



GUJARAT UNIVERSITY
DEPARTMENT OF GEOGRAPHY
SCHOOL OF SCIENCES

M.Sc. Geoinformatics Syllabus – Effective from 2018-19

1. INTRODUCTION

The Postgraduate M.Sc. Course in Geoinformatics offered by the Gujarat University, seeks to provide a theoretical and practical based knowledge in the Geospatial science. The goal of this M.Sc. course is to provide better scope for the students by educating them through a critical thinking in the field of Geoinformatics. This course will help to develop capabilities of students to generate new tools for the acquisition, processing, transformation, analysis, storage, presentation with the help of geo-spatial information. It intends to prepare students to conduct high quality interdisciplinary research and development projects.

Gujarat University is the first one among all the State universities of Gujarat to offer the M.Sc. Geoinformatics course. This course will help the students to fulfill the dream of 'Digital India'. GIS and RS are rapidly evolving towards becoming standard tools, influencing everyday decision making particularly among professionals and planners. As a multi-disciplinary programme, it includes broad areas of advanced Geographical Information System, advanced Remote sensing and GPS technology applications. This course is combined with the applications of various disciplines such as Earth Sciences, Disaster Management, Natural Resources Management, Land use planning, Agriculture, Forestry, Wild life habitat, Urban transportation and supply network etc. The course is designed for the students to use computers throughout the programme, enabling them to use the latest version of software available in the fields of GIS and Remote Sensing.

The programme includes a dissertation component and the students are required to select an applied research topic in any of the fields mentioned above and submit a research report in the form of dissertation. In this connection, the students will get opportunity to interact with the experts from the renowned institutions of Gujarat. The Department of Geography will help the students to find suitable institutions to conduct their research study.

2. AIMS AND OBJECTIVES

This Course aims to provide skilled human resources in the fields of Geoinformatics.

The objectives of the programme are;

- ✓ To nurture students in the field of Geoinformatics.
- ✓ To provide an in depth understanding of fundamentals of GIS, Remote sensing and their applications.
- ✓ To prepare highly skilled manpower to fulfill the dream of Digital India.
- ✓ To foster the research and development in the field of Geoinformatics.

3. Programme Eligibility for M.Sc in Geoinformatics.

Students having Bachelor's / Master's degree in Physics, Chemistry, Botany, Zoology, Statistics, BCA, Mathematics, Geology, Geophysics, Earth and Natural Sciences, Geography, Atmospheric Science, Agriculture, Electronic Science, RS&GIS and other related sciences can apply to this course.

Students having Bachelor's degree (B.E / B.Tech) in Engineering / Bachelor's degree in Planning or in other engineering branches and equivalent can also apply to this two years MSc. course in Geoinformatics.

The candidates who are employed and eligible for admission need to produce evidence of leave granted to follow the programme and a letter of release from the relevant Head of the Department/Institution.

4. Course Structure:

The course shall be spread over 4 (Four) semesters. The structure of the course shall be as follows:

Each theory subject has 4 Credit including 45 hours of Lectures and 15 hours of seminar.

Each practical subject has 04 credit including 90 hours of lab activities.

5. Admission procedure

MSc. In Geoinformatics (Duration 2 year)

- The selection will be made on the basis of merit.
- Advertisement for admission into this course will be made through Daily News Papers and in the Gujarat University website.
- Admission will be made provisional for candidates appearing in the final examination in the year of admission. In case the qualifying examination mark sheet is not supplied by the month of August in the ongoing academic session, the admission will be cancelled as per University Rules.
- A person in professional service nominated by the Govt. employer or working as a faculty in a recognized educational institution may also be considered for admission into this course. The candidates who are employed and eligible for admission need to produce evidence of leave granted to follow the programme and a letter of release from the relevant Head of the Department/Institution.
- In all cases the decision of admission committee will be final.

Criteria for Admission:

The admission to this course will be on the basis of marks obtained at Bachelor's / Master's (or Bachelor's in engineering) degree level, an entrance test conducted by the department / University, and a personal interview of the candidate.

The entrance test will consist of 50 objective-type and multiple choice questions on the basic concepts related to geography, remote sensing, spatial data and quantitative reasoning carrying one mark each. Weightage given to marks obtained at Graduation degree level, entrance test, and personal interview will be as follows:

- B.Sc. / B.E / B.Tech.: 50% of the per cent marks obtained.
- Entrance Test: Marks Obtained (out of maximum of 20).
- Personal Interview: Marks Obtained (out of maximum of 30).
- Total Maximum Marks: 100.

Combined merit so formed will be the basis of admission.

Note: The reservations policy is followed as per Gujarat University rules and regulation for scheduled caste (SC), scheduled tribe (ST) and other backward classes.

6. Students Intake:

- Maximum 30 seats (High Payment Programme)
- Admission will be confirmed only on payment of necessary fees in a given time.

This fees structure is applicable to all applicants.

Rs. 17,500/- per semester for all the seats

Examination fees per semester will be collected as per university rules.

- Full amount would be collected at the commencement of each semester. No part payment is allowed under any circumstances
- Fee refund policy: once paid will not be refunded

8. Examination and Evaluation:

- Internal test will be conducted for both theory and practical in all semesters except for final semester. Seminar and assignment will be of complete internal evaluation.
- Project evaluation will be partly by Guiding Supervisor (15%) { Internal Supervisor (15%) and appointed Panel of Examiners (70%).
- Final result (Theory and Practical) will be prepared considering internal test (30% Weightage which includes; seminar, assignment, attendance and viva-voce) and external term examination (70%) weightage.
- Minimum attendance is compulsory for this course as per University rules.
- A student will be awarded M.Sc. Degree by Gujarat University.

9. Sessions & Medium of teaching

MSc. IN GEOINFORMATICS (Duration 2 year)

- I. The academic session will start as per university Schedule.
- II. The medium of teaching in this course is English

10. Career Opportunities:

There will always be a wide range of jobs open to well trained and motivated students of Geoinformatics. These can include research oriented jobs as well as policy oriented jobs in government.

The environmental field is wide open: The Resource Management Act has created a vast market for Geoinformatics in consultancy, regional and local government. Those who gain technical expertise in areas such as Geographic Information Systems (GIS) and remote sensing can be in heavy demand from both the public and private sectors. Other options include:

Geo-Scientist, Geological Assistant, Development analyst, Country or Rural planner, Environmental consultant, Cartographer, Recycling manager, Weather analyst, GIS analyst, Travel agent, Soil conservationist, Landscape Architect, Land Manager, Tourism manager etc.

There are many organizations where a Geoinformatics student can establish his/ her career. Few among them are listed here- As Teacher (College & University), Indian Space Research Organization Centres (ISRO, Govt. of India), Defense Research & Development Organization (DRDO, Ministry of Defense), State Remote Sensing Centres, Department of Science & Technology, National Thematic Mapping Organization (NATMO), National Bureau of Soil Survey and Land Use Planning (NBSS & LUP) and other departments of Government of India.

Course Coordinator: Dr. Shital H. Shukla

Associate Professor and Head, Department of Geography
School of Sciences, Gujarat University, Ahmedabad- 380009

Credit System (M.Sc. Geoinformatics): Details of the Courses and Credits – Effective from 2018-19

COURSE CODE	COURSE TITLE	Credit	Teaching (Hours)		
			L	T	P
SEMESTER I					
GIN 401	Fundamentals of Remote Sensing	4	3	1	0
GIN 402	Fundamentals of Geographic Information System	4	3	1	0
GIN 403	Climatology and Oceanography	4	3	1	0
GIN 404	Global Navigation Satellite System (GNSS)	4	3	1	0
GIN 405PR	Practical 1	4	0	0	6
GIN 406PR	Practical 2	4	0	0	6
Total for semester I		24	12	4	12
SEMESTER II					
GIN 407	Photogrammetry and Digital Image Processing	4	3	1	0
GIN 408	Spatial Database and Modeling	4	3	1	0
GIN 409	Spatial Analysis and Statistical Methods	4	3	1	0
GIN 410	Research Methodology and Project Management	4	3	1	0
GIN 411PR	Practical 3	4	0	0	6
GIN 412PR	Practical 4	4	0	0	6
Total for semester II		24	12	4	12
SEMESTER III					
GIN 501	Internet/ Web GIS	4	3	1	0
GIN 502	Application of Geoinformatics for Natural Resources Management & Disaster Mitigation	4	3	1	0
GIN 503	Subject Elective-I	4	3	1	0
GIN 504	Subject Elective-II	4	3	1	0
GIN 505PR	Practical 5	4	0	0	6
GIN 506PR	Practical 6	4	0	0	6
Total of semester III		24	12	4	12
SEMESTER IV					
GIN 507	Project (Dissertation)	16	0	0	40
	Seminar	04	0	24	0
	Assignment	04	0	24	0
Total of semester IV		24	0	48	40
TOTAL CREDITS OFFERED		96			

Elective Subject:

1. Application of Geoinformatics for Urban & Regional Planning.
2. Application of Geoinformatics for Agriculture & Forestry
3. Application of Geoinformatics for Geomorphology

Semester I

Code No: GIN: 401		Title: Fundamentals of Remote Sensing
No. of Credits: 4		No. of Lectures : 45
Unit	Topics	Sub-topics
I	Introduction to Remote Sensing & Interaction of EMR	Remote Sensing: History, Development, Definition, Concept & Principles Electromagnetic Radiation (EMR): Spectrum and its properties, Radiation laws, Interaction of EMR with atmosphere; Atmospheric windows & Interaction of EMR with Earth's Surface, Spectral Signature and its Response: Soil, Vegetation, Rocks and Water bodies etc.,
II	Platforms, Sensors & Orbits	Types and characteristics of platforms & satellite orbits. Sensor classification: Active and Passive, Optical-Mechanical Scanners & Push-broom scanners , whisk broom scanners; Earth Resource Satellites, Oceansat, LANDSAT, IRS Resourcesat and Cartosat, Meteorological Satellites, INSAT, Ikonos Satellites Series, Geoeye, Quickbird, RADAR, LIDAR, MODIS, NOAA and other platforms.
III	Image Pre-processing And Enhancement	Digital images: Types Satellite data acquisition and image file formats, File values and Look up table Resolutions: Spatial, Spectral, Radiometric and Temporal. Preprocessing: Atmospheric correction, Radiometric correction, Geometric correction, noise/haze removal Contrast enhancement: Linear, non-linear, logarithmic and exponential, Gaussian stretch, density slicing. Spatial filtering: low frequency, high frequency, edge enhancement, band rationing and band combination
IV	Remote sensing data analysis	Visual Analysis, Elements of image interpretation , Ground Truth Verification: Remote Sensing Applications: Land use Land cover, Agriculture, Forestry, Water resources , Regional and Urban Planning, Geology, Disaster Management, Atmospheric Science and Oceanographic studies, Soil and Hydrology

Books:

1. Anji Reddy, M. (2008): Textbook of Remote Sensing and Geographic Information System, B.S. Publication, Hyderabad
2. Drury, S. A. (2001): Image Interpretation in Geology, Blackwell, Oxford
3. Campbell, J. (2002): Introduction to Remote Sensing, Taylor & Francis, London
4. Jensen, J. R. (2005): Introductory Digital Image Processing, Prentice Hall, New Jersey
5. Jensen, J.R., (2006) "Remote Sensing of the Environment – An Earth Resources Perspective", Pearson Education, Inc. (Singapore) Pte. Ltd., Indian edition, Delhi.
6. Joseph, G. (2004): Fundamentals of Remote Sensing, Universities Press, Hyderabad, India
7. Lillesand, T. M., Kiefer, R. W. and Chipman, J. W. (2008): Remote Sensing and Image Interpretation, John Wiley & Sons, New Delhi
8. Sabins, F.F. Jr., (2007) Edition. 'Remote Sensing – Principles and Interpretation', W.H. Freeman & Co.
9. Reeves, Robert G. (1991), "Manual of Remote Sensing, Vol. I, American Society of Photogrammetry and Remote Sensing, Falls Church, Virginia, USA

Code No: GIN: 402		Title: Fundamentals of Geographic Information System
No. of Credits: 4		No. of Lectures : 45
Unit.	Topics	Sub-topics
I	Introduction to GIS	Basic concepts: Definition and history Components of GIS, Hardware & Software requirements. 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
II	GIS database	Representation of geographic features in vector, raster data models. Concept of arc, node, vertices and topology. Computer representation for storing spatial data: Block code, Run-length encoding, Chain coding, Quadtree. Issues governing choice of models.
III	Mapping in GIS platform	Mapping Concept – Map Elements, Map scales and representations, Map Projection, Geometric rectification, Digitization, error identification. Errors: Types, sources, correction. Editing and topology building. Map Output Generation.
IV	Database Management System	DBMS & RDBMS RDBMS: components, concept, database schema, tables and relationships. Database design Hierarchical, Network, Relational models. Database security, role of database administrator (DBA), Metadata. , and basic concepts of entity, relationship and primary key, Image storage formats, Data retrieval & Data compression techniques,

Books:

1. Burrough, P. A. and McDonnell, R. A. (2000): Principles of Geographical Information Systems, Oxford University Press, New York
2. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York Longley.
3. Demers, M. N. (2000): Fundamentals of Geographic Information Systems, John Wiley and Sons, New Delhi
4. Heywood, I., Cornelius, S., Carver, S. (2011): An Introduction to Geographical Information Systems, Pearson Education, New Delhi
5. Korte, G. B. (2001): The GIS Book, Onward Press, Bangalore
6. Lo, C. P., Yeung, A. W. (2002): Concepts Techniques of Geographical Information Systems, Prentice-Hall of India, New Delhi
7. P. A., Goodchild, M. F., Maguire, D. J., Rhind, D. W. (2002): Geographical Information Systems and Science, John Wiley & Sons, Chichester.

Code No: GIN: 403		Title: Climatology and Oceanography
No. of Credits: 4		No. of Lectures : 45
Unit	Topics	Sub-topics
I	Basic Climatology	Nature and Scope of Climatology, Earth's Atmosphere: Evolution, Structure and Composition, Elements of Climate and factors affecting the climatic parameters such as Solar Insolation, temperature, pressure and wind.
II	Advanced Climatology	Jet stream, Air masses and fronts, characteristics, movements, frontogenesis – extra tropical cyclones, tropical cyclones, Models of general circulation of the atmosphere, Classification of climates and,

		climate change, Using INSAT data for understanding the spatial and temporal change in climatic parameters such as solar radiation, humidity, temperature etc.
III	Basic Oceanography	Physical and chemical properties of sea water, sources and factors affecting the distribution of temperature and salinity.
IV	Advanced Oceanography	Marine Ecosystem and biozones, Plankton, Nekton and Benthos, ocean deposits, coral reef. Impacts of Humans on the Marine Environment – Laws of the sea, marine resources, development and pollution, EEZ and resource utilization, CZMP, Assessing changes in ice-caps and coastal zone by RESOURCESAT Satellite, ICZM

1. Davis Richard, J.A. (1986): Oceanography – An Introduction to Marine Environment, Wm.C.Brown, Iowa.
2. David Ross (1973): Introduction to Oceanography.
3. Duxbury, C.A. and Duxbury, B. (1996): An Introduction to World's Oceans, C.Brown Iowa (2ndEd.).
4. Garrison, T. (2001): Oceanography – An Introduction to Marine Science, Books/Cole, Pacific Grove, USA.
5. Gross M.Grant (1987): Oceanography – A view of the Earth, Prentice Hall Inc. New Jersey.
6. Lutgens, Federic K. & Tarbuck Edward J (1995): 'The Atmosphere: An Introduction to Meteorology', Prentice Hall, New Jersey.
7. Lal, D.S. (1998): 'Climatology', Chaitanya Publishing House, Allahabad.
8. Strahler, A.H. and Strahler (1992): Modern Physical Geography, John Wiley and Sons (Asia) Pvt. Ltd.
9. Savindra Singh (2005): 'Climatology', Prayag Pustak Bhavan, Allahabad.
10. Singh Savindra : Oceanography, Allahabad.
11. Tusk, Jonathan (1985): Introduction to Environmental Studies, Sanders, College Publishing, Tokyo.
12. Ummerkutty, A.N.P. (1985): Science of the Oceans and Human Life, National Book Trust, New Delhi.
13. Wright, R.T. and Nebel, B.J. (2004): 'Environmental Science: Toward a sustainable future, Prentice Hall of India, New Delhi.

Code No: GIN: 404		Title: Global Navigation Satellite System (GNSS)
No. of Credits: 4		No. of Lectures : 45
Unit	Topics	Sub-topics
I	Overview of GNSS	Introduction to GNSS, History, Satellite Navigations constellations–GPS system, GPS signals and data, Geo-positioning-Basic Concepts. Different kinds of Navigation Systems
II	Indian Satellite Navigation	Indian Regional Navigation Satellite System, GPS Aided GEO Augmented Navigation (GAGAN) :Technology and Applications, Navik and its Applications
III	Surveying	DGPS-GPS data processing and Accuracy. Planning a GPS Survey, Positioning methods – point positioning, relative positioning, Static, Fast static, RTK, Differential Data Processing: Accuracy measures, software modules, GIS and GPS data integration
IV	GPS Application	Future of GPS: Modernization plans of navigational satellites, Hardware and software improvements, Selection of Reference Station, Reference Station Equipment: GPS Application in Surveying and Mapping, Navigation Military, Location Based Services, Vehicle tracking.

Books:

1. Ahmed, E. L., Rabbany (2002): Introduction to Global Positioning System, Artech House, Boston
2. Bao, J., Tsui, Y. (2005): Fundamentals of Global Positioning System Receivers, John Wiley Sons, Inc., Hoboken

3. Bradford W. Parkinson & James Spilker., Global Positioning System: Theory and Applications, Vol I, 1996
4. Gunter Seeber, (2003), Satellite Geodesy Foundations-Methods and Applications,.
5. Hofmann W.B & Lichtenegger, H. Collins., Global Positioning System – Theory and Practice, Springer-Verlag Wein, New York, 2001.
6. Kresse, W. and Danko, D. (2002): Springer Handbook of Geographic Information, Springer Drecht, London

Code No: GIN: 405PR		Title: Practical 1
No. of Credits: 4		No. of hours : 90
Unit	Topics	Sub-topics
1	Introduction to GIS Softwares	- Introduction to ArcMap and ArcCatalog - Visualization of Geographic Datasets - Viewing properties - Basic ArcMap features (zoom – in, zoom out, pan etc.) - Symbology view and change
	Maps and Projections	- Introduction to coordinate systems - Defining geographic coordinate system - Projection to another - Importing coordinate systems - Projection of a text file
2	Database Management	- Data organization in catalog - Importing data into a Shape file, MDB and GDB, Arc Coverage file - Creating layers - Creating topology
	Creating Digitization and Generation	- Creating and editing annotations - Editing shared features and topologies - Understanding generation of features - Digitisation of Point line polygon from Toposheet– Exercises
3	Queries	- Attribute data handling - Various types of queries and their executions (select by feature, location) Queries attribute data, combine spatial and attribute query - Raster query
4	Representation of Cartographic data	Basic Concept of cartography, Categories of maps, Study and interpretation: SOI toposheet, cadastral and thematic maps, Numbering, scales, grid reference, signs and symbols, color system, cartographic design issues, map lettering, map compilation, Generalization, dot, isopleth and choropleth mapping, multivariate and dynamic mapping, map production, methods of map composing and printing,
	Relief representation techniques	Visualization of geospatial data: Design aspects, Multiscale and geometric aspects scale, dissemination of (visualized) geospatial data, data products, use and users of products, Various issues in map visualization

Books:

1. Agarwal, C. S. Garg, P. K. (2000): Remote Sensing, Wheeler A. H., New Delhi
2. Drury, S. A. (2001): Image Interpretation in Geology, Blackwell, Oxford Lillesand, T. M., Kiefer, R. W. and Chipman, J. W. (2008): Remote Sensing and Image Interpretation, John Wiley & Sons, New Delhi
3. Joseph, G. (2004): Fundamentals of Remote Sensing, Universities Press, Hyderabad, India
4. Wolf, P. R. (1974): Elements of Photogrammetry, McGraw Hill Inc., Kogakscha

5. Burrough, P. A. and McDonnell, R. A. (2000): Principles of Geographical Information Systems, Oxford University Press, New York
6. Demers, M. N. (2000): Fundamentals of Geographic Information Systems, John Wiley and Sons, New Delhi
7. Heywood, I., Cornelius, S., Carver, S. (2011): An Introduction to Geographical Information Systems, Pearson Education, New Delhi.
8. Korte, G. B. (2001): The GIS Book, Onward Press, Bangalore

Code No: GIN: 406PR		Title: Practical 2 Image Processing and GNSS
No. of Credits: 4		No. of Hours : 90
Unit	Topics	Sub-topics
I	Introduction to Software, Image visualization	Introduction to Image Processing Software -ENVI and SAGA Elements of Image Visualization and Feature Identification
II	Georeferencing	- Adding extensions - Control point locations - Defining lat, long for an image - Georeferencing and rectification
III	Image Processing	- Raster Data Download - Layer Stacking - Mosaicking , Atmospheric and Radiometric corrections.
IV	Terrestrial Surveying Methods For Geospatial Data Collection AND GPS Survey	Introduction to GPS and initial setting Creating codes and attribute table for GPS receiver, GPS data collection for point, line and area calculation, GPS and GIS integrations output preparation, <i>Field Surveys</i> : Mapping of Natural Features, Mapping of Cultural Features, Non-Geospatial Data Collection. Applications of GAGAN and Navik

Books:

1. Gregory, S. (1978): Statistical Methods for Geographers, Longman
2. Gupta, K. K. Tyagi, (1992): Working with maps, Survey of India Publication, DST, New Delhi
3. Croxton, F. E., Cowden, D. J., Klein, S. (1975): Applied General Statistics, Prentice-Hall of India, New Delhi
4. Frank, H. Althoen, S. C. (1994): Statistics Concepts and Applications, Cambridge University Press
5. Peterson, M.P. (1995) "Interactive and Animated Cartography" Upper Sadde River, NJ: Prentice Hall.
6. Ramamurthy, K. (1982): Map Interpretation, Rex Printers, Madras
7. Robinson, A. H., Morrison, J. L., Muehrcke, P. C., Kimerling, A. J. Guptill, S. C. (1995): Elements of Cartography, Wiley, New York
8. Singh, R. L. (1979): Elements of Practical Geography, Kalyani Publishers, New Delhi
9. Singh, R.L &Dutt. P.K, "Elements of Practical geography", Students Friends Allahabad
10. Tamaskar, B. G., Deshmukh, V. M. (1974): Geographical Interpretation of Indian Topographical Maps, Orient Longman Ltd., Bombay
11. Understanding Map Projection (2003-2004): GIS by ESRI, Redlands
12. Vaidyanadhan, R. (1968): Index to a set of sixty Topographic Maps: Illustrating Specified Physiographic Features from India, Council of Scientific and Industrial Research, Ministry of Education, Government of India
13. Yeates, M. (1974): An Introduction to Quantitative Analysis in Human Geography, McGraw-Hill, New York

Semester II

Code No: GIN: 407		Title: Photogrammetry and Digital Image Processing
No. of Credits: 4		No. of Lectures : 45
Unit	Topics	Sub-topics
I	Photogrammetry	Fundamentals of aerial photography, Vertical and Oblique aerial photography, Aerial cameras, Photogrammetry; Basic concepts of scale, object height and length, object area and perimeter, grayscale tone/color of objects, Photo interpretation techniques, Stereo photogrammetry and stereovision, Parallax bar and its applications. Stereo Photogrammetry: Stereovision & Stereoscopes, Stereoscopic Parallax & Parallax Equations Digital photogrammetry: Model deformation & Rectification, Relief displacement, Vertical exaggeration, Triangulation, Control & Mapping. Digital Terrain Model (DTM/DEM)
II	Digital image classification & Image Interpretation	Supervised classification: Training sites selection and statistical information extraction, Discriminate functions. Classifier: Maximum Likelihood, Euclidian distance, Mahalanobis distance, Paralleloped. Unsupervised classification. Classification accuracy assessment and error matrix Digital Image interpretation, Pattern recognition, shape analysis, Textural analysis, Decision concepts, fuzzy sets and Evidential reasoning, Change detection, multitemporal data merging, multi sensor image merging- merging image data with ancillary data, Expert system, Artificial Neural Network; Integration with GIS.
III	Thermal and Hyperspectral Remote Sensing Introduction to LiDAR	Thermal Infrared: Introduction, Radiation Properties, Kinetic Heat, Temperature, Radiant Energy and Flux, methods of transferring heat Thermal properties of terrain: Heat Capacity, conductivity, Inertia, Infrared, Interpreting Thermal Scanner Imagery, Radiometric Calibration of Thermal Scanners, Temperature mapping with Thermal Scanner Data Comparison of Multispectral and Hyperspectral Image Data, , Hyperspectral sensors and image characteristics,: (Spectrographic imagers- hyperspectral sensors, AVIRIS, CASI, NOAA, Moderate Resolution Imaging Spectrometer (MODIS), Hyperion. Concepts of LiDAR sensor system Introduction to Lasers and Lidar – Definitions - History of Lidar Development - Lidar System Components - LIDAR sensors single-return, multi return, waveform, , Characteristics of Lidar Data - interaction of laser energy with earth surface features
IV	Microwave Remote Sensing	Microwave Remote Sensing Introduction and technology, Microwave: Passive & Active Sensors, Radar Principle, Factors affecting microwave Measurements, Microwave Bands, their frequency, wavelengths and uses, Microwave satellites and their utility in India. Introduction to SAR

Books:

1. Campbell, J. B. (2002): *Introduction to Remote Sensing*. 5th ed. Taylor & Francis, London.
2. Burrough, P.A. and McDonnell, R. (1998): *Principles of Geographic Information Systems*. Oxford University Press, Oxford.
3. Cha, B., Dattaa, D., Majumdar (2001): *Digital Image Processing Analysis*, Prentice-Hall of India, New Delhi

4. Curran, P.J. (1985): *Principles of Remote Sensing*, Longman, London.
5. George, J. (2003): *Fundamentals of Remote Sensing*. Universities Press (Pvt.) Ltd, Hyderabad.
6. Girard, M. C. and Girard, C. M. (2003): *Processing of Remote Sensing Data*. Oxford & IBH, New Delhi.
7. Floyd, F., Sabins, Jr. (1986): *Remote Sensing : Principles and Interpretation*, W.H. Freeman, New York
- Jensen, J. R. (2005): *Introductory Digital Image Processing*, Prentice Hall, New Jersey
8. Guham, P. K. (2003): *Remote Sensing for Beginners*. Affiliated East-West Press Pvt. Ltd., New Delhi.
9. Harry, C.A. (ed.) (1978): *Digital Image Processing*, IEEE Computer Society.
10. Hord, R.M. (1982): *Digital Image Processing of Remotely Sensed Data*, Academic Press, New York.
11. Leuder, D.R. (1959): *Aerial Photographic Interpretation: Principles and Application*. McGraw Hill, New York.
12. Lillesand, T. M., Kiefer, R. W. Chipman, J. W.(2008): *Remote Sensing and Image Interpretation*, John Wiley & Sons, New Delhi
13. Nag, P. Kudrat, M. (1998): *Digital Remote Sensing*, Concept Publishing Company, New Delhi
14. Reeves, R.G. (ed.) (1983): *Manual of Remote Sensing*, Vols. 1 & 2, American Society of Photogrammetry & Remote Sensing, Falls Church, Virginia.
15. Richards, J. A, Jia, X. (1999): *Remote Sensing and Digital Image Processing*, Springer, Verlag Berlin
16. Sabins, F. F. (1996): *Remote Sensing: Principles an Interpretation*, W. H. Freeman Company, New York
17. Swain, P.H. and Davis, S.M. (ed.), (1978): *Remote Sensing: The Quantitative Approach*. McGraw Hill, New York.

Code No: GIN: 408		Title: Spatial Database and Modeling
No. of Credits: 4		No. of Lectures : 45
Unit	Topics	Sub-topics
I	Introduction to SQL	Definition, purpose, data abstraction, instances, schema, database manager, database administrator Normalization (1NF, 2NF, 3NF forms) Data definition manipulation using SQL, SQL query processing, operations on tables, integrity constraints,
II	Data Models	Geo-relational Model – Vector Data structure, Advantages & Disadvantages, Non spatial: Hierarchical structure, Network structure, Relational Structure, Spatial Data Bases: Hybrid Data Model, Integrated Data Model
III	Data Quality	Types of uncertainty in a GIS: Obvious sources from natural variations & original measurements, Data Quality parameters (Positional accuracy, Attribute accuracy, Logical consistency, Completeness Lineage)
IV	Data Errors in GIS	Handling Errors in GIS, Normalization in GIS, Levels of Measurements: Nominal, Ordinal, Ratio and Interval.

Books:

1. A. Silberschats, Henry F. Korth (1998) “Database System Concepts”, 3rd Edition, TMH, Bonham Carter
- G.F (1994) GIS for Geoscientists: Modeling with GIS Pergamon Publications.
2. Goodchild, M.F. (1978) - Statistical Aspects of the Polygon Overlay Problems, in Harvard papers on GIS, Ed. G. Dulton, Vol. 6, Addison Wesley and Reading Press.
3. Mary Summer, Computers: Concepts and Uses, Prentice Hall, Englewood Cliffs. New Jersey.
4. Mac Donald, A. 1999, Building a Geodatabase, Redlands CA: ESRI Press.
5. Sanghavi, Hitesh (1998) Oracle Miracles, Express computers methods, 1998.
6. Samet, H. 1990, The Design and Analysis of Spatial Data Structures, Addison–Wesley.

Code No: GIN: 409		Title: Spatial Analysis and Statistical Methods	
No. of Credits: 4		No. of Lectures : 45	
Unit	Topics	Sub-topics	
I	Introduction to Spatial analysis and Statistical Methods	<p>Sources, types, discrete and continuous series, scales of measurements, measures of central tendency and dispersion</p> <p>Correlation and spatial autocorrelation, Regression Analysis . Scatter Diagram & Residual mapping, Methods of Interpolation by Variogram and Kriging</p> <p>Multivariate regression and correlation. Principal Component Analysis (PCA), Normal, Binomial and Poison Probability</p> <p>Mathematical operations: Image overlay, scalar image operations, image attribute transformation.</p> <p>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.</p> <p>Context operators: Surface analysis, filtering pattern analysis, grouping watershed, determination, hinterland determination.</p>	
II	<p>Spatial analysis – Vector based</p> <p>Raster based</p>	<p>Overlay operations: Point-in-polygon, Line-in-polygon, polygon-in-polygon. Single layer operations: Feature identification, extraction, classification manipulation.</p> <p>Multilayer operation: Union, intersection, symmetrical difference, update, merge, append and dissolve</p> <p>Map algebra, grid based operations, local, focal, zonal and global functions, cost surface analysis, optimal path and proximity search</p>	
III	Network, Point & Surface analysis	<p>Concepts, evaluation of network complexity using Alpha-gamma indices. C-matrices for evaluating connectivity of the network.</p> <p>Network data model. Path analysis.</p> <p>Linear referencing and segmentation. Types of network analysis: Optimum cyclic path, vehicle routing, path determination and cost-path analysis.</p> <p>Spatial Sampling techniques</p> <p>Interpolation methods:</p> <p>Trend surface analysis, IDW, kriging, measures of arrangement and dispersion, autocorrelation, semi-variogram, DEM, TIN, slope, aspect, hillshade and view shed</p>	
IV	Spatial modeling	<p>Role of spatial model, explanative, predictive and normative models.</p> <p>Correlation-regression analysis in model building.</p> <p>Handling complex spatial query and case, Object oriented models: advantages and disadvantages.</p>	

Books:

1. Burrough, P. A. and McDonnell, R. A. (2000): Principles of Geographical Information Systems, Oxford University Press, New York
2. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York
3. Demers, M. N. (2000): Fundamentals of Geographic Information Systems, John Wiley and Sons, New Delhi
4. Makrewski, J. (1999): GIS Multi-criteria Analysis, John Wiley and Sons, New York
5. Longley, P. A., Goodchild, M. F., Maguire, D. J. Rhind, D. W. (2002): Geographical Information Systems and Science, John Wiley & Sons, Chichester

6. Lo, C. P. Yeung, A. W. (2002): Concepts Techniques of Geographical Information Systems, Prentice-Hall of India, New Delhi

Code No: GIN: 410		Title: Research Methodology and Project Management
No. of Credits: 4		No. of Lectures : 45
Unit	Topics	Sub-topics
I	Research Meaning, stages of research process	Meaning of research, Identification of research problem, Literature survey, Research Approaches, Process of Research Projects
II	Methods	Sampling Technique, Data collection and types of data Sources, Analysis and Report Writing
III	Project Design Raster based	Mind mapping- Understanding the methods of organizing knowledge, ideas, observations to develop the concept map OR model of a project, open floor discussion, brain storming, mind mapping. Resource Planning- Identifying material requirements, defining milestones, estimating time, budgeting Finances
IV	Project Assessment, Implementation, Monitoring and verification	Understanding the methods a project -SWOT , Logical Framework. Understanding techniques of monitoring the project progress- Gantt Chart, PERT Diagram Understanding the methods of verifying the expected v/s achieved, cross mapping designed v/s implemented, mile-stones, lessons learnt, product and services for future use, conclusion.

Books:

1. Harold Kerzner, 2000, Project Management: A System Approach to Planning, Scheduling, and Controlling, 7th Edition. John. Willey & Sons.
2. Robert B. Angus, Norman A. Gundersen, Thomas P. Cullinane, 1999, Planning, Performing and controlling Projects: Principles and Applications (3rd Edition).

Code No: GE: 411PR		Title: Practical 3
No. of Credits: 4		No. of Lectures : 90
Unit	Topics	Sub-topics
1	Spatial Statistics	- Zonal Stats (raster vs Raster and Raster Vs Vector) - Local Stats - Spatial weigh matrix - General clustering - Getis Ord General G - Autocorrelation (Moran's I) - Hot Spot
	Spatial Patterns and Interpolation	- Mean center, - Directional distribution - Histogram - QQ plot - Box plot - Voronoi Map - Semivariogram Cloud - IDW - Contour Line - Spline
2	Terrain Modelling	- Contour - Slope - Hillshade , Aspect
	Hydrology	- Profile graph - Sinks - Basin - Fill - Flow direction - Flow accumulation - Stream link - Stream order - Stream to polyline - Watershed - Pour points
	Network Analysis	- Building a network - Shortest path - Closest facility - Allocation - Location allocation
	Site Suitability (Multi criteria Analysis)	- Weighed analysis - Reclassification - Overlay - IDW - Weight analysis - Proposed School Site

3	HYPERSPECTRAL	SOFTWARE: ENVI 1. Introduction to HyperCube 2. Data visualization and spectral analysis 3. Comparison and identification with existing data materials 4. Atmospheric Correction (FLAASH module) 5. Dimensionality Reduction 6. SAM classification 7. Spectral Feature Fitting
	SAR	SOFTWARE : ENVI/ENVI Classic 1. Introduction to SAR 2. Data visualization, Quick Stats, View Stats, Polarization variants 3. Filter (Adaptive Lee) 4. Band math (for correction) 5. Backscattering 6. Multilook 7. Speckle Filtering 8. Radiometric Calibration 9. Analysis
4	LIDAR	SOFTWARE : SAGA/ARCGIS 1. Data Downloading (Aerial) 2. Point Cloud, Information, File Info 3. Conversion – LAS to Multipoint 4. Multipoint to TIN to Raster 5. Raster DEM noise filtering 6. Contouring, Profile Graph, Contour Map 7. Hillshade Relief Map, Visualization, Continuous Choropleth Map
	Photogrammetry	DEM Generation and Ortho-rectification of Image

Books:

1. ERDAS (2010): ERDAS field Guide, ERDAS incorporation, Norcross, GA, USA
2. http://geospatial.intergraph.com/Libraries/Tech_Docs/Erdas_Field_Guide.sflb.ashx 3. Gupta, R. P. (2003): Remote Sensing Geology, Springer, Verlag Berlin
3. John R. Jenson (1986) "Introducing Digital Image Processing" - Prentice Hall, New Jersey
4. M. Anji Reddy, Textbook of Remote Sensing and Geographical Information systems, BS Publications, Hyderabad. 2011. ISBN : 817800-112-8
5. Robert A. Schowengerdt, "Techniques for Image Processing and Classification in Remote Sensing"; 1984. ISBN 13: 9780126289800
6. Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman Remote sensing and image interpretation John Wiley & Sons, 2008
7. Booth, B., Shaner, J., MacDonald, A., Sanchez, P. Pfaff, R. (2004): ArcGIS,
8. Geodatabase Workbook, Redlands
9. Environmental Systems Research Institute, Inc. (1998): Understanding GIS: The Arc/Info Method, ESRI Press, Redlands
10. ESRI (2003): Introduction to ArcGIS- I, Course Lectures, GIS Education Solutions
11. Melania, H. M., Rhonda, P., Minami, M., Hatakeyama, A. M. (2004): ArcGIS, Using
12. ArcMap, ESRI Press, Redlands
13. Mitchell, A. (1999): The ESRI guide to GIS analysis, Redlands
14. Zeiler, M. (1999): The ESRI guide to Geodatabase design, Redlands

Code No: GIN: 412PR		Title: Practical 4
No. of Credits: 4 No. of Lectures : 90		
Unit	Topics	Sub-topics
I	C Language	Introduction to C: History of Programming language, importance of computer languages, Understanding Compiler. Input /Output functions: Console input output, Formatted input output. Data types and operators: types and uses of various operators. Control structures: Various looping mechanism, types of loops.
II	Array and File Handling	Introduction to Array: Understanding Array, Working with Single multidimensional array. Limitations of array, Structure Unions. Introduction to functions: Need of function, defining, calling function, different types of functions. Understanding of pointer. File handling: Reading and writing the data to file
III	C++Language	Introduction to OOP: Importance of OOP Understanding Classes, objects, Methods and properties. Characteristic of OOP: Abstraction, Inheritance, Polymorphism, Encapsulation.
IV	OOP	OOP and POP: Difference between OOP and POP Constructors and destructors: Creating classes and objects. Memory allocation of Objects. Heap and stack memory. Managing input /Output File handling: C++ stream classes, formatted I/O manipulators. Access modifiers: modifying access of Classes, methods using public, private keywords. Functions and Operators: Function overloading and Overriding, Operator precedence, Operator overloading, Friend and virtual function.

Books:

1. Gregory, S. (1978): Statistical Methods for Geographers, Longman, London
2. Ebdon, D. (1977): Statistics in Geography, Basil Blackwell, Oxford
3. Frank, H. and Althoen, S. C. (1994): Statistics: Concepts Applications, Cambridge University Press, Cambridge
4. Hammond, R. and McCullagh, P. (1991): Quantitative Techniques in Geography, Clarendon Press, Oxford
5. Rogerson, P. A. (2010): Statistical Methods for Geography, Sage Publications, London
6. Balagurusamy, E. (2006): Object Oriented Programming with C++, Tata McGraw Hill, New Delhi
7. Balagurusamy, E. (2002): Programming in ANSI C, Tata McGraw Hill, New Delhi
8. Kernighan, R. (1998): C Programming Language, (ANSI C Version), Prentice Hall, New Jersey
9. Kanetkar, Y. (2000): Let US C++, BPB publications, New Delhi
10. Kanetkar, Y. (2001): Let Us C, BPB Publications, New Delhi
11. Evjen, B., Hollis, B., Rockford, L. (2006): Professional VB.NET (2003), Wiley Publishing Inc. USA
12. Holzner, S. (2010): Visual Basics.NET Programming Black Book, Paraglyph Press USA
13. Dreamtech Press
14. <http://www.ebooksdownloadfree.com/Miscellaneous/C-Black-Book-BI20346.html>
15. http://www.tutorialspoint.com/csharp/csharp_tutorial.pdf

Semester III

Code No: GIN: 501 Title: Internet/Web GIS		
No. of Credits: 4 No. of Lectures : 45		
Sr. No.	Topics	Sub-topics
I	Introduction To Open Web Mapping	Web Page Basics, Web Mapping, Geospatial Web Services, OGC-framework of open web mapping, importance of open web mapping, international open web standards as published by the Open Geospatial Consortium, explain the importance of international open standards to developers, users and businesses.
II	Internet GIS Concepts & Web GIS	Overview of Internet GIS concepts & features: Internet protocol, Domain Name System, Internet services, www, Web servers, Web clients. CGI, The web and GIS, Web GIS origin and Evolution, -concept-Applications Evolution-Impact-webcontent-function and interfaces –Mashup design and implementation- challenges and prospects-uses and benefits-supporting technology-solution and production
III	Geoportals	Concept-uses-functions-architectures-geoportal applications-challenges and prospects. Web page design principles, HTML, XML, data formats, helper applications, Java, databases and the Web Application of Internet services to GIS, Internet GIS software, interoperability issues & Open GIS-GSDI and NSDI, Applications-e-business, e-government
IV	Indian Geo-Portals	Bhuvan, Mosdaik, Vedas

Books:

1. Burrough P.A., (1980) Principles of Geographical Information System for Land Resources Assessment, Oxford Publications.
2. Kang-tsung Chang , (2008), Introduction to Geographical Information System, , Fourth Edition, Tata McGraw Hill,
3. Pinde Fu and Jiulin Sun, (2010) Web GIS: Principles and applications, ISBN:9781589482456, ESRI.
4. www.vedas.sat.gov.in

Code No: GIN: 502 Title: Application of Geoinformatics for Natural Resources Management & Disaster Mitigation		
No. of Credits: 4 No. of Lectures : 45		
Unit	Topics	Sub-topics
I	Basics Soil Degradation & Management	Concept of Natural Resources, classification, Ecological, social and economic dimensions of Natural resource Management. Environmental satellites GEOS, NOAA, AVHRR, CZCR Monitoring land, water, atmosphere and ocean using Remote Sensing Data. Spectral characteristics of soil- Soil formation- classification of soils- soil survey interpretation and mapping- impact of agricultural and industrial activity on soil properties. RS & GIS in assessing Soil salinity- alkalinity- water logging studies- soil erosion- types and estimation -control measures.
II	Water Quality And Ground Water Pollution	Spectral characteristics of water- classification of water quality -Data base creation and quality modeling using GIS. Aquifer Vulnerability -Intrinsic and specific vulnerability- contaminant transport model Atmosphere: Chemicals, Particulate matters present in the atmosphere,

	Air Quality And Coastal Studies	allowable limits, Remote Sensing techniques - Monitoring atmosphere constituents- air pollution - industrial activity, modeling using GIS - Ecology studies- Coastal color monitoring- marine studies.
III	Disasters Types and Impact	Basic concepts and principles - Disaster types and classification, Risk Assessment: Frequency, significance and probability of Disasters Disasters Impact Analysis; Social, economic and macroeconomic, Disaster losses and Expenditures.
IV	Disaster management	Disaster Management: Models of Disaster risk and Vulnerability Assessments, Case Studies, Risk Reduction Strategies, Disasters and Development, Mainstreaming Disaster management in development planning, Use of Internet - Communication Network –Early Warning system - Post disaster review - Case studies. Disaster legislation and policy; Role of Government administration, NGO's - International disaster assistance - Training - Education - Public awareness - Roles of media.

Books:

1. Bell, F.G. Geological Hazards: Their assessment, avoidance and mitigation. E & FN SPON Routledge, London. 1999.
2. Burrough, P.A. and, McDonnell, R.A., (1988) Principles of Geograj1JhicaJ Information Systems, Oxford University Press.
3. David Alexander (1993), Natural Disasters, UCL Press, London, Research Press, New Delhi,.
4. Geocoded Satellite Images, John & Wiley Sons, New Delhi
5. George G. Penelis and Andras J. Kappos (1997) -Earthquake Resistant concrete Structures. E & FN SPAN, London,
6. Environmental Systems Research Institute, Inc. (1998): Understanding GIS: The ARC/INFO Method, ESRI Press, Redlands.
7. Lilliesand, T.M. and Kiefer, R, W., (1994) Remote Sensing and Image Interpretation, John Wily and sons.
8. Lintz, J. and Simonet (1994), Remote Sensing of Environment, Addison Wesley Publishing Company.
9. Mitigating Natural Disasters, Phenomena, Effects and options, A Manual for policy makers and planners, United Nations. New York, 1991.
10. Nick Carter. W. Disaster Management -A Disaster Manager's Handbook. Asian Development Bank, Philippines.
11. Shukla Shital (2014) Vulnerability and Risk Measurement of Climate Induced Disasters in Gujarat, Academic Foundation, New Delhi

Code No: GIN: 503/504 Title: Application of Geoinformatics for Urban & Regional Planning.		
No. of Credits: 4 No. of Lectures : 45		
Sr. No.	Topics	Sub-topics
I	Urban Planning And Development	Principles of urban area development and land use planning. Large scale mapping for cadastral database, traffic and parking surveys, urban land use classification, monitoring, change detection analysis, utility planning, integrated development planning, urban conservation, transportation planning and Land Information System
II	Regional Planning And Development	Theoretical framework of rural development and geographical perspective: Rural economy under different production systems – experiences of developed and developing world with examples. Growth Pole theories and the developing world, Regional Environmental Issues.
III	Urbanization in India	Historical perspective, Features of metropolitan development (with special reference to India), Urban Environmental Problems in Gujarat

IV	Application Areas	<p>Analysis of rural settlement: Cause and effect associations, distribution of rural settlement with special reference to size and spacing; Rural service centres – Nodal settlement of market centres and growth centres – Studies on rural urban continuum. Brief introduction of Remote Sensing applications on Urban landscape</p> <p>Population estimates, housing quality studies, site selection processes, traffic and parking studies,</p> <p>Urban & rural change detection studies, Remote sensing applications in Biological systems.</p>
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Books:

1. Beaujen Garnier J. (1966): Geography of population, Longman Group Ltd., London.
2. Ambrose, Peter (1970): Concepts in Geography Vol.I: Settlement Pattern, Longman.
3. Chandna R.C. (1986): Geography of Population – Concepts, Determinants and Patterns, Kalyani Publishers, New Delhi.
4. Clarke J.J. (1984): Geography and Population – Approaches and Applications, Progress Press, Oxford.
5. Chisholm, M. (1962): Rural Settlements and Landuse, Hutchinson, London.
6. Carter, H. (1972): The study of urban Geography, Edward Anold.
7. Deshpande, C.D. (1992): India: A Regional Interpretation, ICSSR & Northern Book Centre, New Delhi.
8. Dutt, Ashok K. (Ed.)(1972): Indian – Resources, Potentialities and Planning, Kendall/Hunt Publishing Company, Dubuque.
9. Government of India (2007): National School Atlas, NATMO, Kolkatta.
10. Gautam, A. (2006): Advance Geography of India, Sharda Pustak Bhawan, Allahabad.
11. Herbert David & C.J. Thomas (1982): Urban Geography – A First Approach, John Wiley & Sons, Binghamton, N.Y.
12. Hudson, R.S. (1970): A Geography of settlements, McDonald and Sons, London.
13. Khullar D.R. (2005): India-A comprehensive geography, Kalyani Publishers, Ludhiana.
14. Knox, P.L. and Taylor (P.J. (1995): World cities in world system, Cambridge University Press, U.K.
15. Short, John. R. (1984): An Introduction to Urban Geography, Routledge and Regan Paul, London.

Code No: GIN: 503/504 Title: Application of Geoinformatics for Agriculture & Forestry			
No. of Credits: 4		No. of Lectures : 45	
Sr. No.	Topics	Sub-topics	Lectures
I	Spectral Characteristics Of Leaf	Structure of leaf - Spectral behavior of leaf – Vegetation indices – NDVI, TVI, SVI, PCA – Vegetation classification and mapping - Estimation of Leaf area index, Biomass estimation – Estimation of terrestrial carbon assimilation in forests - case studies	06
II	Forest Mapping	Forest type and density mapping and forest stock mapping using RS technique -factors for degradation of forests – deforestation/afforestation/. Change detection in forests - case studies Forest: Image processing for forest, vegetation classification mapping, forest inventory, sampling techniques, Growing stock estimation, biomass estimation, forest management, fire risk zonation, land evaluation for forestry, RS of forest ecosystem	12

III	Biodiversity Characterization Mapping	Forestry – Forest taxonomy – Linnaeus classification - Biodiversity characterization – Forest fire risk zonation – wildlife habitats suitability analysis - case studies.	07
IV	Agricultural Applications Soil & Water Application	Identification of crops -acreage estimation -production forecasting - pests and disease attacks through remote sensing -crop stress detection due to flood and drought - catchments and command area monitoring. Soil survey and land use classification - water logging - characters of saline, alkali soils - soil erosion – types – Estimation of soil loss from USLE using Remote sensing and GIS. Wasteland development Watershed hydrology, physical processes in watershed, principles of remote sensing in water resource assessment, river valley project, planning, organization and design of spatial and non-spatial data in water resource engineering. Hydrological modeling	20
V	Seminar		01 (Credit)

Books:

1. Steven, M.D and Clark, J.A., "Applications of Remote Sensing in Agriculture", Butterworths, London 1990.
2. Remote Sensing Applications Group, Space Applications Centre, Crop Acreage and production Estimation (CAPE): An Anthology from January 1986 - June 1996. (Publications in Journals, Seminars I Symposium proceedings), Ahmedabad, August 1996.
3. Negi, S.S., A Handbook of forestry. International Book distributors, Dehradun, 1986. Space Applications Centre, Manual of procedure for Forest mapping and Damage Detection using satellite data, Ahmedabad, 1990

Code No: GIN: 503/504		Title: Application of Geoinformatics for Geomorphology	
No. of Credits: 4		No. of Lectures : 45	
Unit	Topics	Sub-topics	
I	Spectral Properties Of Rocks And Minerals Geological Structure And Applications	Reflectance Properties of Rocks, minerals in visible, NIR, MIR, SWIR, TIR and Microwave regions Laboratory spectroscopy - laboratory and field spectral data comparative studies, Spectral reflection curves for important Rocks, Minerals Significance of Geological structures, Role of aerial photographs, Photo interpretation characters of photographs and satellite images, structural mapping, Fold, fault, Lineaments, Direction circular features. Intrusive rocks, rock exposure, Fractures and Joints, Rose diagram. Digital image processing for structural mapping	

II	Lithological Mapping	Introduction on Igneous rocks, sedimentary rocks, metamorphic rocks, mapping of regional scale lithological units, Image Characters of igneous rocks, sedimentary and metamorphic rocks, examples. Digital image processing of various rock types, resolution and Scale of lithological mapping and advantages
III	Geomorphological Mapping	Significance of landform, Geomorphological guide, interpretation and image/photo characters, Tectonic landforms, Fluvial landforms, Denudational landforms, Volcanic landforms- Aeolian landforms, Coastal landforms. Importance of ground truth and geological field data collection
IV	Geological Survey Techniques And Data Integration	Geophysical survey, surface and subsurface investigation, Gravity survey, Seismic survey, refraction methods, reflection methods, applications, Magnetic survey and Electrical resistivity survey, Self potential methods, potential drop methods, resistivity values, data interpretation, Curve fitting, GIS data generation , integration and analysis

Books:

1. Drury, S. A. 1993, Image interpretation in Geology,. Chapman and Hall, London.
2. John J. Qu , Wei Gao, Menas Kafatos , Robert E. Murphy, Vincent V. Salomonson, 2007, Earth Science Satellite Remote Sensing, Springer
3. Gupta, R.P 2003, Remote sensing Geology, Springer,.
4. Jean-yves scanvk, 1997, Aerspatial Remote Sensing in Geology, A.A. Balakarma, Netherlands,
5. Pandey, S. N. 1987, Principles and applications of Photogeology, Wiley eastern.

Code No: GIN: 505PR		Title: Practical 5
No. of Credits: 4		No. of Lab Hours : 90
Unit.	Topics	Sub-topics
I	Introduction Controlling user access	Introduction: DBMS, RDBMS, SQL and Oracle architecture Data base security concept and advantages of RDBMS and ER modeling Control database access, Privileges, creating user, concept of Role, creating, granting privileges to role, revoking privileges. Changing password
II	Managing schema object Manipulating dataset using SQL statement	Data types, DDL, DML, DCL Constraints: types of constraints, Primary key, foreign key, check constraint, Not Null, Altering constraint, concept of backup recovery. Overview of Index, view Basic select statement, selecting specific column, using arithmetic expressions, defining column alias, Using where clause
III	Restricting & Sorting data SQL Function displaying data from multiple tables, Sub-query	Using comparison condition (=,<=,>=etc), using logical operator: AND, OR, NOT, using BETWEEN, LIKE conditions Rule of Precedence. Using order by clause Concept of function, types, group functions, use of group by, having clause. Types of joins, concept of sub-query, types of sub queries
IV	PL/SQL	Introduction to PL/SQL, variables and types declaration in PL/SQL. Simple program in PL/SQL: Assignment operator, output statement, accepting input from user. Simple program in PL/SQL using table: syntax of using 'select' statement in PL/SQL, 'If' statement and Loops in PL/SQL. Creating procedure, function, cursor, trigger packages

Books:

1. Deshpande, P. S. (2008): SQL & PL/SQL for Oracle 10g, Blackbook, Dreamtech Press, New Delhi
2. Freeman, R. G. (2000): Oracle DBA 7.3 to 8 Upgrade, Dreamtech Press, New Delhi
3. http://docs.oracle.com/cd/B19306_01/server.102/b14220.pdf
4. <http://www.smart-soft.co.uk/tutorial.html>
5. <http://ask2seenu.blogspot.in/2011/09/best-oracle-plsql-ebooks-download-for.html>

Code No: GIN: 506PR		Title: Practical 6
No. of Credits: 4		No. of Hours : 90
Unit	Topics	Sub-topics
I	HTML	Introduction: HTML, various HTML tags like image, Text, Color, Frames and Tables, Introduction to frames CSS: Cascading Styling sheets, Introduction to DHTML
II	Java script	Introduction to java script, importance of Java script, creating sample program. Data type operators: Various Data type and its importance. Understanding and using various types of operators.
III	Python Introduction	Introduction to python, Data type operators: Data types, Basic sample programming control flow, arrays, list and strings. Classes modules: Creating modules and classes, implementing OOP
IV	Python	Script Windows Application: Creating script Working with windows forms. Event handling: Handling various events in Windows forms application. Exception handling: Usage of Try, catch block. Debugging: debugging script for windows forms based application

Books:

1. Balagurusamy, E. (2011): Programming with JAVA- a Primer, Tata-McGraw Hill Education Pvt. Ltd., New Delhi
2. Horton, I. (2008): Beginning Java 2, Wiley-India Inc., New Delhi
3. <https://wiki.python.org/moin/BeginnersGuide/nonprogrammers>
4. Holzner, S. (2008): HTML Black Book, Dreamtech Press, India Paraglyph Press, USA
5. Lutz, M. (2010): Programming Python, O'Reilly Media California, (URL: <http://itbook.info/book614>)

Semester IV

Code No: GE: 507	Title: Project	No. of Credits
	Dissertation	16
	Seminar	04
	Assignment	04