VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2016-2017

M.Tech. Geoinformatics

I SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical /Field Work/ Assignment	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16CGI11	Fundamentals of Geostatistics	4	-	3	20	80	100	4
2	16CGI12	Fundamentals of Remote Sensing	4	-	3	20	80	100	4
3	16CGI13	Fundamentals of Geographic Information System (GIS)	4	-	3	20	80	100	4
4	16CGI14	Fundamentals of Photogrammetry	4	-	3	20	80	100	4
5	16CGI15X	Elective-1	3	-	3	20	80	100	3
6	16CGI16	Geoinformatics Laboratory-I		3	3	20	80	100	2
7	16CGI17	Seminar	-	3	-	100	-	100	1
TOTAL			**19**	**6**	**18**	**220**	**480**	**700**	**22**

Elective –I	
16CGI151	Geospatial Database Management System
16CGI152	Advanced Remote Sensing
16CGI154	Advanced Geographic Information System

I I SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/ Assignment	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16CGI21	Satellite Data Image Processing	4	-	3	20	80	100	4
2	16CGI22	Applications of Geoinformatics in Natural Resources and Environmental Management	4	-	3	20	80	100	4
3	16CGI23	Cartography, Geodesy and Global Positioning System	4	-	3	20	80	100	4
4	16CGI24	Web Applications in Geoinformatics	4	-	3	20	80	100	4
5	16CGI25 X	Elective-2	3	-	3	20	80	100	3
6	16CGI26	Geoinformatics Laboratory-II		3	3	20	80	100	2
7	16CGI27	Seminar	-	3	-	100	-	100	1
TOTAL			**19**	**6**	**18**	**220**	**480**	**700**	**22**

Elective –II	
16CGI251	Basics of Computer Engineering
16CGI252	Applications of Geoinformatics in Urban Planning and Management
16CGI253	Applications of Geoinformatics in Ocean, Marine and Coastal Resources Management
16CGI254	Geoinformatics in Demography, Business, Health and Infrastructure

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III SEMESTER: Internship

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical /Field Work/ Assignment	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16CGI31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	-	-	-	25	-	25	20
2	16CGI32	Report on Internship	-	-	-	50	-	50	
3	16CGI33	Evaluation and Viva-Voce of Internship	-	-	-	-	75	75	
4	16CGI34	Evaluation of Project phase -1	-	-	-	25	-	25	1
TOTAL			**-**	**-**	**-**	**100**	**75**	**175**	**21**

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IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical /Field Work/ Assignment	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16CGI41	Geoinformatics in Project Planning and Management	4	-	3	20	80	100	4
2	16CGI42	Elective-3	3	-	3	20	80	100	3
3	16CGI43	Evaluation of Project phase -2	-	-	-	50	-	50	3
4	16CGI44	Evaluation of Project and Viva-Voce	-	-	3	-	100+100	200	10
TOTAL			**-**	**-**	**6**	**60**	**75**	**450**	**20**

Elective	
16GCI421	Applications of Geoinformatics in Disaster Management
16CGI424	Emerging Trends in Geoinformatics

Note:

1. Project Phase-1: 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.

2. Project Phase-2: 16-week duration during 4th semester**.** Evaluation shall be done by the committee constituted comprising of HoD as Chairman, Guide and Senior faculty of the department.

3. **Project Evaluation**: Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall conducted

4**. Project evaluation:**

a. Internal Examiner shall carry out the evaluation for 100 marks.

b. External Examiner shall carry out the evaluation for 100 marks.

c .The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.

d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

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I SEMESTER			
FUNDAMENTALS OF GEOSTATISTICS			
Subject Code	16CGI11	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

To introduce and familiarize the students with the basic concepts and techniques of statistical analysis which serve as a prerequisite for understanding digital image processing and spatial analysis and modeling in GIS.

Modules	**Teaching Hours**
Module-1	
Basics and Fundamental Concepts: Histogram – univariate and bivariate, estimation of basic statistical parameters, viz., mean, standard deviation, variance, covariance. **Probability Theory:** Introduction to probability theory, kinds of probability – classical or apriority probability, A posteriori or Frequency probability, probability models, an inside to set theory, sample space and events, conditional, joint probability and independence.	**10 Hours**
Module-2	
Random Variables, Distribution Functions and Expectation: Introduction and summary, Cumulative distribution function, Density function, Expectations and moments. **Special Parametric Families of Univariate and Multivariate Distributions:** Introduction and summary, Discrete and continuous distributions – binomial, poisson, exponential, Gaussian/Normal distribution functions, joint and continuous distributions, bivariate and multivariate normal distribution. **Estimation Theory:** Introduction and summary, methods of finding estimators, properties of point estimators, unbiased estimation, location or scale invariance, Bayes estimators – posterior distribution, loss function approach, min-max estimators, maximum likelihood estimators.	**10 Hours**
Module-3	

Stratification and Sampling: Introduction, sampling, sample mean, sampling from normal distribution, stratification and sampling. **Testing of Hypothesis:** Introduction and summary, simple hypothesis testing, composite hypothesis, tests of hypotheses – sampling from normal distribution, chi-square tests, tests of hypotheses and confidence intervals, sequential test of hypotheses**.** **Estimation and Quality** Control: Introduction, point estimates and interval estimates: basic concepts, interval estimates and confidence intervals, calculating interval estimates of the mean from large samples, calculating interval estimates of the proportion from large samples.	**10 Hours**
Module-4	
Geo-statistics for Spatial Analysis and Modeling: Cluster analysis concepts and techniques, Spatial autocorrelation, Multivariate Correlation, Linear regression, Multiple regression. Statistical Surfaces-Interpolation, Variogram, Krieging. geostatistical models, stochastic models, probabilistic models, Deterministic models; enthalpy; Geo-statistics soft-wares- SpaceStat, S-Plus.	**10 Hours**
Module-5	
Time Series and Forecasting: Introduction, variation in time series, trend analysis, time series analysis in forecasting.	**10 Hours**
Course Outcome:	
The students would develop analytical skills, quality assessment and forecasting techniques.	
Question Paper pattern: • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	
REFERENCE BOOKS: 1. 1.Richard I.Levin, David S. Rubin, Sanjay Rastogi, Masood Hussain Siddiqui, Statistics for Management, 7th edition, Pearson Education Inc,2013 2. 2.Alexander M Mood, Franklin A Graybill and DuaneC Boes, Introduction to the Theory of Statistics, 3rd Edition, McGraw-Hillseries in probability and statistics, (1974). 3. 3 Fruend John E and Miller, Irwin, Probability and Statistics for Engineering, 5th Edition, Prentice Hall (1994) 4. Jay L Devore, Probability and Statistics for Engineering and Sciences, Brooks/Cole Publishing company Monterey, California (1982) 5. Sampling theory, Cochran WG	

6. Multivariate Statistical Inference, W A Anderson
7. Principles of Geographic Information System by Peter ABurrough and Rachael A McDonnnel
8. Introduction to Geostatistics. Applications in Hydrogeology, ISBN: 9780521587471
9. Spatial Statistics and Computational Methods, ISBN:0387001360
10. GSLIB. Geostatistical Software Library and User's Guide. (2nd Ed), Clayton V. Deutsch, Andre G. Journal, Oxford University Press, ISBN: 0195100158

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I SEMESTER			
FUNDAMENTALS OF REMOTE SENSING			
Subject Code	16CGI12	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:
To understand the basic concepts of remote sensing, systems & techniques of data acquisition and to acquire skills in image processing techniques and interpretation of remote sensing data.

Modules	**Teaching Hours**
Module-1	
Introduction: Definition of terms, Concepts and types of remote sensing; evolution of remote sensing technology, stages in remote sensing technology, spatial data acquisition, interdisciplinary nature and relation with other disciplines, applications of remote sensing, advantages of RS over conventional methods of survey and inventorying. **Basic Principles of Remote Sensing :** Characteristics of electro-magnetic radiation; Interactions between matter and electro-magnetic radiation; Types of remote sensing with respect to wavelength regions; active and passive remote sensing, Definition of radiometry; Black body radiation; Reflectance; spectral reflectance of land covers; Spectral Signature; Radiative transfer equation; energy interaction in the atmosphere.	**10 Hours**
Module-2	
Sensors: Types of sensors- passive sensors and active sensors; imaging systems, photographic sensors, characteristics of optical sensors; Sensor resolution- spectral, spatial, radiometric and temporal; Characteristic of optical detectors; Cameras for remote sensing; Film for remote sensing; non-imaging radiometers, imaging sensors, Panchromatic, Multispectral,	**10 Hours**

hyperspectral, stereo images, Optical mechanical line scanner; Push broom scanner; Imaging spectrometer; space borne imaging sensors, active and passive microwave sensors; Thermal sensors; Atmospheric sensors; Sonar; LIDAR, RADAR, hyperspectral sensors. **Platforms:** Types of platforms- airborne remote sensing, space borne remote sensing; Atmospheric condition and altitude; Attitude of platform; Attitude sensors; Orbital elements of satellite; Orbit of satellite; Satellite positioning systems including IRNSS, Various satellites for Land, Ocean, and atmospheric studies	
Module-3	
Image Interpretation and Analysis: Fundamentals of aerial photos and satellite image interpretation; Types of imaging, elements of interpretation; Techniques of Visual interpretation; Generations of Thematic maps. Importance of ground truth, reference data, use of smart phone, geo-tagging.	**10 Hours**
Module-4	
Digital Image Processing: Digital data manipulation and analysis; image rectification – Radiometric correction, Atmospheric correction, Geometric correction; image enhancement – Spatial feature manipulation and multi-image manipulation; classification techniques – Supervised classification and unsupervised classification.	**10 Hours**
Module-5	
Advanced Remote Sensing Technologies: Microwave remote sensing, Synthetic Aperture Radar; Hyper spectral Imaging Spectrometer; Thermal Imaging System; Advanced Laser Terrain Mapping.	**10 Hours**
Course Outcome:	
The students will be familiarized with the Fundamentals of Remote Sensing	
Question Paper pattern: • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	
REFERENCE BOOKS: 1. Fundamentals of Remote Sensing: George Joseph 2. Remote Sensing and Image Interpretation: Lillesand & Keifer. 3. Manual of Remote Sensing: ASP Falls Church Virginia USA. 4. Physical aspects of Remote Sensing: PJ Curran. 5. Remote Sensing Principles and Interpretation: F.F. Sabins. 6. Introduction to Remote Sensing: J.B. Campbell. 7. Introductory Digital Image Processing: A Remote Sensing Perspective, John R	

Jensen.
8. Remote sensing Models and methods for image processing by Robert A. Schowengerdt, second edition, 1997, Academic Press

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I SEMESTER			
FUNDAMENTALS OF GEOGRAPHIC INFORMATION SYSTEMS			
Subject Code	16CGI13	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:
To understand the basic principles of GIS, creation of GIS database and develop basic practical skills in the use of GIS software for data input and error correction.

Modules	**Teaching Hours**
Module-1	
Introduction to GIS: Definitions, Basic Concepts, history and evolution, Components, Need, Scope, interdisciplinary relations, applications areas, and overview of GIS. **Data- Types and Models:** Spatial/Geometrical Data- Raster data, Vector data, Non-spatial / Attribute Data. Data models- Basic Data Models – raster and vector, Spaghetti and Topology, Choice between data models; Advanced data models- Grid model, TIN model, network model, other models, combination of models. Data formats – Raster data, vector data, advantages and disadvantages of raster and vector data formats. Compression of vector and raster data.	**10 Hours**
Module-2	
Data Sources: Data collection, modes of data acquisition- Primary and secondary methods of acquisition of spatial and non-spatial data- surveying, remote sensing, Photogrammetry, Database creation, Data capturing, map scanning and digitizing, data conversion from other digital sources, data exchange standards, topology building, editing and cleaning, linking of spatial and non-spatial data.	**10 Hours**
Module-3	

Data Processing: Updation, corrections, modifications, scale changes, Coordinate thinning, geometric transformations and map projection transformations, conflation sliver removal, edge matching, interactive graphic editing, rubber sheeting. **Data Quality and Standards:** Definition of data quality, components of geographic data quality – lineage, positional accuracy, attributes accuracy, temporal accuracy, logical consistency and completeness; Accuracy, precision, error and uncertainty. Sources and types of errors, error propagation and error management; Geographic data standards components and types of GIS standards, international GIS standards, interoperability of GIS, quality control.	**10 Hours**
Module-4	
Elementary Spatial Analysis and Modeling: introduction to spatial analysis and modelling, Spatial awareness, Euclidean space, Topology of space, Network analysis and pattern. Metric spaces, spatial data relationships, topological relationships and geometrical relationships, proximal, directional relationships **Basic Spatial Analysis, Integration and Modelling:** Logic operations, general arithmetic operations, general statistical operations, geometric operations, query and report generation from attribute data, geometric data search and retrieval, complex operations of attribute data, classification reclassification, integrated geometry and attributes, overlay, buffer zones, raster data overlay, integrated data analysis.	**10 Hours**
Module-5	
Advanced Analysis and Modelling: Spatial reference systems, trend surface analysis, Network and Raster connectivity operations, Spatial interpolation and proximity operations, fuzzy analysis, GIS analytic models, Digital Terrain models, Hydrologic modeling, engineering GIS.	**10 Hours**

Course Outcome:

The students are equipped with the basics of GIS

Question Paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Concepts and Techniques of Geographic Information Systems, CP Lo Albert K W Yeung, 2005 Prantice Hall of India.
2. Principles of GIS for Land Resources Assessment by P.A.Burrough, Oxford: Science publications, 1986.
3. Geographic Information Systems – An introduction by Tor Bernhardsen, John Wiley and Sons, Inc., New York, 2002.

4. GIS – A computing Perspective by Michael F. Worboys, Taylor & Francis, 1995.
5. Remote Sensing and Image Interpretation by Thomas M. Lillesand and Ralph W. Kiefer, John Wiley and Sons Inc., New York, 1994.
6. Geographical Information Systems – Principles and Applications, Volume I edited by David J. Maguire, Michael F Goodchild and David W Rhind, John Wiley Sons. Inc., New York 1991.
7. Geographical Information Systems – Principles and Applications, Volume II edited by David J. Maguire, Michael F Goodchild and David W Rhind, John Wiley Sons. Inc., New York 1991.

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I SEMESTER			
FUNDAMENTALS OF PHOTOGRAMMETRY			
Subject Code	16CGI14	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

Understand the basic concepts of photogrammetry, systems and techniques of extraction and analysis of information from aerial/satellite stereo-data.

Modules	**Teaching Hours**
Module-1	
Introduction: Definition and terms, history of photogrammetry, concepts, principles and types of photogrammetry, types of aerial photographs vertical photographs, tilted photographs, ortho photographs, aerial cameras, geometry and scale orientation and measurements, distortions, displacements and their corrections, rectification and ortho photographs, digital imaging devices and their characteristics and advantages over other analogue cameras, satellite stereo images. **Stereoscopy:** Principles of stereoscopic vision, types of stereoscopes, stereoscopic viewing, stereoscopic parallax, stereoscopic plotting and mapping instruments, soft copy plotters.	**10 Hours**
Module-2	
Analytical Photogrammetry: image measurements, control points, colinearity, coplanarity, analytical interior orientation, analytical relative orientation, analytical absolute orientation, analytical self-calibration.	**10 Hours**
Module-3	

Project Planning: flight planning, pre-pointing and post pointing, photographic end lap and side lap, purpose of photography, photo scale, flying height, ground coverage, weather conditions, season of the year, flight map, specifications, cost estimation and scheduling. **Ground Control for Aerial Photogrammetry**: selecting photo control points number and location of photo control, planning the control survey, traditional field survey methods for horizontal control and vertical control, ground control surveys by GPS, artificial targets for photo identifiable control points, indexing ground control. **Aero triangulation**: GPS supported AT, geometric relationship between a camera and GPS antenna with respect to position, and attitude, synchronization of GPS coordinates with camera exposures, entering GPS coordinates, and INS parameters in bundle block adjustments for each exposure stations. Requirements with GPS and INS.	**10 Hours**
Module-4	
Orientation Procedures: Purpose of fiducial marks, image coordinate system and object space coordinate system, IO, EO procedures in digital photogrammetry, advantage of digital IO over analogue and analytical system, advantage of digital EO over analogue system. **Concept of Block/Bundle/Strip Adjustments:** definition of block, types of block adjustments, planning of photo control, selecting photo control images, number and location of photo control, bundle block adjustment, accuracy of block adjustment, (IO,EO) colinearity condition equations, epipolar geometry, space resection, space intersection, reasons for digital AT superior over analogue AT.	**10 Hours**
Module-5	
Digital Photogrammetry: Digital photogrammetric systems, Digital photogrammetric work station and its configuration, photogrammetric scanners, inputs to DPWS, Various formats of data, contrast enhancement, spectral transformation, multiscale representation, epipolar geometry, 3D visualization in digital environment, feature extraction by2D and 3D, data models, Advantages of digital photogrammetry, digital photogrammetric softwares. **Introduction to DTM:** digital surface modeling by DTM/DHM and DSM/DEM, Interpolation techniques, GRID and TIN, break lines, profiles, mass points, / random points, factors influencing choice of sampling patterns, DTM generation process, preprocessing, main processing, post processing, differential rectification, mosaicing. Data sources, / input to DTM, Direct and indirect data collection method, field survey, photogrammetry and Remote sensing data, maps. **Photogrammetry and GIS:** input of data from photogrammetry for GIS database, photogrammetric applications in GIS.	**10 Hours**

Course Outcome:

The students understand the basics of making measurements using aerial photographs and their applications.

Question Paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Elements of Photogrammetry with applications in GIS by Paul R Wolf and Bon A. Dewitt, 3rd edition, 2004, ISBN 007-123689-9
2. Aerial Photography and Image interpretation second edition by David P paine, and James D Kiser, 2003, John Wiley and Sons Inc. ISBN 0-471-20489-7
3. Interpretation of Aerial Photographs: TE Avery
4. Elementary Air Survey: W. Kilford.
5. Manual of Photogrammetry: ASP Falls Church Virginia.
6. Modern Photogrammetry by Edward M Mikhail
7. Photogrammetry Vol. I- Kranss

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I SEMESTER			
GEOSPATIAL DATABASE MANAGEMENT SYSTEMS (Elective-I)			
Subject Code	16CGI151	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

On completion of this subject, students should have a sound knowledge about the database concepts, database management systems and their applications in GIS and modeling the real world.

Note: The subject will be taught as applied to Geospatial Database Management

Modules	**Teaching Hours**
Module-1	
Databases and Users: Introduction, characteristics of database approach, intended uses of a DBMS, implications of database approach. **Database System Concepts and Architecture:** Data models, schemas and instances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of database management systems.	**10 Hours**
Module-2	
Data Modeling: High level conceptual data models for database design, ER model concepts, schema constructs and simple applications. **Record Storage and Primary File Organizations:** Secondary storage devices, buffering of blocks, placing file records on disk, operations on files – heap files and sorted files – hashing techniques. **Index Structure of Files:** Single-level and multilevel ordered indexes, dynamic multilevel indexes using B-trees and B+ trees. **Relational Data Model:** Concepts and constraints, update operations on relations, relational algebra, simple examples.	**10 Hours**
Module-3	

Structured Query Language: Data definition in SQL, queries, update statements, views in SQL, simple examples. Introduction and basics of Relation Database Management System. **Database design:** Functional dependencies and normalization for relational databases, Normal forms based on primary keys, gene general definition of second and third normal forms, Boyce-Codd normal form. **Query Processing:** Basic algorithms for executing query operations. **Transaction Processing Concepts:** Introduction, transaction and system concepts, properties, schedules and recoverability.	**10 Hours**
Module-4	
Concurrency and Recovery: Locking techniques for concurrency control, recovery concepts and techniques. **Design and implementation of Geospatial database:** Spatial database system, Spatial Indexing, SDBMS or RDBMS models	**10 Hours**
Module-5	
Advanced database concepts: Object–relational database management system (ORDBMS), Distributed databases, web services and XML, OLAP (Online Analytical Processing), OLTP (Online transaction processing). **New Applications:** Discussion on new applications like Decision Support System, Data Mining, Data Warehousing and Spatial Databases, Recent Developments.	**10 Hours**

Course Outcome:

Students will be exposed to basics of database, software tools and familiarization with geospatial database creation.

Question Paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Elmasri R. and Navathe S.B., "**Fundamentals of Database Systems**", Benjamin/Cummings Publishing Co. Inc. (Addison- Wesley world student series), 2002

2. Trembley J.P. and Sirenson P.G., "**An Introduction to Data Structures with Applications**", Tata McGraw-Hill.
3. Date C.J., "**An Introduction to Database Systems**", Vol-I, Addison-Wesley.
4. A.Silberschatz, H.F.Korth and S.Sudarshan, "**Database System Concepts**", McGraw-Hill International Editions, Computer Science Series.

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I SEMESTER			
ADVANCED REMOTE SENSING (Elective-I)			
Subject Code	16CGI152	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

Upon completion of this subject students should have gained the knowledge of optical and microwave remote sensing and also they become familiar with the basic principles and advantages of thermal and Microwave RS.

Modules	**Teaching Hours**
Module-1	
Thermal Remote Sensing: Thermal radiation principles, processes and thermal properties of materials, thermal conductivity, thermal capacity, thermal inertia, thermal diffusivity, emissivity, sensing radiant temperatures, radiant versus kinetic temperatures, blackbody radiation, atmospheric effects, interaction of thermal radiation with terrain elements, IR detection and imaging technology, thermal sensors and scanners, airborne IR surveys, satellite thermal IR images, spatial resolution and ground coverage, thermal IR broad band scanner and multispectral scanner, geometric characteristics of across track and along track IR imageries, distortions and displacements, radiometric calibration of thermal scanners, interpretation of thermal IR imagery, temperature mapping with thermal scanner data, thermal inertia mapping, apparent thermal inertia, applications of thermal remote sensing in geology, hydrogeology, urban heat budgeting.	**10 Hours**
Module-2	

Passive Microwave Remote Sensing: Basics of spectral characteristics of microwave radiometers, passive microwave scanners and sensors, applications in atmosphere, ocean and land.	**10 Hours**
Module-3	
Active Microwave Remote Sensing: RADAR- definition and development, Radar Systems –airborne and space borne Side Looking Radars (SLR), and their components, imaging systems, typical images, radar wavelengths, scattering theory, RADAR equation, factors affecting radar resolution, real aperture and synthetic aperture RADAR systems, geometric characteristics of radar imagery and transmission characteristics of radar signals, SLR stereoscopy and RADARgrammetry, RADAR return and image significance, coherence, phase unwrapping, polarization, image registration, baseline determination, measurement of surface topography and deformation analysis, satellite radar systems and images, image processing, RADAR image interpretation. SAR interferometry- principle, image processing, factors affecting SAR interferometry, Applications of active microwave sensors.	**10 Hours**
Module-4	
LIDAR Remote Sensing: Physics of laser, spectral characteristics of laser, laser interaction with objects, LiDAR: principle, Multiple return, Components of LiDAR Airborne Laser Terrain Mappers (ALTM), system, INS technology, INS-GPS integration, measurement of laser range, calibration, flight planning, laser range, accuracy of various components of LiDAR, raw data of DEM processing, data classification techniques, LiDAR data integration with spectral data, Space- borne LIDARS, LiDAR Applications	**10 Hours**
Module-5	
Hyper-spectral Remote Sensing: Hyper-spectral Imaging: Hyper spectral concepts, data collection systems, calibration techniques, data processing techniques; preprocessing, N-dimensional scatter-plots, Special angle mapping, Spectral mixture analysis, Spectral Matching, Mixture tuned matched filtering, Classification techniques, airborne and space-borne hyperspectral sensors, applications. High resolution hyper-spectral satellite systems: Sensors, orbit characteristics, description of satellite systems, data processing aspects, applications.	**10 Hours**
Course Outcome:	
Students will get exposure to modern and advanced satellite remote sensing techniques including retrieval of physical parameters like SST, LST, Terrain Analysis etc.	
Question Paper pattern: • The question paper will have ten questions. • Each full question consists of 16 marks.	

- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Fawaz T Ulaby, Richard K Moore and Adrian K Fung, Microwave Remote Sensing active and passive, Vol. 1, 2 and 3 Addison – Wesly Publication company 1981, 1982, and 1986.
2. Philip N Slater, Remote Sensing, optics and optical systems. 1980
3. Robert M Haralick and Simmonet, Image processing for remote sensing 1983.
4. Robert N Colwell Manual of Remote sensing Volume1, American Society of Photogrammetry 1983.
5. Travett J W Imaging Radar for Resources surveys, Chapman andHall, London 1986.
6. Remote sensing and Image Interpretation by Thomas M Lillesand and Ralph W. Keifer fourth Edition, 2002, 2003, John Wiley and Sons Inc.
7. Remote Sensing Geology by Ravi P Gupta, Second edition, 2003, Springer
8. Remote Sensing Principles and Interpretation by Floyd F Sabins, 1997, W H Freeman And Company

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I SEMESTER			
ADVANCED GEOGRAPHIC INFORMATION SYSTEMS (Elective-I)			
Subject Code	16CGI153	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

Upon completion students would be able to model and analyse the spatial data, utilize GIS as navigation guide, decision support and expert tool. Understand how to use a wide range of vector-based GIS tools to address quarries relevant to natural resource management. Analyse the requirements of a proposed application and synthesise an appropriate solution and customise a GIS.

Modules	**Teaching Hours**
Module-1	
Geodatabase: Basic geodatabase and structure, Types of geodatabase, Advantages of geodatabase, Basic geodatabase structure, Topology, relational classes, geometric networks, raster data - Creating geodatabase, organizing data, defining database structure - Understanding spatial reference in geodatabase – Modifying spatial domain, Simple feature creation in geodatabase, Creating and editing map topology, - Types of geodatabase annotation - Adding behaviour to a geodatabase.	**10 Hours**
Module-2	
Surface Analysis: Slope and aspect - Hydrologic functions - Viewsheds - Shaded relief maps Spatial analysis - Surface analysis - 3-D analysis – Map algebra - Cell statistics DEM, DTM and TIN **Model Building and Spatial Modeling:** Why build models - Anatomy of a model - Model elements - Introduction to scripting. The object model in GIS. Vector and raster data extraction for modeling, Land use classification, Temporal land use analysis, Spatial modeling procedure, Cellular automata modeling, Methods of spatial interpolation. **Data Accuracy, Error Assessment and Propagation:** Spatial data standards, Positional accuracy, Accuracy measurement techniques, Error in linear and area feature, Land use classification accuracy, Attribute accuracy, Error propagation in spatial attribute	**10 Hours**

Advanced Cartography: Annotations, labels, and metadata; Map making with advance tricks Working with labels and annotations – Managing (organizing and modifying) labels and annotations - Metadata file creation and management with new tools.	
Module-3	
Multi-Criteria Decision Analysis and Spatial Decision support System (SDSS): Elements of multi-criteria decision analysis, classification of decision problems, criteria evaluation, hierarchical decision alternatives and constraints, alternatives and decision variables, deterministic variables, criteria weighting , estimation weights, ranking methods, decision rules, multi-attribute decision rules, sensitivity analysis, SDSS, what is SDSS, requirements multi-criteria spatial decision support systems (SDSS). SDSS for location planning, application-specific capabilities.	**10 Hours**
Module-4	
Expert GIS : Introduction to concepts of Expert GIS, Data formats, Proprietary file formats, translator and transfer formats, open formats, standards, metadata, standards gazetteer, XML and GML, GIS and databases Spatial databases, relational databases, object databases, advanced database technology, derived mapping – generalization, text placement, automated cartography, data from imagery, Web GIS, simple maps in web pages, web software, Mobile GIS –positioning, location based services, personal and vehicle navigation, LBS for mass market, telematics. –Applications	**10 Hours**
Module-5	
Enterprise GIS : User need assessment; old and new spatial database models, SDE layers, Geodatabase, architecture design, capacity planning(Hardware), security planning, RDBMS, RDBMS software selection, GIS software selection, planning for migration. Enterprise GIS management. **Case Studies:** GIS analysis in transportation, GIS analysis in water management, urban development, environmental analysis, hydrological modeling, Habitat suitability modeling, virtual cities 3D modeling and visual simulation, Automata based models of Urban system	**10 Hours**
Course Outcome:	
Students will be equipped with modern tools, softwares of GIS and be confident to implement a GIS project independently or as a team effort.	
Question Paper pattern: • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2full questions (with a maximum of four sub questions) from each module.	

- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. GIS and Multi-criteria decision analysis by Jacek Malczewski, John Wiley and sons.
2. Expert Systems by Peter Jackson, third edition, 1999, Pearson Education.
3. Concepts and Techniques of Geographic Information Systems, CP Lo, Albert K W Yeung, 2005 Prantice Hall of India
4. Geographic Information Systems – An introduction by Tor Bernhardsen, John Wiley and Sons, Inc., New York, 2002.
5. Remote sensing and Image interpretation by Thomas M. Lillesand and Ralph W. Kiefer, John Wiley and Sons Inc., New York, 1994.
6. Geographical Information Systems – Principles and Applications, Volume I & II, edited by David J. Maguire, Micheal F Goodchild and David W Rhind, John Wiley Sons. Inc., New York 1991.

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I SEMESTER			
GEOINFORMATICS LABORATORY-I			
Subject Code	16CGI16	**IA Marks**	20
Number of Lecture Hours/Week	03	**Exam Marks**	80
Total Number of Lecture Hours	40	**Exam Hours**	03

Course Objectives:

Upon completion students would be able to model and analyse the spatial data, utilize GIS as navigation guide, decision support and expert tool. Understand how to use a wide range of vector-based GIS tools to address quarries relevant to natural resource management. Analyse the requirements of a proposed application and synthesise an appropriate solution and customise a GIS.

Modules	**Teaching Hours**
Module-1	

Remote Sensing: Familiarization with Maps of different scales (SOI Toposheets) Familiarization with Monochromatic and Multispectral Satellite Imagery (Creation of FCC) Downloading Satellite Images Study of Spectral Signatures with Spectroradiometer Geometric Correction of Satellite Data(Georeferencing, Mosaicing and Subsetting)	**10 Hours**
Module-2	
Geographic Information System: Import and Export of Satellite data to various formats using different softwares Visual Interpretation of Aerial photographs & Satellite Imagery and area measurement (Dot grid, Planimetetrs etc.) Spatial Data creation using field data in GIS Software environment Feature extraction (Vectorization) using GIS Softwares	**10 Hours**
Module-3	
Photogrammetry: Stereo Test Familiarization with Mirror Stereoscope Familiarization with the use of Parallax Bar Determination of height of objects from stereo pairs	**10 Hours**
Module-4	
Photogrammetry: Feature extraction and tracing of details from stereo pairs Demonstration on Digital Photogrammetric Station Orthophoto generation	**10 Hours**
Course Outcome:	
Students will be equipped with modern tools, softwares of GIS and be confident to implement a GIS project independently or as a team effort.	

REFERENCE BOOKS:

1. **ERDAS Field Guide,** 4th Edition, 1997, ERDAS Inc, Georgia
2. **Using ArcCatalog,** Aleta Vienneau, 2001, ESRI
3. **ArcGIS 9 – Using ArcGIS Desktop,** 2006, ESRI
4. **ArcGIS 9- Getting Started with ArcGIS,** 2004, ESRI
5. **Building a Geodatabase,** Andrew McDonald, 2001, ESRI
6. **ArcGIS 9 – Geodatabase Workbook,** 2004, ESRI
7. **Introducing Geographic Information Systems with ArcGIS,** Michael Kennedy, 2006, John Wiley &Sons Inc, New Jersey
8. **ERDAS Stereo Analyst User's Guide,** 2000, ERDAS Inc., Georgia
9. **IMAGINE OrthoBASE User's Guide,** 2001, ERDAS
10. Elmasri R. and Navathe S.B., "**Fundamentals of Database Systems**", Benjamin/Cummings Publishing Co. Inc. (Addison-Wesley world student series), 2002

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II SEMESTER			
SATELLITE DATA IMAGE PROCESSING			
Subject Code	16CGI21	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

The course aims at introducing the various processing techniques used to enhance, interpret images and extract information from images.

Modules	**Teaching Hours**
Module-1	
Digital Data: Introduction- Satellite data acquisition –Storage and retrieval – Data Formats – Compression – Satellite System – Data products – Image processing hardware and software. **Image Rectification and Restoration:** Geometric correction- Radiometric correction – Noise removal.	**10 Hours**
Module-2	
Image Enhancement: Contrast Manipulation –Gray-Level Thresholding- Level Slicing Contrast Stretching – Convolution – Edge Enhancement – Spatial feature manipulation –Fourier Analysis. **Multi Image Manipulation:** Spectral Ratioing –Principal and Canonical Components– Vegetative Components – Intensity – Hue – Saturation – Colour Space Transformation**.** **Rectifying a Camera Image:** Perform Image to Image Rectification – Check Map Models – Ortho-rectification- Area correlation –Resampling- Multi-image fusion- Spatial and spectral domain fusion.	**10 Hours**
Module-3	
Information Extraction: Principal Component Analysis (PCA), Ratio Images, Multispectral Classification – Supervised and Un-supervised Classification methods, Graphical representation of the spectral response patterns, Quantitative expression of category separation, Self-classification of training set data, interactive preliminary classification,	**10 Hours**

representative and subsene classification, Hybrid –Classification – Classification of Mixed Pixels. **Output generation:** Graphic Products – tabular data, Digital Information files – Post Classification Smoothing – Classification Accuracy Assessment. Classification error matrix, sampling consideration, evaluating classification error matrix.	
Module-4	
Data Merging and GIS Integration: Multi-temporal Data merging, Multi-sensor image merging – Merging of image data with Ancillary data- Incorporating GIS Data in automated land cover classification. **Change detection:** Binary change detection, multi-date composite image change detection.	**10 Hours**
Module-5	
Hyper-spectral Image Analysis and Radar image analysis: Atmospheric correction – Hyper-spectral image analysis techniques. SAR data processing and analysis. **Image Analysis and Understanding:** Pattern recognition – Shape analysis- Textural and contextual analysis – Decision concepts – Fuzzy sets and evidential reasoning. **Advanced Concepts:** Artificial intelligence and expert systems – Artificial Neural Network concepts, genetic algorithms and programming.	**10 Hours**
Course Outcome:	
Students will acquire skills of information extraction from raw data; they would also learn data processing, enhancement and output generation.	
Question Paper pattern: • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	

REFERENCE BOOKS:

1. John R Jenson 'Introducing Digital Image Processing" Prantice Hall. New Jersy 1986.
2. R. A. Schowengergt, 'Techniques for Image Processing and Classification in Remote Sensing'; 1983
3. Robert A Schowengergt, 'Remote Sensing – Models and Methods for Image Processing' Academic Press 1997
4. Hord R M, Academic Press, 1982.

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II SEMESTER			
APPLICATIONS OF GEOINFORMATICS IN NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT			
Subject Code	16CGI22	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

On completion of study of this subject the students would have a sound knowledge of application of remote sensing, GIS, GPS and other tools for understanding the concepts of natural resources management, changes in environment, monitoring the pollution affected areas and would be able to prepare suitable action plans for sustainable development.

Modules	**Teaching Hours**
Module-1	

Concepts of natural resources management: Types of natural resources, renewable, non-renewable, Linkages of natural resources with the economy, impact of natural resources utilization on Earth system functioning, , National Natural Resources Management Systems (NNRMS), Natural Resources Census, Natural Resources Information Systems. **Geological Resources Exploration:** Geomorphological Mapping: Mapping geological structures-folds, faults, joints and lineaments, Lithological mapping, Mineral resources mapping and Mineral Resources Information System; encroachment mapping, GIS in mine remediation and mine reclamation **Land Resources Management:** Soil survey, soil classification, soil series establishment, profile studies, Land Use Land Cover Mapping, Wetland Mapping, Wasteland Mapping, Land Degradation and Desertification Mapping, Soil Conservation Measures, Soil Erosion Modeling, Land capability Maps, land/ soil irrigability maps and Land Resources Information Systems (LRIS).	**10 Hours**
Module-2	
Agro-ecosystem management: Agro-climatic zonation, Crop Acreage Production Estimation (CAPE), Forecasting Agriculture output through Satellite and Land-based observations (FASAL), Crop norm violation, Cropping systems analysis, RS basis for crop insurance claim. Satellite agro-meteorology; Thermal RS application for crop stress detection, & Microwave application in agriculture, Space inputs for precision agriculture, Agro-climatic planning and information Bank (APIB), Site suitability studies for agricultural crops, horticultural crops. Horticulture, Sericulture, inputs management. **Forest Resources management:** Mapping and inventorying of forest resources, Forest biomass estimation, carbon sequestration, forest fire mapping and monitoring, forest fire risk zonation, Biodiversity conservation planning, eco-restoration and eco-development; encroachment mapping and monitoring, Forest Management Plans, and Working Plans. Inputs for preparation of working plan/management plan. Environmental Impact assessment of mining and Industrial activities., Microwave application in Forestry, Wildlife ecology applications- Habitat management- wildlife habitat selection, habitat fragmentation, protected areas, Catchments area treatment plans, waste land development, forest plantations and its monitoring, joint forest management, forest resource information system.	**10 Hours**
Module-3	

Water Resources Management: Hydrological cycle, Surface water resources mapping and management; Integrated river basin management, Inter river basin connectivity mapping, river diversion studies, Site suitability for surface storages and hydro-electric power plants, Digital elevation models and their applications, storage yield analysis and reservoir sizing, Floodplain mapping and flood plain zoning, flood mitigation measures, flood water diversion for irrigation. Ground water modeling, preparation of ground water prospecting and recharging maps.	**10 Hours**
Module-4	
Introduction to Environment: Components of environment, biotic and abiotic components, laws of conservation of mass and energy, the basics of thermodynamics, concepts of ecosystem, bio-geo-chemical cycles, ecological pyramids, food webs, energy flow and ecosystem functioning. **Sustainable Development:** Concept of sustainability, Integrated Mission for Sustainable Development, Watershed characterization, Acton Plans for Sustainable development, watershed prioritization, developmental impact assessment, Action plans for Sustainable Agriculture and Space-based Information System for Decentralized Planning (SIS-DP), Sujala Watershed Project in Karnataka.	**10 Hours**
Module-5	
Water Pollution Applications: Siltation estimation and storage loss estimation, water quality index mapping, point source pollution mapping, non-point source pollution modeling, eutrophication and water vegetation mapping, methane production area mapping and modeling, Modeling of dams and reservoirs for estimation of damage to natural resources, oil slicks tracing and monitoring, sea turbidity and sedimentation mapping, coastal erosion mapping, coastal habitat degradation mapping, ground water contamination studies, Groundwater-pollution hazard assessment and protection planning using GIS techniques; groundwater quality index mapping. **Air and Atmospheric Pollution Applications:** Aerosol remote sensing, air quality indexing and mapping, dynamic air pollution modeling, mapping and measuring troposphere pollutants, environmental sensitivity index mapping; spread and dispersion of smoke plumes from industries and power plants, forest fires, oil wells, etc. **Miscellaneous Applications:** RS and GIS Applications in noise pollution and light pollution monitoring. GIS modeling for bioterrorism, ecology of vectors of epidemics, mapping epidemic vulnerable zones.	**10 Hours**
Course Outcome:	
Students would learn the basic concepts of natural resources management, environmental protection, earth system functioning, ecosystem services, sustainable development.	

Question Paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Introduction to Environmental Remote Sensing by Barrett E.C., Curtis, I.F., Chapman and Hall, New York, 1982
2. Remote Sensing principles and Interpretations- Sabins, F.F., (Ed) W.H. Freeman and Co., New York, 1986
3. Remote sensing and Image interpretation - Thomas M. Lillesand and Ralph W. Kiefer, John Wiley and Sons Inc., New York, 1994.

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II SEMESTER			
FUNDAMENTALS OF CARTOGRAPHY, GEODESY AND GLOBAL POSITIONING SYSTEM			
Subject Code	16CGI23	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

Upon completion of this subject students should have gained the knowledge of Cartography, Geodesy, and Global Positioning System and also they become familiar with the basic principles and their applications in Geoinformatics Projects.

Modules	**Teaching Hours**
Module-1	

Introduction to Cartography: Definitions, terms, concepts, types, history, applications, conventional cartography v/s digital cartography, cartographic process, cartographic products, cartographic materials, overview of cartography. **Introduction to Map:** Types of map, map scale, classes of maps, map composition, the mapping process, map projection, Map Numbering Systems; Base Maps & Thematic Maps; Map Legend, Symbols & Border Information; Design & Layout of Maps, geographic content of the map, label placement. **Digital Cartography:** Cartography in context of GIS, Principles of cartographic design in GIS, cartographic generalization, atlases and electronic atlases, hypermaps and digital spatial libraries.	**10 Hours**
Module-2	
Geodesy **Introduction to Geodesy: Definitions**, terms, types, history, fundamental goals of geodesy; shape and size of the earth, applications, overview. **Projections and Co-ordinate Systems:** Classification of map projections, Datum surfaces and Coordinate system, Transformations, Introduction to Azimuthal, Conical and Cylindrical projections with emphasis on LCC, Polyconic and UTM. **Geometric Geodesy:** Earth, geoid and reference Ellipsoid, Everest Spheroid, WGS 84, Vertical datum, Mean Sea Level, geometry of ellipsoid, level surfaces, plumb line and deflection of the vertical, coordinate system in geodesy.	**10 Hours**
Module-3	
Satellite Geodesy: Introduction – Normal orbits, Equation of motion and laws of Kepler, geometry of elliptic orbit, line orbit in space, perturbed orbit, Lagrange and Gaussian Planetary equations, Gravitational perturbation, Doppler surveying	**10 Hours**
Module-4	
Introduction to satellite-based Positioning systems: GPS Definition, concept, GPS working principle, history and timeline, overview. Components of GPS – Space segment; control segment, user segment- types of receivers ; GPS satellite signals, GPS data, position and time from GPS, code phase tracking, Accuracy and error sources, Techniques to improve accuracy- augmentation, precise monitoring, GPS time and data, GPS modernization.	**10 Hours**
Module-5	

DGPS – History, need for DGPS, concepts and principles, differential corrections, accuracy in DGPS, local area DGPS, wide area DGPS, carrier phase DGPS, pseudolites, LAAS, WAAS; rapid methods with GPS – rapid static method, semikinematic method, kinematic method. Real time DGPS. **Planning and Realization of GPS Observations:** Ground control for geometric correction of satellite imagery using DGPS. Ground control points, types, density, planning, reconnaissance survey, field observations, Criteria for Selecting reference station, reference station equipments, operational procedures, post processing, Georeferencing. **Applications: A**pplications in Engineering and Monitoring; Special applications of GPS, etc., GPS Technique and project cost.	**10 Hours**

Course Outcome:

Familiarization with Maps, Map reading, projection systems, Global Navigation, Satellite Systems & their applications in infrastructure planning & facilities of management.

Question Paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Satellite Geodesy: Gunter Seebar,
2. GPS satellite surveying: Alfred leick
3. Essentials of GPS, N K Agrawal

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II SEMESTER			
WEB APPLICATIONS IN GEOINFORMATICS			
Subject Code	16CGI24	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

On completion of study of this subject, students would have a sound knowledge about the Web GIS and its Applications for serving the geospatial data to the clients. One would be able to web design utilizing web GIS softwares.

Modules	**Teaching Hours**
Module-1	
Introduction to Web GIS: Definition, concept of Web GIS, History of web GIS, components of web GIS, internet, web GIS v/s Internet GIS, Fundamentals of computer networking – network environment – network communication models –protocols – TCP/IP. Applications of web GIS, users and stake holders of web GIS, advantages and limitations of web GIS, overview of Web GIS. **Client/server Computing:** Client – server – glue – client/server system partition– layered architecture – advantages and disadvantages of client server architecture. Distributed component framework – web mapping – static and interactive web mapping – open GIS web map server.	**10 Hours**
Module-2	
Distributed geographic information services: Principle – components – logic and data components. **Geographic Markup Language:** Principles – characteristics – commercial web mapping programs - mobile GIS. Distributed GIS in data warehousing and data sharing.	**10 Hours**
Module-3	
Functions of Web GIS: Display of general information for the public, display of planning information, interactive display of spatial information sharing and distribution of spatial data as well as management of spatial data.	**10 Hours**

Design of User Graphic Interface User friendly interface, characteristics, menus and icons, common terms. Graphic Appearance - colours, sizes, fonts, scales and arrangement.	
Module-4	
Web GIS Software. Brands of software used to develop web GIS at the server and client sides. Evaluation of different brands, ArcIMS, Map Objects, Mapguide, Map Server, Geomedia web map, Fulcrum, Vectoreyes. **Web GIS Data.** Classification of WEB GIS data, Geospatial data, type, characteristics, distribution, GIS interactive maps, - general maps at regional level, very detailed maps down to lot level. Level of Service (LOS) Level of Contents (LOC) Level of GIS Functions or Level of Functions (LOF). A Cross Tabular Matrix (CTM) approach. **Stake–holders,** users, owners and organizations of web GIS, policies and laws pertaining to web GIS, Watermarking Geo-Spatial Data.	**10 Hours**
Module-5	
Applications of WEB GIS: Participatory GIS -Web-based GIS For Collaborative Planning And Public Participation, Digital Democracy for planning, web GIS An Aid To Local Environmental Decision-making, web GIS for regional and local level planning. Community GIS, Internet GIS Applications in intelligent transportation systems, planning and resource management. E-Governance, Bhoomi project, Bangalore-1, Electronic Government Proposals.	**10 Hours**
Course Outcome:	
Students understand the concept of client-server model, hosting of server/client application. Development of application and integration with database for data reviewed. Functionalities of development of customized web application.	
Question Paper pattern: • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	
REFERENCE BOOKS: 1. Zhong- Ren Peng, Ming-Hsiang Tsou, (2003) Internet GIS: Distributed Geographic Information Services for the Internet and Wireless Networks, Wiley. 2. Korte, G. B., (2001})"The GIS book": 5th Edition, Onward press, Australia. 3. Cartwright, W., M.P. Peterson, G. Gartner (Eds) "Multimedia Cartography',	

Berlm: Springer.
4. Kraak, M., and A. Brown (2001)" Web Cartography: Development and Prospects, London": Taylor and Francies.
5. Kraak, M. and F. Ormeling (2003) "Cartography: Visualization of Geospatial Data", Delhi: Pearson Education.

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II SEMESTER			
INTRODUCTION TO COMPUTER ENGINEERING (Elective-II)			
Subject Code	16CGI251	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03
Course Objectives:			
Modules			**Teaching Hours**
Module-1			
Introduction: Functionalities of Computer, Generations of computers, Types of Computers, Components of Computer, Central Processing Unit, Input/output Devices, Memory, RAM,ROM, Motherboard, Memory Units, Ports, Data & Information, Networking, Operating Systems, Internet & Intranet. **Computer Architecture:** Fundamentals of Computer Design, Instruction Level Parallelism, Multithreading, Thread level Parallelism, Multiprocessing, Memory Hierarchy Design.			**10 Hours**
Module-2			
Operating Systems: Operating system Structures, Process Management, memory management, Storage management, Protection & Security, Virtual machines, Distributed systems, Influential Operating systems, Case Studies: Linux, Windows			**10 Hours**
Module-3			

Programming Languages: Introduction, Programming Language Syntax, Name Scope and Bindings, Semantics Analysis, Target Machine Architecture, Control Flow, Data Types, Data Abstraction and Object Orientation, Functional Languages, Concurrency, Scripting Languages, Building a Runnable Program, Run time Program management, Code improvement	**10 Hours**
Module-4	
Python Scripting: Introduction, Environment setup, Syntax, Variable Types, Operators, Decision statements, Loops, Numbers, Strings, Lists, Tuples, Dictionary, Modules, File I/O, Exceptions & Exception Handling, Classes & Objects, Classes & functions, Sets of Objects, Inheritance, linked Lists, Stacks, Queues, Trees.	**10 Hours**
Module-5	
HTML & JavaScript: HTML: Syntax, Elements, Attributes, Headings, Paragraphs, Styles, Formatting, Comments, Colours, CSS, Links, Images, Tables, Lists, Blocks, Classes, HTML JavaScript; JavaScript: Lexical Structure, Types, Values and Variables, Expressions and Operators, Statements, Objects, Arrays, Functions, Classes & Modules, Pattern Matching with Regular Expressions.	**10 Hours**

Course Outcome:

Basics of computer components, Basic of Operating System (OS), CPU & Softwares. Skill will be imparted to web enable the spatial data.

Question Paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Computer Architecture A Quantitative Approach - John L. Hennessy, David A. Patterson, 4th Edition, Elsevier, 2006
2. Operating System Concepts – Avil Sillberschatz, Peter Baer Galvin, Greg Gayne
3. Programming Language Pragmatics - Michael L. Scott, 2nd Edition, Elsevier,2006
4. Programming Languages Concepts and Constructs - Ravi Sethi, 2nd Edition, Pearson Education, 1996.
5. How to think like a computer scientist : learning with Python - Allen Downey, Je_rey Elkner, Chris Meyers.
6. JavaScript: The Definitive Guide - David Flanagan, 6th Edition

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II SEMESTER			
APPLICATIONS OF GEOINFORMATICS IN URBAN PLANNING AND MANAGEMENT (Elective-II)			
Subject Code	16CGI252	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

Upon completion of this subject the student would be able to understand the concepts and principles and use the tools and techniques of geo-informatics for efficient planning and management of Urban area.

Modules	**Teaching Hours**
Module-1	
Large Scale Mapping and Cadastral Information System: Technologies for Large Scale Mapping (LSM) of urban areas – Aerial Photography - High- Resolution Satellite Remote Sensing - Electronic Distance Measurement (EDM) -Total Station - Differential Global Positioning System (DGPS) – Issues in Large Scale Mapping (LSM), Integrated approach to LSM, Concept of Cadastre, History of cadastral survey, Cadastral survey methods and survey maintenance, cadastral map reproduction, development of cadastral information system.	**10 Hours**
Module-2	
Urban Mapping and Spatial Analysis: Urban process, the physical structure and composition of urban areas, Urbanisation process, growth trend, problems of urbanisation, information requirements for perspective planning, Scale and resolution concepts and interpretation techniques for urban and regional analysis, urban GIS, spatial analytical techniques, statistics and visualization, conceptual modelling of urban processes; Urban Sprawl: Change detection in Land Use Land Cover monitoring physical growth of urban area, trends in urban sprawl and associated problems. **Urban Planning:** Plans – planning needs, types of plans, urban and regional planning; LU/LC mapping Urban Planning: Zoning of Land Use, Zonal Land Use Plan, Object oriented GIS data modeling for urban design, landscape architecture, urban infrastructure, Site selection for urban development, site suitability analysis for utilities and civic amenities, interim master plan, Master Plan.	**10 Hours**

AM/FM Applications: GIS/GPS applications in Automated mapping (AM) and Facility management (FM), Urban infrastructure planning and management.	
Module-3	
Demographic and Business Applications: Geo-Demographics- Population distribution maps by age, gender, education, occupation, socioeconomic grouping, health criteria index, crime rates and types. **Business GIS -** Market analysis, retail site selection, retail planning, health care planning, financial services planning, educational institutions planning, water demand modeling and planning distribution network, household analysis, real estate inventory, mapping and GIS. Crime Analysis, Electoral Redistricting. **Network Applications:** Transportation demand modeling and analysis, transportation planning, Vehicle Routing and Scheduling, Vehicle Tracking and Navigation: Integration of GPS and GIS data, intelligent transportation systems, streets network analysis; pavement management system (PMS) Water and sewage related- GIS based urban water demand analysis, pipeline planning and alignment	**10 Hours**
Module-4	
Urban Ecology Applications: Air quality indexing and mapping, monitoring atmospheric haze, smoke, toxic gas movement and prediction of vulnerable zones. Noise pollution zonation, Natural resources inventory and management- conservation of water bodies, vegetation, storm water system GIS; soil and groundwater conservation, site suitability for ground water recharging and rain water harvesting, urban area heat budgeting, Logistic management and spatial planning for solid waste management. **Urban Disaster and Emergencies Management:** Mapping vulnerable zones with respect to earthquake, flood, fire, terrorist attacks, and finding optimum routes for ambulances, and emergency services, GIS modeling for Hazard risk and emergencies management	**10 Hours**
Module-5	
Cultural GIS: Mapping heritage buildings, monuments, places of worship, tourism spots, recreation facilities, sports facilities and serving on web GIS. **Urban Governance:** Governance of urban regions: mapping administrative boundaries, city base map generation, property enumeration and property GIS, tax revenue rationalization, e-governance, Metropolitan Spatial Data Infrastructure, metropolitan information management system, Urban GIS and Smart Cities.	**10 Hours**
Course Outcome:	

Basics of Urban Planning, Demographic changes & an assessment of infrastructure needs will be learnt.

Question Paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Remote Sensing and Urban Analysis Jean-Paul Donnay et al, GISDATA Series, 2001, Taylor and Francis Inc.
2. GIS and GPS based asset management for Road and Railway Transportation Systems - GPS based vehicle tracking system. www.gisdevelopment.net, www.esri.com, www.aboutgis.com

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II SEMESTER			
APPLICATION OF GEOINFORMATICS IN OCEAN, MARINE AND COASTAL RESOURCES MANAGEMENT (Elective-II)			
Subject Code	16CGI253	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

Upon completing the study of this subject the student would be able to use RS/GIS software and various modeling tools in understanding the Earth's oceans, the ocean resources and their management. They will have been exposed to geo-informatics applications to oceanography, marine and coastal environment.

Modules	**Teaching Hours**
Module-1	

Marine Resources Management: Types of marine resources, Marine life and marine environment, properties of sea water, thermocline and pycnocline, air-sea interactions, ocean circulation, Upwelling and Downwelling, Monsoons, El Nino-Sothern Oscillation conditions, Tides and tidal energy, marine pollution and management.	**10 Hours**
Module-2	
Oceanographic Studies: Interdisciplinary nature of oceanography, Remote sensing of oceans, ocean processes, ocean resources, satellites and sensors for ocean studies, spectral bands for study of ocean parameters, sea ice monitoring, Physical applications – Estimation of wind velocity & direction, sea surface temperature, upwelling, sea surface velocities, mixed layer depth, salinity, ocean colour, etc; Biological applications - Phytoplankton mapping, Ocean primary production, potential fishing zones, Suspended Sediment concentration mapping; monitoring seafloor morphological changes, Coastal Bathymetry; Coastal Geomorphology, identification & monitoring of Coastal habitat (Mangrove, Coral reefs, wet lands etc); Integrated Coastal Zone Management, addressing coastal environmental issues. Marine Atlas Project;	**10 Hours**
Module-3	
Coastal Engineering Applications: The Coast- beaches and shoreline processes, Coastal Hydrodynamics– coastal erosion and protection – different Coastal protection works – design of Breakwaters – Hydrodynamics of pollution dispersion – Estuaries and their impact on coastal process – Modelling of suspend sediment.	**10 Hours**
Module-4	
Coastal Zone Applications : Introduction – Major issues/problem – coastal wetland classification – thematic maps on coastal resources- site suitability analysis for aquaculture – Coastal Regulation zone – Coastal aquifer modeling using GIS- Integrated coastal Zone Management – conflict analysis – Resources association.	**10 Hours**
Module-5	
Meteorology Applications: Estimation of weather and climate parameters, and modeling aspects, global climatology. Rainfall mapping, hydrometrics and field measurement of water flows and water quality parameters, potential and actual Evapo-transpiration, Hydrometeorology: atmospheric water content, cloud mapping, rain forecasting, artificial rain, cyclone forecasting.	**10 Hours**
Course Outcome:	

Students would learn the basic relationship between Marine & Coastal Resources Air-Sea interactions & basic of weather monitoring & climate change.

Question Paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Introduction to Environmental Remote Sensing Barrett E.C., Curtis, I.F., Chapman and Hall, New York, 1982
2. Remote Sensing principles and Interpretations Sabins, F.F., (Ed) W.H. Freemanand Co., New York, 1986
3. Remote sensing and Image interpretation Thomas M. Lillesand and Ralph W. Kiefer, John Wiley and Sons Inc., New York, 1994.
4. Coastal and Marine Geo-Information Systems: Applying the Technology to the Environment. David R. Green, Stephen D. King, 2003.

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II SEMESTER			
GEOINFORMATICS IN DEMOGRAPHY, BUSINESS, HEALTH AND INFRASTRUCTURE PLANNING (Elective –II)			
Subject Code	16CGI254	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

On completion of study of this subject the student would be able to analyze demographic data, economic data, epidemiological data and others and use it for making spatially informed decision.

Modules	**Teaching Hours**

Module-1	
Geodemographics: Spatial distribution of population according to age, gender, and socio-group, racial and socioeconomic segregation, geoethnography, labour market exploration, health equality, crime analysis, population and environmental linkage, spatial planning, temporal analysis, spatial dispersal and sparsity, changing pattern of demography, GIS functionality for demographic analysis.	**10 Hours**
Module-2	
Business GIS: Competitive market analysis, trade area analysis, site analysis and selection for distribution centers and shopping centres, customer service stations, facility management, target marketing, market demographics demographic analysis for marketing based on customer profiling, lifestyle matching and consumer behaviour, sales promotion planning, advertisements targeting; geo-market segmentation by product category, sales territory rationalization, forecasting market potential and modeling sales.	**10 Hours**
Module-3	
Health GIS: Spatial epidemiology: RS and GIS in study of epidemics and their control- malaria, leprosy, polio, TB, filariasis, dengue, chikengunya, cholera, AIDs Cancer; disease mapping, ecological analysis, disease clustering, bioterrorism and disease surveillance, infectious disease modeling. Health infrastructure and facility location mapping, planning future health facility requirement, disease surveillance and monitoring and other health indicators, Karnataka Health Systems Development Project, health and disease atlas of India and medical geography, internet and health GIS, integrated disease surveillance system, spatial distribution and spread of diseases.	**10 Hours**
Module-4	
Power: Site suitability assessment for power plants- thermal, hydroelectric, nuclear, mini-hydroelectric power plants, wind power, and impact assessment. Electrification and network planning, GIS in management of electricity distribution network, underground cable maintenance and management in power sector, GIS as decision support system, **Telecommunication:** Applications of GIS in telecommunication industry, internet GIS for telecommunication, facility management in telecommunication industry, optical fiber cable alignment. **Transportation:** Transportation GIS: vehicle routing and scheduling, optimizing routes and schedules, delivery routing/fleet management, vehicle navigation, vehicle tracking system, intelligent transportation system	**10 Hours**
Module-5	

Tourism: Tourism internet GIS applications, tourism planning, tourism marketing, tourism research, tourism impact, ecotourism planning, **Archeology:** RS and GIS applications in mapping cultural heritage, spotting historical monuments and sites, identification of palaeorivers, GIS of historical maps.	**10 Hours**

Course Outcome:

The students will be exposed to the concepts of spatial Based Decision Supports in the areas of Health, Power, Transportation etc., and how the spatial based related data can be analysed and applied for better facilities.

Question Paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. "GIS and GPS based asset management for Road and Railway Transportation Systems "- GPS based vehicle tracking system.
2. www.gisdevelopment.net, www.esri.com www.aboutgis.com

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II SEMESTER			
GEOINFORMATICS LABORATORY-II			
Subject Code	16CGI26	**IA Marks**	20
Number of Lecture Hours/Week	03	**Exam Marks**	80
Total Number of Lecture Hours	40	**Exam Hours**	03

Course Objectives:

Upon completion students would be able to model and analyse the spatial data, utilize GIS as navigation guide, decision support and expert tool. Understand how to use a wide range of vector-based GIS tools to address quarries relevant to natural resource management. Analyse the requirements of a proposed application and synthesise an appropriate solution and customise a GIS.

Modules	**Teaching Hours**

Module-1	
Digital Image Processing: Atmospheric & Radiometric Correction of Satellite Images Image Enhancement Techniques(Spatial, Spectral and Radiometric) Classification Techniques – Unsupervised and Supervised Classification and Change Detection Calculation of area and Accuracy Assessment	**10 Hours**
Module-2	
Geographic Information System: Editing Vector Layers, Spatial and Non spatial querying using open source and proprietary GIS packages, Spatial data quality evaluation Overlay Analysis, Buffer Creation and Analysis, Network Analysis, DEM and TIN Creation	**10 Hours**
Module-3	
Global Positioning System: Familiarization with GPS Instrument and Software GPS Survey of Natural and Man-made features GPS & GIS data integration and output preparation	**10 Hours**
Module-4	
Environmental Management Applications: Delineation of Ltithological/geomorphic units Identification of forest types and area estimation Use of spectroradiometer and crop signature generation NDVI and biomass relationship Field visit and soil profile study LU/LC Map Preparation Delineation of Watershed	**10 Hours**
Course Outcome:	

Students will be equipped with modern tools, softwares of GIS and be confident to implement a GIS project independently or as a team effort.

REFERENCE BOOKS:

1. **ERDAS Field Guide,** 4th Edition, 1997, ERDAS Inc, Georgia
2. **Using ArcCatalog,** Aleta Vienneau, 2001, ESRI
3. **ArcGIS 9 – Using ArcGIS Desktop,** 2006, ESRI
4. **ArcGIS 9- Getting Started with ArcGIS,** 2004, ESRI
5. **Building a Geodatabase,** Andrew McDonald, 2001, ESRI
6. **ArcGIS 9 – Geodatabase Workbook,** 2004, ESRI
7. **Introducing Geographic Information Systems with ArcGIS,** Michael Kennedy, 2006, John Wiley &Sons Inc, New Jersey
8. **Using ArcGIS Geostatistical Analyst,** Kevin Johnnston, Jay M. Ver Hoef, Konstantin Krivoruchko and Neil Lucas, 2001, ESRI
9. **Using ArcGIS Spatial Analyst,** Jill Mc Coy and Kevin Johnson, 2001, ESRI
10. **ArcGIS 9 – Geoprocessing in ArcGIS,** 2004, ESRI

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IV SEMESTER			
GEOINFORMATICS PROJECT PLANNING AND MANAGEMENT			
Subject Code	16CGI41	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

The objective of this subject is to enable the students to formulate, plan, execute and manage Geoinformatics projects.

Modules	**Teaching Hours**
Module-1	
Introduction: Definition of plan, project, program and scheme. Functions of planning and management. Components of Geoinformatics project. Overview of Geoinformatics projects, types of projects. **GIS Project Planning:** Project phases and Project life cycle, project stakeholders, system development lifecycle, Software development models, Project initiation, systems planning and methodology, systems analysis and user requirements studies, GIS software evaluation and selection, Hardware considerations and acquisition, Geographic database design – conceptual, logical, and physical data modeling, planning and database issues - screening of project ideas, selection of project based on techno-economic feasibility analysis, project formulation, product and project design, project report preparation. Project proposals. A case study.	**10 Hours**
Module-2	
Project Costs: Elements of cost, costing techniques, resources planning, cost components of a geo-informatics project- men, Hardware and software costs, cost of Remote Sensed Data /Imageries, Maintenance cost, organizational cost, service charges, outsourcing cost, pricing the product / service. Cost budgeting. **Project Appraisal:** Project appraisal Methods -Discounting and non-discounting techniques, Benefit Cost Ratio, Break Even Point Analysis, Cost and Return simulation, return on investment. **Project Time, Quality and Cost Management:** Project scheduling-network analysis, PERT and CPM techniques, Gant chart, time and cost	**10 Hours**

crashing. Project cost and time control, feedback mechanisms, quality control / quality assurance. Data standards, interoperability, ISO standards.	
Module-3	
Planning A Geo-informatics Project: Government Geo-informatics projects, Corporate or Enterprise GIS, Health GIS, Census GIS, Market/Business GIS, GIS Strategic Plan, Needs Assessment and Requirements Analysis, Organizational Involvement, Evaluating Existing Data, Accuracy, Completeness. Maintenance, Software and hardware Selection, Technical Environment, Assessing Costs and Benefits, Pulling the needs and ends together. **Project Scope and Risk Management:** Project scope definition, scope verification, scope change control, risk management planning, project risk identification, quantitative and qualitative risk analysis, risk response planning, risk monitoring and control.	**10 Hours**
Module-4	
GIS Organizations: Vision, mission, goals and objectives, organizational chart, organizational approaches- democratic, authoritative, roles and responsibilities of personnel, recruitments, training, motivation, organizational behaviour, conflict resolving, team building, promotion/ demotion.	**10 Hours**
Module-5	
Management Issues in GIS: Making GIS efficient, effective and safe to use, data as management issue, GIS as a management tool, impact of broad societal issues. **Trends in GIS:** Enterprise GIS, Corporate GIS, BPO in GIS, Spatial Data Warehouse, Interoperability and Open GIS, NSDI**.**	**10 Hours**
Course Outcome:	
Students will learn the essentials of project costing, scheduling, monitoring & management of the projects. They would acquire skills related to project appraisal.	
Question Paper pattern: • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	

REFERENCE BOOKS:

1. A guide to the Project Management Body Of Knowledge -2000 edition, Project Management Institute, USA
2. The Design and Implementation of Geographic Information Systems, John E. Harmon, Steven J. Anderson by Wiley Publishers ISBN: 0-471-20488-9
3. Geographic Information Systems, abridged by Paul A Longley, Michael F Goodchild, David J. Maguire, and David W. Rhind, second edition, 2005
4. Project Management using PERT / CPM – Weist & Levy, PHI
5. Concepts and Techniques of Geographic Information System by C P Lo Albert K W Yeung, 2002, EEEPrantice Hall of India Private Ltd.
6. Project Management PERT / CPM & Precedence Diagramming Moder, Philip, Galgotia
7. UNIDO Guide to Project Appraisal

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IV SEMESTER			
APPLICATIONS OF GEOINFORMATICS IN DISASTER MANAGEMENT (Elective - III)			
Subject Code	16CGI421	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

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

Modules	**Teaching Hours**
Module-1	
Introduction: Definition, classification of disasters, types of Disaster, importance of RS and GIS in Disaster Management- Reconnaissance, forecast, forewarning systems, Disaster preparedness with respect to different disasters. SDI to facilitate Disaster Management. GIS based DSS for disaster management. Satellite surveillance for disaster mitigation.	**10 Hours**
Module-2	

Drought: Drought types, causes, mitigation measures, delineation of drought vulnerable areas using RS and GIS; Drought Information System; Drought monitoring; GIS based drought analysis; Desertification factors, Assessment of drought impact using RS and GIS. Monitoring vegetative biomass, Drought management- prediction, preparedness, monitoring of drought., . El-Nino damage assessment using RS and GIS. **Earthquakes and Tsunami:** Causes of earthquake, prediction of earthquake, Geomatics in earthquake mitigation, seismic damage evaluation and loss estimation, RS and GIS application for post-quake rehabilitation, GIS database for previous earthquakes, space technology and earthquake prediction, geospatial information system for earthquake disaster management, Tsunami- types, causes, RS and GIS applications for post Tsunami damage assessment and rehabilitation **Forest Fire:** Forest fire causes, forest fire management using geospatial information system, forest fire risk zonation mapping, forest fire monitoring, forest fire, forecasting system using internet GIS and Satellite Remote Sensing, delineation of coal fire risk zonation.	**10 Hours**
Module-3	
Cyclones and Floods: Floods types-flash and riverine floods, snowmelt floods, ice jams, and mud flows; causes and mitigation measures, flooding potential zonation mapping, flood hazard assessment, flood risk analysis using RS and GIS, tropical cyclone monitoring using INSAT, ERS-1,NOAA, and DMSP satellites, RS and GIS in Hurricane mapping and mitigation, flood disaster monitoring and reporting system, terrain modeling for flood plain zoning, digital surface modeling and flood hazard simulation, ice cover monitoring and its role in flooding. Flood damage impact minimization, damage assessment in hurricane / tornado affected areas. Cyclone tracking, Cyclone warning, cyclone management.	**10 Hours**
Module-4	
Landslide: Landslides, causes, types, and mitigation measures, land slide zonation, land slide susceptibility mapping, land slide monitoring, landslide analysis in GIS, geospatial technology for landslide management, sand drift in Indian desert, topographic and morphometric features affecting in landslide. **Soil Erosion:** Types, causes, and mitigation measures, application of RS and GIS for soil erosion and sediment estimation, RS and GIS application for desertification studies, desertification studies, estimation of soil erosion, soil erosion mapping universal soil loss equation and GIS, land degradation studies, sodic soil mapping	**10 Hours**
Module-5	

Volcano: Volcanoes, types causes of volcanoes, hazards of volcanoes, remote sensing of geothermal field, mapping lava flows, ash falls and lahars, mapping damage, volcano hazard management. **Disaster Management in Human Settlements:** Mapping disaster vulnerable zones, fire hazards, flood and storm water inundations, earthquake impact assessment **Recent Trends:** The role of Mobile GIS and SDI as an integrated framework in Emergency Management	**10 Hours**

Course Outcome:

Students will learn the impact of disasters on economic development, the causes & effects and major disasters, importance of disaster risk reduction in overall Disaster Management Programme

Question Paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Amdahl G (2002) Disaster Response: GIS for Public Safety, Published by ESRI, Redlands California.
2. http://www.esri.com/news/arcnews/winter0102articles/gishomeland.html - visited on October 2002.

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IV SEMESTER			
EMERGING TRENDS IN GEOINFORMATICS (Elective - III)			
Subject Code	16CGI422	**IA Marks**	20
Number of Lecture Hours/Week	04	**Exam Marks**	80
Total Number of Lecture Hours	50	**Exam Hours**	03

Course Objectives:

The objective of this subject is to enable the students to have a fair knowledge about global and Indian Geo-informatics Industry and its major stake holders, trends, and scenarios.

Modules	**Teaching Hours**
Module-1	
Global and Indian Scenario of Geo-informatics - Current status and Recent Advances in the field of RS, GIS, Photogrammetry, GPS, products and process, software and hardware. **Global and Indian R&D Organizations:** Global Institutions- NASA, ESRI, ERDAS, Canadian Institute of Remote Sensing, International Institute of Photogrammetry and Remote Sensing, Google, India- ISRO and its subunits, NRSA, SAC, Antrix, IIRS, RRSSCs; State Remote Sensing Centres; Funding Sources for R&D projects; Global and National Spatial Data Centres, Satellite data sources and procurement procedures.	**10 Hours**
Module-2	
World and Indian Space Programmes: Satellites and sensors and their products and applications; Geoinformatics usage by Government and Private Sectors - User Departments of Central Govt. and State Govt. and their major projects: Central - SOI, MOEF, MOUD, MOD, few Case studies. **Global and Indian Geoinformatics Market:** Present trends and future prospects and problems, GIS BPO in private sector in India, GIS companies in India.	**10 Hours**
Module-3	
Global and National Major Initiatives in RS and GIS: Digital Earth, GSDI, 3D Cities, NSDI	**10 Hours**

Module-4	
Education and Training facilities in Geoinformatics: Global Geoinformatics Courses, scholarships; Web Resources for e-learning; eBooks; open sources of free softwares; International Journals, Review magazines, News Letters, e-journals.	**10 Hours**
Module-5	
Laws and Policy Perspectives and International Co-operations: Laws and policy matters at international and national level with respect to Space, Sea, photogrammetry, data sharing and data security, interoperability; Global and national Geoinformatics survey reports, case-studies, show cases of best practices.	**10 Hours**
Course Outcome:	
Students will learn modern trends in satellite Remote Sensing, its integration with GIS & in value edition to geospatial data.	
Question Paper pattern: • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	
REFERENCE BOOKS: 1. "GIS Development".net, ESRI web site, NCGIA, UCGIA, Google Earth, Yahoo Maps, NASA web site, ISRO website.	