Department of Geoinformatics

University of Kashmir, Srinagar- I90006, J & K

Course Structure and Syllabi

for

Masters
in
Geoinformatics

Choice Based Credit System

Effective from academic session 2015

Choice based Credit System (CBCS) Scheme and course structure for M.Sc. Geoinformatics 1st semester effective from academic session 2015 and onwards

1st Semester

Course Code	Course Name	Paper Category	Hours per week			Credits
			L	T	P	
GI15101CR	Computers & Geoinformation Management	Core	3	0	2	3+0+1=4
GI15102CR	Fundamentals of Remote Sensing.	Core	3	0	2	3+0+1=4
GI15103CR	Fundamentals of GIS	Core	3	0	2	3+0+1=4
GI15104DCE	Cartography & Geoinformation Visualization.	Elective (DCE)	2	2	0	2+1+0=3
GI15105DCE	Applications of Remote sensing & GIS	Elective (DCE)	2	2	0	2+1+0=3
GI15106DCE	Surveying techniques	Elective (DCE)	2	2	0	2+1+0=3
GI15307GE	Climatology	Elective (GE)	2	2	0	2+1+0=3
GI15108GE	Environmental Geology	Elective (GE)	2	2	0	2+1+0=3
GI15109OE	Introduction to Remote sensing and GIS	Elective (OE)	2	2	0	2+1+0=3
18 Credit= 23 Contact Hours			21	12	6	18
L= Lecture; T= Tutorial; P= Practical						

GI15101CR: COMPUTERSANDGEO-INFORMATIONMANAGEMENT

Course Goals

- Develop basic skills and understanding of the computer operations.
- Development of basic computer programming skills.
- Geo-information data handling and management.

ComputerBasics:

Introduction to computers: Characteristics and history. Classification of computers, hardware: Input/ output devices, Secondary storage devices, Software: types, translators, interpreters, compilers and editors. Introduction to operating systems: DOS, WINDOWS, and UNIX. Introduction to number system.Flowcharts and Algorithms with examples. Mobile operating systems: android.

Fundamentals of 'C':

'C' character set, Identifiers and key words, data types, constants, variables, operators, expressions, statements, symbolic constants. Control statements: If statements, If-Else, Loops: While Loop, Do- While Loop, For Loop, Switch-Case statements, Introduction to: Arrays, Structures, Functions and Pointers. Introduction to Python.

Geospatial Data Handling:

Ideal computer configuration for satellite data analysis and geospatial modeling, Role of computers in GIS and remote sensing data analysis, Meta data: introduction, importance, and standards. RS data types: Signed, unsigned, integer float, double, complex. Data compression techniques-their advantages and disadvantages. Data conversion in RS/GIS: necessity, advantage/disadvantage.

Practical:

Hands on computers

- Computers: Handling and maintenance
- Hands on MS Office (MS Word, MS Excel, MS Powerpoint)
- Control statements: If statements, If-Else, Loops: While Loops, Do- While Loops, For Loop, Switch-Case statements.
- Data conversions.

References:

Computers in Geography, *Maguire. D. J.* Addison-Wesley Longman Publishing Co.
Computer Applications in Geography.*Mather, P.M.* John Wiley and Sons
Basic Programming with Applications, *Jain, V.K*. Tata Mc Graw Hill, New Delhi.

Computer concepts and C programming, *Kumar, U. J.* Vikas Publishing House Pvt Ltd.
A first course in computers.*Saxena, S.* Vikas Publishing House Pvt Ltd.
Elements of Data Compression.*Drozdek, A.*Vikas Publishing House Pvt Ltd.

Modern Database Management.*Mcfadden, F. R., Hoffer, J. A*., Prescott, M.B. Addison Wesley Longman.
Programming in ANSI C, *Balaguruswamy, E.* Tata McGraw Hill.

Current review and comparisons of different hardware and software published frequently, particularly for the DOS environment in magazines such as Byte and PC Magazine.

GI15102CR: FUNDAMENTALS OF REMOTE SENSING

CourseGoals

- Developing an understanding of the current state of knowledge in Remote sensing.
- To expose the students to the principles of electromagnetic radiation,satellitesystems platforms& sensors.
- Interpretation of digital images, and how to effectively extract desirable information from images.

Concepts and Overview of Remote Sensing:

Remote sensing: Definition, history and scope. Overview of remote sensing systems: Typical Remote Sensing system and its components, sensor resolution (Spatial, spectral, temporal and radiometric), important satellite systems; LANDSAT, SPOT, IRS, MODIS, IKONOS, ASTER. Electromagnetic radiation (EMR) and Electromagnetic Spectrum (EMS): parts of electromagnetic radiation, theories of electromagnetic radiation, radiation laws, atmospheric windows. Interactions of EMR with atmosphere, interaction of EMR with earthôs surface features; vegetation, water, and soils. Spectral signatures of common land-cover types and criterion of choosing signatures.

Satellite Data Interpretation:

Types of Sensors: OM Line scanners, CCD Line and Area scanners. Photo-grammetry: types and characteristics of aerial photographs (scale, resolution, projection, overlaps), measurement of scale and height, relief displacement, stereoscopy. Stereo-imaging: principles, and sensors for stereo-imaging (ASTER). Principles of visual image interpretation: elements of visual image interpretation, importance and factors governing the interpretability.Use of ancillary information for satellite data interpretation. Ground Truth Collection: importance, methods, and Ground truth details.

Digital Image Processing:

Digital Image processing (DIP): Introduction to DIP. Digital data and storage formats (BSQ, BIL,BIP, GeoTIFF and HDF). Image statistics, particularly histogram and scatter plots. Geometric and Radiometric distortions. Pre-processing of satellite data (radiometric and geometric corrections), Color composites: band combination, false color composite and true color composites. Image enhancements: linear, non- linear, and histogram equalization.

Practical

Digital Image Processing

- Tutorial on different modules of image processing software,
- Import and export of satellite data,
- Different image and remote sensing data formats
- Utility of image statistics in image interpretation
- Visual interpretation of different earth features from the images
- Spectral response of different earth features from multi-spectral image data
- Preparation of satellite data for analysis like rotate, subset, layer stacking.
- Pre-processing of satellite data like haze reduction, image registration and geo-correction.
- Image processing operations like, image enhancements, math operations, reprojecting and resampling.
- 3-4 days field trip for the ground truth of the generated products

References:

Remote Sensing and Image Interpretation, *Lillesand, R. M. and R. W. Kiefer,* 1994, 3rd Ed. NY: John Wiley and Sons, Inc.

Introductory Digital Image Processing, A Remote Sensing Perspective, *Jensen, J. R.*, 1996, Upper Sanddle River:, Prentice Hall.

Introduction to Remote Sensing *Cracknell, A.P and L.W.B.Hayes,* 1993*, London*: Taylor & Francis.

Manual of Remote Sensing Colwell, R.N. 2nd (ed), 1983 V.AAmerican society of Photogrametry.

Introductory Digital Image Processing. *Jensen, John R.* 2004.3rd Edition. Prentice Hall Asian

Remote Sensing: Principles and Interpretation, Sabins, F.J.

GI15103CR: FUNDAMENTALSOFGEOGRAPHICINFORMATIONSYSTEM

CourseGoals

- Impart the basic knowledge of the principle concepts of geo-spatial data handling with GIS
- Develop competence in the use of geospatial tools for, analysis and use of thematic, spatial and spatio-temporal data.

Over View of GIS

GIS basics: Introduction, Definition, historical perspective, Components of GIS. Types of GIS. concept of data, examples of GIS; Geographic data sources(Remote Sensing, GPS, Maps and Field observations).Spatial and non-spatial data: introduction, importance and integration.

Databases and Data Models:

Data models: Concept and types, Raster data model, Vector data model, Advantages and disadvantages of raster and vector data models, issue related to data model conversation. Data errors, data editing.Concept and applications of Topology in GIS.

Geospatial Data Analysis:

Geospatial analysis: Introduction, vector-based analysis (Non-topological and topological functions with examples of each type), Raster-based analysis (Local operations, neighborhood operations, extended neighbourhood operations, regional operations with examples of each type).

Practical
Geospatial analysis

- Familiarization with GIS software systems
- Data input; digitization, scanning
- Data editing of spatial and non-spatial data
- Use of attributes and other tabular data
- Database creation, linking, joining and registration
- Geo-processing of geospatial data like buffering, proximity analysis etc.
- Data query and preliminary data analysis

- Map making and production
- 3-4 days field trip for the ground truth of the generated products *Individual/Group assignment*

References

Principles of Geographic Information Systems for land resources assessment: *Burrough, P.A.*, 1996. Oxford: Clarendon Press.

Fundamentals of Geographic Information Systems, *Demer, Michael, N.*, 2000., JW & Sons.

Introduction to GIS, Chang, K. 2004.. 2nd Edition. McGraw-Hill, Dubuque, Iowa.

Getting Started with Geographical Information Systems *Clarke, K.C.* 2003.. 4th Edition. Prentice Hall, Upper Saddle River, New Jersey.

Concepts and techniques of Geographic Information System *: Lo C.P: Albert*. Prentice Hall.

Fundamentals of Geographic Information Systems**.** *De Mers, M.N.*2002, 2nd Edition. John Wiley and Sons, New York.

Exploring Geographic Information Systems**,** *Chrisman, N.* 2002. 2nd Edition., JW & Sons

Introduction to GIS**,** *Chang, K.* 2004. 2nd Ed. McGraw-Hill, Dubuque, Iowa.

GI15104DCE: CARTOGRAPHY AND GEO-INFORMATION VISUALIZATION

Course Goals

- Expose students to the basic & advanced techniques of digital cartography Forvisual exploration and presentation of the geo-information data.
- Develop map design, composition and editing skills
- Teach techniques for Integration of thematic, spatial and non-spatial data atvarious scales

MapMaking:

Maps: Introduction, types of maps, uses of maps. Cartography: analogue and digital cartography, cartographic generalizations. Map composition: map design and layout, map scale, legend, annotations. Coordinate systems, Geoid, shape of earth and datums, Map projections: introduction, properties and aspects of map projections, classification of map projections.

DataSourcesandVisualization:

Data sources for mapping: remote sensing, field observations, GPS, maps and other ancillary data. Survey of India (SOI) map index and National Mapping Policy, Use and users of geo- spatial data, Data products w.r.t land surface processes, disasters, EIA and geology. DEM,need, methods, data sources and products,Visualization techniques: Visual exploration for different features/surfaces, virtual reality and scenario mapping. Lidar, Stereo-images, Aerial photos and InSAR.

Statistical Data Analysis:

Measurement Scales: nominal, ordinal, interval, and ratio. Measures of central tendency: mean, median, mode, Measures of Dispersion: range, Variance, standard deviation,

coefficient of variation, skewnessand kurtosis. Regression and correlation analysis.Basic concepts of time series data analysis.

Data Presentation:

Geospatial data dissemination: maps, graphics, animations, multi-media, internet and posters. Quantitative representation of spatial and non-spatial data. Digital and cartographic landscape models. Exaggerations and omissions. Map updating using GPS and Remote Sensing data. Assessing the accuracy of maps.

References

Cartography: visualization of geospatial data, *M. J. Kraak& F.J. Ormeling*, Harlow, Essex: Longman.

Elements of Cartography. *Robinson, Arthur H., Joel L. Morrison, Phillip C. Muehrcke, A. Jon Kimerling, and Stephen C. Guptill*: John Wiley and Sons, New York.

Fundamentals of spatial information systems, *Laurini, R and Thompson, D.:* Academic Press London.

Geographic Information Systems and Science, *Longley, Paul A., M. F. Goodchild, D. J. Maguire, and D. W. Rhind:* John Wiley & Sons, New York.

Fundamentals of Geographic Information Systems, *Michael N. Demers:* John Wiley and Sons, Inc.

Planning Support Systems: Integrating Geographic Information Systems,Models, and Visualization Tools, *Richard K. Brail, and Richard E. Klosterman,* ESRI Press.
Fundamentals of Remote Sensing *Panda C.B*: Viva Books Private Ltd.

Concepts and techniques of Geographic Information System *: Lo C.P: Albert*. Prentice Hall

GI15105DCE: APPLICATIONS OF REMOTE SENSING AND GIS

GIS Applications and Case Studies:

Utility mapping using GIS, Wild life habitat analysis, Land suitability analysis, Geoinformatics for Environmental impact analysis (EIA), Disaster vulnerability analysis (seismic microzonation, landslide hazard zonation), Geoinformatics for Land information System (LIS).

Geospatial Modeling and Applications:

Geospatial Modeling: introduction, importance and techniques. Land degradation modeling, watershed prioritization.Hydrological modeling, flood vulnerability zonation. Environmental modeling: Integrated Environmental analysis and assessment of Carrying Capacity using GIS, Eco-zonation mapping. Crop growth modeling in GIS environment.

Remote Sensing Applications:

Role of Remote Sensing in Landslide mapping, Flood and Agriculture management /monitoring. Land use / land cover mapping and monitoring, Urbanization (urban land use, urban sprawl).Role of Remote Sensing in Fishery and wildlife application.

Advanced Applications of Remote Sensing:

Vegetation applications (Deforestation, Net primary productivity estimation, Leaf area index. Cadastral mapping. Geological applications (lithology, tectonics). Water resources management(snow and glaciers, ground water exploitation) Environmental evaluation and monitoring(wetlands, desertification)

References

Fundamentals of Geographic Information Systems.*DeMers, M.N.* 2002, 2nd Edition. John Wiley and Sons, New York.

Exploring Geographic Information Systems, *Chrisman, N.* 2002. 2nd Ed. JW & Sons, New York.

Introduction to Remote Sensing *Cracknell, A.P and L.W.B. Hayes,* 1993*, London*: Taylor

Manual of Remote Sensing Colwell, R.N. (ed), 1983, 2nd Ed. Falls, Chruch, V.American society of Photogrametry.

Introductory Digital Image Processing,A Remote Sensing Perspective, Jensen, J. R.,1996,Upper Sanddle River:, Prentice Hall

GI15106DCE: SURVEYING TECHNIQUES

Introduction to Surveying and Sampling:

Introduction to surveying. Key concepts and principals of Surveying. Designing surveys, processing of survey data, Process of Map Making, Data sources for mapping: remote sensing, field observations, GPS, maps and other ancillary data. Introduction to sampling. Probability sampling; Simple Random sampling, Systematic sampling and Stratified sampling. Methods of computer assisted data collection.

Modern survey methods:

Modern surveying electronic equipments: digital levels, digital theodolites, EDMs, Total stations; Principles, working and applications; Lasers in surveying, GPS working principals and components.

Remote Sensing and GIS based Surveys:

Remote Sensing principles, components as a tool for data generation and mapping;Introduction to modern techniques ï Air photographs and Satellite Imagery and their basic properties, concept of GIS and GPS and their components, Types scales and ground coverage.Advantages of Aerial photographs over conventional on-the-ground observations.

Tutorial

- GPS survey of the University Campus or Dal Lake, Shalimar/Nishat garden.
- Validation of the Satellite based Digital Elevation Model with the GPS data.
- Accuracy assessment of the satellite based land use and land cover data.
- Group assignment on any of the above field based observations.

References

GPS Satellite Surveying, *Leick A* (1995): 2nd end. Wiley, New york ChichesteBrisbane Toronto Singapore.

GPS Theory and Practice, *Hofmann-Wellenhof B, Lichtenegger H:* (2007). Springer (5th eds), Wien New York.
Global Positioning System and GIS, An Introduction, Kennedy, M. Ann Arbor,MI, 1996.
Cartography: visualization of geospatial data, *M. J. Kraak& F.J. Ormeling*, Harlow, Essex: Longman.
Elements of Cartography. *Robinson, Arthur H., Joel L. Morrison, Phillip C Muehrcke, A. Jon Kimerling, and Stephen C. Guptill*: John Wiley and Sons, New York.
Conceptsand techniques of Geographic Information System: *Lo C.P: Albert*. Prentice Hall. Fundamentals of spatial information systems, *Laurini, R and Thompson, D.:* Academic Press London.
Geographic Information Systems and Science, *Longley, Paul A., M. F. Goodchild, D. J. Maguire, and D. W. Rhind:* John Wiley & Sons, New York.
Fundamentals of Geographic Information Systems, *Michael N. Demers:* John Wiley and Sons, Inc.

GI15107GE: CLIMATOLOGY

Atmospheric Layers and Thermal Variation: Nature, composition and layered structure of the atmosphere. Factors controlling insolation; heat budget of the atmosphere. Horizontal and vertical distribution of temperature; Inversion of temperature. Green house effect and importance of ozone layer.

Atmospheric Layers and Wind Circulation: Global atmospheric pressure belts and their oscillation. General wind circulation. Jet stream and index cycle. Monsoon mechanism with reference to jet stream.General Circulation Models (GCM); Regional Climate Models; IPCCC climate Change scenarios. Climate Change Impact Studies; glaciers; water resources; food security; downscaling and upscaling of climate data; Paleo-climate inference from lake sediments, ice-core; paleosols.

Precipitation and Air mass: Processes and forms of condensation. Mechanism and forms of precipitation- Ice Crystal theory, Collision-coalescence Theory. Airmass: typology, origin and characteristics. Warm and cold fronts; frontogenesis and frontolysis.

Weather Disturbance and Climatic Classification: Tropical cyclone. Mid-latitude cyclone and anticyclone. Climatic classification after Koppen. Climatic Classification after Thornthwaite: 1931 and 1948.Hydrological cycle; Global climatic change and role and response of man in climatic changes, Applied climatology and Urban climate. Synoptic weather forecasting, prediction of weather elements such as rain, maximum and minimum temperature and fog; hazardous weather elements like thunderstorms, duststorms, tornadoes.

Books recommended

Ahren, C.D., 2012: Meteorology Today, 10th edition, Cengage Learning.
Anthes, R. 1997: Meteorology, 7th edition, Prentice-Hall Inc., Upper Saddle River.
Barry, R.G. & Chorley, R.T. 1992: Atmosphere, Weather & Climate, 6th edition, Routledge, London.

Brigg, G.R. 1996: The Ocean and Climate, Cambridge University Press, Cambridge..
Critchfield, H.J. 1983: General Climatology, 4th edition, Prentice Hall India Ltd., New Delhi.
Das, P.K. 1995: Monsoons, 2nd edition, National Book Trust, New Delhi.
Elsom, D.M. 1992: Atmospheric Pollution: A Global Problem, 2nd edition, B.Well Pub. Co., London.
Lal, D.S. 1993: Climatology, 3rd edition, Chaitanya Pub. House, New Delhi.
Linacre, E. and Geerts, B. 1997: Climates and Weather Explained, Routledge, London.
Lutgens, FK & Tarbuck, EJ, 1998 : The Atmosphere: An Introduction to Meteorology, P. Hall
McIlveen R., 2010: Fundamentals of Weather and Climate,2nd edition, Oxford Uni. Press,
Oliver, J.E, Hidore, J.J., et al., 2009: Climatology, 3rd Edition, Prentice Hall.
Pant, G.B. and Kumar, R.K. 1997: Climates of South Asia, J.Wiley and Sons Ltd., Chichester.
Roger G.B. and Richard, J.C., 2009: Atmosphere, Weather and Climate, 9th edition, Routledge.
Rohli, R.V. and Vega, A.J., 2011: Climatology, 2nd edition,Jones and Bartlett Publishers, Inc.
Smith, K. 1996: Environmental Hazards: Assessing Risk & Reducing Disaster, 2nd ed. R. London.
Taylor, J.A. 1974: Climatic Resources and Economic Activity, David & Charles, London.
A.G. Pimente, J. D. 1993: World Soil Erosion and Conservation, CU Press, Cambridge.

GI15108GE: ENVIRONMENTAL GEOLOGY

Environmental Geology: Introduction, Earth, man and environment ï Basic environmental problems. Fundamental concepts of environmental geoscience. General relationship between landscape, climate and biomass. Geoscience factor in environmental planning. Earth processes; endogenic and exogenic

Cenozoic climate extremes, their impact on evolution of life especially on human evolution. Health Geochemistry: essential and toxic elements & radon emission; impacts of aerosols including black carbon on environment.

Impact assessment of degradation and contamination of surface water and groundwater quality due to industrialization and urbanization. Water logging problems due to the indiscrete construction of canals, reservoirs and dams. Soil profiles and soil quality degradation due to irrigation, use of fertilizers and pesticides.

Seismic hazard assessment, seismic micro-zonation. Preparation of seismic hazard maps. Distribution, magnitude and intensity of earthquakes in Indian Himalayas. Tectonics and climate change. Disaster vulnerability assessment; earthquakes and floods.

Books recommended

Lundgren, L, 1986, Environmental Geology. Prentice Hall.
Michael, A., Basic of Environmental Science.
Parasnis, D. S., 1975: Principles of Applied Geophysics. Chapman Hall.
Pipkin, B. W. & Trent, D. D., 1997: Geology and the Environment. West wardsworth.
Singh, A., Modern Geo-Technical Engineering.
Smith, K., 1992: Environmental Hazards. Rutledge, London.

Valdiya, K. S., 1987: Environmental Geology -Indian Context. Tata McGraw Hill.
Venkat, R. D., Engineering Geology for Civil Engineers.
Waltham, A. C., 1997: Foundations of Engineering Geology. Blackie Academic & Professional. Subramaniam, V., 2001: Textbook in Environmental Science-Narosa International

GI15109OE: INTRODUCTION TO REMOTE SENSING AND GIS

Concepts and Overview of Remote Sensing:

Electromagnetic radiation (EMR) and Electromagnetic Spectrum (EMS): radiation laws, sources of electromagnetic radiation, theories of electromagnetic radiation, scattering, absorptance, reflectance, transmittance and atmospheric windows. Interactions of EMR with atmosphere, interaction of EMR with earthôs surface features; vegetation, water, and soils.

Concepts and Overview of Remote Sensing:

Remote sensing: Definition, history and scope Overview of remote sensing

systems.Typical Remote Sensing system and its components, sensorresolution (Spatial,spectral, temporal).Important satellite systemsLANDSAT,IRS.

Overview of GIS:

GIS basics: Introduction, Definition, historical perspective,Components of GIS, types of GIS. Concept of data, examples of GIS; Geographic data sources (Remote Sensing, GPS, Maps and Field observations).

GIS Data:

Spatial and non-spatial data: introduction, importance and integration. Concept and applications of Topology in GIS: Data models: Concept and types, Raster data model, Vector data model

References

Remote Sensing and Image Interpretation, *Lillesand, R. M. and R. W. Kiefer,* 1994, 3rd

Introductory Digital Image Processing, A Remote Sensing Perspective,*Jensen, J. R.*,1996,

Upper Sanddle River:, Prentice Hall.

Introduction to Remote Sensing *Cracknell, A.P and L.W.B. Hayes,* 1993*, London*: T& F.
Geographic Information Systems for land resources assessment: *Burrough, P.A*., 1996. Oxford: Clarendon Press.

Fundamentals of Geographic Information Systems,*Demer,Michael, N*., 2000., John Wiley and Sons, Inc.

Introduction to GIS, Chang, K. 2004. 2nd Edition. McGraw-Hill, Dubuque, Iowa.

Getting Started with Geographical Information Systems*Clarke, K.C.* 2003.. 4th Edition. Prentice Hall, Upper Saddle River, New Jersey.

Concepts and techniques of Geographic Information System *: Lo C.P: Albert*. Prentice Hall.

Fundamentals of Geographic Information Systems**.** *DeMers, M.N.* 2002, 2nd Ed. JW.

General Instructions for the Candidates

1. The two year (4 semesters) PG programme is of 96 credit weightage i.e, 24 credits / semester (24x4=96).
2. A candidate has compulsorily to opt for 12 credits from the core component in each semester.
3. A candidate has to obtain a maximum of 6 credits (2-3 papers) from the Discipline Centric Electives (DCE) offered by his/her own Department.
4. A candidate has compulsorily to obtain a minimum of 6 credits (2-3 paper) from Generic Elective (GE) or Open Electives (OE) or a combination of both offered by the departments other than his/her own.
5. A candidate can earn more than the minimum required credits (i.e, more than 96 credits for four semester programme) which shall be counted towards the final result of the candidate.

Choice based Credit System (CBCS) Scheme and course structure for M.Sc. Geoinformatics 2nd semester effective from academic session 2015 and onwards

2nd Semester

Course Code	Course Name	Paper Category	Hours per week			Credits
			L	T	P	
GI15201CR	Fundamentals of Microwave Remote Sensing	Core	3	0	2	3+0+1=4
GI15202CR	Advanced Remote Sensing and Image Processing	Core	3	0	2	3+0+1=4
GI15203CR	Advanced Geoinformatics	Core	3	0	2	3+0+1=4
GI15204DCE	Soils and Land Degradation	Elective (DCE)	2	2	0	2+1+0=3
GI15205DCE	Disaster, Risk & Hazard Assessment	Elective (DCE)	2	2	0	2+1+0=3
GI15206DCE	Remote Sensing for Urban and Regional Planning	Elective (DCE)	2	2	0	2+1+0=3
GI15207GE	Database Management Systems	Elective (GE)	2	2	0	2+1+0=3
GI15208GE	Oceanography	Elective (GE)	2	2	0	2+1+0=3
GI15209OE	Applications of Geoinformatics	Elective (OE)	2	2	0	2+1+0=3
18 Credit= 23 Contact Hours			21	12	6	18
L= Lecture; T= Tutorial; P= Practical						

GI15201CR: FUNDAMENTALS OF MICROWAVE REMOTE SENSING

Course Goals

- Develop an understanding of the radar remote sensing principles.
- Promote complimentary use of optical and microwave remote sensing products.
- Expose the students to new applications in the field of microwave remote sensing.

Introduction:

Microwave region of Electromagnetic spectrum, Historical perspective of microwave remote sensing. Details of the Space-borne and airborne radar systems: ERS/JERS-1/ALOS/A-SAR/AIRSAR SAR systems. Advantages and disadvantages of radar remote sensing viz-à-viz optical remote sensing. Definition and concept of SLAR, Synthetic Aperture Radar (SAR). SAR viewing geometry: slant range, ground range, azimuth, look angle, incidence angle, Local incidence angle. Backscattering coefficient and sigma naught expression of SAR. Radar equation for point and distributed targets.

Sensor and Target Characteristics:

Concept of wavelength and frequency in SAR, Radar penetration, SAR polarization, Dielectric constant, SAR dependence on dielectric constant w.r.t. angle and frequency. SAR sensitivity to surface roughness, Roughness-frequency dependence, Roughness-incidence angle dependence. Speckle: Definition and causes of speckle in SAR images, speckle removal methods; Lee, Lee-sigma, Frost, Gamma adaptive filters, Multi-looking, Topographic influences on radar imaging: shadow, foreshortening and layover, methods for minimizing topographic influences on SAR images.

Radar Backscattering Modeling:

Backscattering of earthôs features, Introduction to radiative transfer theory, some common modeling approaches like discrete, continuous, first order scattering, and second order scattering. Examples of these modeling approaches viz. cloud model and MIMICS model. Scattering mechanisms of SAR signals with surface (bare soil) and volume (vegetation). Interferometry: concept and application, base line, repeat pass interferometry. Polarimetry: Definition and scope. Applications: Cryosphere; snow parameters (extent, depth, density, SWE), glacier geometry and dynamics (ELA, Velocity), GPR applications, Forestry: Woody biomass and tree height estimation; Hydrology; flooding, soil moisture determination

Practical

Microwave

- Exploratory microwave data analysis
- Conversion of Intensity to sigma naught image
- Speckle removal algorithms
- Incidence angle image creation and topographic normalization
- Spectral signatures of the common earth features
- Comparison of the optical and microwave remote sensing LULC

References:

Satellite microwave remote sensing, *Allan, T. D.*:Chichester, Ellis Hardwood Microwave remote sensing, *Ulaby, F. T., Moore, R. K., Fung, A. K.*, vol.I, II & III. Massachusetts, Adison Wilsey.

Imaging radar for resource survey, *Trevett, J. W.,* Chapman and Hall, London Microwave Remote Sensing of the Earth: Physical Foundations, *Eugene A. Sharkov, SpringerVerlag*

Remote Sensing and Image Interpretation, *Lillesand and Kiefer*: John Wiley and Sons, Inc. Remote sensing principles and interpretation, *Sabins, F. F.,* W H Freeman, San

Francisco. Introduction to remote sensing, *Campbell, J. B.,* Taylor and Francis, London

GI15202CR: ADVANCED REMOTE SENSING & IMAGE PROCESSING

Course Goals

- Develop skills for advanced remote sensing and image processing of satellite data.
- Impart know-how on the methods of extracting information from the satellite data.
- Demonstrate the usefulness of satellite data for real world applications

Advanced Remote Sensing Systems:

Remote sensing in 21st century. Extraterrestrial/ Planetary Remote Sensing, Geophysical Remote Sensing and its applications. Thermal remote sensing: introduction and applications. Hyper-spectral remote sensing: introduction and applications. Concepts of LiDAR. Integration of multi-sensor data: introduction, technique, constraints and applications.

Image Processing Techniques:

Uni-variate and multi-variate statistics in Digital Image Processing. Filtering: introduction, high pass filter, low pass filters, density slicing, edge enhancement and detection filters. Band math and ratioing: image indices (VI, NDVI, PVI, SAVI). Principal component analysis (PCA): introduction, technique and applications.

Classification of Satellite Data:

Image classification: Supervised and Unsupervised approaches, Parametric and Non-parametric classifiers, Per- and Sub-pixel Classification, Stages of supervised classification. Feature selection and feature reduction. Classification algorithms: ISODATA, K-means, Maximum likelihood, Mean distance to means, Parallel piped, Mahalanobis. Limitations of statistical classifiers. Advanced image classification techniques: Knowledge based classifier, Artifical Neural Networks and Fuzzy c-means clustering. Classification Accuracy Assessment: testing samples, error matrix, errors of commission and omissions, Kappa statistics.

Practical

Advanced Image Processing

- Advanced image processing techniques viz.,
- Principle component analysis of remote sensing data
- Mosaicing of images
- Image Fusion
- Digital Image Classification: Unsupervised and Supervised.
- Accuracy assessment of thematic maps
- Comparison of different classification algorithms.
- Microwave data processing and Quantification of backscattering from different features

- Development of spectral indices using optical remote sensing data
- Use of Spatial Modeller for image analysis.
- Change Detection Analysis
- Individual/Group-wise assignment

References:

Gupta, R. P., 2003: *Remote Sensing Geology*, Springer-Verlag

Rencz, AN.1999: ñManual of Remote Sensingò, V3. RS for Earth Sciences, JW & Sons.

Richards, J.A., and Jia, X. 2005: ñRS Digital Image Analysis: An Introductionò Springer Verlag

Manual of remote sensing, American Society of Photogrammetry and Remote Sensing, vol.I and II, Falls church, Virginia, US

Remote Sensing and Image Interpretation, *Lillesand, R. M. and R. W. Kiefer*, 1994 ,3rd Ed. NY: John Wiley and Sons, Inc.

Remote sensing principles and interpretation, *Sabins, F. F.,* WH Freeman, San Francisco. Introduction to remote sensing, *Campbell, J. B.,* Taylor and Francis, London.

Remote Sensing Digital Image Analysis, *John A. Richards:*Springer-Verlag, 1993. Introductory Digital Image Processing, A Remote Sensing Perspective, *John R. Jensen,* Prentice Hall.

Digital Image Processing, *R.C. Gonzales, R. E. Woods:*Addison Wesley, 1993. Techniques for Image Processing and Classification in Remote Sensing, *R. A. Schowengerdt:*Acad. Press, 1983.

International Journal of Photogrammetry and Remote Sensing (ISPRS), *Taylor & Francis UK.*

GI15203CR: ADVANCED GEOINFORMATICS

CourseGoals

- Imparting advanced concepts of geo-informatics, GNSS,GPS
- Development of skills in the use of geo-information technology formodeling land surface processes.

Contemporary Issues in Geoinformatics:

Emerging trends and scope of Geoinformatics. Technological advancements in Geoinformatics, Information Technology and Sensor technology. Data standardization: Data standards, data quality, Scale issues in RS and GIS. GIS design methodology, design and implementation, technical, manpower and institutional issues.

Recent advancements in Geoinformatic Science and applications:

Enterprise Geographic Information System (GIS): definition trends, implementation and its applications. GPS data use and importance in geospatial analysis. Data integration in GIS: Socio-economic GIS, integration and application of socio-economic and environmental data, fundamentals of multi-criteria analysis. GIS based decision support system: fundamentals and applications.

Interpolation & Digital Elevation Models:

Sampling theory: Geographic data sampling methods Interpolation: Introduction, importance, data sources for interpolation, types of interpolation, Methods for interpolation

(thesein polygons, inverse distance weighted, splines and krigging).Uses of interpolation, Issues involved with interpolation of spatial data. Surface mapping: Concept, types of surfaces and application. Digital Elevation Model (DEM): Definition, methods of development, and applications of DEM.

Practical
Geospatial modeling

- Geospatial data editing, and attributes
- Use of Model Builder for Geospatial Analysis.
- Spatial data analysis
- Census and other socio-economic data analysis. Detailed analysis of the Census data for different applications.
- Spatial modeling in GIS environment particularly land degradation, and hydrological Modelling.
- Individual/Group-wise assignment on spatial modeling

References

Principles of Geographic Information Systems for land resources assessment: *Burrough, P.A*., 1996. Oxford: Clarendon Press.

Fundamentals of Geographic Information Systems,*Demer,Michael, N*., 2000., JW & Sons, Inc.

Introduction to GIS, Chang, K. 2004.. 2nd Edition. McGraw-Hill, Dubuque, Iowa.

Getting Started with Geographical Information Systems*Clarke, K.C.* 2003. 4th Edition. Prentice Hall, Upper Saddle River, New Jersey.

Concepts and techniques of Geographic Information System *: Lo C.P: Albert*. Prentice Hall.

Fundamentals of Geographic Information Systems.*DeMers, M.N.*2002 2nd Edition. John Wiley and Sons, New York.

GI15204DCE: SOILS & LAND DEGRADATION

Coarse goals

- To implement geoinformation techniques for the collection, storage and analysis of spatial data including field data capture techniques for soil resources.
- To enable interpretation satellite images including digital image processing and GIS for such studies

Principles of Soil Science:

Physical, chemical, and biological properties of soils. Process of soil formation. Occurrence of soils on the landscape and soil classification. Soils and climate; emphasis on soil forming factors and their contribution to fertility e.g. leaching of nutrients vs. non-leached; accumulation of organic matter. Major soil types in India with special reference to soil types in Jammu and Kashmir.

Remote Sensing in Soil Studies:

Spectral characteristics of soils, physiographic analysis and soil mapping using satellite remote sensing data, soil information system. Use of hyperspectral remote sensing in soil resource inventory, soil spatial variability, soil morphology and classification, Digital image processing techniques for soil resource mapping.

Digital Terrain Modelling for Soil Studies:

Digital terrain modelling (DTM) for terrain slope, aspect and physiographic analysis for soil mapping. Concept and approaches of land evaluation, Identification and mapping of different landforms including volcanoes, plateaus, folded mountain ranges, stream channels degraded lands etc.

GIS for Land Evaluation:

Soil erosion modeling and hazard assessment, Process-based soil erosion modeling, watershed analysis and prioritization *vis a vis* soil conservation, Soil conservation planning, Decision support system for land use planning, optimal land use planning for sustainable development. Land suitability analysis using multicriteria analysis. Land reclamation. Concepts and processes used in land reclamation, emphasizing soils and landforms disturbed by such activities as mining, construction, and agriculture, and the techniques of revegetation of these soils.

References:

Land Degradation: creation and Destruction, Douglas L. Johnson, Laurence A. Lewis, 006. Rowman and littlefield Publishers.

Natural Hazards and Human-Exacerabated disasters, Edgardo Latrubesse.National UoC.

Collaborative Decision Making: Perspectives and Challenges,2008,Pascale Zarate, James and James science Publisher.

Our Earthôs Changing Land, 2006.Helmut Geist, Wiley Publishers

Urban growth and Land degradation in developing cities,2007. Roy Maconachie. M Publishers

Desertification (ed.) E. M. Brodges, I. D. Hannam, L. R. Oldeman, peningdeVries and Sompatpanit. Oxford Press, Khon Kean. Thailand.

Geographic Information Systems for land resources assessment. Burrough, P.A.: OU Press.

Lillesand, R. M. and R. W. Kiefer, 1994, Remote Sensing and Image Interpretation,3rd Ed. NY: John Wiley and Sons, Inc.

Singh, A. N., and Dwivedi, R. S. (1983). Land degradation studies in part of West Coast region of India using Landsat data. Technical Report, Vol. 16, National Remote Sensing Agency, India.

Zuquette, L.V. Pejon, O. J. Collares, J. Q. 2003: Land degradation Assessment geoindicators in the Fortaleza metropolitan region, state of ceara, Brazil. Journal of Environmental Geology

GI15205DCE: DISASTER, RISK & HAZARD ASSESSMENT

Coarse goals

- To learn about the application of geoinformatics for disaster management.
- To develop and devise logistic action plans for the post disasters with the help of GIS analysis.

Principles of Disaster Management:

Principles of Disaster Management: Natural disasters, anthropogenic disasters hazards, risks and vulnerabilities. Assessment of disaster vulnerability of a location and vulnerable groups. Preparedness and mitigation measures for various disasters. Earthquake, floods, fire, landslides and other natural calamities. Information systems &decision making tools. Disaster management with respect to seismic, flood and other disaster prone areas of Jammu and Kashmir.

Disasters: Types and Genesis:

Global scenarios of natural disasters: Climatic change and global sea rise, coastal erosion, environmental degradation (deforestation, changes in larger biomes, wetlands, lakes, etc), large dams and earthquake, road building and landslide, ports in cyclonic path, reclamation of land, urbanization and its intensity in eco-fragile area. Glacier related disasters.

Remote Sensing for Disaster Management:

Remote sensing for disaster management: Satellite remote sensing for disaster management, real time disaster analysis and management, identification of flood prone areas using remote sensing and other ancillary data, post disaster analysis of inundated areas, area estimations, crop loss estimates etc. Forest fire identification and zonation using remote sensing data. Forest fire prevention strategies. Remote sensing based surveys for seismic zonation, identification of probable seismically active zones using geological studies.

Geoinformatics for Disaster Assessment and Management:

Geoinformatics for disaster assessment and management: Organizational structure for disaster management, disaster management schemes. Natural disasters and mitigation efforts, flood control, drought management, cyclones, avalanches, land use planning, operations management (OM). GPS for early warning system for earthquakes. Risk assessment and disaster response, Quantification techniques. Recent trends in disaster information provider laser scanning applications in disaster management, Statistical seismology, Quick reconstruction technologies.

References:

Aki, K. and P.G. Richards (2002) Quantitative Seismology, University Science Books, S, CA.
Bolt, B.A. (1992) . Inside the Earth, W.H. Freeman, San Francisco.

Building safer cities, 2003.Alcira Kreime, Margaret Arnold,Anee Carlin, NYork U N. Press.
Collaborative Decision Making :Perspectives and Challenges,2008,Pascale Zarate, James and James science Publisher.

Fowler, C.M.R.(1990). The Solid Earth: An Introduction to Global Geophysics, C. Press.

Fundamentals of Geographic Information Systems Demer,Michael, N., 2000: JW. and Sons, Inc.

Iyer, H.M. and K. Hirahara (Eds.) (1993) Seismic Tomography Theory and Practice, C&H,NY.

Landslides-Risk reduction. KyojiSassa, Paolo Canuti.. 2008, Kluwer Academic Publishers. Lay, T. and T.C. Wallace (1995) Modern Global Seismology, Academic Press, San Diego. Natural Hazards and Human-Exacerabateddisasters, Edgardo Latrubesse. National Uni of Colombia.
Risk management and Society-Eve Coles, Denis Smith,Steve Tombs,2000

GI15206DCE: REMOTE SENSING FOR URBAN AND REGIONAL PLANNING

Coarse goals

- To use different high-resolution satellite data products for urban planning.
- To develop a credible remote sensing and GIS system for urban area related problems.

Introduction to Urban Planning:

Principles of urban area development and land use planning. Importance of Urban and regional planning. Urbanization trends in Jammu and Kashmir with special reference to the Srinagar and Jammu city centers. Impact of urbanization on different natural resources of Jammu and Kashmir with reference to some case studies. Master planning for urban land use.Unplanned urbanization and resource mis-management.

Remote Sensing for Human Settlement Analysis:

Urban area identification and interpretation using high and moderate resolution remote sensing data, Various classification systems; Residential area classification; Space use classification system; Urban land use classification systems, interpretation, monitoring and change detection analysis using satellite imagery. Mapping urban land use and urban sprawl with remotely sensed data.

Socio-economic GIS:

Census operation in India, census data and field observations, Demographic and social patterns, Socio economic and residential area evaluation.Remote sensing for population studies and settlement, slum settlement detection. Updating of population data, Traffic and parking survey with high spatial resolution satellite data, Role ofGeoinformatics in Transportation Planning. Geoinformatics for cadastral based land information system.

GIS for Urban Resources and Services Planning:

Eco-zonation of ecologically fragile landscapes. Urban facility mapping, Advancement of Geoinformatics in services sector particularly Utilities. Urban land evaluation and suitability analysis, Urban hazards and risk management. Seismic microzonation of urbanized areas.

References:

Urban Crowding and its Consequences, Breese, Gerald 1974.Praeger Publishers, New York.
Albert, M. 1999. Modeling the Urban Ecosystem: A conceptual Framework. Environment and Planning B 26,no.4,605-630.

Urban Ecosystem studies in Malaysia, 2003. Noorazuan MD-Hashim,RuslanRainis.
Remote sensing of urban environment .1999 Jenson,SK and FA, Rashid.

Branch ,M.C., 1971,City Planning and Aerial Information. Cambridge, Harvard Uni.Press.

Burrough, P.A., 1996.*Principles of Geographic Information Systems for land resources assessment*: Oxford: Clarendon Press.

Demer, Michael, *N.*, 2000.*Fundamentals of Geographic Information Systems*, John Wiley and Sons, Inc.

Gottmann,J.,1994,Towards a Global Urbanization-The post-Industrial City, Systema Terra-

Remote Sensing and the Earth,3(3):4-7
Green, K., Kempka and L.Lackey,1994,Using Remote Sensing to Detect and Monitor Land cover and Landuse change, Photogrammetric Engineering and Remote sensing,60:331-337

GI15207GE: DATABASE MANAGEMENT SYSTEMS

Coarse goals

- To make an understandingabout the working of database management system.
- To define queries in the standard language SQL, stored tables and queries.
- To learn about the aspects of database design and its applications.

Fundamentals of Database Management System:

Database concepts, database development, implementation and design, Database management system (DBMS): Network DBMS, Hierarchical DBMS, Relational DBMS, Comparison between these DBMS. Editing and Storing GIS databases

DBMS Concepts

Concept of Keys in a database. Theoretical and mathematical understanding of database querying: Relational Algebra, Querying using SQL. Steps in database design, GIS Data modeling using Entity Relationship Diagrams. GIS database application development. GIS database application tools.

Advanced DBMS:

Database Backup, Transaction logs and Properties. Database Recovery, Data Storage and Causes of System failures, Recovery Techniques: Mirroring, Shadow Paging. Data Integrity: Entity Integrity, Referential Integrity and Domain Integrity. Data Security: Requirements and Risks. Role of a database administrator. Granting and Revoking Privileges and Roles.

Regional and Global databases:

Global land use datasets, global ecosystem maps, datasets related to vegetation, topography, land use. Agriculture data sets like FAOSTAT etc., global NPP datasets. Global forest datasets AVHRR global forest resource assessment. Global Seeps database. Global topographic data SRTM, ASTER, CartoDEM. Other global datasets like BALANS land cover data, NIMA DCW VMAP0, GEOnet names server, gridded population of the world, Bhuvan, , Landsat Geo Cover.

References:

R. Elmasri, S.B Navathe. Fundamentals of Database Systems, Pearson Education. 2007.

An introduction to Informatics in Organizations Benynon-Davies, P. (2002).Information Systems: Palgrave (formally Macmillan).

An introduction to Database Systems, Date, C..J.(2000). Reading, M.A. Addison-Wesley.
Database Management Systems, *Ramakrishnan, R. and J. Gehrke* (2003). Boston, M. A,

McGraw.

Database Model Design: The fundamental Principles *Teorey, T.J.* (1994). San Mateo, CA, Morgan Kaufmann.

GI15208GE: Oceanography

Oceanography: Ocean circulation: Horizontal circulation, vertical circulation. Circulation in different Oceans. Coastal erosion and Wave study. Changing levels of the Shoreline. Ocean circulation and climate change

Waves: Characteristics, Wind-generated waves, Tsunami, Internal waves. Tides: Characteristics and origin, Tidal currents, Tides as a source of power.

Composition of seawater ï Classification of elements based on their distribution; major and minor constituents; behavior of elements; chemical exchanges across interfaces and residence times in seawater.

Chemical and biological interactions ï Ionic interactions; cycling and air-sea exchange of important biogenic dissolved gases; carbon dioxide-carbonate system; alkalinity and control of pH; abiotic and biotic controls of trace elements in the ocean; biological pump and controls on atmospheric composition

Books recommended

Kennett, J. P., 1982: Marine Geology. Prentice Hall.

Pinet, P. R., 1992: Oceanography, An Introduction to the Planet Oceanus. West Pub. Co.

Seibold, E. and Berger, W. H., 1982: The Sea Floor. Springer-Verlag.

Smoot, N. C., Choi, D. R & Bhat, M. I., 2002. Marine Geomorphology. XLIBRIS Corp.

Smoot, N. C., Choi, D. R. & Bhat, M. I., 2002. Active Margin Geomorphology. XLIBRIS Corporation Thurman, H. B., 1978: Introductory, Oceanography. Charles, E. Merrill Pub. Co.

GI15209OE: APPLICATIONS OF GEOINFORMATICS

Introduction to Landuse/ Landcover:

Introduction to Landuse and Landcover mapping; Basic concepts, Sensor characteristics: low-, medium- and high-resolution multispectral sensors, hyperspectral sensors

Introduction to Image Classification:

Image classification: Supervised, Unsupervised, training samples and statistical issues. Classification algorithms: ISODATA, K-means, Maximum likelihood, Mean distance to means, parallel piped, Mahalanobis. Classification accuracy: test sites, error matrix, errors of commission and omissions.

Application of Geoinformatics in Geology:

Application of Geoinformatics in geology- an overview Basic concept of geomorphology, earth surface process and resultant landforms Drainage patterns and its significance in geologic interpretation. Lithological interpretation of Igneous rocks; Lithological interpretation of Sedimentary rocks; Lithological interpretation of Metamorphic rocks; Structure ï Definition, types and structural mapping Interpretation of folds, faults, unconformities and lineament.

Application of Geoinformatics in Waste Management

Application of Geoinformatics in Waste site disposal.Habitat analysis, watershed management and identification of point and nonpoint source pollution sites. Erosion estimation using GIS.

References

Principles of Geographic Information Systems for land resources assessment: *Burrough, P.A.*, 1996. Oxford: Clarendon Press.

Fundamentals of Geographic Information Systems,*Demer,Michael, N.*, 2000., John Wiley and Sons, Inc.

Introduction to GIS, Chang, K. 2004. 2nd Edition. McGraw-Hill, Dubuque,

Getting Started with Geographical Information Systems*Clarke, K.C.* 2003.. 4th Edition. Prentice Hall, Upper Saddle River, New Jersey.

Concepts and techniques of Geographic Information System *: Lo C.P: Albert*. Prentice Hall.

Fundamentals of Geographic Information Systems**.***DeMers, M.N.*2002 2 Wiley and Sons, New York.Edition. John

Introduction to remote sensing, *Campbell, J. B.,* Taylor and Francis, London. Remote Sensing Digital Image Analysis, *John A. Richards:*Springer-Verlag, 1993.

Introductory Digital Image Processing, A Remote Sensing Perspective, *John R. Jensen*, Prentice Hall.

Remote Sensing and Image Interpretation, *Lillesand, R. M. and R. W. Kiefer,* 1994, NY: John Wiley and Sons, Inc.

Introductory Digital Image Processing, A Remote Sensing Perspective,*Jensen, J.R.*,1996,Upper Sanddle River:, Prentice Hall.

Introduction to Remote Sensing *Cracknell, A.P and L.W.B. Hayes,* 1993*, London*: Taylor & Francis.

Manual of Remote Sensing Colwell, R.N. (ed), 1983, 2 Ed. Falls, Chruch, V.A American society of Photogrametry.

Remote Sensing: Principles and Interpretation, *Sabins, F.J. Jr.* 1996.

Freeman and Company, New York.

General Instructions for the Candidates

1. The two year (4 semesters) PG programme is of 96 credit weightage i.e, 24 credits / semester (24x4=96).
2. A candidate has compulsorily to opt for 12 credits from the core component in each semester.
3. A candidate has to obtain a maximum of 6 credits (2-3 papers) from the Discipline Centric Electives (DCE) offered by his/her own Department.
4. A candidate has compulsorily to obtain a minimum of 6 credits (2-3 paper) from Generic Elective (GE) or Open Electives (OE) or a combination of both offered by the departments other than his/her own.
5. A candidate can earn more than the minimum required credits (i.e, more than 96 credits for four semester programme) which shall be counted towards the final result of the candidate.

Choice based Credit System (CBCS) Scheme and course structure for M.Sc. Geoinformatics 3rd semester effective from academic session 2015 and onwards

3rd Semester

Course Code	Course Name	Paper Category	Hours per week			Credits
			L	T	P	
GI15301CR	Field Survey and GPS.	Core	3	0	2	3+0+1=4
GI15302CR	Advanced GIS Data Analysis and modelling	Core	3	0	2	3+0+1=4
GI15304DCE	Hydroinformatics	Core	3	2	0	2+1+0=3
GI15303CR	Term Work (compulsory)*	Elective (DCE)	0	6	0	0+3+0=3
GI15305DCE	Glaciology	Elective (DCE)	2	2	0	2+1+0=3
GI15306DCE	Natural Resources Management	Elective (DCE)	2	2	0	2+1+0=3
GI15307DCE	Earth system science	Elective (GE)	2	2	0	2+1+0=3
GI15308GE	Himalayan Geology	Elective (GE)	2	2	0	2+1+0=3
GI15309GE	Geomatics for Hazard Assessment and Archeology	Elective (OE)	2	2	0	2+1+0=3
18 Credit= 23 Contact Hours			21	12	6	18
L= Lecture; T= Tutorial (seminar) ; P= Practical, * Compulsory for Geoinformatics Students						

Seminar: A candidate shall have to deliver one seminar lecture in the subject per semester in the 3rd and 4th semesters carrying weightage of 1 credit. The topic of the seminar lecture shall be allotted by the concerned teachers/Department to the candidate well in advance.

GI15301CR: FIELDSURVEYANDGPS

Course goals

- To make students understand the importance of fieldwork and enable them to collect fielddata on various aspects of earth system.
- To acquire the skills of interpreting, synthesizing and disseminating field data and Information.
- To make use of data derived from the field into a GIS.

Introduction to Surveying and Mapping:

Geographic data collection, spatial location and reference. Identification of problems during the fieldwork. Basic principles of surveying, Type of surveys, (a) Surveying techniques, (b) Procedure of field survey, (c) Collection of data, (d) Error adjustments. Designing database structure for the data collected.

Digital Field Data Capture Techniques:

Traditional Field Equipments:- Theodolite, Abney Level, Plane Table. Application of latest technology instruments like GPS, 3D Laser Scanners, EDM, Total Station for field mapping. Compilation of data: Data quality assessment, Digitizing and the creation of a geospatial database. Data interpretation by integration of field and remotely sensed data.

Global Positioning System (GPS): GNSS & Applications

Introduction to GNSS, concept, types, components. GPS satellite constellation including Russian, European, GAGAN, IRNSS,. Geo-positioning basic concepts, GPS accuracy, Wave frequencies , error corrections. Ground data collection: spatial and nonspatial data for analysis and modeling. GPS signal interferences. Concepts of DGPS.Applications of GPS in resources surveys, mapping, crustal deformation and navigation.

Practical

Field Survey and GPS

- Accuracy assessment of the satellite based land use and land cover data.
- GPS survey of the University Campus or Dal Lake, Shalimar/Nishatgarden.
- Validation of the Satellite based Digital Elevation Model with the GPS data.
- Signature development for forest, aquatic and agriculture vegetation.
- Field data collection for vegetation, soils and water.
- 2 weeks field visit to the advanced national facility in Geoinformatics.
- Group assignment on any of the above field based observations.

References:

GPS Satellite Surveying, *Leick A* (1995): 2nd end. Wiley, New york Chicheste Brisbane Toronto Singapore.

GPS Theory and Practice, *Hofmann-Wellenhof B, Lichtenegger H:* (2007). Springer (5th eds), Wien New York.

Global Positioning System and GIS, An Introduction, Kennedy, M. Ann Arbor,MI,1996. Concepts and techniques of Geographic Information System *: Lo C.P: Albert*. Prentice Hall.

Remote Sensing and Image Interpretation, *Lillesand, R. M. and R. W. Kiefer*, 1994, 3rd Ed.

NY: John Wiley and Sons, Inc

GI15302CR: ADVANCEDGIS-DATAANALYSISANDMODELLING

Coarse goals

- To analyse and apply models for planning (e.g. decision support, risk analysis)
- To integrate numerical and statistical part of different types of geospatial data using various GIS softwareôs

Modeling concepts:

General approaches to modeling: deduction vs. induction, hypothesis testing vs. exploratory data analysis, forward modeling vs. inversion, knowledge-driven, data-driven, model-driven, iterative methods. Model concepts: distributed models, lumped models, empirical models, semi-empirical models, theoretical models; Modeling the Human-ecosystem interactions (Agent modeling). Concepts on modeling the historical and futuristic Land cover changes. Representation of physical properties in numeric terms, Statistical approaches of representing natural variations.

Model Evaluation:

Knowledge driven models: Boolean logic, Index overlaying, Multi-class overlaying, fuzzy logic. Data-driven models: Bayesian methods, Weights of evidence, Evidence belief, Logistic regression and other techniques. Model validation: selection of the "best model", Expert judgment, Statistical measures of agreement. Model calibration. Data quality issues with observations. Importance of observation networks to understand and predict land surface and climate processes.

Modeling Approaches:

Geospatial model Input parameters w.r.t. Hydrological, Erosion and Nutrient models. Remotely sensed hydro-meteorological parameters and their use in modeling and prediction of land surface and climate processes. Scale issues in modeling and understanding of land surface processes. Downscaling and upscaling of geospatial data. Introduction to PC Raster: Modeling and programming. Importance of Socio-economic GIS, Socio-economic GIS techniques.

Practical

Advanced Geospatial analysis and modelling

- Socio-economic GIS database
- NSDI data models and developing a prototype NSDI/SSDI
- Assessing the social vulnerability to disasters, earthquake and flooding
- PC Raster modeling and programming
- Assessing the hydrological processes using geospatial modeling environment
- Nutrient load assessment using geospatial modeling environment

References:

A review of Statistical Spatial analysis in geographical information system, Bailey, T.C 1994 Taylor and Francis.

Quantitative Geography:Prespective on Spatial data Analysis, Fortheringham A.S.2000 Sqage Publications.

Spatial Analytical Prospective on GIS,London:*Fischer,M.,Scholten.*Taylor and Francis.

Dynamic Modelling and Geocomputation .*Burrrough,Peter A.19*98.A Primer, P. Longley,S.Brooks,B.Macmillan,andR.McDonnell(eds),pp 165-192,New York:Wiley.

Fundamentals of spatial information systems, Laurini, R and Thompson, D.: Academic Press London

Exploring spatial analysis in geographical information systems, *Chou, Y. H.:* Onward Press, New Mexico, US.

GI15303CR: TERM WORK

Topics for dissertation research work will be given to the students and they will be asked to make a synopsis presentation which would orient them with respect to the basic aims, objectives and tentative methodology to carry out their proposed work. Further, a mid-semester review presentation will be conducted in order to assess the progress of the students

GI14304DCE: HYDROINFORMATICS

Coarse goals

- To assess and manage the water resources *vis a vis* the application of geoinformatics.
- To learn to develop site specific strategies or plans for water resource management using the geoinformatics.
- To enable the identification and management of potential ground water resources.
- To enable the students to study and assess the Himalayan Cryosphere.

Hydrological Cycle and Processes:

Hydrological cycle and processes: precipitation, evaporation, transpiration, interception, infiltration, percolation and groundwater recharge. Global water resources. Water resources in Kashmir Himalayas. Water resource assessment methods. Importance of hydrology to society w.r.t. Jammu and Kashmir State. Water Resources Planning and Management. Hydrometeorology: stream flow and precipitation measurement and Statistical methods for the analysis of stream flow and precipitation data, runoffi flow duration curve, flow mass curve, hydrograph ï its components.

Remote Sensing for Surface and Ground Water:

Remote sensing techniques for water resources assessment: Interpretation of satellite data for water resources, impact of spatial resolution on water resources mapping. Monitoring the surface extent of water bodies. Surface water bodies mapping (visual interpretation and digital image processing for mapping irrigation tanks, ponds, reservoirs, lakes etc.). Role of remote sensing for quantifying the hydrological processes. Groundwater exploration using remote sensing and GIS. Geophysical investigations for Ground-water Hydrology. Surface water- Groundwater interactions.

Geoinformatics for Watershed Management:

Watershed management, planning and conservation principles. Geoinformatics for watershed management.Watershed characterization and hydrological modelling. Concept of Runoff and overland flow, Factors affecting runoff processes. Watershed factors that affect runoff: size, topography, shape, orientation, aspect, geology, soil interflow and base flow.DEM applications in water resources. Geoinformatics for water quality and quantity modelling using different approaches; distributed semi-distributed, lumped and empirical approaches.

Snow and Glacier Studies using Geoinformatics:

Snow and glacier resources of Kashmir. Climate change and glaciers. Visible, infrared and microwave remote sensing for snow and glacier studies. Normalized Difference Snow Index (NDSI) and other ratio methods for snow/glacier mapping.Snow hydrology, snowmelt run-off modeling. Glacier inventory (areal extent, depth) Change detection studies of glaciers. Mass balance studies of glaciers using geological, geodetic and hydrological approaches. Traditional and remote sensing approaches for snow parameter retrieval (snow depth, snow water equivalence, snow density).

Books suggested:

Hand Book of Applied Hydrology: (Ed) Ven T. Chow Water Resources Engineering: Linsley and Franzin Remote Sensing in Hydrology: E.T. Engman & R.J. Gurney Elementary Hydrology: V. P. Singh

Principles of Water Resources Planning: Alvin, S. Goodman

Freshwater Ecology (Concepts and Environmental Applications): Walter K. Dodds Environmental Hydrology: Andy D. Ward and Stanley W. Trimble

Hydrology and Water Resources Engineering: K. C. Patra Ground Water Hydrology: David Keith Todd

Snow and Glacier Hydrology: Kayee Brubaker

Hydroinformatics Tools, 1998. Jiri ,Marasalak, Cedo, Maksimovic, EvzenZaman. Kluwer Academic Publishers.

Practical Hydroinformatics, 2008 .Robert J. Abrahart, Linda M. See, Dimitri P. Solomatine . Morgan Kaufmann Publishers, Inc., San Francisco.

Distributed hydrological modeling, 1996. Michael B. Abbott, J.C. Refsgaard luwer A. Pubs.

Geographic Information Systems for land resources assessment. *Burrough, P.A*.: Oxford: Oxford University Press.

GI15305DCE: GLACIOLOGY

Introduction to Glaciers and Glacial Landforms:

Glaciers: Glacier Formation, glacier features and types. Movement of glaciers and transport by glaciers. Glacier and ice sheet reconstructions. Glacial deposits, Glacial and interglacial periods. Glacial Sedimentation and landforms of glacial deposition on land. Subglacial landforms formed by ice or sediment flow. Glacial sedimentation in water. Landforms of glacial deposition in water.

Himalayan Glaciers:

Himalayan cryosphere; extent, status and behavior; Glacier surge phenomena, Last glacial maximum with special references to alpine glacial system; Glacier dynamics: ELA, AAR, velocity; Glaciers as fresh water reserves, contribution of glacier and snow to stram-flows. Instrumentation for glacier studies.

Glacier Dynamic studies

Mass balance studies of glaciers; geological, photogrammetric, GPS/GPR mass balance. Use of remote sensing for snow and glacier studies; glacier geometry and dynamics, mass

balance, remote sensing approaches for snow parameter retrieval (snow cover, snow depth, snow water equivalence, snow density). Snow depletion curves, Glacier Facies.ice sheets and fluctuations in sea levels.

Climate change and Glaciers:

Snow and glacier resources of Kashmir. Climate change and glaciers. Snow hydrology, snowmelt run-off modeling. Black carbon deposition on glaciers and its impacts on melting, and other feedbacks. Impacts of changing Himalayan cryosphere on political stability in south Asia.

References:

Bennett, M. R. and Glasser, N. F., 2000. Glacial Geology Ice Sheets and Landforms. Wiley Sharp, M., Richards, K. S. and Tranter M., 1998. Glacier Hyrology and Hydrochemistry. Wiley Allan, T. D.: Satellite microwave remote sensing. Chichester, Ellis Hardwood Benn D.I. and Evans J A D., 1997. Glaciers and Glaciation.Woody's Books USA Hubbard, B. and Glasser N. F. 2005. Field Techniques in Glaciology and Glacial Geomorphology. Wiley

GI15306DCE: NATURAL RESOURCE MANAGEMENT

Coarse goals

- To acquaint the students with the applications and use of Geoinformatics for Natural Resource Conservation and Management
- To impart knowledge about the GIS analytical capabilities to solve environmental Problem.
- To equip the students with the know-how about integrated environmental analysis using Geoinformatics.

Fundamentals of Natural Resource Management:

Natural resources: Introduction and classification. Inventory and monitoring major natural resources of Jammu and Kashmir with special reference to water and forests. Ecosystem: concept, types and components. Major biomes of the world: distribution and characteristic features of Forests, Grassland, Tundra, Desert and Marine. Wetlands: Concepts, Ramsar Convention, socio-economic and environmental importance, mapping, inventorying and management.

Climate Change: Process and Consequences:

Basic concepts of climatology, Climate change: introduction, causes & consequences. Green house gases and green house effect. Impacts of climate change on natural resources particularly forest, agriculture and water resources. Energy sources and Climate change. International environmental conventions viz., UNFCCC, UNCBD, UNCCD. Kyoto & Montreal Protocol. Sustainable development of natural resources, concept, principles and limitations. Integrated Environmental analysis. Systems approach to Ecosystem studies.

Remote Sensing of Natural Resources:

Forest Resources Inventory and Management using high and moderate resolution satellite data. Vegetation mapping for change detection studies and biomass estimations. Remote Sensing for Sustainable Agriculture and crop production estimates. Rangelands: spatial and temporal variation in distribution, change detection analysis based on satellite imagery. Mineral wealth of J&K, Application of hyperspectral remote sensing data for mineral exploration and distinction. Water resources (snow and glaciers): inventorying, change detection studies and glacier retreat.

GIS for Natural Resource Management:

Decision Support Systems for NRM. GIS for modeling land surface processes particularly erosion and hydrological processes. Biodiversity: Monitoring, management and loss. Conservation of biodiversity (with special references to biodiversity pool of J&K). Role of Geoinformatics for management of wildlife reserves, habitat analysis of musk dear, black bear and snow leopard in Jammu and Kashmir. GIS for watershed prioritization. GIS for Wetland restoration.

References:

Alan H. Strahler& Arthur Strahler. Physical Geography. Wiley

Bir Abhimanyu Kumar. Remote Sensing and GIS for Natural Resource Management. Eastern Book Corporation.

DS Lal. Climatology. Sharda Pustak Bhawan

Frank Oldfield. Environmental Change: Key Issues and Alternative Approaches. Cambridge University Press.

Jasper S Lee. Natural Resources and Environmental Technology. Interstate Publishers M. Anji Reddy. Remote Sensing and Geographical Information Systems. BS Publications

R.B. Singh. Dynamics of Mountain Geosystems.South Asia Books.

Stanley Aronoff. Remote Sensing for GIS managers. ESRI Press.

GI15307GE: EARTH SYSTEM SCIENCE

Man and Environment:

Inter-relationship of Earth, Man and Environment - population and environment, population and limited resources, disruption of natural system, causes and consequences of growth rates, population and carrying capacity, population control strategies. Earthôs support to mankind.

Ecosystem:

Ecological spectrum - biotic communities; food chains, stratification in biotic communities, community stability, species diversity. Anthropogenic changes in ecosystem. Preserving gene pools and conserving endangered species.

Earth system:

Components of the geosphere and environment - lithosphere, biosphere, hydrosphere and atmosphere.

Biogeochemical:

Biogeochemical cycles ï nitrogen cycle, carbon cycle and phosphorous cycle.

References

Burrough, P. A., 2003: *Principles of Geographic Information* Systems. Oxford University Press. Campbell, J., 2002: *Introduction to Remote Sensing.* Guilford Press, New York.

Demers, M. N., 1999: *Fundamentals of Geographic Information Systems.* John Wiley. Jensen, J. R., 2004: *Remote Sensing of the Environment.* Prentice Hall, New Jersey. John, A., Richards, 1993: *Remote Sensing Digital Image Analysis.* Springer-Verlag.

John, R., Jensen, 2000: *Introductory Digital Image Processing, A Remote SensingPerspective.*

Lillesand, T. M. and Kiefer, RW., 1987: *Remote Sensing in Geology.* J. Wiley. Prentice Hall, Lillesand, T. M. and Kiefer, RW, 2002: *Remote Sensing and Image Interpretation,* J. Wiley. Rees, W. G., 2001: *Physical Principles of Remote sensing.* CambridgeUniversity Press.

Sabbins, F. F., 1985: *Remote Sensing - Principles and Applications.* Freeman

Skidmore, A., 2002. *Environmental modeling with GIS and Remote Sensing.*Taylor& Francis. Longley, D. A., Gordchild, M. F., Maguire, D. J. and Rhind, D. W., 2001: *Geographic Information Systems and Science.* John Wiley & Sons.

GI15308GE: HIMALAYAN GEOLOGY

Major lithotectonic divisions of India. The Himalaya: Formation of Tethys, its paleogeography. Geographical subdivisions, lithological units of Himalayas and their correlation.

Geology of Outer Himalaya, Lesser Himalaya, Tethys Himalaya, Higher Himalayan Crystallines, Suture Zone and Trans-Himalaya,

Tectonic evolution of the Himalaya with special reference to collision zone.

Mineral resources of Himalaya. Major environmental issues in Himalaya: earthquakes, landslides, GLOFs, snow avalanches, floods, cloudburst. Glaciation in Himalaya

Books recommended

Gass I.G. et al 1982: Understanding the Earth. Artemis Press (Pvt.) Ltd. U.K.

Windley B. 1973: The Evolving continents. John Wiley & Sons, New York.

Condie, Kent. C. 1982. Plate Tectonics and Crystal Evolution Pergamon Press Inc.

Gansser, A.Geology Of Himlayas,

Cox , Plate Tectonicsa and Geotectonic reversal,

Heim and Gansser, Central Himalaya,

Sinha, A.K., 1989. Geology of Higher Central Himalaya,

Sinha, A. K., Sassi, F. P. and Papinikolaou, D., 1997. Geodynamic domains in the Alpine-Himalayan Tethys, Sinha, A.K., 1992. Himalayan Orogen and Global Tectonics.

Thakur, V. C., 1992. .Geology of Western Himalaya,

Sharma, K. K., 1991. Geology and Geodynamic evolution of the Himalayan Collission Zone.

Thakur, V. C. and Sharma, K. K., 1983. Geology of the Indus Suture Zone of Ladakh.

GI14309EO : GEOMATICS FOR HAZARD ASSESSMENT AND ARCHEOLOGICAL

Natural Disasters:

Natural Disasters: Introduction and types Disaster management cycle and role of Remote Sensing and GIS in disasters management Remote Sensing and GIS application in Hazard zonation mapping Remote Sensing and GIS application in post disasters.

Geomatics Application in Hazard Assessment:
Forest fire identification and zonation using remote sensing data. Forest fire prevention strategies. Remote sensing based surveys for seismic zonation, identification of probable seismically active zones using geological studies.

Introduction to digital Archeology:
Importance of Archeological and Heritage sites.Role of digital mapping and database development for heritage sites. Surveying and mapping methods for heritage sites, Introduction to digital archeology. Creating archeological database, 3d visualization of Archeological and heritage buildings.

Landscape Archaeology:
Landscape Archaeology: Geo-heritage of Jammu and Kashmir; Geo-heritage sites as a repository of paleoclimate; Remote Sensing and GIS Methods for geo-heritage mapping, photogrammetry in archeological mapping.

References
Bryant, E., 1985: Natural Hazards-Cambridge University Press
Patwardhan, A.M., 1999: The Dynamic Earth System-Prentice Hall
Bell, F.G., 1999: Geological Hazards-Routledge, London
Lock, G. and Harris, T. (2000). Beyond the map: archaeology and spatial technologies, in Lock. G. (ed) Amsterdam Washington, DC, Tokyo, IOS Press
Patrick Daly and Thomas L. Evans (2000). Digital Archaeology: Bridging Method and Theory. Routledge, New york.
Constantin Papaodysseus (2012). Pattern Recognition and Signal Processing in Archaeometry: Mathematical and Computational Solutions for Archaeology. Publisher IGI Global united states of America.

General Instructions for the Candidates

1. The two year (4 semesters) PG programme is of 96 credit weightage i.e, 24 credits / semester (24x4=96).
2. A candidate has compulsorily to opt for 12 credits from the core component in each semester.
3. A candidate has to obtain a maximum of 6 credits (2-3 papers) from the Discipline Centric Electives (DCE) offered by his/her own Department.
4. A candidate has compulsorily to obtain a minimum of 6 credits (2-3 paper) from Generic Elective (GE) or Open Electives (OE) or a combination of both offered by the departments other than his/her own.
5. A candidate can earn more than the minimum required credits (i.e, more than 96 credits for four semester programme) which shall be counted towards the final result of the candidate.

Choice based Credit System (CBCS) Scheme and course structure for M.Sc. Geoinformatics 4th semester effective from academic session 2015 and onwards

4th Semester

Course Code	Course Name	Paper Category	Hours per week			Credits
			L	T	P	
GI15401CR	Project work	Core	0	12	0	0+6+0=6
GI15402CR	Geospatial Statistics	Core	2	0	2	2+0+1=3
GI15403CR	Open Sources GIS	Core	2	2	0	2+1+0=3
GI15404DCE	Geomorphology from Space	Elective (DCE)	2	2	0	0+3+0=3
GI15405DCE	Climate Change	Elective (DCE)	2	2	0	2+1+0=3
GI15406DCE	Advance Remote Sensing in Geosciences	Elective (DCE)	2	2	0	2+1+0=3
GI15407DCE	Himalayan Tectonics	Elective (GE)	2	2	0	2+1+0=3
GI15408GE	Natural Disasters	Elective (GE)	2	2	0	2+1+0=3
GI15409GE	Health and Socioeconomic GIS	Elective (OE)	2	2	0	2+1+0=3
18 Credit= 23 Contact Hours			21	12	6	18
L= Lecture; T= Tutorial (seminar); P= Practical						

Seminar: A candidate shall have to deliver one seminar lecture in the subject per semester in the 3rd and 4th semesters carrying weightage of 1 credit. The topic of the seminar lecture shall be allotted by the concerned teachers/Department to the candidate well in advance.

GI15401:CRPROJECT WORK

As a part of the curriculum, the students would be assigned research/project work related to the use of remote sensing and Geographic Information System for any of the themes/areas on landuse/landcover mapping, cartography, geomorphology, civil engineering, hydrology, agriculture, urban and regional planning, database development, assessment of earth resources and other general environmental problems. The objective is to expose students to various techniques so that they would consolidate their skills learned in the theory and practical sessions of related to various courses.

GI15402CR: GEOSPATIAL STATISTICS

Fundamentals of Geospatial Statistics:
Introduction: importance and application of Statistics for Earth Sciences. Spatial sampling procedures, non- sampling and sampling errors, sampling design. Design of experiments. Confidence intervals. Hypothesis testing. Analysis of variance.The statistical methodology and models to analyze time series data with special reference to geological, environmental and agriculture sciences. Models and methods for the analysis of dataset with missing values.

Techniques and Applications of Geospatial Statistics:
Overview of applications and techniques for univariate and multivariate statistics for multi-dimensional satellite data; spatial continuity analysis; estimation; simulation. Overview of spatial statistics, estimation, and modeling with examples. Autocorrelation principles. Variogram analysis. Applications of variogram analysis for continuously varying phenomena like soil moisture, forest structure

Statistical Analysis:
Descriptive statistics and data analysis, organizing, summarizing and analyzing spatial data, histogram analysis, probability distribution, scatter plots and data redundant analysis for multi-dimensional spatial data, correlation in multivariate data, data transformations (logarithmic, indicator, normal-score, rank-order); principal component analysis. Time series analysis and applications of time series analysis for feature extract from the multi-temporal satellite data, remote sensing applications like soil moisture, vegetation analysis and disaster management

Practical
Geospatial statistics
- R statistical software Basics
- Basic statistical analysis using available statistical data analysis packages
- Hands on exercise on plotting and graphic software

References
Kitanidis (1997).Introduction to Geostatistics. University Press.
Cressie (1993).Statistics for Spatial Data.Wiley & Sons.
Gelfand, Diggle, Fuentes, Guttorp (2010). The Handbook of Spatial Statistics.Chapman & Hall/CRC.
David, M., Hand book of Applied Advanced Geostatistical Ore Reserve Estimation,Elsevier,Amsterdam,216pp.,1988.
Gelfand, A.E., Diggle, P.J., Fuentes, M., and Guttorp, P., eds. (2010) Handbook of Spatial Statistics, CRC Press.
Hald,A. Statistical Tables and Formulas, Wiely,New York,1952.
Isaaks, E.H. and R.M. Srivastava (1989) An Introduction to Applied Geostatistics. Oxford University Press. (QE33.2 .M3 I83 1989)
James E. Burt and Gerald M. Barber, 1996, Elementary Statistics for Geographers, 2nd ed., Guilford Press.
Metheron,G., Principals of geostatistics, Economic Geology,58,1246-66,1963.

Stewart Fotheringham and Peter A. Rogerson (eds.), 2009, The SAGE Handbook of Spatial Analysis, SAGE Publications.
Warrick, A.W.,D. E. Myers and D. R. Nielsen, Geostatistical methods applied to soil sciences, in Methods of Soil Analysis,Part1,Agronomy monogram No.9, American society for Agronomy,Madison,Wis.,1986

GI15403CR: OPEN SOURCES GIS

Fundamental of Open source
GIS
Fundamental of GIS, Types of GIS, Components of GIS, Data sources and types of Data in GIS. Introduction to Open Source GIS, Historyof Open source GIS, GIS & Mapping, history and development, Open Source Web.

Tutorial
Grass
Introduction to GRASS.GRASS features; Using GRASS with Raster Data, Using GRASS with Vector data, GRASS and Krigging interpolation.

Quatum GIS
Introduction to Quantum GIS(QGIS);QGIS features; menu and toolbars; Map navigation; Vector and Raster data analysis.
ILWIS
Introduction to ILWIS; key features; Raster data analysis; vector data analysis.

References
Michelle. E Davis and Jon A. Phillips (2007). Learning PHP and My SQL: A Step-By-Step Guide to Creating
Dynamic, Database-Driven. 2nd Edition. OõReilly Publishers. Michael, Purvis, Jeffrey Sambells, and ameron Turner (2006). Beginning Google Maps Applications with PHP and Ajax: From Novice to Professional. A press Publishers.

GI15404DCE: GEOMORPHOLOGY FROM SPACE
Regional Landform Analysis:
Definitions of Geomorphology; Fundamental Concept; Terminology of Geomorphic Systems; Scale of Study; Role of Geomorphology; Types of Geomorphic Analysis Process Studies and Systems Analysis; Climate Geomorphology; Structural Geomorphology. Modern Techniques for large Scale Geomorphological Analysis; Role of Space Technology

Tectonic Landforms:
Introduction: tectonic landforms, Plate-Tectonic Setting Classification, Divergent plate boundaries, Convergent plate boundaries Transform zones; Plate interior settings.

Fluvial Landforms:
Introduction to Fluvial landforms; Types; Drainage Systems; Drainage Basins; Drainage Patterns; Flood Plains and Terraces; Paleochannels.

Landform Mapping:
Introduction to Landform mapping. Geomorphological mapping theory and development and diversity. Introduction to Geomorphic Mapping; Role of Remote Sensing in mapping, Geomorphic mapping analysis.

References

Nicholas M. Short, Sr. and Robert W. Blair 1986: Geomorphology from Space is an out of print 1986 NASA publication.

Bloom, A. L., 2002: Geomorphology, A Systematic Analysis of L. Cenozoic Land Forms. Prentice Hall Pvt. Ltd., N. Delhi.

Burbank, D. W. and Anderson, R.S., 2001: Tectonic Geomorphology Blackwell Sciences

Easterbrook, Easterbrook, 1994: Surface Processes and Land Forms. Prentice Hall.

Mc Calpin, J., 1996: Paleoseismology Academic Press.

Pitty, A. F, 1982: Nature of Geo-Morphology. University Paper Backs.

Ritter, D. F., 1978: Process Geomorphology. Wm. C. Brown Publishers, Lowa Sharma, V. K., 1986: Geomorphology. Tata McGraw Hill.

Thorrenberry, W. D., 1997: Principles of Geomorphology New Age International, Delhi.

Vishwas, S. K and Gupta, A., 2001: Introduction to Geomorphology Orient Longman

GI15405DCE: CLIMATE CHANGE

Atmospheric Layers:

Atmospheric Layers and Thermal Variation: Nature, composition and layered structure of the atmosphere. Factors controlling insolation; heat budget of the atmosphere. Horizontal and vertical distribution of temperature; Inversion of temperature. Green house effect and importance of ozone layer.

Circulation Models

Circulation Models (GCM); Regional Climate Models; IPCCC climate Change scenarios. Climate Change Impact Studies; glaciers; water resources; food security; downscaling and upscaling of climate data; Paleo- climate inference from lake sediments, ice-core; paleosols

Global climate Change

Global climatic change and role and response of man in climatic changes, Applied climatology and Urban climate. Synoptic weather forecasting, prediction of weather elements such as rain, maximum and minimum temperature and fog; hazardous weather elements like thunderstorms, duststorms, tornadoes.

Wind Circulation

Atmospheric Layers and Wind Circulation: Global atmospheric pressure belts and their oscillation. General wind circulation.Jet stream and index cycle.Monsoon mechanism with reference to jet stream.

References

Climate Modelling Primer, Third Edition, K. McGuffie and A. Henderson-Sellers, John Wiley & Sons, Ltd., 2005.

Atmospheric Science: An Introductory Survey, Second Edition, J. M. Wallace and P. V. Hobbs, Academic Press, 2006.

Climatology, R. V. Rohli and A. J. Vega, Jones and Bartlett Publishers, 2008.

Meteorology Today: An Introduction to Weather, Climate, and The Environment, Ninth Edition, C. D. Ahrens, Brooks/Cole, 2009.
Climate System Modeling, K. E. Trenberth, QC 981 C65 1992.
Physics of Climate, J. Peixoto, QC 981 P.434 1992.
Storm and Storm Dynamics, W. R. Cotton and R. A. Anthes, Academic Press, 1989.
Mesoscale Meteorological Modeling, 2nd Edition, R. A. Pielke, Sr., Academic Press, 2002.
Ecological Climatology: Concepts and Applications, Second Edition, Gordon B. Bonan, Cambridge University Press, pp. 678, 2008.

GI15406DCE: ADVANCED REMOTE SENSINGIN GEOSCIENCES

Concepts and Overview of Remote Sensing:

Space borne remote sensing system and platforms: IRS, LANDSAT, SPOT, and IKONOS. Multi-spectral and hyper-spectral remote sensing, Geophysical Remote Sensing, Active Microwave remote sensing: SAR images, wavelength, penetration, polarization, topographic influences on SAR images, radar interferometry. Thermal remote sensing: Thermal infrared radiation properties, thermal radiation laws and thermal properties of the terrain.

Digital Image Processing

Multivariate image statistics, Optical remote sensing data filters, radar speckle/noise removal techniques, image data formats (BSQ, BIP and BIL), image ratios, Georeferencing and mosaicing of satellite data, data fusion techniques: integration of optical, radar and geospatial data. Knowledge based image classification, Post classification processing of data, classification accuracy estimation.

Remote sensing Applications

Remote sensing application to geosciences: Complimentary use of remote sensing, GIS and field observations. Geological mapping (lithology, structural mapping of faults, folds and suture zones). Use of remote sensing data for snow and glacier mapping, change detection studies (deforestation), Remote sensing for crustal deformation, morphometric and hydrological analysis

Surface mapping:

Surface mapping and interpolation methods, Digital Elevation Model (DEM) and its development from point, contour and stereo-image data, raster and vector data analysis, Applications of GIS for drainage analysis and active tectonics, use of GIS for flood risk assessment and landslide hazard zonation.

References

Burrough, P. A., 2003: Principles of Geographic Information Systems.Oxf. Uni. Press.
Campbell, J., 2002: Introduction to Remote Sensing. Guilford Press, New York.
Demers, M. N., 1999: Fundamentals of Geographic Information Systems. John Wiley.
John, A., Richards, 1993: Remote Sensing Digital Image Analysis. Springer-Verlag.
John, R., Jensen, 2000: Introductory Digital Image Processing, A Remote Sensing

Perspective. Lillesand, T. M. and Kiefer, R W., 1987: Remote Sensing in Geology. J. Wiley. Prentice Hall,
Lillesand, T. M. and Kiefer, RW, 2002: Remote Sensing and Image Interpretation, John Wiley. Rees, W. G., 2001: Physical Principles of Remote sensing. Cambridge Uni. Press.
Sabbins, F. F., 1985: Remote Sensing - Principles and Applications. Freeman
Skidmore, A., 2002.Environmental modeling with GIS & Remote Sensing. T& F, London.

GI15407GE: HIMALAYAN TECTONICS

Diastrophism: Introduction to Epeirogenic and Orogenic movements, Orogenies in space and time. Fundamental concept of Continental Drift, Sea floor spreading, Palaeomagnetism, Polar Wandering and reversal of earthôs magnetic field. Geomagnetic time scale. Plate Tectonics: Concept of Plate Tectonics, Nature and types of Plate Margins, Geometry and Mechanism of Plate Motion.

The Himalaya: Origin and evolution of Himalaya, Phases of upheaval of Himalaya. Longitudinal, latitudinal and geotectonic division of Himalaya. Brief introduction about the geology and regional framework of different tectono-units of Himalaya.

Tectonic framework and geological features of of Molasse Zone of Siwalik foothills. Paleographic, paleoecology and paleoclimatic reconstruction of Outer Himalaya. Tectonic framework and geological features of Kashmir Lesser Himalaya with special reference to biostratigraphy of Kashmir Himalaya.

Tectonic framework and geological features of Crystalline rocks of Higher Himalaya crystalline and Tethyan sediments of NW Himalaya. Tectonic framework and geological features of Flysh & Molasse sediment Indus Suture Zone, Indus ophiolies and ophiolitic Melange, Petrology and Geochemical characterization of Granitic, volcanic rocks of NW Trans-Himalaya.

Books recommended

Gass I.G. et al 1982: Understanding the Earth. Artemis Press (Pvt.) Ltd. U.K.
Windley B. 1973: The Evolving continents. John Wiley & Sons, New York.
Condie, Kent. C. 1982. Plate Tectonics and Crystal Evolution Pergamon Press Inc.
Gansser, A.Geology Of Himlayas,
Cox , Plate Tectonicsa and Geotectonic reversal, Heim and Gansser, Central Himalaya,
Sinha, A.K., 1989. Geology of Higher Central Himalaya,
Sinha, A. K., Sassi, F. P. and Papinikolaou, D., 1997. Geodynamic domains in the Alpine-Himalayan Tethys, Sinha, A.K., 1992. Himalayan Orogen and Global Tectonics.
Thakur, V. C., 1992. .Geology of Western Himalaya,
Sharma, K. K., 1991. Geology and Geodynamic evolution of the Himalayan Collission Zone. Thakur, V. C. and Sharma, K. K., 1983. Geology of the Indus Suture Zone of Ladakh

GI15408GE: NATURAL DISASTERS

Earthquake: definition, types, magnitude and intensity. Seismic waves: types. Seismographs and seismograms. Elastic rebound theory.

Earthquake location: Focus, epicentre and hypocenter; Earthquake belts; Focal depth of

earthquakes. Earthquake Prediction and precautionary measures. History of earthquakes in Kashmir.
Landslides: definition, classification, prevention measures/ methods. Landslide prone areas along Srinagar to Jammu national highway.
Floods: definition, classification, prevention and precautionary measures. History of floods in Kashmir. Coastal hazards, Hazards on Indian coasts, Cyclones and their mitigation methods.
Cloudburst: definition, types, causes, prediction, precautionary measures. Sea level rise: impacts and risks. Desertification: causes, impact and assessment.

Books Recommended

Natural Hazards-Cambridge University Press, by Bryant, E., 1985.
The Dynamic Earth System-Prentice Hall, by Patwardhan, A.M., 1999.
Geological Hazards-Routledge, London, by Bell, F.G., 1999.
Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes (3rd Ed. Edward A. Kellerand Duane E. DeVecchio, 2011.
Natural Hazards and Disastersby Donald Hyndman and David Hyndman, 2013.
The Disaster Diaries: How I Learned to Stop Worrying and Love the Apocalypse by Sam Sheridan, 2013

GI15407OE: HEALTH GIS AND SOCIOECONOMIC GIS

Introduction to Health GIS:
Geographic methods for understanding health Problems. Utilize basic GIS and spatial analysis functions for data processing. Create disease maps (mapping risk, rates and smoothed maps).

Geography and Health:
Different types of environmental hazard and their effects on humans. Access health services using various geographic methods and models. Main types of spatial diffusion associated with infectious diseases. Understand the limitations of infectious disease data. Mapping the spatial distribution.

Introduction to Socioeconomics:
Introduction to socioeconomic data. Sampling method for collection of socioeconomic data. Thematic map generation using GIS. Census operation in India, census data and field observations, Demographic and social patterns, Socio economic and residential area evaluation.

Geoinformatics and Socioeconomics
Remote sensing for population studies and settlement,slum settlement detection. Updating of population data, Traffic and parking survey with high spatial resolution satellite data Role Geoinformatics in Transportation Planning. Geoinformatics for cadastral based land information system.

References

Cliff, A. D. (Andrew David). Atlas of disease distributions: analytic approaches to epidemiological data. (Tacoma Reference) G1046.E51 C5 1992
Kearns, Robin A. and Gesler, Wilbert M. Culture/Place/Health. (Health Sciences Books,

Suzzallo/Allen Stacks) WA 31 G389ca 2002
Lang, Laura. GIS for health organizations.(Tacoma) G70.212 .L364 2000
Mackay, Judith. State Of Health Atlas.(Health Sciences & Soc Work Reference) G1046.E5 M3 1993
Ricketts, Thomas C., et al editors. Geographic Methods For Health Services Research : A Focus On The Rural- Urban Continuum.(Health Sciences Library) WA 20.5 G345m 1994
Urban Crowding and its Consequences, Breese, Gerald 1974.Praeger Publishers, New York.
Albert, M. 1999. Modeling the Urban Ecosystem: A conceptual Framework. Environment and Planning B 26,no.4,605-630.
Urban Ecosystem studies in Malaysia, 2003. Noorazuan MD-Hashim, Ruslan Rainis.
Remote sensing of urban environment .1999 Jenson,SK and FA, Rashid.
Branch ,M.C., 1971,City Planning and Aerial Information. Cambridge, H. University Press.
Lillesand, R. M. and R. W. Kiefer, 1994, Remote Sensing and Image Interpretation, 3rd Ed. NY: John Wiley and Sons, Inc.
Burrough, P.A., 1996.Principles of Geographic Information Systems for land resources assessment: Oxford: Clarendon Press.
Demer, Michael, N., 2000. Fundamentals of Geographic Information Systems, JW & Sons,
Gottmann,J.,1994,Towards a Global Urbanization-The post-Industrial City, Systema Terra-Remote Sensing and the Earth,3(3):4-7
Green, K., Kempka and L.Lackey,1994, Using Remote Sensing to Detect and Monitor Land cover and Landuse change, Photogrammetric Engineering and Remote sensing,60:331-337

General Instructions for the Candidates

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5. A candidate can earn more than the minimum required credits (i.e, more than 96 credits for four semester programme) which shall be counted towards the final result of the candidate.

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