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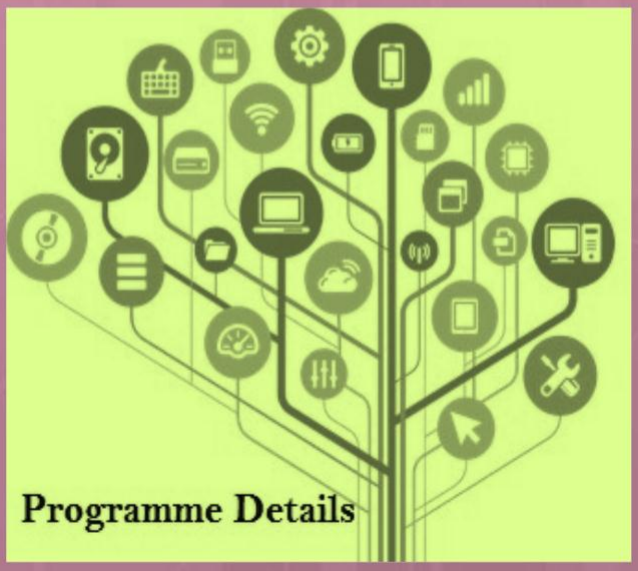
University of Mysore

(Estd.1916)

M.Sc. GEOGRAPHICAL INFORMATION SYSTEMS

Choice Based Credit System (CBCS)



UNIVERSITY OF MYSORE

Centre for Geoinformatics Technology
Department of Studies in Geography
Manasagangotri, Mysuru-570006

Regulations and Syllabus
Master of Science in Geographical Information Systems (M. Sc.)
(Two-year semester scheme)

Under
Choice Based Credit System (CBCS)

Dr. RAMU
Course Coordinator, - MSc in GIS
Centre For GeoInformatics Technology
DOS in Geography, Manasagangothri
University of Mysore
MYSORE-570 006, KARNATAKA, INDIA

UNIVERSITY OF MYSORE
GUIDELINES AND REGULATIONS
LEADING TO
MASTER OF SCIENCE IN GEOGRAPHICAL INFORMATION SYSTEMS (GIS)
(TWO-YEAR, SEMESTER SCHEME UNDER CBCS)

Programme Details

Name of the Center	:	Centre for Geoinformatics Technology
Name of the Department	:	Department of Studies in Geography
Subject	:	Geographical Information Systems (GIS)
Faculty	:	Science and Technology
Name of the Programme	:	Master of Science in Geographical Information Systems (GIS) (M. Sc.)
Duration of the Programme	:	2 years- divided into 4 semesters

Programme Outcomes

The vision of the programme is to impart the Geoscience and Geoinformatics domain to solve the geographical problems. The goal is to prepare the skilled man force equipped with the state-of-the-art technologies viz. GIS, Remote Sensing, Photogrammetry, LiDAR, BIM and GPS Technologies.

Programme Specific Outcome

On successful completion of the course, students will be able to:

- Understand main concepts that define Geographic Information Systems.
- Describe the geographic space with concepts and terms commonly used to build operating models in GIS.
- Use diverse techniques and instruments adequately to measure, locate and find bearings on a map and in a field.
- Photo-interpret basic environmental and socioeconomic variables using photographs taken in Spain.
- Know and use GIS and its geo-processes and functions.
- Know and apply some basic techniques to thematic mapping design.
- Describe Remote Sensing concepts, physical fundaments and components and adequately use vocabulary, terminology and nomenclature of the discipline.
- Know about main Remote Sensing Systems and programs (sensors, platforms, etc.) and assess its potential to spatial analysis.
- Know and use main methods to improve, correct and interpret properly Remote Sensing Images. Describe factors responsible for the main land cover behaviour.
- Use GIS software to perform different spatial analysis and satellite image digital analysis.
- Prepare documents of medium complexity, consisting of text, maps, graphs and tables to clearly present the design specifications of a data model for GIS application.

Scheme of Examination and Details of Course Patterns for M.Sc. Degree Course (CBCS)
MASTER OF SCIENCE IN GEOGRAPHICAL INFORMATION SYSTEMS (M.Sc. in GIS)

FIRST SEMESTER (Credits: 28)

SL. No.	Code	Title of Course	Types HC/SC/OE	Number of Credits			
				L	T	P	Total
1	30901	Principles of Remote Sensing	HC I	3	1	0	4
2	30902	Principles of Cartography	HC II	3	1	0	4
3	Practical	Remote Sensing Analysis and Interpretation	HC III	0	1	3	4
4	30903	Fundamentals of Information Technology	SC I	3	1	0	4
5	30904	GIS for Network Planning and Management	SC II	3	1	0	4
6	30905	Land Use Planning and Land Evaluation	SC III	3	1	0	4
7	30906	Remote Sensing for Coastal Management	SC IV	3	1	0	4

SECOND SEMESTER (Credits: 28)

SL. No.	Code	Title of Course	Types HC/SC/OE	Number of Credits			
				L	T	P	Total
1	30911	Principles of GIS	HC IV	3	1	0	4
2	Practical	Advanced Geospatial Analysis	HC V	0	1	3	4
3	Practical	Surveying Technologies and Data Processing	HC VI	0	1	3	4
4	30912	GIS for Disaster Management	SC V	3	1	0	4
5	30913	GIS for Geomorphological Studies	SC VI	3	1	0	4
6	30914	GIS for Land Resource Management	SC VII	3	1	0	4
7	30915	GIS for Demography and Humanities	SC VIII	3	1	0	4
8	30916	Fundamentals of GIS and GPS	OE I	3	1	0	4

THIRD SEMESTER (Credits: 28)

SL. No.	Codes	Title of Course	Types HC/SC/OE	Number of Credits			
				L	T	P	Total
1	30921	Climate Change and GIS	HC VII	3	1	0	4
2	Practical	Programming for GIS	HC VIII	0	1	3	4
3	30922	Research Methodology and Project Management	HC IX	3	1	0	4
4	30923	GIS for Urban Planning and Management	SC IX	3	1	0	4
5	30924	GIS for Water Resources Management	SC X	3	1	0	4
6	30925	GIS for Environmental Management	SC XI	3	1	0	4
7	30926	GIS for Sustainability Research	SC XII	3	1	0	4
8	30927	Basics of Remote Sensing	OE II	3	1	0	4

FOURTH 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

FIRST SEMESTIER

HARD CORE

COURSE – I: PRINCIPLES OF REMOTE SENSING

Course Outcomes

1. Students gain the fundamentals of earth system dynamics and physical process in the Geographical space.
2. Students learn the concepts of Satellite Technologies and its working principles.
3. Students learn how to handle and process the satellite images for understanding of biophysical phenomena of the earth system.
4. Students will learn the Visible, Thermal and Microwave remote sensing concepts and also other advanced technologies like LiDAR, SONAR, RADAR etc.

Pedagogy

Teaching aid is through the Power Point Presentation, Illustrated Charts, In-house documentary video clips, weekly modules, monthly tests, field visits, and group discussion.

COURSE CONTENT

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.

COURSE CONTENT

Introduction: Definitions, concepts and types of remote sensing, evolution, stages and advantages of remote sensing, spatial data acquisition, Electromagnetic spectrum, electromagnetic radiation, wavelength regions of electromagnetic radiation, types; Satellite, characteristics and Land/Marine observation satellites.

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, polarimetry, airborne and space borne SLRs and their components; LiDAR – principles, components, accuracy, spectral characteristics of laser and error analysis.

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.

Applications of Remote Sensing: Applications of remote sensing in agriculture (crop-yield estimation, agroforestry, moisture), forestry (vegetation index, biomass, biodiversity/species estimation, forest fires), oceans and coastal monitoring (sea surface temperatures, oil spills, flood, other glacial studies), Urban sprawl analysis, land degradation, desertification,and monitoring atmosphere components, applications of thermal remote sensing in geology, hydrogeology mineral exploration, lithological mapping 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

COURSE – II: PRINCIPLES OF CARTOGRAPHY

Course Outcome

1. Students will learn the concepts of geographical locations.
2. Students will gain insights of map making and its process.
3. Students tends to interpret the various sources of maps and its representative factors.
4. Students able to use advanced technologies in preparation of thematic and analysing of spatial and Non-spatial data.

Pedagogy

Teaching aid is through the Power Point Presentation, Making of story maps, sketches, drawing skills, usage and interpretation of various maps, preparation of colour schemes, weekly modules, monthly tests, field visits, and group discussion.

COURSE CONTENT

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

PRACTICAL

REMOTE SENSING ANALYSIS AND INTERPRETATION

Course Outcome

1. Students practically learns about the handling of satellite products.
2. Students are able to interpret various satellite imageries.
3. Students learns the extraction of geographical information and learns how to interpret the information.
4. Students prepares the model to create the Spatio-temporal changes of the earth and to forecast the phenomenal change.
5. At, the end of the course, students tends to develop the quantitative and qualitative information's about the earth surface.

Pedagogy

Teaching aid is through providing real-time working environment through ERDAS Imagine software and transfer of knowledge in Lab through information and communication (ICT) technologies.

COURSE CONTENT

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 of side lap and overlap images.

Image Classification: Determination of land use 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, thematic mapping.

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

COURSE – III: FUNDAMENTALS OF INFORMATION TECHNOLOGY

Course Outcome

1. The M.Sc. in GIS programme is interdisciplinary in Nature and various students from various streams are admitted to the programme. So that there is a requirement of computer literacy and this course creates a basic bridge to synchronise with technical world.
2. Students learns the basics of computers and its components.
3. Students acquires basic knowledge of Information and its importance to the current technological world.
4. Students learns how to prepare the databases for various institutions.
5. Students gains the concepts of problem solving through the course.

Pedagogy

Teaching aid is through the Power Point Presentation, demonstration of physical components of computer, working with computers, basic trouble shooting, logical thinking, weekly modules, monthly tests and group discussion.

COURSE CONTENT

Objectives: Information Technology is a turnkey solutions in the current world of technology which intending to the automation of manual task. So that, this paper teaches basics of computer science and information technology as a bridge course to the interdisciplinary students.

Basics of Computer Systems: Basics of computer, Characteristics of computers, Limitations of computers, System Components, Input devices, Output devices, Computer Memory, Central Processing Unit, Mother Board; Evolution of computers, Classification of Computers, Types of Microcomputers Distributed Computer; Number Systems and Boolean algebra; Software's and Operating Systems Concepts.

Programming and DBMS: Problem solving techniques with Algorithms, Flowcharts, Pseudo codes; Translators-Assemblers, Compilers, Interpreters; Machine Code - Assembly Language - High Level Languages - Systematic Programming - Object-Oriented Programming; Database Management Systems: Introduction; databases, database management system - structure, types of DBMS; application of DBMS.

Information Technology: Information, Quality of Information, Information Processing, IT components, role, benefits, Information privacy, security and reliability in using computer systems and the internet; issues and responsibilities in internet usage; legal issues in IT; Green IT, global perspectives of computing issues; Current trends in IT industries, emerging technologies and applications.

Data Communication and Networking: Communication, Communication Process, Data Representation, Data Transmission speed, Communication Types (modes), Data Transmission Medias, Modem and its working, characteristics, Types of Networks, LAN Topologies, Network Protocols, History of Internet, working, services, browsers, uses, emerging technologies and applications.

Reference:

1. Algorithm Design: Foundations, Analysis and Internet Examples-Michael T. Goodrich
2. Computer Networking: A Top-Down Approach - Kurose James F.
3. Data Communications and Networking - Behrouz A. Forouzan (Fourth Edition)

4. Database Systems: Models, Languages, Design and Application Programming- Ramez Elmasri
5. Fundamentals of Database Systems-Ramez Elmasri
6. Fundamentals of Information Technology, Alexis Leon. Mathews Leon
7. Hutchinson, Using Information Technology- Williams, Sawyer, McGraw Hill.
8. Information Technology for Management – Henry C.Lucas, Jr.
9. Learn to program - Chris Pine
10. Principles of Information Technology - Kathleen M. Austin
11. The Art of Computer Programming- Donald Knuth

COURSE – IV: GIS FOR NETWORK PLANNING AND MANAGEMENT

Course Outcome

1. Students gains the importance of various Networks and its structures
2. Students learnsthe flow of information through the networks in Geography
3. Students prepares a model for network and its interconnectedness to solve the geographical problem.
4. Hands-on experience of transportation model, water, sewerage, social network, electrical, telecommunication networks are taught.

Pedagogy

Teaching aid is through the Power Point Presentation, Illustrated Charts, In-house documentary video clips, weekly modules, monthly tests, field visits, study tours and group discussion.

COURSE CONTENT

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.

Applications of GIS in Network: 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., Utility Networks-Electricity, Water distribution, Sewerage Line and Telecom.

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.

COURSE – V: LAND USE PLANNING AND LAND EVALUATION

Course Outcome

1. Students will learn the basics of earth system.
2. Students learns the distribution and abundance of several ecosystems.
3. Students learns about linkages between Human Induced Environment and Natural Environment.
4. Students can differentiate the land use and land cover systems with various levels of classification and tends to prepare the Spatio-temporal changes in the land systems through the remote sensing products and GIS based analysis.
5. Various Urban and Rural land use models, policiesare studied for planning of sustainable environment.

Pedagogy

Teaching aid is through the Power Point Presentation, Illustrated Charts, In-house documentary video clips, weekly modules, monthly tests, field visits, problem solving techniques and group discussion.

COURSE CONTENT

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.

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

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 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.

COURSE – VI: REMOTE SENSING FOR COASTAL MANAGEMENT

Course Outcome

1. Students learn the importance of coastal ecosystems and marine ecosystems.
2. Students gains deep insight of the coastal resources and its economics
3. Student's gains knowledge of the socio-economic status of coastal demographics.
4. Students studies the coastal landforms, dynamics of shoreline change, environmental implication with respect to estuarial ecosystems, brackish waters and others.

Pedagogy

Teaching aid is through the Power Point Presentation, Illustrated Charts, In-house documentary video clips, weekly modules, monthly tests, field visits, resource management techniques and group discussion.

COURSE CONTENT

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

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.

Remote Sensing Applications: Use of Microwave data, CZCS studies, chlorophyll production index, various sensors used for coastal application, physical oceanographic parameter estimation, sea surface temperature, Suspended sediments, Salinity Mapping, significant wave height, wind speed and directions, coastal bathymetry and sea level rise. Estuaries, Intertidal zones, potential fishing zones.

Reference:

1. GIS in oceanography & Fisheries - Vasilis D. Valavanis
2. Remote Sensing Handbook for Tropical Coastal Management - Alasdair J.Edward
3. Oceanography - 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 – BilianaCicin-Sain Gunnar Kullenburg

SECOND SEMESTIER

HARD CORE

COURSE – I: PRINCIPLES OF GIS

Course Outcomes

1. Students learns the concepts of earth systems, locating of objects in real world.
2. Students gains the knowledge of spatial-temporal modelling of geographical phenomena to study the trend, pattern and process of change.
3. Students learns about the construction of various geodatabases to manage the environmental change.
4. At the end, the student develops the various atmospheric, land, hydrological, networks based models to improve the natural and human induced environment.

Pedagogy

Teaching aid is through the Power Point Presentation, Illustrated Charts, In-house documentary video clips, weekly modules, monthly tests, field visits, imparting spatial thinking and group discussion.

COURSE CONTENT

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: Concepts, History and development of GIS, components of GIS, applications of GIS; Coordinate Systems –datum's, latitudes, longitudes, Geographical Coordinate Systems, WGS84, Projected Coordinate System and UTM; Geospatial data - Data input-existing GIS data, creating new data; Query: Spatial and Non Spatial data query, Boolean algebra.

Data Models and Management: Data format: Raster and Vector data formats; Spatial Data Models – Vector and Raster data models, Non- Spatial Data Models, 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; Coupling-Loose, Tight coupling; Spatial interpolation: elements, sampling schemes, global-local methods, 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, working principles 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.
5. Geographical Information Systems - Maguire, David J.
6. Mathematical Modeling in Geographical Information System, Global Positioning System and Digital Cartography - Sharma, H.S.

PRACTICAL

ADVANCED GEOSPATIAL ANALYSIS

Course outcome:

1. Students are trained to adapt the theoretical concepts in a practical way through the mathematical models of geography.
2. Students will have the hands on training on various modes of spatial and non-spatial data collection, data storage, data analytics, data interpretation and data display through the thematic maps.
3. Students are exposed on spatial thinking to solve the geographical problems with range of proven mathematical and statistical models.
4. Students can employ in various corporate and government organisation where they deal to solve geographical problems.

Pedagogy:

Teaching aid is through providing real-time working environment through ArcGIS software and transfer of knowledge in Lab through information and communication (ICT) technologies.

COURSE CONTENT

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 of hardcopy maps, georeferencing and projection, data encoding, feature and geodatabase creation (point, line and area), digitization, coverage editing, topology, annotations; 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 analysis; Topography - Digital Elevation Model, Slope, Aspect, Hill shade, 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. Exploring spatial relations using Ordinary least square(OLS), Geographical weighted regression(GWR), Spatial autocorrelation;

GNSS/GPSSurvey: 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. Mobile based survey using Open data kit (form building, XML generation, data collection, and mapping)

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

SURVEYING TECHNOLOGIES AND DATA PROCESSING

Course outcome:

1. Students learns the importance of land and its segregation at various scales.
2. Students are familiarised with survey mathematics to perform survey in field.
3. Students tends to learn new technologies of land survey such as Total Station, Drone, Global Positioning Systems and mapping them in CAD environment.
4. Other technologies of LiDAR, Photogrammetry been taught to the students to create the three dimensional environment of the earth.

Pedagogy:

Teaching aid is through providing real-time working environment through Traditional methods, Field Instruments, AutoCAD Map, Micro station software and transfer of knowledge in Lab through information and communication (ICT) technologies.

COURSE CONTENT

Objectives: To make students to learn basic principles of surveying, to handle various survey instruments, gathering of survey data, and processing it, for better planning and maintenance of required applications

Basics of Surveying: Operating of Handheld GPS, D-GPS, Total Station, Airborne Laser Scanning (ALS), and Terrestrial Laser Scanning (TLS) devices, LiDAR Derived Products, Aerial Photography using Drone Techniques and Orthophoto with Seam line Generation/Mosaicking.

CAD and GIS: Acquiring survey data, Data interoperability, Data warehousing, Feature alignment, Scaling, Layer Generations, Layer Editing, Block referencing, Coordinate geometry, Drawing cleanup, Topology checking, Quality Audit, Feature Data analysis, symbolizations, thematic map generations, Map books, data archival and other case studies.

LiDAR data capture and processing: Fleet Planning, Automation, LiDAR Data Acquisition, Data conversion, LAS file compression, coloring, classification of ground, air points, Vegetation's, Buildings, Low Points and Water bodies; Generations of Digital Terrain Models (DTM), Digital Surface Model (DSM), Delineation of Features, Vectorizing Features and other case studies.

Photogrammetry and 3D modeling: Unmanned Aerial Systems, Ground based Systems, Camera calibrations, Acquisition of Vertical and Horizontal Images, Conversion of Images, Generation of Tie points, building mesh textures, draping images, scaling model and aligning 3D models to real-world locations and other case studies.

Reference:

1. Aerial Photogrammetry and Image Interpretation – David P Paine
2. Close Range Photogrammetry: Principles, Techniques and Applications: Thomas Luhman
3. Digital Image Processing: A Remote Sensing Perspective - Jensen, John R.
4. Elementary Air Survey – W. Kilford
5. Geoinformation: Remote Sensing, Photogrammetry and GIS – Gottfried Konecny
6. Integration of GIS, Remote Sensing, Photogrammetry and Cartography: The Geoinformatics Approach - Ehlers, M.
7. Introduction to Photogrammetry, T. Schenk
8. Topographic Laser Ranging and Scanning: Principles and Processing –Jie Shan, Charles K.Toth

SOFT CORE

COURE-II: GIS FOR DISASTER MANAGEMENT

Course outcome:

1. Students learns the earth systems and its dynamics over the space and time.
2. Students gains the differentiation of Natural and Manmade disasters
3. Students learn the various stages of disaster management at various scales.
4. Students tends to adopt the remote sensing and GIS techniques to manage the pre event and post events of disasters.

Pedagogy:

Teaching aid is through the Power Point Presentation, Illustrated Charts, In-house documentary video clips, weekly modules, monthly tests, field visits, case studies of pre and post preparedness of various disasters and group discussion.

COURSE CONTENT

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, Spatial Data infrastructure to facilitate Disaster Management, GIS based Decision support system 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.

COURSE-III: GIS FOR GEOMORPHOLOGICAL STUDIES

Course outcomes:

1. Students learns the concepts and evolution of landforms
2. Students gains the knowledge of various process inducing the morphological changes in the landform by the various agents.
3. Students learns the hazardous/disasters and their root cause of the events through the remote sensing and GIS concepts.

Pedagogy:

Teaching aid is through the Power Point Presentation, Illustrated Charts, In-house documentary video clips, weekly modules, monthly tests, field visits, field trips and group discussion.

COURSE CONTENT

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 - SC. Kalwar et.al.
5. Indian Geomorphology - Sharma, H.S.
6. Geomorphology - Savindra Singh.

COURSE-IV: GIS FOR LAND RESOURCE MANAGEMENT

Course outcomes:

1. Students learn the concepts, importance of land, landforms and land disputes.
2. Students are exposed to identify and classify the land use and land cover types at various levels of classification.
3. Students gains the applications of geospatial technologies on land resource, planning and management at various scales.
4. Students adapts various plans and procedures for development of sustainable environment.

Pedagogy:

Teaching aid is through the Power Point Presentation, Illustrated Charts, In-house documentary video clips, weekly modules, monthly tests, field visits, field trips and group discussion.

COURSE CONTENT

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 irritability, 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.

COURSE-V: GIS FOR DEMOGRAPHY AND HUMANITIES

Course outcome:

1. Students learns the importance of spatial distribution of population.
2. Students gains the knowledge of age, gender, group and socio-economic changes over the geographical space.
3. Students prepares GIS based map of origination of specific groups of communities, crime pattern, and epidemiological disease outbreak to predict the trend, pattern and process of phenomenal change.

Pedagogy:

Teaching aid is through the Power Point Presentation, Illustrated Charts, In-house documentary video clips, weekly modules, monthly tests, interaction with communities and group discussion.

COURSE CONTENT

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, facilitymanagement.

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

OPEN ELECTIVE

COURSE-VI: FUNDAMENTALS OF GIS AND GPS

Course outcome:

1. Students learns the concepts of earth systems, locating of objects in real world.
2. Students gains the knowledge of spatial-temporal modeling of geographical phenomena to study the trend, pattern and process of change.
3. Students learns about the construction of various geo databases to manage the environmental change.
4. At the end, the student develops the various atmospheric, land, hydrological, networks based models to improve the natural and human induced environment.

Pedagogy:

Teaching aid is through the Power Point Presentation, Illustrated Charts, In-house documentary video clips, weekly modules, monthly tests, field visits, imparting spatial thinking and group discussion.

COURSE CONTENT

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.
5. Geographical Information Systems - Maguire, David J.
6. Mathematical Modeling in Geographical Information System, Global Positioning System and Digital Cartography - Sharma, H.S.

THIRD SEMESTER

HARD CORE

COURSE-I: CLIMATE CHANGE AND GIS

Course outcome:

1. Students learns the origin of earth systems and dynamics through geological time period.
2. Students learns the climate systems of geographical spaces with respect to global and regional scales.
3. Students prepares the climate models based on the historical records to study the plausible and probable changes in the ecosystems.
4. Students learns the human interventions on environment to explore the changes happening around the world and establishes the linkages among the ecosystems for rehabilitation of ecotopes.

Pedagogy:

Teaching aid is through the Power Point Presentation, Illustrated Charts, In-house documentary video clips, weekly modules, monthly tests, field visits, scenario studies and group discussion.

COURSE CONTENT

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: Origin of Earth and its forms, Introduction to atmosphere, hydrosphere, biosphere, lithosphere, and human interventions in earth system dynamics and operations, anthropogenic activities and global warming.

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

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

Geoinformatics Applications: Concepts of Hazards, risks and vulnerability; their analysis relating Climate projections and their uncertainties; 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.

PRACTICAL

PROGRAMMING FOR GIS

Course outcome:

1. Students gains the concepts of problem solving, data flow, algorithms, schemas of various problems and database.
2. Students acquires the object oriented programming approach though Python programming.
3. Students learns the integration of GIS workflows with Python Scripting to meet the time requirements.
4. Students gains the knowledge of cloud computing, Web based GIS languages to create a spatial visualisation of such datasets to deliver them in browsers.

Pedagogy:

Teaching aid is through providing real-time working environment for solving a problems through Python automations and transfer of programming knowledge in Lab through information and communication (ICT) technologies.

COURSE CONTENT

Objective: Programming for GIS practical paper is targeted to the students who have no or very little programming knowledge and experience. The goal of this practical is to get students familiar with programming concepts and constructs, automate the daily workflow adapted in geospatial academia and industries.

Introduction to programming: Programming concepts, problem-solving techniques, Programming Language vs. Presentation Language with examples; Command Line and GUI based programming; Language translators; Coding, Error handling, Role of Programming in GIS.

Basics of Python Programming: Introduction to Python, Installing Python 2.7 Interpreter, importing various libraries, working with numbers, variables, writing statements, strings, lists, use of python objects, functions, methods, paths, built-in modules, external modules, controlling flow with conditional statements, looping structures, getting user input, commenting scripts and error handling.

Python for GIS: Geoprocessing with Python, Importing ArcPy, use of built-in tools, setting environments, tool messages, working with vectors and its geometries, raster data handling, batch processing, Map automations, working with toolbox, model builders and development of Graphical User Interfaces(GUI), development of python addins for ArcMap.

Programming for WebGIS: Basics of HTML, CSS and JavaScript for WebGIS Programming; Introduction to Leaflet JavaScript API, Geoserver, OpenLayers. Working with Leaflet, Installation of Geoserver, Creating Snippet codes, Configuring Bootstraps, code deployment and hosting in local/cloud servers, Physical Server Setups, Domain Purchasing, working with cPanel, URL Redirections, Leech protection.

Reference:

1. ArcPy and ArcGIS – Geospatial Analysis with Python; Silas Toms
2. Getting to Know ArcGIS: Model Builder; David W. Allen, ESRI
3. Getting to Know WebGIS: Pinde Fu, ESRI
4. Learning PHP, MySQL, and JavaScript: Robin Nixon
5. Learning Python(5th Edition): Mark Lutz
6. OpenLayers Cookbook; Antonio Santiago Perez

7. Programming ArcGIS 10.1 with Python Cookbook; Eric Pimpler
8. Python for Informatics; Charles Severance
9. Python Geospatial Development(2nd Edition); Erik Westra
10. Python Scripting for ArcGIS - Paul A. Zandbergen, , ESRI
11. Spatial Mathematics, Theory and Practice through Mapping: Sandra LachArlinghaus and Joseph J. Kerski

COURSE-II: RESEARCH METHODOLOGY AND PROJECT MANAGEMENT

Course outcome:

1. Students gains the concepts of research and research methodology.
2. Students learns how to identify the key problems of research
3. Students acquires knowledge about the data requirement to address the identified problem.
4. Students gains the knowledge to meet the corporate requirement to manage the various stages from project acquisition to delivery of projects to the clients.

Pedagogy:

Teaching aid is through the Power Point Presentation, Illustrated Charts,weekly modules, monthly tests, field visits, corporate visits and group discussion.

COURSE CONTENT

Objectives: Research methods that are common in all kinds of scientific research will be handled, and the students will be experienced in a range of quantitative and qualitative research methods. The students will also gain knowledge and aiming to provide a valuable tool for them in academic writing. In other hand, Project Management is designed to address the growing complexities of corporate projects and incorporates key project management tools and techniques. Students will gain an understanding of the core competencies required by project managers to drive projects to a successful conclusion.

Basics of Research: Research: Meaning, definition, objectives, characteristics, types, steps involved in Research, Research ethics, motivations, approaches, significance, research and scientific methods, research process, criteria of good research,research problem, research questions, statement of problems, objectives formulation, Research design, review of literatures., Basics of SPSS.

Qualitative and Quantitative Research: Research methods versus methodology, Qualitative Research, quantitative research, mixed research methods;Sampling Scheme and methods, data collection and types, Hypothesis, testing of hypothesis, limitations of the tests of hypothesis.Interpretation of Results, charting, tabulation, documenting – reports, thesis, journals and its structure.

Business Strategies and Project Management: Corporate Projects, Project Management(PM), Program Management, Portfolio Management, PM Framework, PM Skills,Interpersonal Skills Management, PM Methodologies, Organizational System, Project Life Cycle and its Phases, PM Process, Procurement Process, Contracting, Strategic Planning and use of PERT/CPM, Scope of a Project, Project Charter; Resource Levelling, Communication Planning, Project Status Reporting.

Risk, Quality, Budget and Time Management: Work breakdown structure (WBS), Activity Sequencing and Network Diagrams, Gantt Charts for Time Management; Project Cost Estimation and Tracking, Management, Project Resources, Cost Control and Earned Value Management(EVM); Quality Planning, Assurance, and Control; Project Risk and Change Management; Integration management and Final Deliverables. Case studies of GIS and other related projects.

Reference:

1. A Guide to the Project Management Body of Knowledge PMBOK 5th Edition – Project Management Institute(PMI)
2. Geospatial Technology Project Management - Open Courseware, Penn State University
3. GIS Research Methods: Incorporating Spatial Perspectives-Sheila Lakshmi Steinberg
4. Information Technology Project Management, 8th Edition-Schwalbe
5. Research Methodology: Methods and Techniques - Kothari, C. R.

SOFT CORE

COURSE-III: GIS FOR URBAN PLANNING AND MANAGEMENT

Course outcome:

1. Students gains the knowledge of urban land use models and its structure for planning.
2. Students learns the planning of Automated Mapping (AM)/Facility Management (FM) for utility management.
3. Students acquires the human, socio-economic, environmental status and mapping using GIS technologies.
4. Student's gains the micro level planning of amenities and urban furniture's for creating sustainable cities.

Pedagogy:

Teaching aid is through the Power Point Presentation, Illustrated Charts, weekly modules, monthly tests, field visits, studies of urban amenities and group discussion.

COURSE CONTENT

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 - NetzbandMaik
3. Remote Sensing of Urban and Suburban Areas - TarekRashed, CarstenJürgens
4. Remote sensing and urban analysis - Jean-Paul Donnay, Michael John Barnsley
5. Urban Remote Sensing - QihaoWeng, Dale A. Quattrochi
6. Radar Remote Sensing of Urban Areas, Remote Sensing and Digital Image Processing - SoergelUwe
7. Analysis of Urban Growth and Sprawl from Remote Sensing Data - BasudebBhatta

COURSE-IV: GIS FOR WATER RESOURCES MANAGEMENT

Course outcome:

1. Students gain the deep insight of abundance of water at various forms viz. aerosols, surface and subsurface.
2. Students learns the process of hydrological cycle on the earth.
3. Students tends to map the spatio-temporal changes in the water quantity and water quality in a geographical setting.
4. Students studies the policies of water management at global, national and local scale to meet the water requirement.

Pedagogy:

Teaching aid is through the Power Point Presentation, Illustrated Charts, weekly modules, monthly tests, field visits, case studies on water management and group discussion.

COURSE CONTENT

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 and seaweed mapping, potential fishing zones, suspended sediment and bathymetry mapping.

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

COURSE-V: GIS FOR ENVIRONMENTAL MANAGEMENT

Course outcome:

1. Students gains the knowledge of scope, concepts of global and regional environment.
2. Students learns the relationship of various ecosystems and its process.
3. Students will be able to understand the relationships between Human activities and environmental changes.
4. The key factors of environmental change and the underlying cause are explored by the students to solve the critical problems through the remote sensing and GIS technologies for the sustainable development of the earth at various scales.

Pedagogy:

Teaching aid is through the Power Point Presentation, Illustrated Charts, weekly modules, monthly tests, field visits, case studies on Environmental Management and group discussion.

COURSE CONTENT

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 quality, moisture, conservation measures, soil erosion and deposition modeling, land capability maps, land/soil irrigabilitymapping.

Water Resource: 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; coastal, river and reservoir sedimentation mapping; ground water level, potential zones, vulnerability, 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.

COURSE-VI: GIS FOR SUSTAINABILITY RESEARCH

Course outcome:

1. Students understand the concepts of sustainability and its pillars.
2. Students acquires the knowledge to develop strategies for creating sustainable environment.
3. Student's gains deep insight to various policies to address the human, social, economic and environmental needs at various scales.
4. Students learns the requirement and adopts the suitable techniques for capacity building of various community to solve the associated problems to create a sustainable environment.

Pedagogy:

Teaching aid is through the Power Point Presentation, Illustrated Charts, weekly modules, monthly tests, field visits, case studies on sustainability and group discussion.

COURSE CONTENT

Objective: Students of GIS for Sustainable Development, in the context of, say, urban environment or resources management, needs to understand the research process which contributes to an informed critique of their fields of study and research. This self-study elective is not intended to give training in research techniques but rather to make students aware of a broad sweep of investigative analytical stages and techniques. This course is designed to introduce students to the principles, frameworks, and tools of sustainability in several modes.

Sustainability Frameworks and Systems: Sustainability and Sustainable Frameworks; Design is the Problem (a class discussion);Exercise: Map any system, Field Trip**:** local garbage dump, recycling centre, or a waste (water, solid) processing plant to gain insights on sustainability question in the development contexts.

Resources Use: Co-creating new social compact; stakeholder needs interviews and analysis in the context of sustainability at the individual, family, community and area levels; Leading change through sustainability; Exercise: Further observations and field work in rural and urban communities (2 villages nearby and 2 urban neighbourhoods with typical urban problems).

Making the case for sustainability: Making the case internally: Real-World experiences; Making the case externally: Real-World experiences; Making the case externally: Building partnerships for sustainable development; Exercise: Class discussion on 'Concept Generation, Brainstorming and Selection of strategies from the exercise'; Frameworks and approaches for gender matrix and stakeholder analysis.

Sustainability in a Greater Context: Class discussion of 'Lessons Learned', from the

exercises and case studies; Skills assessment: Critical analysis skills, research skills, collaboration skills, discipline specific techniques skills; Understanding sustainability, meaning and value creation, creativity and critical thinking skills; Oral, written and visual communication skills.

Textbooks

1. Design is the Problem, Shedroff, N. Rosenfeld Media, New York.
2. GIS for Sustainable Development, Michele Campagna
3. Leading Change Towards Sustainability,Doppelt, R.

OPEN ELECTIVE

COURSE-VII: BASICS OF REMOTE SENSING

Course outcome:

1. Students gain the fundamentals of earth system dynamics and physical process in the Geographical space
2. Students learn the concepts of Satellite Technologies and its working principles.
3. Students learn how to handle and process the satellite images for understanding of biophysical phenomena
4. Students will learn the Visible, Thermal and Microwave remote sensing concepts and also other advanced technologies like LiDAR, SONAR, RADAR etc.

Pedagogy:

Teaching aid is through the Power Point Presentation, Illustrated Charts, In-house documentary video clips, weekly modules, monthly tests, field visits, and group discussion.

COURSE CONTENT

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

FOURTH SEMESTER

HARD CORE

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, photogrammetry, LiDAR, CAD related,GIS and GPS, including Computer work in a prestigious lab. Internship must begin at the first week in the commencement of fourth semester and end with an eight 8-weeks (two months) from the date of joining.

Course outcome:

1. Students gains the corporate experience through corporate environment
2. Students learns the new concepts and technologies adopted by various companies
3. Students tends to work at under pressure within given time
4. Students learns smart work in execution of company project workflows

Pedagogy:

Students are sent to the Research Institutions/ Corporate Sectors for parallel learning the new technologies through hand-on training for a duration of 8 weeks. At the end, students are entitled to prepare the internship report.

MAJOR RESEARCH PROJECT

Course outcome:

1. Students learns the concept of problem solving at laboratory and field level
2. Students tends to acquire the knowledge about project handling and execution within the time period
3. Students learns how to handle various literatures at the review stage
4. Students gain knowledge about the preparation of the reports, thesis and journals

Pedagogy:

Students are advised and mentored from the faculties to choose the research topics along the research problem with objectives, statistical analysis, GIS and Remote sensing based problem solving been thought to the students to fulfill the research work. At the end, students are entitled to prepare the Research report.

COURSE CONTENT

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 after Internships program .

- 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.

Course Outcome:

Based on the various courses in M.Sc. GIS programme, the students gain the core competence in advanced technologies adopted in the programme. At, the end students are smart enough to fulfill the global requirements in tackling of geographical problems which is necessary for the sustainable development of the nation. Information's of Earth systems are brought to centralised geographical database from collection of data to the delivery of such data in the form of digital maps. The maps act as the novel tool to explore the earth systems. The students can join the various organisation and corporate companies for continues development of careers and some of them are listed below.

1. Agricultural Department
2. Agriculture
3. Archaeological Survey of India
4. BBMP
5. BMRCL
6. BMRDA
7. CADA
8. CGWB,
9. Coastal and Ocean Management Organisations.
10. Corporation Offices
11. COWI
12. CYIENT,
13. Deduce Technologies
14. Department of Forestry
15. Department of Mines and Geology
16. E- GIS Infrastructure Pvt Ltd, Bangalore
17. Edge Maps
18. EI Technologies, Ahmedabad
19. EI Technologies, Bangalore
20. ESRI,
21. Fishery Department
22. Forest Department
23. GeoKno India Pvt Ltd
24. Geological Survey of India
25. Geospectrum
26. HERE and others government agencies.
27. Here Maps(Nokia), Mumbai
28. ICAR
29. ICRISAT
30. IIRS
31. IISc
32. IIST

34. IIT
35. INCOIS
36. Indian Institute of Science
37. Indian Meteorological Department,
38. IndiGeo Consultants
39. InfoMaps Pvt Ltd, Chennai
40. Infosys Technologies Pvt. Ltd., Mysore
41. INTERGRAPH,
42. IntraSpatial Pvt. Ltd, Bangalore
43. Irrigation Department,
44. ISRO
45. Karnataka Forest Department
46. KSRSAC, Bangalore
47. KSRTC, Mysore
48. KSUWS&DB, Mysore
49. L&T Infotech Pvt Ltd. Mysore
50. Layer Informatics
51. Madhusiri Geoinformatics Pvt Ltd, Bangalore
52. Magnasoft, Bangalore
53. MCC, Mysore
54. Mines and Geology
55. MUDA, Mysore
56. NABARD
57. NakshaTech Pvt. Ltd.
58. National and State Disaster Monitoring and Management Cells,
59. National Institute of Epidemiology
60. National Institute of Oceanography,
61. NBSS and LUP, Bangalore
62. Near
63. NIO
64. North-South GIS
65. NRDMS
66. Planning Department
67. Pollution Control Board
68. Revenue Department
69. RMS,
70. RMSI,
71. Rolta
72. ROLTA,
73. SAC
74. SECON,
75. Sky Group GIS Pvt. Ltd., Bangalore
76. Soil Survey of India
77. Survey of India
78. TOMTOM,
79. University of Agricultural Science, Dharwad
80. Urban Development Authorities,
81. Urban Planning Authority
82. Utility Management Department
83. Water Supply unit
84. Watershed Management Board