CHOICE BASED CREDIT SCHEME

CENTRE FOR GEOINFORMATICS TECHNOLOGY

DOS in Geography, Manasagangothri, University of Mysore, Mysuru – 570006

REVISED SYLLABUS BY SEMESTERS

MASTER OF SCIENCE IN GEOGRAPHICAL INFORMATION SYSTEMS (M.Sc. in GIS)

For students admitted in 2016-17

I Semester (Credits: 28)

SL. No.	Code	Title of Course	Types HC/SC/OE	Number of Credits			
				L	T	P	Total
1		Principles of Remote Sensing	HC I	3	1	0	4
2		Fundamentals of Cartography	HC II	3	1	0	4
3	Practical	Advanced Remote Sensing Analysis	HC III	0	1	3	4
4		Computer Applications in GIS	SC I	3	1	0	4
5		Qualitative and Quantitative Research Methods	SC II	3	1	0	4
6		Land Use Planning and Land Evaluation	SC III	3	1	0	4
7		Application of Remote Sensing in Coastal Management	SC IV	3	1	0	4
Note: All three Hard Core Courses are compulsory. Among the Four Soft Core courses, students have the option to choose any two Soft Core Courses.							

II Semester (Credits: 28)

SL. No.	Codes	Title of Course	Types HC/SC/OE	Number of Credits			
				L	T	P	Total
1		Geographical Information Systems and Global Positioning Systems	HC IV	3	1	0	4
2	Practical	Advanced GIS and GPS Techniques	HC V	0	1	3	4
3		Principles of Photogrammetry	HC VI	3	1	0	4
4		Applications of GIS in Disaster Management	SC V	3	1	0	4
5		Geography of Network Analysis	SC VI	3	1	0	4
6		Application of GIS in Geomorphology	SC VII	3	1	0	4
7		GIS for Land Resource Management	SC VIII	3	1	0	4
8		Fundamentals of GIS and GPS	OE I	3	1	0	4
Note: All three hard cores are compulsory. Among the Four soft cores, students have the option to choose any two Soft Core Courses. Open Elective Courses are offered for the students of other Department.							

III Semester (Credits: 28)

SL. No.	Codes	Title of Course	Types HC/SC/OE	Number of Credits			
				L	T	P	Total
1		Climate Change and GIS	HC VII	3	1	0	4
2	Practical	Programming in C	HC VIII	0	1	3	4
3	Practical	Mapping in AutoCAD	HC IX	0	1	3	4
4		GIS for Urban Planning and Management	SC IX	3	1	0	4
5		GIS for Water Resources Management	SC X	3	1	0	4
6		GIS for Environmental Management	SC XI	3	1	0	4
7		GIS for Demography and Humanities	SC XII	3	1	0	4
8		Basics of Remote Sensing	OE II	3	1	0	4
Note: All three hard cores are compulsory. Among the Four soft cores, students have the option to choose any two Soft Core Courses. Open Elective Courses are offered for the students of other Department.							

IV Semester (Credits: 12)

SL. No.	Codes	Title of Course	Types HC/SC/OE	Number of Credits			
				L	T	P	Total
1		Internship	HC X	0	1	3	4
2		Major Research Project	HC XI	0	2	6	8
3		Fundamentals of GIS and GPS	OE III	3	1	0	4

Internship and Projects are compulsory. Open Elective Courses are offered for the students of other Department.

Note: All course works / programs are compulsory for M.Sc-GIS students.

- **Internships:** Are done in a Government, research and implementation institution and / or a Private, Corporate institution of repute with specialization on the technologies of Cartography, Remote Sensing, GIS and GPS, including Computer work in a prestigious lab. Internship must begin in the first week of February and continue till the end of March.
- **Project work:** This is a Major Project of 3 full months or about 12 weeks, on a larger, manageable program of research, requiring a report of 90 pages including maps and diagrams and tables (40 pages) and text (50 pages). Project work begins in the first week of April.

Seminars are a part of Internships and Project work in which seminars have specific purposes. Students make power point presentations on their chosen theme of research for project work, outlining the background, rationale and objectives of research, on their chosen Methodology and the rationale behind them and on their Draft Final report at the end of the 20th week of the semester (end of June) under the guidance and supervision of their tutors/advisors/guides.

Field work and **educational tours** are also compulsory for the students and are conducted by the students with explicit guidance and supervision from the faculty members. They are better performed before the beginning of the second and fourth semesters.

The students are very intensively engaged by the course works of Internship, Project work, seminars, field work and educational tours, with constant monitoring and evaluation of the work carried out by the teachers. Final seminar where the students make their presentations on their Final Project Report of their major research work will be jointly evaluated by two internal examiners / experts.

OPEN ELECTIVES

II SEMESTER

Sl. No	**Codes**	**Course Title**	Number of Credits			
			L	T	P	Total
01		Fundamentals of GIS and GPS	3	1	0	4

III SEMESTER

Sl. No	**Codes**	**Course Title**	Number of Credits			
			L	T	P	Total
01		Basics of Remote Sensing	3	1	0	4

IV SEMESTER

Sl. No	**Codes**	**Course Title**	Number of Credits			
			L	T	P	Total
01		Fundamentals of GIS and GPS	3	1	0	4

CHOICE BASED CREDIT SCHEME

CENTRE FOR GEOINFORMATICS TECHNOLOGY

DOS in Geography, Manasagangothri, University of Mysore, Mysuru – 570006

REVISED SYLLABUS BY SEMESTERS

MASTER OF SCIENCE IN GEOGRAPHICAL INFORMATION SYSTEMS (M.Sc. in GIS)

For students admitted in 2016-17
(Hard Core, Soft Core and Open Elective Papers by Semester)

FIRST SEMESTER

HARD CORE

PAPER: PRINCIPLES OF REMOTE SENSING

Objective: *The objective of this paper is to understand the basic concepts of Remote Sensing and to impart to students the skills necessary for remote sensing analysis and interpretation so that students acquire transferable and also employable skills in remote sensing. This is a step ahead of the fundamentals and more practical for learning.*

Introduction: Definitions, concepts and types of remote sensing, evolution, stages and advantages of remote sensing, spatial data acquisition, Electromagnetic spectrum, Characteristics of electromagnetic radiation, wavelength regions of electromagnetic radiation, types and platforms of sensors – LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRD.

Digital Image Processing: Image processing systems, data formats of digital image, pre-processing, image enhancement and transformation and image classification, multispectral images, Visual Image Interpretation, remote sensing products, elements of visual interpretation, interpretation keys, generating thematic maps; thermal and radar image interpretation.

Remote Sensing Technologies: Thermal Remote Sensing – Thermal radiation principles; Precision remote sensing – spatial, spectral and temporal precision; Passive and Active Microwave Remote Sensing; RADAR – definition, development, wavelengths, airborne and space borne SLRs and their components; LiDAR – principles, components, accuracy, spectral characteristics of laser and error analysis.

Applications of Remote Sensing: Applications of remote sensing in agriculture (crop-yield estimation), forestry (vegetation index, biodiversity/species estimation), oceans and coastal monitoring (sea surface temperatures, oil spills), and monitoring atmosphere components, applications of thermal remote sensing in geology, hydrogeology and urban heat budgeting.

Reference:

1. **Remote Sensing and GIS** - Bhatta, B.
2. **Introduction to Remote Sensing and Image Interpretation**; Lillesand T.M.
3. **Introductory Remote Sensing** - Gibson, Paul. J.
4. **Digital Image Processing: A Remote Sensing Perspective** - Jensen, John R.
5. **Microwave Remote Sensing: active and passive** – Fawas T Ulaby, Richard K Moore
6. **Imaging Radar for resources surveys** – Travett J W

HARD CORE

PAPER: FUNDAMENTALS OF CARTOGRAPHY

Objective: *This course enables the students to learn the fundamental techniques and skills in Cartography and the new theoretical approach that is part of the innovative evolution of cartography.*

Introduction: Definition, concepts, types, history, applications, conventional cartography and digital cartography, cartographic communication process, cartographical cube, types of map and functions, map scale, map numbering system.

Cartographic abstraction and symbolization: Cartographical data models, classification, simplification, Base maps, thematic maps, choropleth map, Socioeconomic map, Water resources map, Geologic map, Forest map, Agriculture map, Water resource map, Water quality map, Soil survey map, Map for hot spots manipulation; map composition, cartographic elements, symbolization of features – point, line and area.

Map perceptions and design: Objectives, functions, scope of design, perceptual consideration, graphic communications, control of map design and design planning, design excellence, principles of cartographic designs, cartographic generalization, atlases and hypermaps; Mapping Algorithms - Contouring algorithms, Surfaces and surface interpolation algorithms; 3D Visualization with stereo anaglyph images.

Projections and Geodesy: Classification of map projections, datum surfaces and coordinate system, Transformation, Azimuthal, Conical and Cylindrical projections with emphasis on LCC, Polyconic and UTM; Geodesy – definition, types, shape and size of Earth, geoid, reference ellipsoid, Everest Spheroid, WGS 84 and geometry of ellipsoid.

References

1. **Elements of Cartography** - Robinson, A.H., et. al.
2. **Fundamentals of Cartography** - Misra, R.P. and Ramesh A.
3. **Cartography: Visualisation of Spatial data** - Kraak, M.J. and F.J.Ormeling
4. **Introduction to Thematic Cartography** - Tyner, J.
5. **Satellite Geodesy** – Gunter Seebar

HARD CORE

PAPER: ADVANCED REMOTE SENSING ANALYSIS

Objective: *Remote Sensing Technology is applied to problems and issues in sustainable development. Remotely sensed data are manipulated for feature extraction, spatial analysis and raster based GIS modeling*.

Data Acquisition: Obtaining multi-spectral data from Landsat, IRS, SPOT, MODIS Terra/Aqua, NOAA; obtaining elevation data from Cartosat - I, SRTM, ASTER, Topographical Maps and GEBCO,

Data Preprocessing: Image enhancement - contrast manipulation, density slicing, and colour coding, image rectification: noise removal, radiometric correction, spatial correction, spectral correction, pan sharpening; geometric correction; image registration, subset, mosaic.

Image Classification: Determination of classes and various classification scheme; Unsupervised – K Means, Isodata; Supervised classification – training sets, Parametric and Non-Parametric rules; Object based classification; Visual Image Interpretation; Accuracy assessment – Confusion matrix, Kappa – coefficient.

Modelling – indices modelling - DVI, NDVI, SAVI, MSI, NDBI, NDWI; building of model using model maker – Tasseled Cap Transformation (Brightness, Wetness and Greenness), land surface temperature, study of histograms and layer information.

References

1. **Introduction to Remote sensing and Image interpretation**- Lilesand and Keifer
2. **Introductory Remote Sensing**- Paul. J. Gibson
3. **Fundamentals of Remote Sensing and Air Photo Interpretation** -Avery, T.E.
4. **Introduction to Remote Sensing** -James B. Campbell
5. **Remote Sensing and Image Interpretation** -Lillesand, T.M. & R.W.Kiefer

SOFT CORE

PAPER: COMPUTER APPLICATIONS IN GIS

Objective: *This course teaches skills such as basic computer skills, computer cartography, and spatial analysis tools to query databases and manage relational databases, identifying appropriate data sources via the Internet and offline and presentation skills related to maps and GIS data.*

Introduction: Computers and its generations, Hardware Components – Processor, Main memory, Secondary Memory, Input Devices, Output devices, Storage Devices; Software Component – Software/Program, Application Software; Operating System - OS Functions, Types of OS – Windows, Unix/Linux, Solaris; Network - LAN, WAN, World Wide Web, Internet

Programming and DBMS: Assemblers, Compilers, Interpreters, Machine Code, Assembly Language, High Level Languages, Systematic Programming, Object-Oriented Programming**;** DBMS: Introduction; databases, structure, types of DBMS; application of DBMS in GIS; data management using MS-Excel, SQL.

Computer Applications in Geography: Colour schemes Versus Black and White / Grayscale; graduated symbols; dot density; symbolizing types of features; Linking data to geography; extracting data from the map; site selection vs. site planning; data suitability.

Web mapping: Static and interactive web mapping, collaborative web mapping, Web Mapping Services, OpenLayers, Goggle maps, Yahoo maps and Microsoft map services, Mashups, GeoRSS, applications of internet in GIS, Mobile GIS.

References

1. **Computer Applications in Geography**- Mather, P.M.
2. **Elements of Cartography**- Robinson
3. **GIS: A Short Introduction**- Schuurman, N.
4. **The Power of Maps** - Routledge
5. **Geographical Information System Concepts and Business opportunities**- Prithvish Nag

SOFT CORE

PAPER: QUALITATIVE AND QUANTITATIVE RESEARCH METHODS

Objective: *This course is designed for field methods, to practice and apply in research and work related to it. The students of GIS may use qualitative and quantitative research methods to improve their performance in participatory methodologies.*

Research methodology: meaning, objectives, motivation, types, approaches, significance and process of research, research methods- qualitative and quantitative.

Qualitative research methods: Introduction, merits and demerits, data collection methods, manipulation and analysis, report writing, Participatory action research, participatory appraisal, gender matrices and stakeholder analysis.

Quantitative research methods: Introduction, merits and demerits, data collection methods, manipulation and analysis, report writing, sampling, sampling error, hypothesis testing.

Mixed research methodology: Blending (why and how) of qualitative and quantitative research methods, advantages and disadvantages, applications of mixed research methods.

References

1. **Practical Work in Geography** - Garnier, B.J.
2. **Applied Multivariate Statistical Analysis** - Johnson, R.A. and D.W. Wichern
3. **Research methodology** - Kothari, C.R.
4. **Quantitative Methods in Geographical Research** - Najma Khan
5. **Quantitative Techniques in Geography** - Hammond, P. and McGullah, P.S.
6. **Quantitative and Statistical Approaches to Geography** - Mathews, J.A.

SOFT CORE

PAPER: LAND USE PLANNING AND LAND EVALUATION

Objective*: This course is to motivate the students to study land use systems, land uses, land utilization types, land evaluation and land use planning. Essentially, the course places the above aspects in the context of natural resources systems analysis so that students could gain insights on the land use and land evaluation perspectives.*

Land Use: Land use systems, land utilization types; land use classifications – rural and urban land uses and land use patterns, Municipal Lands and Open Spaces in Cities and Town, Agriculture and Forest Land Management, Recreational Lands, Wetland Management.

Data Sources for Land Evaluation: Land-soil-water resources surveys; remote sensing and GPS surveys of land uses; land use and land cover classification from remotely sensed data; vegetation indices, supervised and unsupervised classification.

Land Evaluation: Logical basis of land evaluation; land evaluation for land use planning; Biophysical models of land evaluation, the FAO two-stage approach to land evaluation; other approaches to land capability and suitability classifications

Land Use Planning: Importance and difficulty of land use planning, Urban Land Use Planning Strategies, land use policies, principles of land use planning and land use management; urban land use planning, critical issues of land use planning in India; land holdings, reserved and restricted lands, hazard and disaster prone areas, land acquisition.

References

1. **Modeling in Resource Management and Environment: through Geoinformatics** - Sharma H.S. and Binda P.R
2. **Guidelines for land use planning**, UNFAO- FAO
3. **Agricultural land use planning** - Vink, A.P.A.

SOFT CORE

PAPER: APPLICATION OF REMOTE SENSING IN COASTAL MANAGEMENT

Objective: *This course is to familiarize the students about the fundamentals of coastal process and the remote sensing applications in the field of Coastal Management.*

Coastal processes: Definition, importance of coast, Oceanic circulation, Upwelling and sinking, Waves, Wave Characteristics, Wave generated currents, Catastrophic waves, Tides, Tidal forces, Littoral drift, Bathymetry, Navigational Charts

Coastal Zone Management: Introduction, major issues/ problems, Thematic maps on coastal resources, wetland classification, mapping of shore line changes, coastal interactions, coastal regulation zone mapping, creation of CZIS, ICZM model concepts and case studies, resolving conflict on resources utilization, coastal aquifer modeling.

Coastal Dynamics: Coastal Hydrodynamics, Estuarian dynamics, Hydrodynamics of pollution dispersion, Modeling of suspended sediments, Coastal erosion, Shore line change dynamics, Coastal protection works, Design of Breakwater

Remote Sensing Application: Use of Microwave data, CZCS studies, chlorophyll production index, various sensors used for coastal application, physical oceanographic parameter estimation, sea surface temperature, significant wave height, wind speed and directions, coastal bathymetry and sea level rise.

Reference:

1. **GIS in oceanography & Fisheries** - Vasilis D. Valavanis
2. **Remote Sensing Handbook for Tropical Coastal Management** - Alasdair J.Edward
3. **Oceangraphy** - Grant Gross M.
4. **Shoreline Management Guidelines** - Karsten Manager
5. **Beach process and sedimentation** - Paul D.Kumar
6. **Introduction to Coastal Engineering and Management** – J. William Kamphuis
7. **Integrated Coastal and Ocean Management** – Biliana Cicin-Sain Gunnar Kullenburg

CHOICE BASED CREDIT SCHEME

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REVISED SYLLABUS BY SEMESTERS

MASTER OF SCIENCE IN GEOGRAPHICAL INFORMATION SYSTEMS (M.Sc. in GIS)

For students admitted in 2016-17
(Hard Core, Soft Core and Open Elective Papers by Semester)

SECOND SEMESTER

HARD CORE

PAPER: GEOGRAPHICAL INFORMATION SYSTEMS AND GLOBAL POSITIONING SYSTEMS

Objective: *The concepts of GIS, components of GIS and application areas of GIS are comprehensively understood. Students will go beyond the conventional fundamentals in GIS and GPS and move forward into modeling and applications, including specialized GPS surveys for planning studies.*

Introduction: Definitions, History and development of GIS, components of GIS, applications of GIS; Coordinate Systems - Geographical Coordinate Systems, Projected Coordinate System, map projections; Geospatial data - Data input-existing GIS data, creating new data; attribute data query, spatial data query, raster data query.

Data Models and Management: Data format: Raster and Vector data formats; Spatial Data Models –Vector and Raster data models, Non- Spatial Data Models, Spaghetti model and Topology models, Grid model, TIN model, Network model, applications; Data collection, capture and Geo processing: Sources, input methods, editing, re-projection, geometric transformation, map scale, precision and accuracy.

GIS Modelling and analysis: Basic elements of GIS modeling; Spatial interpolation: elements, global methods, local methods, kriging method, comparison of spatial interpolation methods; Vector data analysis: buffering, overlay; raster data analysis– local operations, neighborhood operations, zonal operations; terrain mapping and analysis- DEM and TIN, contour, hill shading, slope and aspect.

GPS, DGPS and GNSS: definition, history, components; types and application of GPS, GLONASS, GALILEO, COMPASS; system segmentation – control segment, user segment, space segment, types of receivers; DGPS – differential corrections, accuracy in DGPS; GNSS: different GNSS, GNSS Augmentation; RNSS - IRNSS, WAAS, EGNOS, MSAS, QZSS, SNAS, SDCM and WAGE; advantages and disadvantages.

References:

1. **An Introduction to Geographical Information Systems** - Ian Heywood
2. **Geographic Information Systems: A Management Perspective** - Aronoff, S.
3. **GIS - Fundamentals, Applications and Implementations** - Elangovan, K.
4. **Introduction to Geographical Information Systems** - Chang, Kang-Tsung
5. **Remote Sensing and GIS** - Bhatta, B.
6. **Geographical Information Systems** - Maguire, David J.
7. **Mathematical Modeling in Geographical Information System, Global Positioning System and Digital Cartography** - Sharma, H.S.

HARD CORE

PAPER: ADVANCED GIS AND GPS TECHNIQUES

Objective: *This is a practical course offering theme based, problem solving techniques of GIS methodology from data creation to advanced GIS and GPS analysis for student's analytical skill development.*

Data capture and Management: Scanning, registration and projection, data encoding feature and geodatabase creation (point, line and area), digitization, coverage editing, topology; attribute data – joining, editing and integration, field calculation, query by attribute, query by spatial relationship and query by graphics, class interval selection, thematic mapping and output.

Spatial Analysis Modeling: Proximity – Buffer; Topography - Digital Elevation Model, Slope, Aspect, Hillshade, and View shed; Watershed and Morphometric – Stream order, Flow Direction, Flow Accumulation, Watershed delineation, bifurcation ratio; Network analysis – shortest path, service area, closest facility, location and allocation; Interpolation and Extrapolation – Kriging, IDW, Spline, Trend, Natural neighbor, Thiesson polygon, topo to raster.

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.

GNSS/GPS Survey: Collection of Ground Control Points (GCP), Way Points, and transformation of GNSS/GPS data into GIS; Ground Truth Verification of GIS data; Precision, Vertical and Horizontal Accuracy, inputting GPS data into computer.

References:

1. **An Introduction to Geographical Information Systems** – Ian Heywood
2. **Spatial analysis and Location-Allocation Models** - Ghosh, A. and G. Rushton
3. **Geographic Information Systems and Cartographic Modelling** - Tomlin, C.D.
4. **Geographic Information Systems and Science** - Paul A. Longley, et. al.
5. **Geographic Information Systems and Environmental Modeling** - Clarke, C., K.
6. **Introduction to Geographic Information Systems** - Tsung Chang Kang

HARD CORE

PAPER: PRINCIPLES OF PHOTOGRAMMETRY

Objective: *To introduce basics and concepts of Photogrammetry, systems, acquisition, techniques of extraction and analysis of information from aerial/satellite stereo data.*

Introduction: Definition and concepts, history of Photogrammetry, principles and types of Photogrammetry and aerial photographs, vertical and tilted photographs, orthophotographs, aerial cameras, geometry and scale orientation and measurements, distortions, displacements and their corrections, digital imaging devices and their characteristics, satellite stereo images.

Stereoscopy and Project Planning: Principles of stereoscopic vision, types of stereoscopes, stereoscopic parallax, stereoscopic plotting and mapping instruments, soft copy plotters; Flight planning, photo scale, flying height, ground coverage, weather conditions, cost estimation and scheduling, aerial mosaics – types.

Analytical and Digital Photogrammetry: Concept of interior, relative, absolute orientation; object, image measurement, control points, analytical self calibration, scaling and leveling, analytical procedures; digital photogrammetric system – advantages, work station, scanners, formats of data, contrast enhancement, anaglyph, digital image matching, software.

Aerotriangulation and Terrestrial Photogrammetry: Elements of Aero-triangulation and analytical methods, blocks, types of block adjustments, selecting photo control images, bundle block adjustment, advantages of digital AT over analogue AT.

Reference:

1. **Elements of Photogrammetry with applications in GIS –** Paul R Wolf
2. **Aerial Photogrammetry and Image Interpretation –** David P Paine
3. **Interpretation of Aerial Photographs –** T E Avery
4. **Elementary Air Survey –** W. Kilford
5. **Modern Photogrammetry** – Edward M Mikhail
6. **Photogrammetry** – Kranss
7. **Geoinformation: Remote Sensing, Photogrammetry and GIS –** Gottfried Konecny

SOFT CORE

PAPER: APPLICATIONS OF GIS IN DISASTER MANAGEMENT

Objective: *The course aims at introducing various types of natural disasters and application of space inputs for disaster management and GIS techniques used for mapping, impact assessment, forewarning, preparedness and mitigation of adverse effects.*

Introduction: Definition, types of disasters, importance of RS and GIS for disaster management, forecast, forewarning system, disaster preparedness with respect to different disaster, SDI to facilitate Disaster Management, GIS based DSS for disaster management, satellite surveillance for disaster mitigation.

Drought and Forest Fire: Drought types, causes, mitigation measures, delineation of drought vulnerable areas, drought monitoring, GIS based drought analysis, desertification factors, monitoring vegetative biomass; Forest Fire – causes, management using GIS, risk zonation mapping, forecasting system.

Earthquake, volcanoes, landslides and soil erosion: Causes, types, effects and mitigation measures, RS and GIS in earthquake prediction and post quake rehabilitation, GIS for earthquake disaster management, mapping tectonic lineament; Volcano: RS of geothermal field, mapping lava flows, volcano hazard management; Landslides: RS and GIS for zonation, monitoring and management; Soil erosion: RS and GIS for soil erosion and sediment estimation,

Flood, Cyclone and Tsunami: Flood types- flash and riverine floods, snowmelt floods, ice jams and mud flows, causes and mitigation measures, flooding potential zonation mapping, flood hazard assessment, ice cover monitoring and its role in flooding; Cyclone: cyclone monitoring using INSAT, ERS-1, NOAA and DMSP satellites, RS and GIS in hurricane mapping and mitigation, damage assessment, warning; Tsunami: types, causes, RS and GIS for warning, damage assessment and rehabilitation

Reference:

1. **The Environment as Hazards** - Kates, B.I and G.F. White.
2. **Disaster Management** - Singh, R.B.
3. **Disaster Management** - Gupta, H.K.
4. **Space Technology for Disaster Mitigation in India** - Singh, R.B.
5. **Disaster Management in Hills** - Savindra Singh
6. **Disaster Management** - Sharma, V.K.

SOFT CORE

PAPER: GEOGRAPHY OF NETWORK ANALYSIS

Objective: *The paper introduces network theory, applications of network theory in analyzing social and urban networks, especially transport networks. Lectures introduce network data structures and other analytic tools. GIS-T helps students gain knowledge and skills in input, management analysis and reporting on transportation issues.*

Network Theory: Definition, importance and applications of network theory, web applications of social networks, graphs – socio-grams, connections, distances and measures of power and prestige, applications of social networks in geographical information systems applications.

Network data models: Nature and utility of network data models, basic representations of node and link tables, layer-based and object-oriented approaches to network analysis.

Graph Theory: Basic graph definitions, links and their structures, basic structural properties, measures and indices (detour, network intensity, PI, Eta, Theta, Beta, Alpha and Gamma indices), connectivity and total accessibility.

GIS for Transportation (GIS-T): Data representation, analysis and modeling (multi-dimensional GIS-T models), Applications and problems – travelling salesman problem, vehicle routing problem, facility location problems and spatial interaction models.

References

1. **The Geography of Transport Systems** - Rodrique, Jean-Paul
2. **Social Network Analysis: A Handbook** - Scott, John.
3. **Transportation Network Analysis** - Bell, M.G.H. and Iida, Y.
4. **Network Analysis in Geography** - Haggett, P. and Chorley, R.

SOFT CORE

PAPER: APPLICATION OF GIS IN GEOMORPHOLOGY

Objective: *This course offers a detailed application of GIS in geomorphology. Landforms evolve in response to a combination of natural and anthropogenic processes. Mapping these changes in landforms, mining and groundwater resources has a vast scope in RS and GIS.*

Introduction: Disciplines of geomorphology, role of geomorphology in identification of natural hazards - Soil erosion by water and wind, river floods, Slope instability, ground surface subsidence, volcanoes and earthquakes, management of landslides, coastal management, and urban management.

Geomorphological Mapping: Geological survey, geologic mapping and cartographic standards for different scale, mapping geological structures – fold, faults, joints and lineaments, lithological mapping, fracture analysis, Landforms – Deltaic, fluvial, coastal, glacial, tectonic, volcanic, karst/lakes.

Geological Resources Exploration: Mineral resources exploration, mineral mapping and mineral resources information system, mineral prospect zonation, mapping mining area, encroachment mapping, GIS in mine remediation and mine reclamation, oil and gas exploration.

Ground Water Resources: Groundwater potential assessment, groundwater prospect zones mapping, modeling, planning and management, forecasting, selecting the appropriate site for artificial recharge by using RS and GIS, quality mapping, ground and surface water interactions, fluorosis, nitrate pollution and heavy metal contamination.

Reference:

1. **Introduction to Environmental Remote Sensing –** Barrett E C
2. **Geomorphology and Engineering -** Coates, D.R.
3. **Geomorphology in Environmental Management** - Cooke, R.U. and J.C. Doorn Kamp.
4. **Geomorphology and Environment Sustainability** - S C. Kalwar et.al.
5. **Indian Geomorphology** - Sharma, H.S.
6. **Geomorphology** - Savindra Singh.

SOFT CORE

PAPER: GIS FOR LAND RESOURCE MANAGEMENT

Objective: *To develop the skills in utilization of technologies of remote sensing, GIS, GPS, etc. in Land Resource Analysis and planning for sustainable development, soil, forest, ecology and agricultural resources management and studies.*

Geological and Geo-technical studies: Mineral resources exploration, mineral mapping and mineral resources information system, mapping mining area, encroachment mapping, GIS in mine remediation and mine reclamation, oil and gas exploration, site suitability for dams, atomic power plants.

Applications in soil: Soil and Land Use Surveys, Soil classification, soil irrigability, soil erosion mapping, soil salinity, soil alkalinity, surface soil moisture estimation, runoff and sediment yield estimation, desertification mapping, soil fertility mapping, agro-land suitability assessment, soil capability and loss assessment, locational and climatic advantages, settlements and demographic pressure estimation.

Forest and Ecology: RS and GIS for forest cover mapping and monitoring, estimation of biomass, carbon sequestration, Wildlife ecology: wildlife tracking, protected areas, wildlife habitat selection, rangeland applications, forest fire surveillance and forecasting, forest burnt area mapping, fire spread modeling, revegetation, biodiversity characterization, deforestation/ afforestation/encroachment mapping and monitoring, impact assessment of mining in forest.

Application in agriculture: Agro-climatic zonation, site suitability for agricultural and horticulture crops, crop acreage estimation, RS based yield model, crop norm violation, RS basis for crop insurance claim, damage assessment due to cyclone, drought, flood and forewarning, crop stress detection, precision agriculture.

Reference:

1 **Introduction to Environmental Remote Sensing** – Barrett E. C.
2 **Remote Sensing Principles and Interpretations** – Sabins F. F.
3 **Remote Sensing and Image Interpretation** – Thomas M. Lillesand
4 **Modeling in Resource Management and Environment** - Sharma H.S. and Binda P.R.
5 **Genesis, Termination and succession in the life cycle of organizations** - Paul Brown M.

OPEN ELECTIVE

PAPER: FUNDAMENTALS OF GIS AND GPS

Objective: *The concepts of GIS, components of GIS and application areas of GIS are comprehensively understood. Students will go beyond the conventional fundamentals in GIS and GPS and move forward into modeling and applications, including specialized GPS surveys for planning studies.*

Introduction: Definitions, History and development of GIS, components of GIS, applications of GIS; Coordinate Systems - Geographical Coordinate Systems, Projected Coordinate System, attribute data query, spatial data query, raster data query.

Data Models and Management: Data format: Raster and Vector data formats; Spatial Data Models –Vector and Raster data models, Non- Spatial Data Models, TIN model, input methods, editing, map scale, precision and accuracy.

GIS Modelling and analysis: Basic elements of GIS modeling; terrain mapping and analysis-DEM and TIN, contour, hill shading, slope and aspect, Spatial interpolation: kriging method, IDW, spline, trend, natural neighbor, Vector data analysis: buffering and overlay.

GPS and GNSS: definition, history, components; types and application of GPS, GLONASS, GALILEO, COMPASS; system segmentation – control segment, user segment, space segment, types of receivers; DGPS; GNSS: different GNSS, IRNSS - advantages and disadvantages.

References:

1. **An Introduction to Geographical Information Systems** - Ian Heywood
2. **Geographic Information Systems: A Management Perspective** - Aronoff, S.
3. **GIS - Fundamentals, Applications and Implementations** - Elangovan, K.
4. **Introduction to Geographical Information Systems** - Chang, Kang-Tsung
5. **Remote Sensing and GIS** - Bhatta, B.
6. **Geographical Information Systems** - Maguire, David J.
7. **Mathematical Modeling in Geographical Information System, Global Positioning System and Digital Cartography** - Sharma, H.S.

CHOICE BASED CREDIT SCHEME

CENTRE FOR GEOINFORMATICS TECHNOLOGY

DOS in Geography, Manasagangothri, University of Mysore, Mysuru – 570006

REVISED SYLLABUS BY SEMESTERS

MASTER OF SCIENCE IN GEOGRAPHICAL INFORMATION SYSTEMS (M.Sc. in GIS)

For students admitted in 2016-17
(Hard Core, Soft Core and Open Elective Papers by Semester)

THIRD SEMESTER

HARD CORE

PAPER: CLIMATE CHANGE AND GIS

Objective: *Climate change and its corollary global warming are the much talked-about these days for there is an impending danger to the earth we live in by the climate change caused primarily by the human activities on the earth. Climate change has already brought untold sufferings to the world that the world countries met several times to work towards a strategy for reducing global warming and the consequent climate change. This paper offers deep insights into the working of climate change and how to overcome it.*

Earth System Dynamics: Introduction to atmosphere, hydrosphere, biosphere, lithosphere, and human interventions in earth system dynamics and operations, anthropogenic activities and global warming.

Climate Change, the Process: Introduction, Concept, causes, effects, measures, importance of climate change, climate change and energy, climate change and emerging diseases, climate and change and community.

Issues in Climate Change: Global warming, green house effect, carbon cycle, nitrogen cycle, water cycle, ozone depletion, floods, droughts and weather variations, El-NINO and La-NINA, changing ecosystems, snow / glaciers melting.

Geoinformatics Applications: Hazards, risks and vulnerability analysis relating to global warming, floods and droughts, and weather variations, ecosystems changes, and snow/glaciers melting, energy studies, health and diseases studies and other case studies (at least 5).

References

1. **Climate Change: A Multidisciplinary Approach-** Burroughs, W.J.
2. **The Suicidal Planet: How to Prevent Global Climate Change-** Mayer Hillman,
3. **Field Notes from a Catastrophe: Man, Nature, and Climate Change-** Kolbert, Elizabeth.
4. **Cradle to Cradle: Remaking the way we make things** William McDonough,
5. **Integration of GIS, remote sensing, Photogrammetry and cartography: the Geoinformatics approach** -Ehlers, M.

HARD CORE

PAPER: PROGRAMMING IN C

Objectives: *To make students to learn basic principles of problem solving, implementing through C programming language and to design and develop programming skills.*

Introduction: Basic concepts in a C program, flowchart, declaration, assignment, print statements, identifiers, keywords, data types, type conversion, operators, expressions; data structures – meaning, primitive and non primitive data types, abstract data type.

Control Statements and File Management: Sequencing; selection statement – if, if-else, nested if-else, cascaded if-else; switch statement; ternary operator? Go to; Looping statements – for, while, do-while; break &continue; opening and closing of files, input and output operations.

Functions, Arrays and Strings: Functions in C, argument passing – call by value, call by reference; prototypes, program structure, location of functions, recursion; using array with functions, multi-dimensional arrays; strings – declaring, initializing, printing and reading strings, string manipulation functions, string input and output functions, array of strings.

Pointers and Preprocessors: Pointers and address, pointers and functions (call by reference), arguments, pointers and arrays, address arithmetic, character pointer and functions, pointers to pointer, initialization of pointer arrays, dynamic memory allocation method, preprocessors, compiler control directives.

Reference:

1. **Let us C** - Yashwanth Kanithkar
2. **C Programming** - Balaguru Swamy
3. **C Programming** - Kochan
4. **Complete reference using C** – C.C.R.
5. **The C programming Language** – Brian W. Kernighan and Dennis M Ritchie
6. **Computer Concepts and C Programming** – Vikas Gupta
7. **Programming with C** – R S Bichkar
8. **Computer programming in C** – V Rajaraman

HARD CORE

PAPER: MAPPING IN AUTOCAD

Objectives: *This course is intended for students to learn the basic principles, tools and techniques of designing and editing using the AutoCAD software.*

Introduction: Definition, scope, importance, design activities, traditional design process, CAD vs. traditional design, capabilities of CAD, benefits, elements, Hardware for CAD.

Design Process: CAD design process, Engineering analysis, graphics in CAD line, polyline, spline, circle, polygon, ellipse, drawing tools in CAD, modifying tools in CAD, dimensions in CAD.

Techniques in AutoCAD: features, queries, co-ordinate system, rubber sheeting, digitization, error correction, topology, creating topology, topological database, editing topology, conversion from polyline to polygon, export and import to other formats.

Transformation: Types and importance of transformation, 2D transformation, rotation, translation, scaling, 3D transformation, transformation in GIS, Modeling, types of modeling, geometric modeling, surface modeling, solid modeling.

References:

1. **Computer-Aided Design and Drafting/Cadd** – Louis Gary Lamit and Vernon Paige
2. **Using Generic Cadd** – Roger Blaylock
3. **Designing Better Maps: A Guide for GIS Users** – Cynthia A. Brewer
4. **Computer-Assisted Cartography: Principles and Prospects** – Mark S. Monmonier
5. **Practical handbook of digital mapping terms and concepts** – Sandra Arlinghaus

SOFT CORE

PAPER: GIS FOR URBAN PLANNING AND MANAGEMENT

Objective: *To understand the concepts and principles and use the tools and techniques of GIS for efficient planning and management of urban area.*

Urban Planning and Mapping: Importance and types of plans, urban and regional planning, LU/LC mapping, GIS data modeling for urban design, urban infrastructure, urban site selection for urban development, site suitability analysis for utilities and civic amenities; Urban mapping: physical structure and composition of urban areas, urbanization process, growth trend, problems of urbanization, urban sprawl and associated problems.

AM/FM applications: GIS applications in Automated Mapping (AM) and Facility Management (FM), water and sewage related, GIS based urban water demand analysis, pipeline planning and alignment, electric and power supply related, telecom applications, radio coverage prediction, signal strength mapping.

Demography and Urban Governance: Population distribution map by age, gender, education, occupation, socio-economic grouping, health criteria index, crime rates and types; Urban governance: mapping administrative boundaries, city base map generation, property enumeration and property GIS, tax revenue rationalization, metropolitan information management system.

Urban Ecology Applications: Air quality indexing and mapping, monitoring atmospheric haze, smoke, toxic gas movement and prediction of vulnerable zones, noise pollution zonation, natural resources inventory and management, vegetation, soil, surface water and groundwater conservation, site suitability for groundwater recharging and rain water harvesting, urban area heat budgeting.

References

1. **Action Planning for Cities: A Guide to Community Practice** - Hamdi, Nabeel
2. **Applied Remote Sensing for Urban Planning, Governance and Sustainability** - Netzband Maik
3. **Remote Sensing of Urban and Suburban Areas** - Tarek Rashed, Carsten Jürgens
4. **Remote sensing and urban analysis** - Jean-Paul Donnay, Michael John Barnsley
5. **Urban Remote Sensing** - Qihao Weng, Dale A. Quattrochi
6. **Radar Remote Sensing of Urban Areas, Remote Sensing and Digital Image Processing** - Soergel Uwe
7. **Analysis of Urban Growth and Sprawl from Remote Sensing Data** - Basudeb Bhatta

SOFT CORE

PAPER: GIS FOR WATER RESOURCES MANAGEMENT

Objective: *This course will enable the students to use RS and GIS tools in the integrated water resource management, oceanography, glaciology and watershed development.*

Introduction: Hydrology – definition and its importance, hydrological cycle, water budgeting, water demand estimation, surface water bodies, water content in ocean, sea, ice, lakes, dams, tanks, rivers and ground, water resource scenario in India and Karnataka, RS and GIS applications in water resources development and management.

Oceanographic studies: Definition, concepts and importance of ocean, ocean resources, ocean process, satellite and sensors for ocean studies, sea ice monitoring, estimation of wind velocity and direction, sea surface temperature, salinity, ocean colour, phytoplankton mapping, potential fishing zones, suspended sediment concentration mapping, bathymetry.

Meteorology, Glaciology and Surface Fresh Water: Rainfall mapping, potential and actual evapo-transpiration, atmospheric water content, cloud mapping, rain forecasting, water quality parameters, cyclone forecasting; Glaciology: monitoring of snow melt and snow formation, snowmelt runoff estimation, estimation of damages; Surface Fresh Water: river diversion studies, site suitability for surface storages and hydro-electric power plants, storage yield analysis and reservoir sizing.

Irrigation and Watershed: Mapping and monitoring of catchment and command areas, land irrigability mapping, agriculture water demand estimation for different crops, tank information system, wetland mapping, siltation mapping; Watershed: delineation, morphometric analysis, rainfall-surface runoff model, reservoir sedimentation, water-harvesting structures, watershed development planning, mapping of drought prone areas.

References:

1. **GIS for Water Resources and Watershed Management** - John G Lyon
2. **Application of GIS in Hydrology and Water Resources Management** - K.Kovar
3. **Geographic Information Systems in Water Resources Engineering** - Lynn E.Johnson
4. **Developments In Water Science – Water Resources Systems Planning and Management** - Jain S.K and Singh V.P
5. **Water, Waste water and Storm Water Systems** - U.M. Shamsi
6. **Introduction to Environmental Remote Sensing** – Barrett E C
7. **Remote Sensing principles and interpretation** – Sabins F. F.
8. **Remote Sensing and Image Interpretation** – Thomas M Lillesand

SOFT CORE

PAPER: GIS FOR ENVIRONMENTAL MANAGEMENT

Objective: *This course will enable the students to have a sound knowledge of application of remote sensing, GIS and GPS for understanding the changes in environment, monitoring the pollution affected areas.*

Introduction – Definition, scope and importance of environment; Ecosystems - introduction, types, characteristic features, structure and functions of Ecosystems – Forest, Grassland, Desert, Aquatic (lakes, rivers and estuaries); Energy resources – Energy needs; renewable and non-renewable energy sources; use of alternative energy sources; impact of energy use on environment.

Land and Soil application: Land Use Land Cover mapping, Natural Resources Census, wetland mapping, land/soil degradation mapping, desertification mapping, soil conservation measures, soil erosion modeling, land capability maps, land/soil irrigability maps.

Water Pollution: Siltation estimation and mapping, water colour, turbidity, water quality index mapping, point source pollution mapping, non-point source pollution modeling, eutrophication and water vegetation mapping, oil slicks tracing and monitoring sea turbidity and sedimentation mapping, ground water contamination studies.

Air and other pollutions: Aerosol remote sensing, air quality indexing and mapping, dynamic air pollution modeling, mapping and measuring troposphere pollutants, spread and dispersion of smoke plumes from industries and power plants, forest fires, oil wells, bioterrorism, ecology of vectors of epidemics, mapping epidemics vulnerable zones.

References

1. **Introduction to Environmental Remote Sensing** – Barrett E. C.
2. **Remote Sensing Principles and Interpretations** – Sabins F. F.
3. **Remote Sensing and Image Interpretation** – Thomas M. Lillesand
4. **Environmental Impact Assessment: Cutting Edge for the 21st Century** - Gilpin, A.
5. **Environmental Impact Assessment** - Marriot, Cram
6. **Sustainability and Cities. Overcoming Automobile Dependence** - Newman, P. and Jeffrey
7. **Environmental Science Toward a Sustainable Future -** Wright, Richard T.

SOFT CORE

PAPER: GIS FOR DEMOGRAPHY AND HUMANITIES

Objective: *This course will enable the students to analyze demographic data, economic data, epidemiological data and others and use it for making spatially informed decision.*

Introduction: definition and its importance, spatial distribution of population according to age, gender, racial group and socioeconomic segregation, geo-ethnography, labour market exploration, health equality, crime analysis, GIS for demographic analysis, trade area analysis, site selection for shopping centres, facility management.

Health GIS: Spatial epidemiology: RS and GIS in study of epidemics and their control-(malaria, leprosy, polio, TB, filariasis, dengue, chikengunya, cholera, AIDs, cancer), disease mapping, bioterrorism, infectious disease modeling, Health facility location mapping, health and disease atlas of India.

Power and Other Networks: Power – site suitability assessment for power plants (thermal, hydroelectric, nuclear, mini-hydro electric power plants), wind power, and impact assessment, GIS in electricity distribution network; Telecommunication – applications of GIS in telecommunication industry; Transportation – vehicle routing and scheduling, vehicle tracking system, Tourism – GIS application in Tourism planning.

Archeology: Importance of Archeological and Heritage sites, spotting historical monument and archeological sites, Role of digital mapping and database development for heritage sites, Surveying and mapping methods for heritage sites, digital archeology., 3d visualization of Archeological and heritage buildings; Landscape Archaeology.

References

1. **Transportation Network Analysis** - Bell, M.G.H. and Iida, Y.
2. **Network Analysis in Geography** - Haggett, P. and Chorley, R.
3. **The Geography of Transport Systems** - Rodrique, Jean-Paul
4. **Successful Tourism Management -** Seth, P.N.
5. **The Tourism System: An Introductory Text -** Mill and Morrison
6. **Remote sensing and urban analysis** - Jean-Paul Donnay, Michael John Barnsley
7. **Beyond the map: archaeology and spatial technologies** - Lock, G. and Harris, T.
8. **Digital Archaeology: Bridging Method and Theory** - Patrick Daly
9. **Pattern Recognition and Signal Processing in Archaeometry: Mathematical and Computational Solutions for Archaeology** - Constantin Papaodysseus

OPEN ELECTIVE:

PAPER: BASICS OF REMOTE SENSING

Objective: *The objective of this paper is to understand the basic concepts of Remote Sensing and to impart to students the skills necessary for remote sensing analysis and interpretation.*

Introduction: Definitions, concepts and types of remote sensing, evolution and stages of remote sensing, advantages of remote sensing, spatial data acquisition, Electromagnetic spectrum, types and platforms of sensors.

Digital Image Processing: digital image, data formats of digital image, pre-processing, image classification, elements of visual interpretation, interpretation keys, generating thematic maps.

Remote Sensing Technologies: Thermal Remote Sensing, spatial, Passive and Active Microwave Remote Sensing; RADAR – definition, development, components; LiDAR – principles, components, accuracy.

Applications of Remote Sensing: Applications of remote sensing in agriculture, forestry, oceans and coastal monitoring, geology, hydrogeology and urban heat budgeting.

Reference:

1. **Remote Sensing and GIS** - Bhatta, B.
2. **Introduction to Remote Sensing and Image Interpretation**; Lillesand T.M.
3. **Introductory Remote Sensing** - Gibson, Paul. J.
4. **Digital Image Processing: A Remote Sensing Perspective** - Jensen, John R.
5. **Microwave Remote Sensing: active and passive** – Fawas T Ulaby, Richard K Moore
6. **Imaging Radar for resources surveys** – Travett J W

CHOICE BASED CREDIT SCHEME

CENTRE FOR GEOINFORMATICS TECHNOLOGY

DOS in Geography, Manasagangothri, University of Mysore, Mysuru – 570006

REVISED SYLLABUS BY SEMESTERS

MASTER OF SCIENCE IN GEOGRAPHICAL INFORMATION SYSTEMS (M.Sc. in GIS)

For students admitted in 2016-17
(Hard Core, Soft Core and Open Elective Papers by Semester)

FOURTH SEMESTER

HARD CORE

PAPER: INTERNSHIP

Internships are done in a Government, research and implementation institution and / or a Private, Corporate institution of repute with specialization on the technologies of cartography, remote sensing, GIS and GPS, including Computer work in a prestigious lab. Internship must begin in the first week of February and continue till the end of March.

HARD CORE

PAPER: MAJOR RESEARCH PROJECT

Project work, which is a major project of 3 full months or about 12 weeks, on a larger, manageable program of research, requiring a report of 90 pages including maps and diagrams and tables and text. Project work begins in the first week of April.

OPEN ELECTIVE:

PAPER: FUNDAMENTALS OF GIS AND GPS

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Data Models and Management: Data format: Raster and Vector data formats; Spatial Data Models –Vector and Raster data models, Non- Spatial Data Models, TIN model, input methods, editing, map scale, precision and accuracy.

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GPS and GNSS: definition, history, components; types and application of GPS, GLONASS, GALILEO, COMPASS; system segmentation – control segment, user segment, space segment, types of receivers; DGPS; GNSS: different GNSS, IRNSS - advantages and disadvantages.

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3 **GIS - Fundamentals, Applications and Implementations** - Elangovan, K.
4 **Introduction to Geographical Information Systems** - Chang, Kang-Tsung
5 **Remote Sensing and GIS** - Bhatta, B.
6 **Geographical Information Systems** - Maguire, David J.
7 **Mathematical Modeling in Geographical Information System, Global Positioning System and Digital Cartography** - Sharma, H.S.