MANGALORE UNIVERSITY
DEPT. OF MARINE GEOLOGY
M. Sc. GEOINFORMATICS (CHOICE BASED CREDIT SYSTEM) - SYLLABUS
STRUCTURE OF THE PROGRAMME

Semester	Paper Theory / Lab	Instruction hrs/Week Lectures / Practicals	Duration of Exams (hrs)	Marks			Credits
				IA	Exam	Total	
First Semester : Five Hard Cores and One Soft Core							
GI H401	Data Acquisition and Data Processing	4	3	30	70	100	4
GI H402	Remote Sensing and Photogrammetry	4	3	30	70	100	4
GI H403	Computer Science and Web Designing	4	3	30	70	100	4
GI P404	Remote Sensing and Photogrammetry (Lab H)	8	4	30	70	100	4
GIP405	Computer: (Software and Hardware) and Web Designing (Lab H)	8	4	30	70	100	4
GIS 406	Fundamentals of Geological Science	3	3	30	70	100	3
					Semester Total	**600**	**23**
Second Semester : Two Hard Cores, Four Soft Cores and One Open Elective							
GIH 451	Data Base Management System and Spatial Statistics	4	3	30	70	100	4
GIH 452	Geographical Information System	4	3	30	70	100	4
GIS 453	Digital Image Processing	3	3	30	70	100	3
GIS 454	Applied Geomorphology & Geo Environmental Science	3	3	30	70	100	3
GIP 455	Petrology & Geomorphology (Lab S)	6	3	30	70	100	3
GIP 456	Geographical Information System and DBMS (Lab S)	6	3	30	70	100	3
GIE 457	Geo Informatics of Natural Resource (Open Elective)	3	3	30	70	100	3
					Semester Total	**700**	**23**
Third Semester : Two Hard Cores, Five Soft Cores and One Open Elective							
GIH 501	Water resources	4	3	30	70	100	4
GIH 502	Marine Geoinformatics	4	3	30	70	100	4
GIS 503	Cartography	3	3	30	70	100	3
GIS 504	Disaster Management	3	3	30	70	100	3

GIS 505	Applied Geo informatics	3	3	30	70	100	3
GIP 506	Digital Image Processing and Cartography (Lab S)	6	3	30	70	100	3
GIP 507	Water Resources and Marine Geoinformatics (Lab S)	6	3	30	70	100	3
GIE 508	Geo informatics of Coastal Environment (Open Elective)	3	3	30	70	100	3
					Semester Total	**800**	**26**
Fourth Semester :							
GI 551	Dissertation & Viva - Voce				200	280	16
					80		
	Internal assessment						
	i. Field Work				60	120	
	ii. Field Report				60		
					Semester Total	**400**	**16**
					Grand Total	**2500**	**88**

Approved

H Gangadhara Bhat

6/12/17

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Note: GI - Geoinformatics, H - Hard core, S - Soft core, P - Practical / Project Work, and E - Elective. *Not included for CGPA calculation.

Course / Credit Pattern:

Semester Credits	Hard Core (H)	Soft Core (S)	Elective (E)	Practical / Project Work (P)	Total Credits
First	12	3	--	8 (H)	23
Second	8	6	3	6 (S)	20 + 3
Third	8	9	3	-- , 6 (S)	23 + 3
Fourth	--	--	--	16 (H)	16
Total	28	18	6*	24 + 12	82 + 6*

Total Credits from all the Four Semesters = 23 + 23 + 26 + 16 = 88

FIRST SEMESTER

GIH 401: DATA ACQUISITION AND DATA PROCESSING

Unit 1	**Definition** of data and information, historical evolution and need for information, Basic Concepts of Spatial Data and a spatial data, spatial information	06 hrs
Unit 2	**Primary data:** Map data, data from aerial photos, satellite data, surveys.	06 hrs
Unit 3	**Secondary data:** Source of secondary data, advantages and limitations of secondary data.	06 hrs
Unit 4	**Spatial data:** Vector and Raster data format. Advantage and disadvantage of vector data and Raster data.	06 hrs
Unit 5	**Extraction of data**: Data from Toposheets, aerial Photos, Satellite Data (Hard copy & Digital Data products, thematic maps)	06 hrs
Unit 6	**Data capture**: Digitization and Scanning, Digitization Tablet, Scanners-Flat bed Scanner, Drum Scanner, limitations of Scanned data	06 hrs
Unit 7	**Attribute Data:** Source of attribute Data (need, methodology and relevance), Data input, Data Storing and Data Structuring	06 hrs
Unit 8	**Analog and digital data**: introduction, analogue to digital data conversion, digital to analogue data conversion.	06 hrs

References

1. Avery T.E., and G.L.Berlin, 1985, *Interpretation of Aerial Photographs*, 4th Ed, Bergess, Minneapolis, Minn, 34-98.
2. Betnstein, R. 1978, *Digital Image processing for remote Sensing*, IEEb Press, New York, 26-64.
3. Bruno Marcolongo and Franco Mantovani, 1997, *Photo geology, Remote sensing Applications in Earth science*, Oxford and IBH Pub. Co Pvt. Ltd., New Delhi, 12-108.
4. Drury, S. A. 1987, *Image Interpretation in Geology*, Allan & Unwin (Publishers) Ltd, 23-67.
5. Kenneth R, Castle man, 1979, Digital *Image Processing*, Prentice Hall**,** 24-98.
6. Falls Church, 1980, *Manual of Remote sensing* Vol I and II, American Society of Photogrammetry, 4th Ed, 39-58.
7. Miller and Miller, 1961, *Photo geology*, Mc Graw-Hill Book Company, New York,.
8. P. M. Mather, *Computer Processing of Remotely Sensed Images- An Introduction*, John. Wiley and Sons, 1999.
9, Pandey S. N., 1987, *Principles and Applications of Photo geology*, Wiley Eastern,.
10. Ravi. P. Gupta, 1991, *Remote Sensing Geology*, Publisher- Berlin: Springer; Vela.
11. Reddy, A. M., 2006, Remote *Sensing and Geographical Information Systems.* BS Publications, 1-436.
12. Robert, H. Arnold., *Interpretations of Air Photo and Remotely Sensed Imagery*

	GIH 402 : REMOTE SENSING AND PHOTOGRAMMETRY	
Unit 1	**Introduction:** History and concept of Remote Sensing, Electromagnetic Spectrum, Energy Interaction with atmosphere and earth surface features. Basic concepts of visible, Optical, Thermal (Infrared), and Microwave remote Sensing. Platforms and Sensors. **Optical Remote Sensing:** Principles of Optical remote sensing, spectral reflectance of earth's features in different Wavelength regions, multispectral concepts of remote sensing, Scanners, applications of optical Remote Sensing Indian Remote Sensing Programme and important Indian Satellites.	06 hrs
Unit 2	**Thermal Remote Sensing:** Principles of thermal remote sensing, black body, radiant temperature, radiation from Earth's objects, thermal conductivity, thermal capacity, thermal inertia, thermal diffusivity, Thermal Radiometers, scanners, calibration of scanners, mapping with Thermal scanners, Imaging Spectrometer, Application of Thermal Remote Sensing.	06 hrs
Unit 3	**Hyper Spectral Remote Sensing:** Introduction to Hyper spectral Remote Sensing Sensors/Imaging Spectrometers, Hyper spectral Satellite Systems, Hyper spectral Image Analysis Techniques including Correction.	06 hrs
Unit 4	**Microwave Remote Sensing & RADAR Remote Sensing***:* Concept and principles of Microwave Remote Sensing, SLAR, SAR and Scaterometer, Application of Microwave Remote Sensing. Outlines of Radar Image Interpretations. **Image Interpretation:** Visual and Digital Interpretation techniques - Basic concepts of visual interpretation, tone, color, texture, pattern, shape and contextual features. Digital Image Interpretation-	06 hrs
Unit 5	**Principles of Aerial photography; Geometry of aerial photography:** Fundamentals of photogrammetry and aerial photography: History, aerial cameras, aerial films and processing. Types of aerial photos. Fundamentals and geometry of aerial photographs, Scale, Advantages and disadvantages of small scale and large scale aerial photographs.	06 hrs
Unit 6	**Relief and tilt displacements,** mosaics and types of mosaics, stereoscopic vision and stereoscopes, image displacement due to relief, concepts of stereo-photogrammetry, normal vision, depth perception and vertical exaggeration. **Planning for aerial photographs**, flight procedures, planning and execution of photographic flights, radiometric characteristics. Elements of aerial photo interpretation: tone, color, texture, pattern, shape, size and associated features, geotechnical analysis and convergence of evidence.	06 hrs
Unit 7	**Principles and Applications of Aerial Photography:** Aerial photo interpretation in resource evaluation – geology, delineation of geological structures, mineral exploration, geomorphology, geological structure.	06 hrs
Unit 08	Digital photogrametry and interpretation techniques: definition, creation of digital images, automatic measurements, automatic surface modeling, aerial triangulations, digital photogrammetric workstation	06 hrs

References

1. Avery T.E., and G.L.Berlin, 19085, Interpretation of Aerial Photographs, 4th Ed, Bergess, Minneapolis, Minn, 34-908.
2. Betnstein, R. 19708, Digital Image processing for remote Sensing, IEEb Press, New York, 26-64.
3. Bruno Marcolongo and Franco Mantovani, 1997, Photo geology, Remote sensing Applications in Earth science, Oxford and IBH Pub. Co Pvt. Ltd., New Delhi, 12-1008.
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13. Robert, H. Arnold., Interpretations of Air Photo and Remotely Sensed Imagery.
14. Robert, K. Vincent., Fundamentals of Geological and Environmental Remote Sensing.
15. Sabins, F.F., 19086, Remote sensing Principles and Interpretations, 2nd Ed. W.H. Freeman and Company, New York.
16. Schowengerd R .A. 1995 Techniques for Image processing and classification in Remote Sensing, Academic Press. New York.
17. Siegel, B.S. and Gillespie, A.R. 1994, (eds). Remote sensing and Image Interpretations, John Wiley and Sons, New York.
18. Swain P. H. Davis S.M. (Editor), 19708, Remote Sensing, The quantitative approach, McGraw, Hill Book co., New York,.
19. Thomas M. Lillesand and Ralph W. Kiefer., 2000Remote sensing and Image Interpretations, John Wiley and Sons, New York, , 4th Edition, 24-254.
20. Verbyla, D. 1995, Satellite remote sensing for natural resources; Lewis Publishers, Boca Rotaon, FL,.
21. Rees, W.G. 1990, Physical Principles of Remote sensing, Cambridge University Press.
22. Wolf, P. R. 19083, Elements of Photogrammetry, 2nd Ed, Mc Graw-Hill, New York.

GIH 403: COMPUTER SCIENCE AND WEB DESIGNING

Unit 1	**Basics of Computers:** An introduction to computers, development of computers, Hardware and Software. Fundamentals of Computers—operating systems, input devices, output devices, storage devices-primary, secondary, central processing unit, computer languages, translators.	08 hrs
Unit 2	**Information Super Highway:** Introduction to Internet. Scope of Internet. Equipment required for an Internet Connection. Electronic Mail. Concepts of Information Storehouse. Surfing the Net. Browsing the WWW. Search Engines and their applications. Application of internet to Geoinformatics. Introduction to networks, Local area network devices, topologies, protocols, wide area networks, servers, hubs, nodes, moderns, Internet.	08 hrs
Unit 3	**Web design: HTML:** Basic & advanced HTML, Types of tags, Document creations, Linking, Creating Link List, handling Images, tables and, style sheets. Types of tags, Creating hypertext links. Formatting the text (example). Creating Image Links. Outlines of Python.	08 hrs
Unit 4	**Microsoft Power Point:** Introduction to Microsoft Power Point. Functions and Exploring Power Point Views. Creating a Presentation. Delivering and Printing a Presentation. Animations and Slide Show applications to Geoinformatics **Microsoft Excel:** Functions of Microsoft Excel. Starting Microsoft Excel. Excel Work Environment. Changing the Size of a Workbook and Excel Window. Cell and Cell address. Standard Toolbar. The Formatting Toolbar. The Formula Bar. Components of an Excel Workbook. Moving Data, Copying Data, Relative Cell Addressing, Absolute Cell Addressing. Formulas using Numbers. Simple graphs. Functions and Applications of Microsoft Excel to Geoinformatics.	08 hrs
Unit 5	C Programming: Overview of C, Constants, Variables and Data types. Managing input and output operations. Decision Making Statements: Branching (simple if,else,nested if else,elseif ladder) and looping statements(while, do while, for loops). Arrays: One-dimensional, Two-dimensional arrays, declaring and initializing arrays. Handling of Character strings – Declaring and initialising string variables.	08 hrs
Unit 6	C++ Programming: Introduction to C++. C++ Tokens, Expressions and Control Structure Object oriented concepts: classes and objects, Functions: Defining Member functions Inheritance, Polymorphism, operator overloading, Constructors and Destructors Control structures statements	08 hrs

References

1.Beekman, G. 1999, Computer Confluence: Exploring Tomorrow's Technology. Addison-Wesley, Reading, MA. (3rd. ed).

2.Willis H. Means 19087A content analysis of six introduction to computer science textbooks ACM New York, NY, USA, 403 - 413

3.Beekman, G. George Beckman 2000 Tech Nation. Online. Internet. [March 14,]. Available WWW:http://www.computerconfluence.com/about/tech.htm

4.Cheryl SchmidtComplete 19908, Computer Repair Textbook, Scott Jones, 22-408.

5. Dix, A., Finlay, J., Abowd, G., and Beale, R. 1999. Human-Computer Interaction. Prentice-5. Hall, Herts. UK. 67-089.

6.Goldberg, M. W. CALOS: Feb, 1997), First Results From an Experiment in Computer-Aided
7. Learning for Operating Systems, in Proceedings of the Twenty-eighth SIGCSE Technical Symposium on Computer Science Education. ACM Press. 408-52.
8.Goldberg, M. W. WebCT and First Year Computer Science June, 1997: Student Reaction to and Use of a Web-Based Resource in First Year Computer Science, in Proceedings of the ACM's ITiCSE Conference on Integrating Technology into Computer Science Education. ACM Press. 127-129.
9. Shelly Cashman 2000, Course Technology. About Shelly Cashman Series. Online. Internet. [March 14,]. Available WWW: Http://www.scseries.com/about_sc.cf

GIP 404: REMOTE SENSING AND PHOTOGRAMMETRY (LAB H)

Aerial mosaics, compilation, annotation, scaling and preparation of Photo index, Photo base determination and numerical problems on aerial photographs.
Spectral reflectance: Plotting of Spectral Reflectance Curves- Rocks, Soil, Vegetation and Water .

Visual Analysis: Study of aerial photographs under pocket and mirror stereoscopes and interpretation of satellite images (Black & White and FCC images)

Interpretation of satellite data Products and generation of thematic maps.

Elements of Aerial Photo: Study of Stereo pairs of aerial Photos. Flight planning, Determination of scale and slope. Outlines of parallax measurement.

GIP 405: Computer: (Software and Hardware) and Web Designing (Lab H)

Introduction to Visual Basics. Use of Visual Basics. Applications of Visual Basics.

C programming: character set, data types, variable constants, operators: arithmetic, logical operators in C. Application of C program in Geoinformatics

C ++ Programming: Basics of C++, Tokens , Expressions, control structures, Functions of C++, Classes & Objects, Constructors & Destructors, Operator Overloading and type Conversions, Inheritance: Extending Classes, Pointers, Virtual Functions, Polymorphism, Object Oriented Systems & Development, New Features of Ansi C++ Standard. Programs to illustrate the use of C++ in Geoinformatics.

SPSS: Introduction to SPSS. Use of SPSS in creating a data base. Application of SPSS in Correlation Co-efficient. Use of SPSS in Linear Regression,
Modeling and Prediction. Application of SPSS in GIS data modeling.

HTML: Introduction to WEB and its Applications in Geoinformatics.
Creation of web pages. Use of HTML text formatting tags, Hyperlinks, Images tags.

GIS 406: FUNDAMENTALS OF GEOLOGICAL SCIENCE

Unit 1	**Introduction,** Formation of the earth, composition of earth crust, mantle core, plate tectonics Major and Minor plates, continental drift, ocean floor spreading.	08 hrs
Unit 2	Mineralogy: Introduction to Rock forming Minerals	08 hrs
Unit 3	Outlines of Igneous Rocks: Granites, Basalts, Dolerite, Andesite etc.	08 hrs
Unit 4	Outlines of Metamorphic Rocks: Gneiss, Schist, Quartzite, Granulites, Marble, Slate, etc.	08 hrs
Unit 5	Outlines of Sedimentary Rocks: Origin of sediments. Breccia, Conglomerate, Sandstone, Limestone, Shale Morphology & Origin of Laterites.	08 hrs
Unit 6	**Structural Geology:** Primary and Secondary Structures. Folds, Faults, Joints & Unconformities.	08 hrs

References

1. Mukerjee, P.K. 1997, A Text book of Geology. The World Press Pvt. Ltd, 1-6308.
2. Allen, J. R. L, 1969. Physical Processes of Sedimentation; New York, American Elsevier, 3-36.
3. Straller, A. N. 1976, *Principles of Earth Sciences*, Harper & Row, 269-315.
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6. Head, J. W., C. A. Wood, and T. A Mutch. 1977, *Geological Evolution of Terrestrial Planets*, 65-19-21.
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8. Linslay R. K, Kohler, M. A. and Paul Hus J. L. H. *Hydrology for Engineers*. McGrow Hill, New York, 23-244.
9. Christopherson, R. W., 1995, Elemental Geosystems. Prentice Hall, New Jersey, 3-540.
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15. Hatcher, Robert D. (1995)Structural Geology Principles, Concepts and Problems, 2nd Edition, New Jersey Prentice
16. W.H. Freeman, New York - Twiss, Robert J. (1992) Structural Geology
17. McGraw Hill - Timothy Whetten (1975) Structural Geology

SECOND SEMESTER

GIH 451: DATA BASE MANGEMENT SYSTEM AND SPATIAL STATISTICS

DATA BASE MANAGEMENT SYSTEM

Unit 1	**Data and database**: Organization of database Components of Database Management Systems Files: key, file directories and file storage. Data retrieval and Data Security Basics of Database models: Entity-relationship model, Flat File system, Network Data model. Concept of Data Mining and Data Warehousing.	06 hrs
Unit 2	**Structured Query Language (SQL).** **Relational and Hierarchical Data Models:** Relational Algebra, Projection operators, Selection operators (Arithmetic & Logical operators), Set unions, Set differences, Cartesian product. Record Storage & primary File Organization, Buffering of Blocks, Hashing Techniques, Index Structures for Files. Transaction Processing Concepts, Database Recovery Techniques, Data base Security Authorizations, Functional Dependencies and Normalization for Relation Databases.	06 hrs
Unit 3	**JAVA:** Fundamentals of Objects-Oriented Programming. Overview of Java, Data types, Variables, Constants, Operators and Expressions Decision Making: Branching and looping statements, Classes, Objects and methods, multiple Inheritance, packages, multi-threaded programming, managing errors and exceptions, applets.	06 hrs
Unit 4	**SPATIAL STATITICS** **Measures of Central Tendency:** Mean, Median and Mode and their application to GIS and Remotely Sensed Data.	06 hrs
Unit 5	**Correlation Co-efficient** and its application to GIS and Remotely Sensed Data. **Linear Regression and Prediction:** Concepts and application to GIS and Remotely Sensed Data.	06 hrs
Unit 6	**Cluster Analysis:** Introduction to Cluster Analysis. Interpretation of Q-mode and R-mode Clusters with reference to Spatial Data. Application of Cluster Analysis to Spatial Data.	06 hrs
Unit 7	**Factor Analysis:** Outlines of Factor Analysis. Interpretation of Factors for Spatial data	06 hrs
Unit 08	**Statistical Package: SPSS** Introduction to Statistical Packages. Introduction to SPSS package. Functions of SPSS. Graphic out-put of processed data using SPSS. Application of SPSS to Geoinformatics. Case studies using SPSS. Use of SPSS in spatial data analysis. Designing of Cluster Analysis and Dendrograms related to Geoinformatics data. .	06 hrs

References

1. K. Majumdar & Bhattacharya. P, 1999, *Database management Systems*. Tata McGraw-Hill Publications.
2. Korth H. F & Silberschatz, A. 19086, *Database Systems Concept* , McGraw-Hill, New York
3. Widerhold G, 19084, *Database Design* ,McGraw-Hill, New York
4. Martin. J, 1977, *Computer Database Organization,* Prentice-Hall, New Jersey.
5. Sir Maurice Kendall., Alan Stuart and J. Keith., *The Advanced theory of Statistics*, Vol 3, 4th Edition (1943-1960)
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9. Davis, J. C. 1973.*Statistics and Data Analysis in Geology.*
10. Krumbein, W. C and Graybill, F. A. 1965.*An Introduction to Statistical Models in Geology*.

GIH 452: GEOGRAPHICAL INFORMATION SYSTEM

Unit 1	**Basics of Geographic Information System**: Definition, components, packages, capabilities and purpose of GIS. History of Geographic Information System, Development of GIS as an information and decision making system, Application of GIS in India.	06 hrs
Unit 2	Definition- Maps and spatial information, Components of GIS, maps and spatial data- Thematic characteristics of spatial data, other sources of spatial data- sensors, survey data, air photos, satellite images and field data.	06 hrs
Unit 3	Spatial and attribute data, spatial entities, raster and vector spatial data structure, comparison of raster and vector methods, linking spatial and attribute data.	06 hrs
Unit 4	Digitization, Editing and Structuring of Map Data: Mode of digitization, editing, topology creation and structuring map data. Data Quality and Sources of Errors: Nature of geographic data, sources of errors in GIS database, data quality parameters, handling errors in GIS.	06 hrs
Unit 5	**GIS Data and Analysis:** Spatial Analysis, Classification, Overlay, Polygon Neighborhoods, Data analyzing operations in GIS, Buffering and neighboring functions , integrated data, raster and vector overly method, problems of vector and raster overlay, spatial interpolation, GIS for surface analysis and network analysis.	06 hrs
Unit 6	**Concepts of 3D models:** Digital Elevation and Terrain Models (DEM & DTM), Generation and structure of DEM/DTM and their applications. Geospatial Triangulated Irregular Network (TIN) model, slope, aspect, hill shade.	06 hrs
Unit 7	Fundamentals of GPS- Introduction, space segments, user segments and control segments, observation principle and signal structure, accuracy of GPS measurements, point positioning and relative positioning, methods of surveying with GPS, Static and Kinematic positioning, navigation with GPS, differential GPS, navigational receivers.	06 hrs
Unit 8	**GIS Modeling:** Cartographic models, Inductive and Deductive Models, Model Flow Charting, Model Implementation and Verification. Principles of Design and GIS Output, GIS Project design and Management.	06 hrs

References

1. Bonham – Carter G.F., Geographic Information System for Geoscientists, Pergamon Press, Tarrytown, New York, 1994.
2. Burough, P.A., and Rachael A, Mec Donnell. Principles of Geographic Information System., Oxford University Press-19908 (Indian Print).
3. Demers, Michael; Fundamental of Geographic Information System, John Wiley, 1999 (Indian Print)
4. Fraser Taylor., P.A., Geographic Information System – The Microcomputer and Modern Cartography, Pergamon Press, 1991.
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6. Keaies, J.S. Cartographic design and Production London, Longman group, 1973.
7. Les Worell, (Ed) 1990. Geographic Information System, Development and Applications, Belbaven Press.
8. Longley, P. A., Maguire, D. J., Goodchild, M. F and Rhind, D. W; GIS Principles Techniques ,Applications and Managements, Longman Scientific and Technical, 2001 (very Expensive Book).
9. Maguire, D. J. Goodchild, M. F., and Rhind, D. W. GIS- Principles and application, Longman Scientific and Technical, 1991.

GIS 453: DIGITAL IMAGE PROCESSING

Unit 1	Introduction: Digital images, Sources of errors; Image Pre-processing- Atmospheric, Geometric and Radiometric corrections, Noise removal, Resampling techniques. Image Enhancement Techniques. Contrast enhancement: Linear and Non-Linear Logarithmic contrast enhancement, edge enhancement, density slicing, principal component analysis; IHS Transformation, Spatial filtering, Low frequency and high frequency band ratioing and band combination etc.	06 hrs
Unit 2	Image and Digital Images, types of images and acquisition, simple image model, Sampling and reconstruction, uniform sampling and quantization	06 hrs
Unit 3	**Digital Image Analysis:** Digital data, Image File formats, Image Rectification and Restoration, Radiometric, Atmospheric and Geometric Corrections.	06 hrs
Unit 4	**Image enhancement techniques:** Raw, Processed Images, Contrast Manipulation, Spatial feature Manipulation, Multi-Image Manipulation.	06 hrs
Unit 5	**Contrast Manipulation:** Grey Level Thresholding, Level Slicing, Contrast Stretching- Concept of Digital Number.	06 hrs
Unit 6	**Spatial feature Manipulation:** Convolution, Edge Enhancement, Concept and Use of Fourier Analysis in Digital Image Analysis.	06 hrs
Unit 7	**Multi-Image Manipulation :**Spectral Ratioing, Principle and Canonicle Components, Vegetation Components-TVI & NDVI.	06 hrs
Unit 08	**Digital Image Classification:** Classification scheme; Supervised classification, Training sites selection and statistical information extraction; Discriminant functions; Maximum Likelihood classifier, Euclidian distance, Mahalanobis distance; Unsupervised classification, classification accuracy assessment, Error Matrix.	06 hrs

References

1. *Bracewell , R.o 919780 the fourier transform and its application 2nd edition Mc Grew- hill NY*
2. *Duda, R.o. and Hart p.E. (1973) pattern Classification and Scene analysis. Wiley*
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8. *Siegel, B.S. and Gillespie, A.R. 1994, (eds). Remote sensing and Image Interpretations, John Wiley and Sons, New York.*
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GIS 454: APPLIED GEOMORPHOLOGY AND GEO ENVIRONMENTAL SCIENCE

Unit 1	**Concepts of modern Geomorphology**: Geomorphology and its applications in Natural resources inventory. Geomorphology and its applications to Geoinformatics.	06 hrs
Unit 2	**Geomorphic Environments**: The Fluvial systems, Coastal and Marine geomorphology. Aeolian, Glacial, Karst and Dune Environments. M.O. Ridges, Ocean floor Topography.	06 hrs
Unit 3	Geomorphology and GIS in exploration of the natural environment. Impact of Slope, badlands, Pediments, Streams in geomorphic evolution. Geomorphic controls on the groundwater resources of Coastal, Island and hinterland terrains. Geomorphological factors to be considered while selecting the solid waste disposal sites. Solid waste management and its impact on local and regional geomorphology.	06 hrs
Unit 4	Geo-hazards and geomorphic controls. Application of Remote Sensing and GIS in quantitative and Quantitative interpretations of 'risk area mapping' including forest fires, floods, earthquakes and Tsunami effected terrains.	06 hrs
Unit 5	**General Introduction**: Definition of Environmental, Environmental Pollutant, Environmental Pollution, Environment – Handling, Hazardous substance.	06 hrs
Unit 6	**Environment Management Plan**: Concepts and use of EMP in coastal and marine environments. **Environment Impact Assessment Act**: Definition, use and implementation for specific areas such as Marine Environments, Ports, Harbours, Recreation, Water Quality Standards for class SW-I waters, SW-II, SW-III, SW-IV, SW-V. etc., Noise Standards.	06 hrs
Unit 7	**Coastal Regulation Zones**: Concept of coastal Regulation Zones. Classification of Zones, Criteria of Zonation and Evolution of CEZ norms. Application of cartography, Remote sensing and GIS in mapping of Coastal Regulation Zones.	06 hrs
Unit 8	**Anthropogenic and Natural environmental Hazards**: Reconnaissance mapping of Landslides and use of DEM. Use of GIS and Remote sensing in detection of water – spread areas including monitoring flood scenarios. Use of IKONOS and other digital data products in assessing damage due to earthquakes, Forest fires, flooding, etc. Impacts of Open-cast Mining and monitoring through multi-dated Remote Sensing and GIS techniques.	06 hrs

References

1. Fundamentals of Photogeology, Geomorphology – Verstappen – TTC Holland.
2. Thornbury,W. D., 2004, Principles of Geomorphology, CBS Publ.
3. Wathern, P 1988, EIA: Theory & Practice. Unwin Hyman, London.
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GIP 455: Petrology and Geomorphology (LAB S)

Petrology

1. Megascopic study of common rock forming minerals.

1. Identification of igneous, sedimentary and metamorphic rocks(hand specimen).
2. Study of mega structures, textures and mineralogy of igneous, sedimentary and metamorphic rocks.

Geomorphology

1. Morphometry of drainage basins. Analysis of drainage orientation structure.
2. Preparation of DEM from topographical maps, ASTER and SRTM data.
3. Preparation of Aspect, Shaded relief, and Slope maps from DEM.
4. Longitudinal and cross-valley profiles.
5. Generation of geomorphologic maps- showing fluvial, coastal/marine, denudational, volcanic and glacial landforms.
6. Exercises related to measurements of runoff dynamics, sediment dynamics.

GIP 456: GEOGRAPHIC INFORMATION SYSTEMS AND DBMS (LAB S)

GIS:

Georeferencing – image rectification based on co-ordinate system. Onscreen digitization

GIS and Remote Sensing data integration: Integration of vector and raster data (linking of spatial and non - spatial data)

Extraction of Thematic maps: preparation of thematic layers-onscreen from toposheets, images- Road, Settlement, Drainage, LULC

Map composition and presentation of results Overlay and proximity analysis- clip, erase, intersect, union, buffer

Edge matching/ spatial adjustment Calculation of slope in degrees and percentages. Calculation of area, perimeter and distance using ArcGIS

Creation of 3D maps: TIN, Hill shade, slope, Aspect with ArcGIS

DBMS:

Outlines of DBMS and Application of DBMS in Geoinformatics.

Introduction to SQL and its application in Geoinformatics. SQL Queries (Alter, Insert, Update, Delete).Designing a database: Creation of tables, inserting values into the tables, updating the existing Value, modifying the structure of the database, Use of Drop and delete commands. Use of Numeric, Aggregate, Date, Conversion and character functions.

Application of Java to Geoinformatics data. Creation of java programs and applets. Embedding applet tags in HTML.

GIE 457: GEOINFORMATICS (OPEN ELECTIVE)

Unit 1	**Definition** of data and information, historical evolution and need for information, Basic Concepts of Spatial Data and a spatial data, spatial information. sources of spatial data- survey data, air photos, satellite images and field data	6 hrs
Unit 2	Scope and Importance of Geoinformatics; Basic concepts of remote sensing; aerial photography and satellite remote sensing. Indian Space Program and Indian remote sensing satellites	6 hrs
Unit 3	**Principles of Thermal and Microwave Remote Sensing:** Introduction, Black body radiation, Temperature Radiations from the earth's surface, Applications of thermal remote sensing. Basic concepts of microwave remote sensing, Real Aperture Radars and Synthetic Aperture Radars, Microwave sensors, Interferometry. Applications of Microwave Remote Sensing. Visual and digital image analysis techniques.	6 hrs
Unit 4	Map Concept: Map features, scale, resolution, accuracy, projection and database extent. Map Projection and parameters: Geographical co-ordinate system, spheroid and spheres. Types of projection and parameters. Indian geodetic system and Everest spheroid, world geodetic system -084 (WGS-084)	6 hrs
Unit 5	Geographic Information System: Definition, components, packages, capabilities and purpose of GIS. Data Models: Spatial and non-spatial databases. Vector and Raster models. Application and limitations of GIS	6 hrs
Unit 6	Fundamentals of GPS- Introduction, space segments, user segments and control segments, observation principle and signal structure, accuracy of GPS measurements, point positioning and relative positioning, methods of surveying with GPS, Static and Kinematic positioning, navigation with GPS, differential GPS, navigational receivers	6 hrs
Unit 7	Geoinformatics and other Information Sciences. Geoinformatics- Spatial and Non –Spatial data Management. Spatial information Technology	6 hrs
Unit 8	Applications of Geoinformatics: Geoinformatics technologies and the technologies used in Geographical Studies.	6 hrs

References

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2. Ian Haywood Cornelius and Steve Carver – An introduction to GIS, Longman, New York, 2000.
3. Misra HC – A Handbook on GIS, GIS India, Hyderabad, 1995.
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9. Prentice Hall of India, New Delhi – 2003.

THIRD SEMESTER

GIH 501: WATER RESOURCES

Unit 1	**Water Resources.** Introduction- Concepts of Surface Water, Hydrological Cycle. World water distribution, watershed management.	06 hrs
Unit 2	**Remote sensing and GIS in Water Resources.** Application of Remote sensing and GIS in the study of Water Resources. Visual and Digital techniques in Water Resources Investigations. Selection of appropriate software and Data products useful in Water Resource	06 hrs
Unit 3	**Hydro geomorphic studies in Water Resources** Theory of Geomorphic Controls of Water Resources, Concept of Basin Network Analysis. Surface Runoff, Slope Analysis, Application of DEM in Water Resources, Flood mapping, Quantitative studies of drainage basins.	06 hrs
Unit 4	**Groundwater** Concepts of Ground water, Vertical Distribution of Groundwater, Types of Aquifers, Rock Properties Affecting Groundwater Resources, Lineament studies in Water Resources Groundwater Resources of India, Groundwater Resources of Karnataka	06 hrs
Unit 5	Theory of Groundwater flow- Darcy's law and its applications. Groundwater potential assessment, groundwater prospect zones mapping and groundwater information system.	06 hrs
Unit 6	**Water Resources and Watershed Management** Concept of River Basin Management, GIS applications in water resources development and management. Concept of Natural Recharge, Concepts in Artificial Recharge, Use of DEM in Recharge.	06 hrs
Unit 7	**Groundwater development and management:** Planning and management of groundwater. Methods of artificial groundwater recharge; rainwater harvesting, problems of over-exploitation of groundwater; water management in rural and urban areas, geological and geophysical methods of groundwater exploration	06 hrs
Unit 8	**Water Quality** Physical and chemical properties of water, quality criteria for different uses, groundwater quality provinces of India, Groundwater contamination.	06 hrs

References

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2. Keith, P. B, 1973. Thompson *et al* (ed) *Remote Sensing Water Resources Association*, Urban Illineis, 27-86.
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13. Hydrogeology (2nd ed.) – C.W. Fetter – Merrill Publishing Co. U.S.A.
14. Handbook of Applied Hydrology-V.T.Chow (Ed) – McGraw-Hill Book Co. New York
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19. Elements of Hydrology – V. P. Singh
20. Engineering Hydrology – K. Subramaniam – Tata McGraw Hill Publishing Co. Ltd.
21. Introduction to Hydrology – Viessman, W., Lewis, G. L. and Knapp, J. W. (3rd ed.) Harper and Row, New York

GIH 502: MARINE GEOINFORMATICS

Unit 1	**Introduction:** Introduction to Coastal and Marine Environments, Classification of Coastal and Marine Environments.	06 hrs
Unit 2	Introduction to Remote Sensing and GIS to Oceanography and Environmental studies. Data products and their acquisition	06 hrs
Unit 3	**Coastal Environment:** Concepts of Zonation, Rocky Shores, Sandy Shores, Cuspate Beaches, Spits and Beach Ridges, Back Shore Dune Environments,	06 hrs
Unit 4	**Marine Environment:** Mangrove Environments, Island Environments, Tidal Flat Environments, Intertidal Environments. Major Currents of the Oceans. Currents in Indian Ocean	06 hrs
Unit 5	**Satellite Oceanography:** History of Oceanographic Satellites. Satellites and their payloads for the retrieval of various coastal parameters. Technical Characteristics of Oceansat I & OCM/MSMR.	06 hrs
Unit 6	Outlines of Retrieval of Chlo-a; Dissolved organic substances and Total Suspended Matter. In situ recovery of Chlorophyll, SST, Wind Speed, Sea Surface Currents, Salinity, and TSM. Concepts of Biophysical Coupling. Prediction models of Sea Surface Temperature	06 hrs
Unit 7	**Applied Oceanography**: Satellites and their payloads useful for ocean related studies. Satellite Oceanography and GIS to identify Potential Fishing Zones. Use of GIS and Cartography to Map Morpho-ecosystems of the Coast.	06 hrs
Unit 08	Use of Cartography, GIS and Satellite Oceanography in site selection of Major and Minor Ports and Beach Recreational Environments.	06 hrs

References

1. Andy Mitchell, *The ESRI Guide to GIS Analysis,* Vol 1. ESRI Press. 11-21.
2. Balasubramanian, A. *Ecology Environment & Pollution*, Indira Publishers, Mysore.11-17.
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10. Thomas G. Lane., *Arc View -3D Analyst*. ESRI, Press.13-22.

GIS 503: CARTOGRAPHY

Unit 1	**Introduction to Cartography** **Ancient Cartography:** Evolution of Cartography, Modern Cartography and Applications, Definition of Maps. Outlines of Map Projections. .	08 hrs
Unit 2	**Cartographic Themes and Types of Maps** Introduction to Cartographic themes. Cadastral and Chorographical Maps. Representation of Choroschematic maps, and Chorochromatic maps. Concepts of Hydrogeomorphic Maps. Introduction to Population diffusion and the importance of Dot and Multi Dot maps	08 hrs
Unit 3	**Topographic Maps:** Introduction to Topographic Maps. Spatial Information and Marginal Information of Topographic maps. Recovery of Spatial Information from Topographic Maps. Concept of 'Central Theme' and examples.	08 hrs
Unit 4	**Hydrographic Charts**: Introduction to Hydrographic Charts. Marginal Information and Depth Information of Hydrographic Charts. Scales of Hydrographic Charts. Recovery of Spatial Information from Hydrographic Charts.	08 hrs
Unit 5	**Cartographic models**: Inductive and Deductive Models, Model Flow Charting, Model Implementation and Verification. Principles of Design and GIS Output, GIS Project design and Management.	08 hrs
Unit 6	**Remote Sensing satellites used for Cartography.**	08 hrs

References

1. Andy Mitchell, The ESRI Guide to GIS Analysis, Modeling Our World: ESRI Press, (2000). 12-15
2. Bonham – Carter G.F., Geographic Information System for Geoscientists, Pergamon Press, Tarrytown, New York, 1994. 1-34.
3. Burough, P.A., and Rachael A, Mec Donnell. Principles of Geographic Information System., Oxford University Press-1998, 22-39.
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GIS 504: DISASTER MANAGEMENT

Unit 1	Disaster Management Concepts of disaster; Types of disaster Natural and manmade : Cyclone, flood, land slide, land subsidence, fire and earthquake. Issues and concern for various causes of disasters. Principles of Disaster Management, Natural Disasters, Hazards, Risks and Vulnerabilities.	08 hrs
Unit 2	Assessment of Disaster Vulnerability of a location and vulnerable groups. Preparedness and Mitigation measures for various Disasters. Preparation of Disaster Management Plans.	08 hrs
Unit 3	**Issues in Environmental Health,** Water & Sanitation, Earthquake Mitigation, Floods, Fire, Landslides and other natural calamities. Post Disaster Relief & Logistics Management.	08 hrs
Unit 4	Emergency Support Functions and their coordination mechanism. Resource & Material Management. Management of Relief Camp.	08 hrs
Unit 5	Information systems & decision making tools. Role of Remote Sensing, Science & Technology. Rehabilitation Programmes	08 hrs
Unit 6	Voluntary Agencies & Community Participation at various stages of disaster management. Role of military and paramilitary forces during disaster.	08 hrs

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1. Ecology, Environment & Pollution-A. Balasubramanian (1995) M/s. Indira Publishers, Mysore.
2. Atmosphere, Weather and Climate: An introduction to Meteorology-Narora-S. B. Saunders Co., Philadelphia
3. Physical Geology -A. N. Strahler
4. Meteorology - William L. Donn (1975) - McGraw-Hill Book Co., New York.
5. An introduction to Dynamic Meteorology - J. R. Holton (1992) - III Ed, Academic Press.
6. R.W. Tank: Focus on Environmental Geology (p.256)

GIS 505: Applied Geoinformatics in urban & infrastructure development

Unit 1	Concepts- Urban, Urbanism, Urbanisation Regional Concept and Types Planning process, presentation and preparation Origin and Growth of Urbanisation in the World Urban Problems: Pollution, Slum, Housing, Social wellbeing	08 hrs
Unit 2	Globalisation, Regional spaces and Development Regional/Rural Development practices- India, Case Studies. Regional/Multilevel Planning and Vision 2020- case Studies.	08 hrs
Unit 3	Application of GIS,GPS and RS in Urban and Regional Planning Research Methods in Urban and Regional Studies	08 hrs
Unit 4	**RS and GIS Applications for Agriculture and Rural Development** Concept of Rural Development – Globalization and its impact on Agriculture and Rural Development Significance of agriculture – growth and development – types of agriculture Livestock (types of agriculture)	08 hrs
Unit 5	Use of RS and GIS technologies for Rural Development Use of RS and GIS for agriculture and watershed management Use of RS and GIS for Socio economic Information Analysis Agricultural Information System- Land Holdings – Irrigation, Land Use, Land Reforms	08 hrs
Unit 6	Application of RS and GIS in rural problem solving situation – Village Information System and planning. Planning in India – Development policies (Five Year Plans) Geo-informatics for Precision Farming- Importance and relevance to Indian Agriculture.	08 hrs

References

1. R.J. Chorley and P. Hayget, Socio-economic models in geography, 1967.
2. Lo, F and K. salih, growth pole strategy and regional development policy, oxford; pergaman press, 19708.
3. Harry W. Richardson, regional and urban economics, 19708.
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17. A.C, Mohapatra and Jay ant K.Routray, Regional development and anning,Rawat, Jaipur, 19908.
18. Vision 2020, Government of AP, Hyderabad, 19908.
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21. Gibbs, Jack P., Urban Research Methods, East West Edition, New Delhi, 1966.
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GIP 506: DIGITAL IMAGE PROCESSING AND CARTOGRAPHY (LAB S)

Digital Image Processing Lab

ERDAS Imagine

- Geometric Correction
- Radiometric correction
- Histogram construction for digital data
- Outputs of linear and non-linear stretch
- 5.Filtered outputs
- Ratio images
- Change detection analysis
- Image classification based on digital values
- Unsupervised classification
- 10.Supervised classification.

CARTOGRAPHY

Topographic Sheets: Identification of Symbols and Interpretation of Central Themes. Retrieval Secondary Data**.**
Thematic Mapping: Geomorphology, Slope, Elevation, Stream Network, Drainage Patterns, Resources and Bathymetry.
Population Density: Grid pattern distribution of population, Dot mapping, Multi Dot mapping and Settlement Mapping.

Representation of Thematic Data: Application of Histograms, Pie Charts, Wind Roses, Ray Diagrams**.** Contour Map construction of Pressure Gradient, Rainfall, Temperature, Wind velocity. Choroschematic mapping.

Multi-dated Thematic Mapping: Shoreline Changes, Forest Cover Changes, Population Diffusion/Urban Growth mapping.

GIP 507: WATERRESOURCES AND MARINE GEOINFORMATICS (lab S)

Use of ArcMap in quantification of Lakes/Reservoirs, Water Bodies, Reserved Forest & Urban Sprawl.

Identification of Drainage pattern, Computation of Stream Density, Stream Frequency,

Ruggedness Number, Theissen polygons, Precipitation contours, Flow net etc.

Generation of Groundwater potential zone mapping

Isohyetal map generation and interpretation

Construction of Chlorophyll-a, SST, Depth, Salinity, Biomass, Total /Suspended matter, Biomass, distribution Maps.

Instrumentation in *In-situ* collection of Oceanographic Data: Secchi Disc, Water Samplers, Grab Samplers, Anemometers, D. O., Salinity, pH meters etc.

Field Mapping of Coastal Geomorphic Attributes.

CRZ mapping using topographic sheets, Hydrographic charts, Air photographs, Digital data products.

Mapping of riverine, beach, tidal flat, rocky and sandy shore environments from aerial photographs.

Identification & Interpretation of Oceansat, Modis, and other Oceanographic Satellite Images.

GIE 508: GEOINFORMATICS OF COASTAL ENVIRONMENTS
(OPEN ELECTIVE)

Unit 1	**Introduction:** Concepts of Geoinformatics. Outlines of Remote Sensing, Air Photo Interpretation, and Geographic Information System. Arial photos and remote sensing of coastal environment	06 hrs
Unit 2	**Outlines of Indian Satellites**: Indian space Program, Scientific Payloads from India and abroad, Bhuvan: Description of 3D Satellite Mapping. IRS-P4, Ocean Sat-II: Description and Payloads. IRS-IC/D. A brief note on Hyperspectral Remote Sensing. Resourcesat, Cartosat-I & II etc.	06 hrs
Unit 3	**Data and Data products:** List of Data and Data Models. Digital Data Products, Topographic Sheets and Theme Analysis, Hydrographic Sheets, Outlines of the I.H.O. Bathymetric measurements and outlines of Echo sounders and Multibeam unit.	06 hrs
Unit 4	**Coastal Environments**: Geomorphology of Coasts. Classification of Coastal Environments. Relevance Geology and Geotectonic to the genesis of coasts.	06 hrs
Unit 5	**Spatial Analysis of Coastal Environments:** Collection of Spatial Data from Coastal Environments. Data Interpretation and use of GIS in modeling studies.	06 hrs
Unit 6	**Coastal Regulations and Zones:** Outlines of CRZ-I, CRZ-II, CRZ-III and CRZ-IV. Amendments to the CRZ norms	06 hrs
Unit 7	**Coastal Development:** Definition and Description of Ports and Harbours. Application of EIA and CRZ to development Ports and Harbours. EIA Norms and Criteria for Recreation and Water sports.	06 hrs
Unit 8	**Coastal Information System:** Concepts of a Coastal Information System. Use of GIS in developing a Coastal Information System. Use of RS and GIS in developing coastal information system.	06 hrs

References

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12 Michael Zeiler 1999 The ESRI Guide to GIS Analysis Vol I. ESRI press.4-16.
13 Michael Zeiler, Modeling Our World: The ESRI Guide to Geodatabase Design. ESRI press. 3-7.
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15 *Experiences*, ISBN: 8131411559, Publ: ICFAI, 324pp.
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FOURTH SEMESTER

GI 551: Dissertation

Each student is required to undertake a project work under the supervision of a faculty member. It shall consist of 36 hours of Project work per week and include the entire fourth semester and the students shall carryout their project work either in a software company, GIS application company, Remote Sensing company or any research institution such as NIO, INCIOS, CESS, C-GIST, NCAOR, etc. In house project work with an affiliation of an external company or research institution with and external guide will also be considered for project work in the last (fourth) semester. The project work will be used to provide a dissertation that shall be submitted to the Chairman BoE. For evaluation as per the regulations for Geo-informatics. A viva- voce shall be mandatory as provided in the regulations for Geo-informatics M.Sc. course. After the dissertation work is completed, students shall submit dissertation/thesis based on the results obtained. The dissertation is evaluated by internal and external examiners. The total of the fourth semester shall be of twenty credits only. 200 marks

Viva -Voce

Each student has to present the dissertation work carried out by him/her in front of the examiners (internal and external) 80 marks

Field Work

Field work carried out by the students under the guidance of faculty members will be evaluated by all the concerned teachers. 60 marks

Field Report

The field report submitted by the students under the supervision of faculty member(s) will be evaluated by the concerned teacher(s). 60 marks

MODEL QUESTION PAPER

First Semester M.Sc. Degree Examination
December 2017
Subject: GEOINFORMATICS

Paper-GIH:

Time: 3 Hours Max. Marks: 70

I. Define any FIVE of the following 2x5= 10

1.
2.
3.
4.
5.
6.
7.

II. Write short notes on any THREE of the following 5x3=15

8.
9.
10.
11.
12.

III. Answer any THREE of the following 5x3=15

13.
14.
15.
16.
17.

IV. Essay type questions

18. 15

OR

19. 15

OR