Regional Concept and Types of Planning process, presentation and preparation Origin and Growth of Urbanisation 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, Agricultural Information System –Land Holdings–Irrigation, Land Use, Land Reforms.	6 hrs
Unit 3	**RS and GIS Applications:** in Agriculture and Rural Development, Concept of Rural Development–Globalization and its impact on Agriculture and Rural Development. Types of agriculture, Livestock.	6 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) Geo-informatics for Precision Farming-Importance and relevance to Indian Agriculture.	6 hrs
GIS in Disaster Management		
Unit 5	**Disaster Management**: Concepts of disaster; Types of disaster Natural and manmade: Cyclone, flood, landslide, land subsidence, fire and earthquake. Issues and concern for various causes of disasters. Principles of Disaster Management, Natural Disasters, Hazards, Risks and Vulnerabilities.	6 hrs

Unit 6	**Assessment of Disaster**: Vulnerability of allocation and vulnerable groups. Preparedness and Mitigation measures for various Disasters. Preparation of Disaster Management Plans.	6 hrs
Unit 7	**Issues in Environmental Health, Water & Sanitation,** Earthquake Mitigation, Floods, Fire, Landslides and other natural calamities. Post Disaster Relief & Logistics Management.	6 hrs
Unit 8	**Information systems & decision making tools**. Role of Remote Sensing in Science & Technology. Rehabilitation Programmes. Voluntary Agencies & Community Participation at various stages of disaster management. Role of military and paramilitary forces during disaster. Emergency Support: Functions and their coordination mechanism. Resource and Material Management. Management of Relief Camp.	6 hrs

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GIS 504: RS AND GIS IN AGRICULTURE AND FORESTRY

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		
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 Resource Mapping: Soil Quality: Indicators, measurement and assessment, Soil pollution: Soil contamination by heavy metals andPesticides, Soil Nutrient Management for Precision Agriculture. Irrigation Systems in Agriculture.	6 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. Impact of LULC change detection on biogeochemical and hydrological cycles. Site suitability for agricultural and horticulture crops. RS and GIS in damage assessment due to cyclone, drought and flood.	6 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.	6 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.	6 hrs
Unit 7	Forest hazards (Deforestation, Degradation and Forest fire), Land and soil degradation, desertification and Pollution (Water, air and soil).	6 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. Mapping of forest density and type, issues in forest management. Forest Fire Modeling, Wild Life Habitat Assessment Modeling, Soil Erosion Modeling.	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.
4. Land, T. G. 1999. ArcView-3D Analyst. ESRI press. 6-23.
5. Michael Zeiler 1999. The ESRI Guide to GIS Analysis, vol. I. ESRI press.4-16.
6. Michael Zeiler, Modeling Our World: The ESRI Guide to Geodatabase Design. ESRI press.3-7.
7. R.W. Tank: Focus on Environmental Geology (p. 256).
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.
10. Remote Sensing With Special Reference to Agriculture and Forestry by National Academy of Sciences.

GIS 505: COMPUTER PROGRAMMING

Skills, employability and entrepreneurship: In this course, students learn about programming languages like C++, Java and Python, which are used in GIS software primarily for customization and automation. Python and Java are commonly used in GIS environments for scripting, spatial analysis, modeling, mapping applications and integrating GIS functions into web-based platforms. There are employment opportunities in MNCs, private companies. Students can start their own entrepreneurship.

Unit 1	**Basics of Computers:** An introduction to computers, development of computers, Hardware and Software. Fundamentals of Computers – operating systems, input devices, output devices, storage devices-primary, secondary, central processing unit, computer languages, translators.	8 hrs
Unit 2	**Information Super Highway:** Introduction to Internet. Scope of Internet. Equipment required for an Internet Connection. Electronic Mail. Concepts of Information Storehouse. Surfing the Net. Browsing the WWW. Search Engines and their applications. Application of internet to Geoinformatics. Introduction to networks, Local area network devices, topologies, protocols, wide area networks, servers, hubs, nodes, modems, internet.	8 hrs
Unit 3	**HTML (Web design):** Basic & advanced HTML, Types of tags, Document creations, Linking, Creating Link List, handling images, tables and, style sheets. Types of tags, Creating hyper text links. Formatting the text (example). Creating Image Links.	8 hrs

Unit 4	**Outlines of Python:** Introduction. Creating/Opening/Closing a net CDF file, Dimensions, Variables, attributes in a net CDF file. Writing and retrieving data from a net CDF file. Numpy, Scipy, Matplotlib modules/packages.	8 hrs
Unit 5	**Handling of Character strings:** Declaring and initializing string variables. C++ Programming: C++ Tokens, Expressions and Control Structure. Object oriented concepts: classes and objects, Functions: Defining Member functions Inheritance, Polymorphism, operator overloading, Constructors and Destructors, Control structures statements.	8 hrs
Unit 6	**JAVA:** Fundamentals of Objects- Oriented Programming. Overview of Java, Data types, Variables, Constants, Operators and Expressions Decision Making: Branching and looping statements, Classes, Objects and methods, multiple Inheritance, packages, multi-threaded programming, managing errors and exceptions, applets.	8 hrs

BIBLIOGRAPHY

1. Beekman, G. 1999. Computer Confluence: Exploring Tomorrow's Technology. Addison-Wesley, Reading, MA. (3rd Ed).
2. Willis H. Means 19087A content analysis of six introduction to computer science textbooks ACM New York, NY, USA, 403 - 413
3. Beekman, G. George Beckman, 2000. Tech Nation. Online. Internet. [March 14]. Available WWW:http://www.computerconfluence.com/about/tech.htm
4. Cheryl Schmidt Complete 1990. Computer Repair Textbook, Scott Jones, 22-408.
5. Dix, A., Finlay, J., Abowd, G., and Beale, R. 1999. Human-Computer Interaction. Prentice-5. Hall, Herts. UK. 67-089.
6. Goldberg, M. W. Web CT and First Year Computer Science June, 1997: Student Reaction to and Use of a Web-Based Resource in First Year Computer Science, in Proceedings of the ACM's ITiCSE Conference on Integrating Technology into Computer Science Education. ACM Press. 127-129.
7. E. Balaguruswamy, Programming in C++
8. E. Balaguruswamy, Programming in Java.

GIP 506: DIP AND COMPUTER PROGRAMMING (Lab S)

Skills, employability and entrepreneurship: In this course, students become proficient in the laboratory by using C++, Python, and Java 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.

	Digital Image Processing Lab
1.	ERDAS Imagine
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.	Changed detection analysis
9.	Image classification based on digital values
10.	Unsupervised and Supervised classifications.
Computer Programming Lab	
1	Applications of C++ programming in Geoinformatics. Programs to illustrate use of classes, objects in processing/performing Geoinformatics related tasks.
2	HTML: Introduction to WEB and its Applications in Geoinformatics. Creation of web pages. Use of HTML text formatting tags, Hyperlinks, Image stags.
3	Application of Java to Geoinformatics data. Creation of Java programs and applets. Embedding applet tags in HTML.

GIP 507: RS AND GIS IN WATER AND MARINE RESOURCES (Lab S)

Skills, employability and entrepreneurship: In this course, students gain knowledge about river basins, their catchments, geomorphology and coastal management and modelling. Students will become expertise 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 own entrepreneurship.

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.
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 ArcGIS.
3	CRZ mapping using topographic sheets, Hydrographic charts, Air 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. Identification & Interpretation of Oceansat, Modis, and other Oceanographic Satellite Images.

BIBLIOGRAPHY

1. Application of Remote Sensing in Forestry by A.G. Koppad and Anup Kumar Das.
2. Groundwater Hydrology (2nd Ed.) – D. K. Todd, John Wiley and Sons Inc. New York
3. Hydrology – S. N. Davis and R. J. M. Dewiest – John Wiley and Sons Inc. New York.
4. Ground Water Assessment, Development and Management – K. R. Karanath – Tata.
5. Global Groundwater Resources and Management: Paliwal - Scientific publishers.
6. Exploitation of Groundwater and their effects: Noor M. - Cyber Tech Publishers.
7. Sabine Latteman, 2010. Development of an Environmental Impact Assessment and DecisionSupport System. 12-23.
8. Ikeda and Dobson, 1995. Oceanographic Applications of Remote Sensing. CRC Press. Tokyo.131-367.
9. Michael Zeiler, Modelling Our World: The ESRI Guide to Geodatabase Design. ESRI Press, 24-31.
10. Pinnet, P., 1992. Oceanography: An Introduction to the Planet Oceans. West Publ. Co., 513.
11. Richard A. Geyer, Marine Environmental Pollution, Elsevier Oceanography Series, 21-32.

GIE 508: GEOINFORMATIS OF COASTAL ENVIRONMENTS (Open Elective)

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 monitoring of coastal and marine environment environments by using remote sensing and GIS techniques. Therefore, students can perform better in their career if they study this course thereby utilizing their skills of the interdisciplinary science. Students have employability in government organizations and private companies including MNCs.

Unit 1	**Introduction:** Concepts of Geoinformatics. Outlines of Remote Sensing, Air Photo Interpretation, and Geographic Information System. Arial photos and remote sensing of coastal environment.	6 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.	6 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.	6 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 andGIS in developing coastal information system.	6 hrs

BIBLIOGRAPHY

1. Áine Ryall 2009. Effective Judicial Protection and the Environmental Impact Assessment Directive in Ireland. Hbk, 1-332.
2. Aradhana, A. 2006. Special Economic Zones: Revisiting the Policy Debate. Economic and Political Weekly, Vol. XLI Nos. 43 and 44, 4-10
3. Aradhana, A. 2009. Genesis, Evolution, and the Changing Role of SEZs in Asia: A Comparative Analysis of Taiwan. Korea and India, Mimeo, Korean Institute of Economic Policy(KIEP) 2-12.
4. Berling, G.L. and Roy, W.W. 1989. Application of Aerial Photographs and Remote sensing Imagery in Urban research and studies. Monticell, 6-33.
5. Bonham- Carter G.F., 1994. Geographic Information System for Geoscientists, Pergamon Press, Tarrytown, New York, 6-9.
6. Brench, M. C., 1971. City Planning and Aerial information. Harvard Uni., Cambridge.12-45.
7. Burough, P. A., 1986. Principles of Geographic Information systems for Land Resources Assessment, Clarendon Press, Oxford, 1-194.
8. Land, T. G. 1999. ArcView-3D Analyst. ESRI press. 6-23.
9. Michael Zeiler 1999. The ESRI Guide to GIS Analysis, vol. I. ESRI press.4-16.
10. Michael Zeiler, Modeling Our World: The ESRI Guide to Geodatabase Design. ESRI press.3-7.
11. Prabha Shastri Ranade, 2009. *Special Economic Zones: Global and Indian Experiences,* ISBN: 8131411559, Publ: ICFAI, 324pp.
12. Sabine Latteman, 2010. Development of an Environmental Impact Assessment and Decision Support System. 12-23.
13. Wood, C., 1995. Environmental Impact Assessment – A comparative Review. 1-337.

FOURTH SEMESTER

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.

GIP 551: Field Work and Field Report

Field work carried out by the students under the guidance of faculty members will be evaluated by all the concerned teachers. The field report submitted by the students under the supervision of faculty member(s) will be evaluated by the concerned teacher (s).	100 marks

GIP 552: Project/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 eitherin a software company, GIS application company, Remote Sensing company orany 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 and 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 regulationsfor 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 twenty credits only.	300 marks

GIP 553: Viva-Voce

Each student has to present the dissertation work carried out by him/her in front of the examiners (internal and external). His (her) performance will be evaluated based on the knowledge of the dissertation work.	100 marks

Question paper pattern

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

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

Time: 3 hours Maximum marks: 70

I. Define/state any five of the following: 5 x 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. Write any three descriptive notes of the following: 3 x 10 = 30

15) ----------
16) ----------
17) ----------
18) ----------

Note to the paper setter: please select questions by covering all units of the syllabus

Prof. Govindaraju 11/07/24 Member	Dr. K. Priya 11/7/24 Member
Smt. S.M. Yamuna 11/07/2024 Member	Dr. Nirmala, R. 11/7/24 Member
B. R. Manjunatha Chairman (BOS)	

CHAIRMAN (BOS)
M.Sc. Geoinformatics
Department of Marine Geology
Mangalore University
Mangalagangothri - 574 199.