ROYAL GLOBAL UNIVERSITY
GUWAHATI

# ROYAL SCHOOL OF ENVIRONMENTAL AND EARTH SCIENCES (RSEES)

## DEPARTMENT OF GEOGRAPHY

## M.Sc. in Geoinformatics

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## 1. Preamble

The LOCF is designed to emphasize the teaching-learning process at the postgraduate in M.Sc. level in Geoinformatics to sensitize and train the students to develop a sound and systematic approach regarding the mechanism and processes of natural and human activities. The focus is to help the students to understand the latest tools and techniques, which would help in giving a focused and precise understanding of a geographical phenomenon. The purpose is to enhance the capability of the students in perceiving, creating and analyzing sound geographical bases and concepts.

This Learning Outcome based Curriculum Framework is designed to emphasize the teaching and learning process at the postgraduate M.Sc. from teacher centric to student centric by strengthening the quality of teaching and learning in the present day real life scenario at the global, regional and local levels. It has considered learning as an activity of creativity, innovations and analyzing geographical phenomena. The committee prepared the major learning outcomes, which would help the students to understand and critically analyze various dimensions of the geographical issues.

The following objectives would be achieved:

1. To orient the students towards the identification and analysis of various facets of geoinformatics.
2. To develop students' aptitude for acquiring basic skills for preparing specialized maps.
3. To facilitate the students to learn skills of digital cartography.
4. To guide students to learn the science and art of collecting, processing and interpreting the data.
5. To expose the students to the use of the updated technologies of remote sensing, IRNSS, GNSS, Geographical Information System (GIS) and GIS Science.

### 1.4 Introduction

Learning Outcomes based Curriculum Framework (LOCF) for Geoinformatics under CBCS. Geoinformatics is the science and the technology which develops and uses information science infrastructure to address the problems of geography, cartography, geosciences and related branches of science and engineering, such as Land Surveying. It helps students establish a connection among people, locations, etc. using spatial information and geo-visualization. Geoinformatics has emerged today as an important technology to the decision- makers across a wide range of disciplines, industries and organisations as it enables them to acquire, process, analyse, visualize spatial information and produce outputs. The power of geoinformatics is its ability to acquire spatial data, integrate spatial data with non-spatial data, analyse them, create and visualize different scenarios and produce outputs which can be used for understanding processes and management and decision making.

It is essential to focus on the current socio-spatial problems, issues and challenges to make the students aware of the application of geoinformatics to sort out the societal upcoming problems. It is also essential to rejuvenate ancestral cartographic knowledge to address the current local and global problems. In the light of exponential changes in the field of arts, science and technology, it is to be studied from multifaceted angles. It is important for the policymakers to consider the geospatial aspects with references to the location and in the context of the best utilization of public utilities. It is further expected that if the above said spatial aspects are considered, it will certainly develop the lagging regions and people living therein.

### 1.4 Approach to Curriculum Planning

Learning Outcomes based Curriculum Framework (LOCF) for geoinformatics curriculum revision incorporates dynamic processes including fundamental and modern techniques, contemporary paradigms such as global initiatives like Sustainable Development Goals (SDGs), Disaster Risk Reduction (DRR), Paris Climate Action and national initiatives like smart cities, Securities of food, water, energy, human health and livelihood, biodiversity, and disaster management. The approaches are to make geoinformatics more scientific and societal-need oriented which could be the panacea to India's developmental challenges. Geoinformatics uses scientific knowledge with the current focus that includes spatio-temporal analysis, skill development, GIScience, sustainable development and human security.

### 1.2.1 Nature and Extent of Masters Programme in Geoinformatics

A Masters in Geoinformatics is a 2 year course which is divided into 4 semesters as under.

| Sl. No. | Year | Mandatory Credits to be secured for the Award |
|---|---|---|
| 1 | After successful completion of 1st Year | 51 |
| 2 | After successful completion of 2nd Year | 51 |

The curriculum inculcates knowledge of essential concepts of geoinformatics together with appropriate techniques using lectures, tutorials, group discussions, presentations, assignment evaluation and lab work. Thus, the pedagogy process includes:

i. Identifying and analysing the physical and human dimensions globally and processes in varied spatiotemporal contexts.
ii. Understanding to integrate spatial data with non-spatial data and analyse to overcome the various global environmental challenges.
iii. Analysing geographic information by using geospatial technologies.
iv. Responding to the global and national challenges and initiatives.

### 1.2.2 Aims of Masters Programme in Geoinformatics:

The overall objectives of the Learning Outcomes-bases Framework (LOCF) for MSc in Geoinformatics are-

i. Appreciate the relevance of geospatial knowledge to everyday life.
ii. Demonstrate the ability to communicate geographic information by utilising both lecture and practical exercises.
iii. Inculcate the ability to evaluate and solve geographical problems effectively.
iv. Demonstrate the skills in using geographical research tools including spatial statistics, cartography, remote sensing, GIS, IRNSS and GIScience.
v. Based on the field knowledge and advanced technologies, the students should be able to understand the ongoing geographical problems in different regions and levels with appropriate pragmatic solutions.

### 1.3 Post Graduate Attributes in Geoinformatics

Some of the characteristic attributes of a postgraduate in Geoinformatics include:

**GA 1: Technical Competence:** Post-graduates in Geoinformatics should have a solid understanding of the principles and concepts of geographic information science, remote sensing, and other related technologies. They should be able to apply this knowledge to solve complex problems and make informed decisions.

**GA 2: Analytical Skills:** Geoinformatics professionals need to be able to analyze and interpret large datasets and identify patterns and trends that can inform decision-making. They should be able to use statistical and mathematical models to analyze data and develop predictive models.

**GA 3: Communication Skills:** Geoinformatics professionals should be able to communicate technical information in a clear and concise manner to a range of audiences, including non-technical stakeholders. They should be able to present data in visual formats, such as maps and charts, to communicate complex information effectively.

**GA 4: Teamwork:** Geoinformatics professionals often work in multidisciplinary teams, including engineers, planners, and scientists. They should be able to collaborate effectively with team members and contribute their expertise to achieve project goals.

**GA 5: Project Management:** Geoinformatics professionals should be able to manage projects effectively, including developing project plans, setting timelines, managing resources, and monitoring progress. They should be able to adapt to changing project requirements and prioritize tasks to ensure project success.

**GA 6: Ethics and Professionalism:** Geoinformatics professionals should adhere to ethical principles and standards of professionalism in their work. They should maintain the confidentiality of sensitive data and ensure that their work aligns with legal and ethical standards.

**GA 7: Lifelong learning:** The core of Geoinformatics is information science infrastructure to address the problems of geography, cartography, geosciences and related branches of science and engineering, which remains relevant for all sectors of knowledge. So, the basic knowledge and the tools of Geoinformatics helps them in their future life and the process of learning will continue throughout life.

### 1.4 Qualification Descriptors for M.Sc. Programme

The qualification descriptors for the M.Sc. Programme in Geoinformatics shall have the learning attributes such as use of advanced tools and techniques for better comprehension of space and society etc. It also involves awareness among the students regarding the issues of different regions and socio-cultural aspects. The main qualification descriptors for the geoinformatics M.Sc. Programme includes:

i. Demonstration of exhaustive understanding of the basic concepts of Geoinformatics and an awareness of the emerging areas of the field.
ii. Acquisition of in-depth understanding of the applied aspects of Geoinformatics as well as interdisciplinary subjects in everyday life.
iii. Improvement of critical thinking and skills facilitating.
iv. The application of knowledge gained in the field of Geoinformtics in the classroom to the practical solving of societal and environmental problems.
v. Development of intellectual capabilities to get into further research in the discipline.
vi. Acquirement of practical laboratory skills, systematic research design and collection of experimental data.
vii. Exhibition of ability to quantitatively analyse the experimental data and writing project reports.
viii. Development of strong oral and written communication skills promoting the ability to present ideas and also teamwork spirits.

### 1.5 The Programme Learning Outcomes relating to M.Sc. degree programme in Geoinformatics

The learning outcome is to prepare the students of MSc degree in Geoinformatics, to understand the development of the subject and delve around issues suited to the needs of the contemporary world. It covers a wide range of papers covering various themes and maintains uniformity of structure across universities in the country. Geoinformatics being interdisciplinary in nature integrates learning derived from all basic and applied sciences.

**PO-1: Technical Competence:** Graduates of a Masters in Geoinformatics should be able to demonstrate advanced technical skills in the collection, analysis, and interpretation of geospatial data using relevant software and tools.

**PO-2: Spatial Data Management:** Graduates should be able to manage large geospatial datasets, including their acquisition, storage, processing, and retrieval, using appropriate data management techniques.

**PO-3: Geospatial Analysis:** Graduates should be able to use geospatial analysis techniques to solve complex spatial problems and make informed decisions.

**PO-4: Project Management:** Graduates should be able to apply project management principles to plan, implement, and evaluate geoinformatics projects effectively.

**PO-5: Communication Skills:** Graduates should be able to effectively communicate geoinformatics concepts and findings to technical and non-technical audiences, both orally and in writing.

**PO-6: Ethical and Legal Issues:** Graduates should be able to identify and address ethical and legal issues related to the collection, use, and dissemination of geospatial data.

**PO-7: Lifelong Learning:** Graduates should have a commitment to continuous learning and professional development in the rapidly evolving field of geoinformatics.

**Programme Specific Outcomes**

**PSO-1:** Acquire, store, manage, and retrieve geospatial data using appropriate database management systems and technologies.

**PSO-2:** Analyze geospatial data using appropriate techniques such as geostatistics, spatial modeling, and spatial data mining.

**PSO-3:** Visualize geospatial data using appropriate tools such as geographic information systems (GIS), remote sensing software, and web mapping technologies.

**PSO-4:** Apply geospatial technologies and techniques to solve real-world problems in fields such as urban planning, natural resource management, environmental monitoring, and disaster management.

**1.6 Teaching Learning Process**

Teaching and learning in this programme involve classroom lectures, tutorials, and remedial classes.

For every core course in each semester, one tutorial class is provided per week as per the structure of the syllabus.

Remedial classes are organized for below mediocre class students who could not pass the particular course as well as those who would like to improve their performance in certain courses, during working days. Classes also could be organized during the long vacation like summer vacation or winter vacation for those students who are genuinely in need of such intensive coaching.

The teaching learning process allows **Direct Assessment** of students in the form of:

1. Written assignments and projects submitted by students the project-based learning
2. Group discussion
3. Home assignments
4. Quizzes and class tests
5. PPT presentations, Seminars, interactive sessions
6. Field visit

**Indirect Assessment** methods include:

1. Tutorial classes that allow closer interaction between the students and the teacher as each student gets individual attention.
2. Co-curricular activity
3. Mentor Mentee activity

**1.6. Programme Evaluation**

1. The course shall be spread over 4 (four) semesters with weightage (contact hours) of 20 each per week. Students leaving the course after completion of 2 (two) semesters will be awarded Post Graduate Diploma in Geoinformatics.
2. In addition to end term examinations, student shall be evaluated for his/her academic performance in a
3. Programme through, presentations, analysis, homework assignments, term papers, projects, field work, seminars, quizzes, class tests or any other mode as may be prescribed in the syllabi. The basic structure of each Programme shall be prescribed by the Board of Studies and approved by the Academic Council.
4. Each Programme shall have a number of credits assigned to it depending upon the academic load of the Programme which shall be assessed on the basis of weekly contact hours of lecture, tutorial and laboratory classes, self-study. The credits for the project and the dissertation shall be based on the quantum of work expected.
5. Depending upon the nature of the programme, the components of internal assessment may vary. However, the following suggestive table indicates the distribution of marks for various components in a semester: -

| | ***Components of Evaluation*** | ***Marks*** | ***Frequency*** | ***Code*** | ***Weightage (%)*** |
|---|---|---|---|---|---|
| **A** | **Continuous Evaluation** | | | | |
| i | Analysis/Class test | Combination of any three from (i) to (v) with 5 marks each | 1-3 | C | 25% |
| ii | Home Assignment | | 1-3 | H | |
| iii | Project | | 1 | P | |
| iv | Seminar | | 1-2 | S | |
| v | Viva-Voce/Presentation | | 1-2 | V | |
| vi | MSE | MSE shall be of 10 marks | 1-3 | Q/CT | |
| vii | Attendance | Attendance shall be of 5 marks | 100% | A | 5% |

| | | | | | |
|---|---|---|---|---|---|
| **B** | **Semester End Examination** | | 1 | SEE | 70% |
| | total | | | | **100%** |

**M.Sc. in Geoinformatics**

**Programme Structure**

| **1st SEMESTER** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sl. No** | **Subject Code** | **Names of subjects** | **L** | **T** | **P** | **C** | **TCP** |
| | | **Core Courses** | | | | | |
| 1 | GEOI164C101 | Principles of Remote Sensing & Global Positioning System | 2 | 0 | 2 | 4 | 6 |
| 2 | GEOI164C102 | Fundamentals of GIS | 2 | 0 | 2 | 4 | 6 |
| 3 | GEOI164C103 | Cartography & Geo Statistics | 2 | 0 | 2 | 4 | 6 |
| 4 | GEOI164C104 | Geosciences & Image Interpretation | 2 | 0 | 2 | 4 | 6 |
| 5 | GEOI164C105 | Case study and Report making | 0 | 0 | 8 | 4 | |
| **Ability Enhancement Compulsory Courses (AECC)** | | | | | | | |
| 6 | CEN984A101 | Communicative English-I | 1 | 0 | 0 | 1 | 1 |
| 7 | BHS984A103 | Behavioural Science-I | 1 | 0 | 0 | 1 | 1 |
| **Discipline Specific Elective (DSE): Any one to be selected** | | | | | | | |
| 8 | GEOI164D101 | Computer Programming | 2 | 0 | 2 | 4 | 6 |
| 9 | GEOI164D102 | Geoinformatics in Water Resources | 2 | 0 | 2 | 4 | 6 |
| **TOTAL CREDITS (C) & TOTAL CONTACT PERIODS (TCP)** | | | **14** | **0** | **24** | **26** | **38** |
| **2nd SEMESTER** | | | | | | | |
| **Sl. No** | **Subject Code** | **Names of subjects** | **L** | **T** | **P** | **C** | **TCP** |
| | | **Core Courses** | | | | | |
| 1 | GEOI164C201 | Digital Image Processing | 2 | 0 | 2 | 4 | 6 |
| 2 | GEOI164C202 | Spatial Analysis & Modelling | 2 | 0 | 2 | 4 | 6 |
| 3 | GEOI164C203 | Project | 2 | 0 | 2 | 4 | 6 |
| 4 | GEOI164C204 | Geoinformatics in Agriculture, Soil & Land Evaluation | 2 | 0 | 2 | 4 | 6 |
| **Ability Enhancement Compulsory Courses (AECC)** | | | | | | | |
| 6 | CEN984A201 | Communicative English-II | 1 | 0 | 0 | 1 | 1 |
| 7 | BHS984A203 | Behavioural Science-II | 1 | 0 | 0 | 1 | 1 |
| | | **Ability Enhancement Elective Courses (AEEC/ SEC-1*)** | 2 | 0 | 0 | 2 | 2 |
| **Discipline Specific Elective (DSE): Any one to be selected** | | | | | | | |
| 6 | GEOI164D201 | Geoinformatics in Regional & Urban Planning | 2 | 0 | 2 | 4 | 6 |
| 7 | GEOI164D202 | Geoinformatics in Disaster Management | 2 | 0 | 2 | 4 | 6 |
| **TOTAL CREDITS (C) & TOTAL CONTACT PERIODS (TCP)** | | | **16** | **0** | **24** | **28** | **40** |

| Paper I Core Course | PRINCIPLES OF REMOTE SENSING & GLOBAL POSITIONING SYSTEM<br>L-T-P-C: 2-0-2-4 Credit Units: 4 Scheme of Evaluation: (T+P) | Subject Code:<br>GEOI164C 101 |
|---|---|---|

**Course Objectives:** *This course intends to show the rationale behind the use of remotely sensed data and its advantages and disadvantages and illustrate how GPS methodologies can be used to address spatial analysis from the theoretical and practical perspective.*

**Course Outcomes**:

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

CO1. **Define** basic concepts of remote sensing

CO2. **Explain** principles and applications of various remote sensing techniques including aerial photography

CO3. **Utilize** remote sensing data products for minor and major projects on environmental/ natural resource assessments and mapping, disaster and hazard management, urban planning, and many applications

CO4. **Apply** the different remote sensing data sets collected from various platforms

CO5. **Interpret** Geospatial data in GIS platforms and perform analysis from various sources of data such as Remote Sensing and GPS for geographical research

**Detailed Syllabus:**

| Modules | Topics and Course Content | Periods |
|---|---|---|
| Unit 1 | Remote Sensing: History, Development, Definition, Concept & Principles; Electromagnetic Radiation (EMR): Spectrum and its properties, Atmospheric windows, Interaction of EMR with atmosphere & Earth's Surface; Spectral signatures & Resolutions: Spatial, Spectral, Radiometric & Temporal; Remote Sensing Systems: Platforms, types of platforms & its characteristics; Sensor classification: Active and Passive, Optical-Mechanical Scanners & Push-broom scanners; Thermal Infrared: Introduction, Radiation Properties, Kinetic Heat, Temperature, Radiant Energy and Flux, methods of transferring heat; Thermal properties of terrain: Capacity, conductivity, Inertia, Infrared; Microwave: Passive & Active Sensors, RADAR, Scatterometer | 14 |
| Unit 2 | Introduction: Fundamentals of Aerial Photography: flight planning & execution Photogrammetry: Basic concepts of measurements of object height and length; Stereo Photogrammetry: Stereovision & Stereoscopes, Stereoscopic Parallax & Parallax Equations; Digital photogrammetry: Model deformation & Rectification, Relief displacement, Vertical exaggeration, Triangulation, Control & Mapping | 12 |
| Unit 3 | Satellites & their characteristics – Geostationary & Sun Synchronous; Earth Resource Satellite: (Sun Synchronous) IRS, LANDSAT, SPOT, IKONOS, QUICKBIRD, MODIS, RADARSAT, ERS, CARTOSAT etc.; Weather & Communication Satellites: (Geostationary) NOAA, TERRA, MOS, INSAT, GOES, etc.; Spectral Signature and its Response: Soil, Vegetation, Rocks and Water bodies etc.; Ground Truth Verification: Remote Sensing Applications: Agriculture, Forestry, Water resources, Regional and Urban Planning | 12 |

| | | |
|---|---|---|
| Unit 4 | Fundamentals of GPS and its applications; Geodesy; Components of global positioning system; Factors affecting GPS accuracy; GPS surveying methods and accuracy; Reference station, reference equipment's and radios | 10 |
| | **Total** | **48** |

**Lab Work:**

Exercise 1 Test of Stereo Vision, computation of photo scales, Orientation of Stereo pair
Exercise 2 Parallax bar handling and height measurements
Exercise 3 Interpretation of satellite image for landuse/landcover, urban sprawl and slope mapping
Exercise 4 Creating codes and attribute table in GPS
Exercise 5 Data collection: Measurements, Line, Area Calculation
Exercise 6 Data collection in DGPS mode.
Exercise 7 Processing of GPS data in the software

**Text Books**:


1. Jensen, J.R., (2006) "Remote Sensing of the Environment – An Earth Resources Perspective", Pearson Education, Inc. (Singapore) Pte. Ltd., Indian edition, Delhi.
2. George Joseph, (2004) "Fundamentals of remote sensing", Universities press (India) Pte Ltd., Hyderabad.


**Reference books**:


1. Sabins, F.F. Jr., (2007) Edition. 'Remote Sensing – Principles and Interpretation", W.H. Freeman & Co.
2. Reeves, Robert G. (1991), "Manual of Remote Sensing, Vol. I, American Society of Photogrammetry and Remote Sensing, Falls Church, Virginia, USA
3. Lillesand, Thomas M. and Kiefer, Ralph, W., (2007) "Remote Sensing and Image Interpretation", 4th Edition, John Wiley and Sons, New York
4. Rampal, K.K., (1999) Handbook of Aerial Photography and Interpretation, Concept Publishing Company, New Delhi
5. N.K.Agrawal , (2004) ,Essentials of GPS, Spatial Network Pvt. Ltd
6. Sathish Gopi, (2000), GPS and Surveying using GPS
7. Leica. A., (2003), GPS Satellite Surveying, John Wiley & Sons, use. New York
8. Terry-Karen Steede, (2002), Integrating GIS and the Global Positioning System, ESRI Press

| Paper II Core Course | GEOGRAPHIC INFORMATION SYSTEMS<br>L-T-P-C: 2-0-2-4 Credit Units: 4 Scheme of Evaluation: (T+P) | Subject Code:<br>GEOI164C 102 |
|---|---|---|

**Course Objectives:** *This course aims to make the students interpret the data, tools and technology and applications of Geoinformatics – Remote Sensing, GIS, and GPS and Construct and Analyse maps using Geospatial Technology.*

**Course Outcomes:**

After the completion of the course, the students will have the ability to:

CO1. **Recall** varied GIS terms, terminologies and techniques.
CO2. **Construct** different types of raster and vector maps.
CO3. **Develop** the skills in preparation of thematic maps at various levels.
CO4. **Analyze** GIS based maps and perform spatial analysis, classify remote sensing satellite based data and prepare large scale maps by using traditional surveying equipment and GPS survey.
CO5. **Assess** the multiple GIS techniques used in various fields and its applications.

**Detailed Syllabus:**

| Modules | Topics and Course Content | Periods |
|---|---|---|
| Unit 1 | Basic concepts: Definition and history; Components of GIS; Data structure and formats; Spatial data models – Raster and Vector; Data base design - editing and topology creation in GIS, Linkage between spatial and non-spatial data; Data inputting in GIS | 12 |
| Unit 2 | Integration of Raster & Vector Data; Cartographic Modeling - Map Algebra; Raster Data & its Representation: Types, Data Structure, Data Compression, Data Files, Data Conversions; Raster Data Analysis – Overlay Operations, Slope & Aspects, Statistical Analysis; Geometric Transformations - Affine Transformation and Geometric Transformation Coefficients, RMS Error; Vector data representation: Topological & Non-topological Vector Data, Map scale, Spatial Resolution, Spatial Data Accuracy, Location Data Accuracy and Precision, Vector Data Sources; Comparison between Raster & Vector Data; Feature Based Topological functions: Buffering Overlay Analysis, Distance Measurements; Layer Based Topological Functions | 14 |
| Unit 3 | Interactive Data Exploration, Vector Data Query, Attribute Data Query; Logical Expressions, Types of Operations; Relational Database Query: Use of SQL, Descriptive Statistics of Attribute Data; Spatial Data Query, Raster Data Query, Query by Cell Value, Query using Graphical Methods, Charts; Geographic Visualization, Data Classification, Spatial Aggregation, Map Comparison; Problem Identification & Designing a Data Model | 14 |
| Unit 4 | Application of GIS Techniques in Various Fields; Web GIS | 08 |
| | **Total** | **48** |

**Lab Work**

Exercise 1 Data Organization (location, attributes, consistency, scale)
Exercise 2 Spatial and Non-Spatial data collection, representation, and standardization
Exercise 3 Graphical Representation of Spatial data (Raster/Vector Method)
Exercise 4 Overlay Analysis, data Linkage for Analysis
Exercise 5 Relational Data Base Query

**Text Books:**


1. Burrough, Peter A. and Rachael McDonnell,(1998), ' Principles of Geographical Information Systems' Oxford University Press, New York.
2. C.P.L and Albert K.W.Yeung (2006) "Concepts and Techniques of Geographic Information Systems" Prentice Hall of India,New Delhi.


**Reference Books:**


1. Demers, Michael N. 2000. *Fundamentals of Geographic Information Systems*. John Wiley, Singapore.
2. ESRI 1993. *Understanding GIS.* Redlands, USA
3. George, Joseph 2003. *Fundamentals of Remote Sensing*. Universities Press (Pvt.) Ltd, Hyderabad.
4. Girard, M-C. and Girard, C. M. 2003. *Processing of Remote Sensing Data*. Oxford & IBH, New Delhi.
5. Heywood, Ian 2003. *An Introduction to Geographical Information Systems*. 2nd ed. Pearson Publ. Co., Singapore.
6. Kang-tsung Chang (2007),'Introduction to Geographic Information Systems' Tata McGraw Hill, New Delhi.
7. Longley, P., Goodchild, M.F., Maguire, D. and Rhind, D. 1999. *Geographic Information Systems. Principles, Techniques, Management, Applications*. John Wiley, New York.
8. Magwire, D. J., Goodchild, M.F. and Rhind, D. M., (2005),'Geographical Information Systems: Principles and Applications', Longman Group, U.K.
9. Martin, D. 1996. *Geographic Information Systems: Socioeconomic Implications*. Routledge, London.
10. Ralston, B. A. 2002. *Developing GIS Solutions with Map Objects and Visual Basic*. OnWord Press: Thompson Learning, New York & Singapore.
11. Reddy, M. Anji 2001. *Textbook of Remote Sensing and Geographic Information Systems*. B. S. Publs., Hyderbad.

| Paper III Core Course | CARTOGRAPHY & GEOSTATISTICS | | | Subject Code: |
|---|---|---|---|---|
| | L-T-P-C: 2-0-2-4 | Credit Units: 4 | Scheme of Evaluation: (T+P) | GEOI164C 103 |

**Course Objectives:** *This course focuses on the basics of cartography and cartographic techniques along with the diagrammatic representation of geographical data.*

**Course Outcomes**:

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

CO1. **Define** about map and its types, map scale, coordinate system and details of topographic maps.

CO2. **Interpret** fundamentals of cartographic designs.

CO3. **Construct** digital cartographic maps using data structures.

CO4. **Analyze** the importance of database queries and infer the results.

CO5. **Interpret** the results of various geostatistical analysis in GIS platforms.

**Detailed Syllabus:**

| Modules | Topics and Course Content | Periods |
|---|---|---|
| Unit 1 | Introduction to cartography: nature and scope; Approximation of Earth, Introduction to Geometrics; Categories & Characteristics of maps, Study of different types of maps, Survey of India national series maps Interpretation of topographic maps; Basics of Map scales; Reference and coordinate system; Indexing and Numbering of topographical maps | 12 |
| Unit 2 | Fundamentals of Cartographic Design, colour, pattern, lettering, compilation, border information, aesthetics; Generalization: Semantic & Geometric, symbolization, dot, isopleth and choropleth mapping; Multivariate and dynamic mapping; Map production, methods of map printing; Visualization of geospatial data: Design aspects, Multiscale and geometric aspects scale, dissemination of (visualized) geospatial data, Graphic Symbology & Variables; Data products, use and users of products; 3D Visualization, Various issues in map visualization, Interactive Cartography | 12 |
| Unit 3 | Digital Cartography - Elements of digital Cartography; Analog to Digital Conversion of Data; Conventional mapping VS Digital Mapping; Nature of Data, Database and Data structures; Data Input: data capture, digitization and scanning; Digital database creation: Point features, Line features, Polygon features; Data Editing-Removal of errors – Overshoot & Undershoot, Snapping; Data Collection and Integration, Non-spatial data attachment working with tables; Dissolving and Merging | 12 |
| Unit 4 | Data base query: Reclassification, overlay cross tabulation, editing, assigning attribute values, extraction of attribute values, histogram, area and perimeter calculation, profile generation, probability classification; Mathematical operations: Image overlay, scalar image operations, image attribute transformation; Distance operators: Distance analysis (spherical distance, cost distance), buffer analysis, direction variable cost distance, dispersion distance, least cost path analysis, spatial allocation and reallocation, Thiessen Polygon; Context operators: Surface analysis, filtering pattern analysis, grouping watershed, determination, hinterland determination; Statistics: Regression analysis (multiple, logistic, pattern analysis, trend surface analysis, spatial auto correlation, quadrant analysis, | 12 |

| | | |
|---|---|---|
| | weighted mean, centre/ standard radius, compaction index, sampling (random, systematic and stratified), standard scores method. | |
| | **Total** | **48** |

**Lab Work**

Exercise 1. Construction of different types of scales; Simple, Comparative, Diagonal Scale.

Exercise 2. Construction of different types of map projection; Conical projection, Cylindrical Projection, Zenithal Projection

Exercise 3. Preparation of UTM grid

Exercise 4. Preparation of Base Map

Exercise 5. Designing, Symbolization, Pattern and Shading techniques

**Text Books:**


1. Keates, J.S., (2008): Cartographic Design and production, London, Longman
2. Ramesh, P. A., (2000): Fundamentals of Cartography, Concept Publishing Co., New Delhi.


**Reference Books:**


1. Rampal, K.K., (2004): Mapping and Compilation, Concept Publishing Co.,New Delhi.
2. Anson, R.W.& Ormeling, F.J., (2008), Basic Cartography, Vol. I&II ed., Elsevier Applied Science Publishers, London.
3. Robinson A.H. & Morrison J.L, (1995) Elements of Cartography, John Wiley & Sons
4. Singh, R.L & Dutt. P.K,(2008), "Elements of Practical geography", Students Friends Allahabad
5. Peterson, M.P., (1995) "Interactive and Animated Cartography" Upper Sadde River, NJ: Prentice Hall.
6. Clark, I. (1979), Practical Geostatistics, Applied Science Publishers, London
7. Davis, J.C. (1973), Statistics and Data Analysis in Geology, Wiley, New York.
8. Matheron, G.F, (1963) Principles of Geostatistics: Economic Geology vol.58
9. Stein, A. (1998), Spatial Statistics for Soils and the Environment, ITC lecture notes.

| Paper IV Core Course | GEO SCIENCES & IMAGE INTERPRETATION<br>L-T-P-C: 2-0-2-4 Credit Units: 4 Scheme of Evaluation: (T+P) | Subject Code:<br>GEOI164C 104 |
|---|---|---|

**Course Objectives:** *The objective of the course is to provide the students with an understanding about the fundamental concept of Geosciences and image interpretation.*

**Learning Outcomes**:
After the completion of the course, the students will have the ability to:

CO1. **Define** concepts of earth system and elements of photo interpretation with special reference to geological studies.
CO2. **Infer** basic understanding of visual and digital satellite image processing.
CO3. **Apply** fundamental knowledge for developing the image characteristics of major landforms.
CO4. **Analyze** and apply geographical data in managing natural hazards and planning process.

**Detailed Syllabus:**

| Modules | Topics and Course Content | Periods |
|---|---|---|
| Unit 1 | Concept of Earth System, Lithosphere, Biosphere, Hydrosphere & Atmosphere; Elements Of Photo Interpretation In Geological Studies- lithotypes and structural features | 12 |
| Unit 2 | Visual and Digital Satellite Image Interpretation; Elements of Image Interpretation; Development of Interpretation Keys; Ground Truth Verification | 12 |
| Unit 3 | Fundamental Concepts: Geomorphic Agents and Processes; Development of Drainage Patterns and their Significance; Image Characteristics of Major Landforms: Fluvial, Aeolian, Glacial and Marine | 12 |
| Unit 4 | Natural Hazard Risk Management; Regional & Urban Planning; Agricultural, Soil and Land Evaluation; Water Resources | 12 |
| | **Total** | **48** |

**Lab Work**

Exercise 1 Tracing of Details from Stereo Pair
Exercise 2 Interpretation of Satellite Imagery in different Bands
Exercise 3 Interpretation of Thermal Image and Drawing of Isotherms
Exercise 4 Identification of different Features using TM, FCC, and Thermal Imagery
Exercise 5 Identification of Cultural Details from Satellite Imagery

**Text Books**:

1. Murk & Skinner, (1999). Geology Today - Understanding Our Planet, John Wiley And Sons Inc, New York
2. Lillisand, T. M. and Keifer, R. W., (2007). Remote Sensing and Image Interpretation', John Willey and Sons, New York, Fourth Edition

**Reference books**:


1. Pandey, S. N. , (1987). Principles and Applications of Photogeology. New Delhi: Eastern Wiley.
2. Jenson, J.R., (2006). Remote Sensing of the Environment – An Earth Resource Perspective, Prentice Hall Inc.
3. Drury, S.A. , (2004). Image Interpretation in Geology, Chapman & Hall, India.
4. Thornbury, W. D., (I969): Principles of Geomorphology, John Wiley and Sons, New York
5. Sabins, Floyd F., (2007). Remote Sensing: Principles and Interpretation, 2nd Ed., Freeman, New York.

| Paper: V Core Course | COMPUTER PROGRAMMING | | | Subject Code: |
|---|---|---|---|---|
| | L-T-P-C: 2-0-2-4 | Credit Units: 4 | Scheme of Evaluation: (T+P) | GEOI164D 101 |

**Course Objectives:**

*The objective of the course is to provide the students with an understanding the fundamental principles of computer programming and the role it plays in GIS based analysis.*

**Course Outcomes:**

After the completion of the course, the students will have the ability to:

CO1. **Recall** fundamental programming concepts and terminology, such as data types, control structures, and functions.

CO2. **Infer** basic understanding of programming language syntax, logic, and concepts, and will be able to explain how different programming languages and tools work.

CO3. **Construct** basic programs using a chosen programming language and apply programming concepts to solve simple problems.

CO4. **Analyze** problems in GIS analysis and design solutions using programming concepts and techniques.

**Detailed Syllabus:**

| Modules | Topics and Course Content |
|---|---|
| Unit 1 | Introduction to Computers: Essential PC hardware, peripherals and software, Data storage a Computer configurations including PCs, terminals & workstations for networks to serve businesses. Broad introduction to the main types of software; Data Communications: Introduc Star and Bus LAN topologies, Central and distributed computing, Wide area and global network Web; Using the Internet and email effectively; HTML Progra Elements<HEAD>,<TITLE>,<BODY>,<P>,<BR>,<CENTER>,<DIV>,<BLOCKQUOTE>,<PRE>,<FO Lists (<UL>,<OL>,<LI>), HR,Text formatting elements(<I>,<B>,<U>,<STRIKE>); Address Ele Addressing; Linking basics: HREF, NAME; Images and Anchors: <IMG>,image alignment, Plug-In Scrolling with <MARQUEE> Text Alignment, Tables and Fonts Word Hinting <NOBR>,<WBR> Sp <SPACER>,<MULTICOL> |
| Unit 2 | C++ Programming: Introduction to Algorithms, C Fundamentals, I/O functions, Control S Preprocessor, Definition of Program & Algorithm, Pseudocode, Flowchart, Implementation Fundamentals: The C character set, identifiers and key words, Data types, constants, vari declarations, expressions, statements, symbolic constants, Operators and Expressions, Arit unary operators, relational, logical and bitwise operators, assignment operators, library functio Preliminaries, getch, getche, getchar, putch, putchar, scanf, printf, gets, puts. Control statemen while, do.. while, for, if..else, switch, break, continue, goto statements. The C Preprocessor: Ma |
| Unit 3 | Visual Basic Programming: Creating Working Directory, Project, Forms, Module, Project wind Controls & Properties : PictureBox, Label, TextBox, Frame, CommandButton, CheckBox, OptionB ListBox, HScrollBox, Timer, DriveListBox, DirListBox, FileListBox, Shape, Line, Image, Graph, Mh their Corresponding Properties; Basic Programming Building Blocks: Variables, Data type Arithmetic and Relational Operators, Branching with if, Select Case, GoTo, For...Next, Do Loo Arrays(ReDim), On...GoSub, On...OnGoTo, InputBox, Msgbox, InputBox, String Functions like S Str$, Len, Trim, Ltrim, Rtrim, Trim$, Mid, Mid$, Left, Left$; Procedures: Procedures (Sub and F Event procedure to a Form or Control, Creating a General procedure.<br>Testing & Debugging: Errors & Watches, Error Trapping |

| | |
|---|---|
| Unit 4 | Relational Database Management System (RDBMS): Introduction to databases, characteristic approach, database users and designers, role of a DBA, advantages of using a DBMS, data instances, DBMS architecture (Three-Schema Architecture); Conceptual Data Modeling: Ph design, entity type, entity set, attributes, keys, value sets, relationships, relationship types, relationship instances, relationship degree, role names, recursive relationships, constraints on attributes of relationship types, weak entity types, ER Diagram, naming conventions and design |
| | **Total** |

**LAB WORKS**

Lab 1 Introduction to computers & programming concept

**Programming in 'C' Language**

Lab 2 Programming using concepts of Variables, Operators

Lab 3 Programming using Control Structures

Lab 4 Programming using Functions and Arrays

Lab 5 Programming using Strings

Lab 6 Programming using Data Structure

Lab 7 Programming using File Handling

**Programming in 'C++' Language**

Lab 8 Programming using concepts of Control Structure, Function & Arrays.

Lab 9 Programming using Classes

Lab 10 Programming using concept of Inheritance

**Text Books:**

1. Byron S. Gottfried, Theory and Problems of Programming with C, Tata McGraw Hill Publication

**Reference Books:**

1. E. Balaguruswamy, *Programming in ANSI C*, Tata McGraw Hill publication
2. Jeffrey P. McManus, *DataBase Access with Visual Basic 6: The Authoritative Solution*, Tech Media, Sams Publishing.
3. Paul Sheriff's *Teaches Visual Basic,* Prentice, Hall India.
4. R.Elmasri, S.B Navathe, *Fundamentals of Database Systems*, Addision, Wesley

| Paper: DSE - 1 | Quantitative Methods in Geography<br>L-T-P-C: 2-0-2-4 Credit Units: 4 (T) Scheme of Evaluation: | Subject Code: GEOI164D101 |
|---|---|---|

**Course Objectives:** *This paper provides an understanding of the pure and applied nature of Geography along with the key elements in the discipline.*

**Course Outcomes**:

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

CO1. **Define** the statistical methods and quantitative techniques used in Geography.
CO2. **Interpret** various methods and techniques of data collection, data tabulation, data interpretation and analysis.
CO3. **Identify** the importance of data in geography.
CO4. **Analyse** data through tabulation, sample size and other methods by handling data in the field.
CO5. **Interpretation** of data and validation of hypothesis

**Detailed Syllabus:**

| Modules | Topics and Course Content | Periods |
|---|---|---|
| Unit 1 | Quantitative and qualitative techniques; Significance and limitations of quantitative techniques; Descriptive and inferential statistics; Levels of measurement; Data sources and acquisition techniques; Sample and sampling techniques; Geographic data matrix. | 12 |
| Unit 2 | Measures of central tendencies (Mean, Median and Mode); Measures of dispersion (Range, Quartile Deviation, Mean Deviation, Standard Deviation; Coefficient of variation); Concept of spatial mean and median centres and standard distance and its uses, Nearest Neighbour Analysis (NNA), Inferential statistics – Chi-square ($\chi^2$) Analysis, Concept of ANOVA and F-test; | 12 |
| Unit 3 | Correlation and regression analysis (simple and multiple), Regression residual mapping, Parametric tests - t -test; Nonlinear relationships - Exponential and power function types; Theoretical distributions: Normal, Poisson and Binomial. | 12 |
| Unit 4 | Basics of matrix algebra: Matrices - definition, types; minors and co-factors, determinant of a square matrix, inverse, adjoint, solutions of linear equations; Linear algebra in developing multivariate regression models; | 12 |
| | **Total** | **48** |

**Note:** Computer / calculator based compulsory home assignments may be given for various units. Scientific calculator may be permitted in the examination hall for this paper.

**Text Books:**


1. Gregory, S., 1978: Statistical Methods and the Geographer, Longman, London.
2. Sarkar, A. 2013: Quantitative Geography: Techniques and Presentations. Orient BlackSwan Private Ltd., New Delhi


**Reference Books:**


1. David Unwin, 1981: Introductory Spatial Analysis, Methuen, London.
2. John P.Cole and Cuchlaine A. M. King, 1968: Quantitative Geography, John Wiley, London.
3. Koutsoyiannis, 1973: Theory of Econometrics, Mcmillan, London.
4. Peter Haggett, Andrew D. Cliff, & Allan Frey, 1977: Location Methods Vol. I and II, Edward Arnold, London.

| Paper: DSE - 2 | Geoinformatics in Water Resources<br>L-T-P-C: 2-0-2-4 Credit Units: 4 (T) Scheme of Evaluation: | Subject Code: GEOI164D102 |
|---|---|---|

**Course Objectives:** *This course aims to make the students understand the basic concepts and principles of geoinformatics in the context of water resources management.*

**Learning Outcomes:**

After the completion of the course, the students will have the ability to:

Recall the basic concepts and terminology related to Geoinformatics and water resource management.

CO1. **Recall** the basic concepts and terminology related to Geoinformatics and water resource management.

CO2. **Interpret** maps and other visual representations of water resources data.

CO3. **Utilize** Geoinformatics tools and techniques to collect, analyze, and visualize water resource data.

CO4. **Evaluate** the accuracy and reliability of Geoinformatics-derived water resource data.

**Detailed Syllabus:**

| Modules | Topics and Course Content | Periods |
|---|---|---|
| Unit 1 | Basic Concept: Hydrologic Cycle, hydrological parameters, Watershed characterization, delineation and codification, Watershed problems and management strategy, Geoinformatics approach for watershed prioritization, Drainage Morphometric Analysis | 14 |
| Unit 2 | Remote Sensing in Surface-Subsurface Water Exploration: Application of remote sensing in hydro geomorphological interpretation for ground water exploration, Water quality monitoring through remote sensing, Geophysical Methods for Groundwater Exploration. | 14 |
| Unit 3 | Operational Applications in Water Resources: Flood Prediction, Drought Evaluation, Snow Cover Mapping, Reservoir Sedimentation Evaluation, Geoinformatics Based Runoff & Hydrological Modelling, Flood Hazards Modelling, Snowmelt Runoff Modelling. | 10 |
| Unit 4 | Case Studies: Hydro geomorphological Mapping in Plateau Region, Flood Prone Zone Mapping in Indo Gangetic Plains, Water Harvesting Initiatives in Urban Built Up Lands, Drought Assessment in Jharkhand. | 10 |
| | **Total** | **48** |

**Text Books:**

1. Schultz, G. A. and Engman, E. T. , (2000), Remote Sensing in Hydrology and Water Management, Springer-Verlag, Berlin, Germany.

**Reference Books:**

1. Murthy, J. V. S. (1994). Watershed Management in India. Wiley Eastern Ltd., New Delhi.
2. Todd David Keith., (2005), Groundwater Hydrology, John Wiley & Sons, New York, Second Edition.
3. Schultz, G.A. & Engman, E.T. ,(2000), Remote Sensing in hydrology and water management, Springer-Verlang, Berlin, Germany.

**Semester-II**

| Paper I Core Course | DIGITAL IMAGE PROCESSING | | | Subject Code: |
|---|---|---|---|---|
| | L-T-P-C: 2-0-2-4 | Credit Units: 4 | Scheme of Evaluation: (T+P) | GEOI164C 201 |

**Course Objectives:** *The course aims to explain the digital image processing system and analysing resources and infrastructure using Geospatial Technologies and develop practical knowledge and skill in advanced technologies.*

**Course Outcomes**:

After the completion of the course, the students will have the ability to:

CO1. **List** the basic concepts of digital images and its characteristics.

CO2. **Interpret** image enhancement and filtering techniques.

CO3. **Apply** multi-band enhancement techniques for better classification.

CO4. **Analyse** and understand the basics of pattern recognition and its classifiers.

**Detailed Syllabus:**

| Modules | Topics and Course Content | Periods |
|---|---|---|
| Unit 1 | INTRODUCTION:<br>Concepts about digital image and its characteristics, Spectral, Spatial, Radiometric and Temporal resolution, Visual vs. Digital methods, Image data storage and retrieval, Image restoration and Noise Abatement, Radiometric and Geometric correction technique, Interpolation methods – linear and nonlinear transformation for geometric corrections | 14 |
| Unit 2 | IMAGE ENHANCEMENT & FILTERING TECHNIQUES:<br>Look-up Tables (LUT) and Types of image displays and FCC; Image Enhancement Techniques: Radiometric and Spatial; Contrast stretching: Linear and non-linear methods; Spatial Filtering: High and Low frequency, Image smoothing, Accuracy Assessment, Error Matrix | 12 |
| Unit 3 | MULTI-BAND ENHANCEMENT TECHNIQUES & CLASSIFICATION:<br>Band ratio, Types of Vegetation indices; Principal Component Analysis, Multi dated data analysis and Change detection; Digital Image Classification: Supervised & Unsupervised | 12 |
| Unit 4 | PATTERN RECOGNITION:<br>Concept of Pattern Recognition, Multi-spectral pattern recognition; Spectral discrimination, Signature bank, Parametric and Non-Parametric classifiers; Kriging | 10 |
| | **Total** | **48** |

**Lab Work:**

Exercise 1 Import / Export of files using DIP Software

Exercise 2 Geo-reference of the Toposheet and imageries

Exercise 3 Display, Analysis, and interpretation of Imageries

Exercise 4 Performing contrast enhancement techniques, Filtration: High, Low frequency

Exercise 5 Sub-setting of area of interest from the satellite image

Exercise 6 Principal Component Analysis

Exercise 7 Classification: Supervised, Unsupervised
Exercise 8 Mosaic of Images
Exercise 9 Map composition

**Text Books**:


1. Sabins, Floyd F. (2007), Remote Sensing: Principles and Interpretation, H. Freeman and C., New York.
2. Thomas M. Lillesand & Kiefer, Ralph W. (2007), Remote Sensing and Image Interpretation, John Wiley & Sons, New York.


**Reference books**:


1. Jensen, JR. (2006), Remote Sensing of the Environment- An Earth Resources Perspective, Prentice Hall Inc.
2. Rencz, Andrew N. , (1999), Remote Sensing for the Earth Sciences: Manual of Remote Sensing, 3rd ed., John Wiley & Sons, Inc., New York.
3. Curran, P., (1985), Principles of Remote Sensing, Longman, London.
4. Campbell, James B., (2006), Introductory Remote Sensing: Principles and Concepts, Routledge.
5. Gibson, P.J., (2000), Introduction to Remote Sensing, 2nd ed., Taylor & Francis, London.
6. Cracknell, A.P. & Hayes, L.W B., (2007), Introduction to Remote Sensing, Taylor & Francis, London.

| Paper II Core Course | SPATIAL ANALYSIS & MODELLING | | | Subject Code: |
|---|---|---|---|---|
| | L-T-P-C: 2-0-2-4 | Credit Units: 4 | Scheme of Evaluation: (T+P) | GEOI164C 202 |

**Course Objectives:** *This course intends to show the rationale behind the use of remotely sensed data and its advantages and disadvantages and illustrate how GIS/GPS methodologies can be used to address spatial analysis from the theoretical and practical perspective.*

**Course Outcomes**:

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

CO1. **Define** the basic concepts of GIS and modelling.

CO2. **Interpret** spatial data analysis techniques.

CO3. **Utilize** geostatistical analysis techniques for spatial interpolation.

CO4. **Apply** this knowledge for decision making through decision support system framework.

**Detailed Syllabus:**

| Modules | Topics and Course Content | Periods |
|---|---|---|
| Unit 1 | INTRODUCTION TO GIS ANALYSIS & MODELLING<br>Spatial Data: Definition, Analysis, Processes & Steps, Software and Tools; Raster-Based and Vector-Based GIS Modeling, Binary Models, Index Models, Regression Models, Process Models; Geodatabase Model, Role of Databases in GIS, Creating, Editing and Managing | 12 |
| Unit 2 | SPATIAL DATA ANALYSIS TECHNIQUES<br>Classification Scheme of Vector-Based and Raster-Based GIS Operations; Raster–Based Techniques: Methods of Reclassification, Overlay Analysis, Slope and Aspects, Buffering, Cost-Distance Calculation; Vector-Based Techniques: Map Manipulation Techniques, Buffering, Overlay Analysis, Network Analysis; Digital Terrain Analyses and Modeling: TIN and DEM, Surface Representation & Analysis | 12 |
| Unit 3 | GEOSTATISTICAL ANALYSIS TECHNIQUES<br>Introduction to Spatial Interpolation: Control Points; Global Methods: Trend Surface Analysis, Regression Models; Local Methods: Thiessen Polygons, Density Estimation, Inverse Distance Weighted Interpolation; Kriging: Ordinary Kriging (Semivariance, Semivariogram), Universal Kriging | 12 |
| Unit 4 | INTRODUCTION TO DSS<br>GIS and decision support system, Introduction to decision making process and decision support systems, Introduction of a framework for planning and decision making, Spatial Decision Making; Development of DSS, DSS Architecture; Principles and components of multiple-criteria decision making; Main multiple-criteria evaluation methods/techniques; Spatial multiple criteria decision making; Multiple-criteria decision making in spatial data analysis; Introduction to AHP, Basic Principles of AHP; Effect Table, Pair Wise comparison, Standardization, Consistency, Wieghtage, performance score, Different method in PWC | 12 |
| | **Total** | **48** |

**Lab Work**

Exercise 1 Creating conceptual models - Site Suitability Model.

Exercise 2 Representing features in Raster data set

Exercise3 Creating TIN surface from vector/ raster data,

Exercise 4 Monitoring of forest fires using DSS
Exercise 5 Spatial Multi Criteria decision making for site selection

**Text Books:**


1. Bonczek, R.H., C.W. Holsapple, and A.B. Whinston, (1981), Foundations of Decision Support Systems, Academic Press, New York. Basic text on DSS
2. Geoffrion, A.M., (1983). "Can OR/MS evolve fast enough? Interfaces 13:10. Source for six essential characteristics of DSS


**Reference Books:**


1. House, W.C. (ed.), (1983). Decision Support Systems, Petrocelli, New York. Basic DSS text
2. Sprague, R.H., (1997). "A framework for the development of decision support systems, "Management Information Sciences Quarterly 4:1-26. Source for DSS development model
3. Sprague, R.H., and Carlson, E.D., (1982). Building Effective Decision Support Systems, Prentice-Hall, Englewood Cliffs NJ. Basic DSS text
4. Burrough, Peter A. and Rachael McDonnell., (1998), Principles of Geographical Information Systems. Oxford University Press, New York
5. Laurini, Robert and Derek Thompson. , (1992), Fundamentals of Spatial Information Systems. Academic Pr., London
6. Kluwer Fotheringham A S, O'Kelly M E., (1998), Spatial Interaction Models: Formulations and Applications.
7. Paul Longley, Michael Goodchild, David Maguire and David Rhind:, (2005), Geographical Information Systems. Principles, Techniques, Applications and Management. John Wiley & Sons.

| Paper III Core Course | PROJECT | | | Subject Code: |
|---|---|---|---|---|
| | L-T-P-C: 2-0-2-4 | Credit Units: 4 | Scheme of Evaluation: (P) | GEOI164C 203 |

**Course Objectives:** *The course aims to enable students to apply GIS to real-world problems, using data from a range of sources, including remote sensing, GPS, and survey data.*

**Course Outcomes**:

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

CO1. **Recall** the basic principles of research design, methods, and ethics.

CO2. **Interpret** and analyze different types of research methods and data collection techniques.

CO3. **Utilize** research-based approaches to develop a hypothesis or research question and design a research project.

CO4. **Analyze** and evaluate the accuracy, reliability, and limitations of data collected and used in the research project.

CO5. **Critique** and propose improvements to research design and methods.

CO6. **Design** and develop a research project proposal, including research question/hypothesis, methods, data collection, and analysis techniques.

**Learning Outcomes:**

**Detailed Syllabus:**

| Modules | Topics and Course Content | Periods |
|---|---|---|
| Unit 1 | Identification of research problem / topic on any one of the following aspects during the 2nd semester while working with a project by the individual student:-<br>Any kind of geographical studies:<br>a. Agriculture, Industry, Mining related issues<br>b. Environmental problems of the locality including disasters and hazards<br>c. Natural resources assessments, planning and management<br>d. Ecological crisis, Climate change and consequences<br>e. Rural / Urban Ecosystems;<br>f. Terrain / basin / watershed characterization and evaluation including integrated development studies<br>*(This list is indicative only, the student may consult the assigned teacher as project supervisor / guide. Project supervisor / guide to each student will be allocated)*.<br>The topic selection / modification may be done just before the 1st Semester End Examination so that the data collection can be done during semester break.<br>A fresh project proposal / modified project proposal of project done in 2nd semester is to be submitted by each student (within 2nd week of the commencement of 2nd semester classes) by mentioning the following:-<br>a. Project title<br>b. Introduction to the problem<br>c. Aims / objectives<br>d. Research questions<br>e. Database and Methodology | 12 |

| | | |
|---|---|---|
| | f. Study of relevant literature<br>g. Organization of study<br>*Marks for internal evaluation = 14* | |
| Unit 2 | Project proposal presentation by each student using PowerPoint during 3rd week of the commencement of the course of 2nd semester.<br>• *Marks for internal evaluation = 14* | 12 |
| Unit 3 | Reporting of data collection, tabulation, processing, mapping/charting and analysis by each student using PowerPoint during 5th week of the commencement of the course of 2nd semester.<br>• *Marks for internal evaluation = 14* | 12 |
| Unit 4 | Preparation of project report in prescribed format during 6th – 8th week of the commencement of course of 2nd semester.<br>Submission of the report after a week of the announcement of routine for 2nd End Semester Examination.<br>Final project presentation by each student using PowerPoint during on the scheduled date of viva-voce examination of this paper.<br>*Marks for external evaluation = Viva-voce 8 + Presentation 20 = 28* | 12 |
| | **Total** | **48** |

**Note:** Submission of project report in prescribed format and on specified date is mandatory. Equal weightages of marks for each stage of the work (upto 3rd stage) for internal evaluation of the project by the supervisor (60% of end semester examination). 40% of the total marks of end semester examination is for viva-voce and final presentation to be evaluated by an external examiner.

**Text Books:**

As per the list of given in syllabus based on topic selected

**Reference Books:**

As per the list of given in syllabus based on topic selected

| Paper IV Core Course | Geoinformatics in Agriculture, Soil & Land Evaluation<br>L-T-P-C: 2-0-2-4 Credit Units: 4 Scheme of Evaluation: (T) | Subject Code:<br>GEOI164C 204 |
|---|---|---|

**Course Objectives:** *This course intends to provide students with an understanding of the different types of spatial data and technologies used in Geoinformatics and their applications in agriculture, soil & land evaluation.*

**Learning Outcomes**:

After the completion of the course, the students will have the ability to:

CO1. **Recall** the basic concepts and terminology related to Geoinformatics in agriculture, soil & land evaluation.

CO2. **Explain** the principles and methods of Geoinformatics and how they can be applied to agriculture, soil & land evaluation.

CO3. **Utilize** Geoinformatics-based approaches to develop management plans for crops, soil health, and land use planning.

CO4. **Evaluate** the effectiveness and efficiency of Geoinformatics-based approaches to agricultural and environmental management.

**Detailed Syllabus:**

| Modules | Topics and Course Content | Periods |
|---|---|---|
| Unit 1 | Estimation & spectral analysis of crops and damage assessment: Spectral Properties of Crops and Yield Parameters, Identification of Crops and Acreage Estimation., Vegetation Indices, Production Forecasting through Digital Analysis, Monitoring, Condition, and Damage Assessment, Detection of Pests and Diseases, Damages due to Droughts and Floods, Water-logging and Salinity, Stress Detection. | 12 |
| Unit 2 | Soil Classification and Mapping: Soil Types in India, Soil Survey Methods, Soil Classification, Problems with Soil Identification, Mapping of Soils using Remote Sensing and GIS techniques | 12 |
| Unit 3 | Land Evaluation & Assessment: Land Evaluation, Role of Remote Sensing in Soil Conservation., Principle and Methods of Land Assessment, Agriculture and Soil Development, RS & GIS in Land Evaluation | 12 |
| Unit 4 | Case Studies: GIS for Drawing out Action Plans & Recent Development in Agro-Climatic Modelling, Watershed Planning, Remote Sensing in Agriculture & Soil studies | 12 |
| | **Total** | **48** |

**Text Books**:


1. Steven, M.D. and Clark, J.A., 1991, Application of Remote Sensing in Agriculture, Butterworths, London
2. Ghassem Asrar, 1989. Theory and application of optical remote sensing. John Wiley & Sons, New York


**Reference books**:


1. Space Applications Centre- Manual of procedure for Forest mapping and Damage Detection using satellite data, Report No. IRS-UP/SAC/FMDD/TN/16/90, 1990: pp-58.
2. Space Applications Centre –Status Report on Crop Acreage and Production Estimation, Report No. RSAM/SAC/CAPE/SR/ 25/90, October 1990, pp-253.

3. Brockington, N.R., (1979): “Computer Modelling in Agriculture”, Oxford University Press
4. Siva Vandana, (2002), “Sustainable agriculture and food security”, Sage Publications New Delhi.

| Paper: V Core Course | Geoinformatics in Regional & Urban Planning | Subject Code: GEOI164C205 |
|---|---|---|
| | L-T-P-C: 2-0-2-4 Credit Units: 4 (T) Scheme of Evaluation: | |

**Course Objectives:** *The course aims to provide students with an understanding of the different types of spatial data and technologies used in Geoinformatics and their applications in regional and urban planning.*

**Learning Outcomes:**

After the completion of the course, the students will have the ability to:

CO1. **Recall** the basic concepts and terminology related to Geoinformatics in regional and urban planning.
CO2. **Interpret** and analyze different types of spatial data and technologies used in Regional & Urban Planning.
CO3. **Apply** Geoinformatics tools and techniques to collect, process, analyze, and visualize spatial data for regional and urban planning.
CO4. **Critique** and propose improvements to Geoinformatics-based regional and urban planning systems.

**Detailed Syllabus:**

| Modules | Topics and Course Content | Periods |
|---|---|---|
| Unit 1 | Basic Concept: Importance & Relevance of Remote Sensing data for Urban and Regional Planning, Visual and Digital Data Analysis Techniques, Scale and Resolution concepts, Scope and Limitations of Remote Sensing Application to Urban and Regional Planning | 14 |
| Unit 2 | Regional and Urban Planning: Urban and Regional Mapping, Base Map Preparation, Regional, City, Intra –City, Scale & Methodology, Urban and Regional Plan Formulation, Application of Remote Sensing Techniques in Regional Plan, Master Plan | 14 |
| Unit 3 | Urban Analysis: Urban Analysis, Urban Growth, Trend Analysis, Change Detection, Slum Development, Housing Typology and Density Analysis, Population Estimation, Information system, Database Organisation- Large Scale Data Entry, Interpretation Manipulation- Retrieval- Attribute Information for Urban Planning. | 10 |
| Unit 4 | Case Studies: Analysis of Urban Land Use Change, Preparation of Master Plan in City Development, Object-oriented GIS Data Modelling for Urban Design, Delineation of socio-infrastructure database into GIS for land use planning | 10 |
| | **Total** | **48** |

**Text Books:**


1. Arnoff, S (1989); Geographical Information Systems: A Management Perspective, WDL Publications, Canada
2. Brench M.C. (1972), City planning and Aerial Information, Harvard University, Cambridge


**Reference Books:**


1. Burrough, P.A (1988), Principles of Geographical Information Systems for land Resources Assessment, Oxford University Press
2. Subudhi A.P, Sokhi, Roy (2001), Remote Sensing and GIS, Application in Urban and Regional Studies, IIRS, Dehra Dun

3. Subudhi, A.P (1992), Design of Automated Land Use Information System for Town & Country planning, Institute of Town planners, New Delhi.

| Paper: DSE - 1 | RESEARCH METHODOLOGY<br>L-T-P-C: 2-0-2-4 Credit Units: 4 (T) Scheme of Evaluation: | Subject Code: GEOI164D201 |
|---|---|---|

**Course Objectives:**

*The course aims to make the students understand the basics of qualitative and quantitative research, literature review, data collection, identification of research problem, formulate research objectives and research questions, formulation of hypothesis and testing, framing of questionnaires, techniques of collection of both qualitative and quantitative data and their analysis.*

**Course Outcomes:**

After the completion of course, the students will have ability to:

CO1. **Define** the concepts and tools of research.
CO2. **Infer** ideas that can be taken up for research work through literature review.
CO3. **Develop** hypothesis and research questions.
CO4. **Identify** appropriate data collection and sampling techniques.
CO5. **Interpret** the various types of data along with **critical evaluation**.
CO6. **Design and develop** a scientific research report

**Detailed Syllabus:**

| Modules | Topics and Course Content | Periods |
|---|---|---|
| Unit 1 | Research: Definition, types, significance and important features; Research methodology in geosciences; Defining a research problem; Statement of the problem; Objectives, and hypothesis/ research questions, Database and methodology, significance, review of research works and bibliography and references. | 12 |
| Unit 2 | Research design: Meaning, need and features of a good design, Inductive and deductive approaches in research, Hypothesis, theories and models in Geography and allied disciplines; concept of model building and hypothesis testing. | 12 |
| Unit 3 | Field techniques in Geography: Types, role and significance; Questionnaire design (Open, Closed, Structured, Non-structured), data collection, Post field processes: construction of data matrix, data processing and analysis; Role of quantitative techniques in Geography | 12 |
| Unit 4 | Sources of geographic data (Conventional and Geospatial technology based), their representation, interpretation and analysis; Research ethics: Plagiarism-classification and prevention; Intellectual property rights; Research report: Structural components and presentation. | 12 |
| | **Total** | **48** |

**Note:** Computer / calculator based compulsory home assignments may be given for various units. Scientific calculator may be permitted in the examination hall for this paper.

**Text Books:**


1. Harvey, D, 1969: Explanation in Geography, Scientific Publisher, Jodhpur.
2. Lenon, B., Cleves, P. 2015. Geography Fieldwork and Skills, Harper-Collins.


**Reference Books:**


1. Evans, M., (1988): "Participant Observation: The Researcher as Research Tool" in Qualitative Methods in Human Geography, eds. J. Eyles and D. Smith, Polity.
2. Special Issue on "Doing Fieldwork" The Geographical Review 91:1-2 (2001).
3. Stoddard, R. H., (1982): Field Techniques and Research Methods in Geography, Kendall/Hunt.

4. Wolcott, H., (1995): The Art of Fieldwork, Alta Mira Press, Walnut Creek, CA.
5. Northey, N., Draper, D., Knight, D.B. 2015. Making Sense in Geography and Environmental Sciences:A Student's Guide to Research and Writing, 6th ed, Oxford University Press.
6. Parsons, T., Knight, P.G. 2015. How To Do Your Dissertation in Geography and Related Disciplines,3rd ed, Routledge.

| Paper: DSE - 2 | Geoinformatics in Disaster Management<br>L-T-P-C: 2-0-2-4 Credit Units: 4 (T) Scheme of Evaluation: | Subject Code: GEOI164D202 |
|---|---|---|

**Course Objectives:** *The objective of the course is to provide the students with an understanding about the fundamental concept of hazards and disasters and usage of Geoinformatics in its mitigation.*

**Learning Outcomes**:
After the completion of the course, the students will have the ability to:

CO1. **Define** hazards and disasters, their characteristics and the role of Geoinformatics in its mitigation.
CO2. **Infer** basic understanding of different hazards.
CO3. **Apply** GIS for modelling management of various hazards.
CO4. **Analyze** case studies to understand the hazards prevalent in India and focus on its mitigation.

**Detailed Syllabus:**

| Modules | Topics and Course Content | Periods |
|---|---|---|
| Unit 1 | Introduction: Hazards and disasters, their types, and characterization, Zonation of hazards, natural and human induced disasters, Disaster and National losses, historical perspective of disasters in India, Fundamental concept of Disaster Management, Government, NGOs and peoples participation disaster management, Existing organization structure for managing disasters in India, Geoinformatics in disaster mitigation. | 14 |
| Unit 2 | Hazards: Landslide, Earthquake, Mining hazards (Land subsidence, Mine flooding etc.), Volcanic hazards, Groundwater hazards, Glacial hazards, Flash floods, River floods, Dam burst, Cloud burst, Cyclones, Coastal hazards and Drought, Forest hazards (Deforestation, Degradation and Forest fire), Land & soil degradation, Desertification, Pollution (Water, air, and soil) | 14 |
| Unit 3 | Geoinformatics Applications: Geoinformatics models in managing forest fires, floods, landslides, cyclone and earthquake mapping. | 10 |
| Unit 4 | Case Studies: Earthquakes in India, Floods in Indo Gangetic plains, Landslides in Himalayan region, Drought in Indian plateau regions. | 10 |
| | **Total** | **48** |

**Text Books:**

1. P.S. Roy (2000) Natural Disaster and their mitigation. Published by Indian Institute of Remote Sensing.

**Reference Books:**

1. Sdidmore A (2002) Environmental Modeling with GIS & Remote Sensing, Taylor & Francis.
2. Anji Reddy. M. (2004) Geoinformatics for Environmental Management. B. S. Publication.