

**BANGALORE**



**UNIVERSITY**

**P.G. DEPARTMENT OF GEOGRAPHY  
JNANABHARATHI, BANGALORE – 560056**

**SELF-FINANCING**

**SYLLABUS FOR **M.Sc.** GEOGRAPHIC  
INFORMATION SCIENCE (GISc)  
SEMESTER SCHEME  
Choice Based Credit System (CBCS)**

**Effective from 2016-17 onwards**

**Dr. Ashok Hanjagi**  
Chairman, BOS

**Syllabus & Regulations Governing the Choice Based Credit System (CBCS) for the Two Years (Four Semesters) Master of Science (M.Sc.) in Geographic Information Science Programme in the Faculty of Science**

**Self-Financing**

**Eligibility for Admission:**

Candidates who have passed any Bachelor Degree examination of Bangalore University or any other Universities are eligible for admission to the course provided they have secured 50% marks in the aggregate of all subjects (45% for SC/ST/Category-I Candidates).

**Scheme and Duration of the Course**

M.Sc Geographic Information Science course consists of 4 semesters in two academic years, first and second semesters will have five theories (core) out of which one paper is soft core and four practical. Third semester will have four theories (core) of which, one paper is elective and one is open elective and four practical. Fourth semester will have Project Work, Internship and Field Study Tour.

In the Internship, the students are expected to work as interns in any of the company / institution / organization, etc in their projects towards application of Geoinformatics to real world problems.

**Duration of the Course:** The duration of the M.Sc. Geographic Information Science Course shall extend over 4 semesters (two academic years) of 16 weeks or more each with a maximum of 90 actual working days of instruction in each semester.

**Course pattern:** In the faculty of Science, the number of credits per semester may vary from 24 to 26, an average of 25 credits per semester and a total of around 100 credits for the programme. The credits shall be based on the number of instructional hours per week, generally 1 credit per hour of instruction in theory and 1 credit for 2 hours of practical or project work or internship per week.

The courses offered in a programme may be the core, elective and soft courses. There shall be soft core courses of 3 hours of instruction per week in the first and second semesters, open electives & elective in the third semester, and project work in lieu of one or two theory / practical in the second / third and / or fourth semesters.

**Exit Option**

The present M.Sc. Geographic information Science course has an **exit option** after two semesters (one year) with Degree of PG Diploma in Geoinformatics. The students completing two years will get Degree with MSc in Geographic Information Science. Students are required to undertake project work and field study which is a part of study at fourth semester. There shall be University examination at the end of each semester. The course pattern & the scheme of examinations are as follows:

**Details for the Scheme of Study & Examination of Choice Based Credit System, Master of Science in Geographic Information Science**

**Semester – I**

Paper Code	Title of the Paper	Type	Instruction Hour per Week	Total No. of Hours	Duration of Exam	IA Marks	Exam Marks	Total Marks	Credits
HC 1.1	Introduction to Spatial Science	Theory	4	52	3	30	70	100	4
HC 1.2	Fundamentals of Cartography	Theory	4	52	3	30	70	100	4
HC 1.3	Fundamentals of Geographical Information Systems	Theory	4	52	3	30	70	100	4
HC 1.4	Basics of Remote Sensing	Theory	4	52	3	30	70	100	4
HC 1.5	Remote Sensing Lab: 1	Practical	4	52	3	15	35	50	2
HC 1.6	Techniques of Mapping & Mapping Analysis	Practical	4	52	3	15	35	50	2
HC 1.7	Open Source GIS	Practical	4	52	3	15	35	50	2
HC 1.8	GIS LAB 1	Practical	4	52	3	15	35	50	2
SC 1.9	<b>Programming Language</b>	Theory	3	39	3	30	70	100	2
<b>TOTAL</b>			<b>35 Hour /week</b>	<b>445 Hours / Sem</b>		<b>210</b>	<b>490</b>	<b>700</b>	<b>26</b>

**Details for the Scheme of Study & Examination of Choice Based Credit System, Master of Science in Geographic Information Science**

**Semester – II**

Paper Code	Title of the Paper	Type	Instruction Hour per Week	Total No. of Hours	Duration of Exam	IA Marks	Exam Marks	Total Marks	Credits
HC 2.1	Photogrammetry	Theory	4	52	3	30	70	100	4
HC 2.2	Surveying and GNSS	Theory	4	52	3	30	70	100	4
HC 2.3	Geoinformatics for Water Resource Management	Theory	4	52	3	30	70	100	4
HC 2.4	Geo-informatics for Regional Planning and Development	Theory	4	52	3	30	70	100	4
HC 2.5	Surveying	Practical	4	52	3	15	35	50	2
HC 2.6	GIS LAB 2	Practical	4	52	3	15	35	50	2
HC 2.7	Remote Sensing Lab: 2	Practical	4	52	3	15	35	50	2
HC 2.8	Mini-Project	Practical	4	52	3	15	35	50	2
SC 2.9	Research Methodology	Theory	3	39	3	30	70	100	2
<b>TOTAL</b>			<b>35 Hour /week</b>	<b>445 Hours / Sem</b>		<b>210</b>	<b>490</b>	<b>700</b>	<b>26</b>

**Details for the Scheme of Study & Examination of Choice Based Credit System, Master of Science in Geographic Information Science**

**Semester – III**

Paper Code	Title of the Paper	Type	Instruction Hour per Week	Total No. of Hours	Duration of Exam	IA Marks	Exam Marks	Total Marks	Credits
HC 3.1	Basics of Statistics	Theory	4	52	3	30	70	100	4
HC 3.2	Disaster Management	Theory	4	52	3	30	70	100	4
HC 3.3	Geonformatics for Environmental Impact Assessment / Geoinformatics for Natural Resource Management	Theory	4	52+ 52	3	30	70	100	4
HC 3.4	Utility Mapping	Practical	4	52	3	15	35	50	2
HC 3.5	Web-GIS	Practical	4	52	3	15	35	50	2
HC 3.6	Remote Sensing Lab 3	Practical	4	52	3	15	35	50	2
HC 3.7	GIS Lab 3	Practical	4	52	3	15	35	50	2
OE 3.8	Geography for All	Theory	4	52	3	30	70	100	4
<b>TOTAL</b>			<b>32 Hour /week</b>	<b>468 Hours / Sem</b>		<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>

**Details for the Scheme of Study & Examination of Choice Based Credit System, Master of Science in Geographic Information Science**

**Semester - IV**

Paper Code	Title of the Paper	Type	Instruction Weeks per Semester	Duration of Exam	IA Marks	Exam Marks	Total Marks	Credits
HC 4.1	Project Work	Project Work	6 weeks	Viva-voce	75	175	250	10
HC 4.2	Internship	Internship	8 Weeks	Viva-voce	75	175	250	10
HC 4.3	Field Study Tour	Field Study Tour	2 weeks	Viva-voce	30	70	100	4
<b>TOTAL</b>			<b>16 Weeks</b>		<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>

Grand Total Marks of all the four semesters.....**2600**

**Medium of instruction:** The medium of instruction shall be English only.

**Attendance:** The course (Theory, practical etc.) shall be treated as an independent unit for the purpose of attendance. A student shall attend a minimum of 75% of the total instruction hours in a course including assignments and seminars in each semester. There shall be no provision for condonation of shortage of attendance and a student who fails to secure 75% attendance in a course shall be required to repeat that semester.

**Internal Assessment:** Marks for internal assessment shall be awarded on the basis of Attendance, Test and Assignments/Seminars. The internal assessment marks shall be notified on the department notice board for the information of the students and it shall be communicated to the Registrar (Evaluation) within 10 days before the commencement of the University examinations, and the Registrar (Evaluation) shall have access to the records of such internal assessment evaluations.

**Intake: 20 seats**

**Reservation of Seats:** Of the total 20 seats, 50% of the seats will be admitted for Bangalore University students with the University norms. 25% of the seats will be allocated to the students belonging to other than Bangalore University within Karnataka state. Remaining 25% of the seats will be allocated to the candidates belonging to outside Karnataka state. However, if the candidates from Bangalore University are fallen vacant then candidates belonging to outside Bangalore University within Karnataka may be admitted. If the candidates both from Bangalore University and within Karnataka have fallen vacant then outside Karnataka candidates may be admitted.

**Board Of Examiners (BOE):** Board of examiners constituted by the University shall consist of a Chairman, internal and external members out of which at least one shall be from the Department offering the course and at least two external members from other universities. The board shall scrutinize the question papers and shall forward for the approval of university.

**Results:** A candidate should obtain a minimum of 40% marks in each of the papers in the University examination and 50% marks including internal assessment marks. A candidate should obtain a minimum of 50% marks in all Semesters. The candidates who have passed in all the semester examinations are eligible for the M.Sc. Degree in Geographic Information Science (GISc).

**Carry Over:** A candidate who fails in a lower semester examination may go to the higher semester, however, the result of the candidates who have passed the IV semester examination but not passed the lower semester examinations shall be declared as NCL (not completed lower semester examinations). Such candidates shall be eligible for the degree only after completion of all the lower semester examinations.

**Scheme of Theory Examination:**

Examination Time 3 Hours

Max. Marks 70

**Section A:** Write brief notes on any four of the following 10 x 2=20

**Section B:** Answer any three of the following 4 x 5 = 20

**Section C:** Answer any two of the following 3 x 20 = 30

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Chairman, BOS

**I Semester**  
**Paper: 1.1 Introductions to Spatial Science**

**Teaching Hour: 52 hrs**

**Unit 1**

Nature & Scope of Geography. Traditions in Geography: Areal Differentiation, Landscape Theme, Environment Theme, Spatial Distribution and Geometric theme. Inter-disciplinary and Intra-disciplinary approaches in Geography. Pioneers and their Contributions to Geography: Ancient period, Medieval period and Modern period. 13 hrs

**Unit 2**

**Geomorphology:** Definition & its fundamental Concepts. Interior structure of the Earth. Weathering & Landforms Theory of Isostasy: Views of Pratt and Aries. Theory of Plate Tectonics & Sea Floor Spreading, Theory of Continental Drift. Earthquake and Volcano, Concept of Cycle of Erosion – W.M. Davis. 13 hrs

**Unit 3**

**Climatology:** Definition, nature & scope of Climatology. Elements of Weather and Climate. Origin, Composition and Structure of Atmosphere. Temperature: Solar Radiation principles, Solar Budget, Greenhouse effects, Global warming and Global Cooling. Pressure Belts. Planetary, Monsoons & Local Winds, Jet Streams. 13 hrs

**Unit 4**

**Oceanography:** Definition & Scope of Oceanography: Configuration of Ocean Floor-Continental Shelf, Slope, Ocean Plains and Ocean Deep, Coral Reefs: Origin, Types and Theories of Origin of Coral Reefs (Darwin, Dally and Murray). Impact of Humans on the Marine Environment. 13 hrs

**References:**

1. **Critchfield H.J.** (2010): General Climatology, prentice Hall of Inida, Pvt. Ltd. New Delhi-01
2. **David Harvey** (2000) Explanations in Geography, Macmillan, New York.
3. **Dikshit R.D.** (2001). Geographical Thought: A Conceptual History of ideas, prentice Hall publishing Company, New Delhi-2
4. **Harvey ME** (2002) theme in Geographical thought, R.K. Publications and distributors, Ansari Road, New Delhi – 2.
5. **King Cuchalaine A.M.** (2012) Oceanography for geographers, Edward Arnold publications, London
6. **Majid Hussain** (2011) Evolution of Geographic Thought, Rawat Publications, New Delhi-02
7. **Siddhartha K** (2011): Atmosphere, weather and climate, Kisalaya Publications Pvt.ltd., C—2, Padma apartment, Mehruli, New Delhi-30.
8. **Strahler A.N.** (1968) The Earth Sciences, Harper & Row Intl. Edn, New York
9. **Thornberry W.D.** (1969) Principles of Geomorphology, 2nd Edition, Wiley Intl. Edn. & Wiley Eastern Reprints 1984.
10. **Woodridge S.W and R.S. Morgan** (2015) An Outline of Geomorphology, The Physical Basis of Geography, Orient Longman, Kolkata.

**Web Resources:**

11. [https://en.wikipedia.org/wiki/Spatial\\_science](https://en.wikipedia.org/wiki/Spatial_science)
12. [www.nsf.gov/sbe/bcs/grs/GSS\\_StrategicPlan\\_2011.pdf](http://www.nsf.gov/sbe/bcs/grs/GSS_StrategicPlan_2011.pdf)
13. [www.roebuckclasses.com](http://www.roebuckclasses.com) › Orientation › Lectures
14. [www.ccrs.nrcan.gc.ca/resource/tutor/fundam/index\\_e.php](http://www.ccrs.nrcan.gc.ca/resource/tutor/fundam/index_e.php)
15. <http://www.crisp.nus.edu.sg/~research/tutorial/rsmain.htm>

**I Semester**  
**Paper: 1.2 Fundamentals of Cartography**

**Teaching Hour: 52 hrs**

**Unit 1:**

**Cartography:** Concept, scope & significance of Cartography. Growth & Development of cartography. Impact of Technology on Cartography. Map as tool in Geographical studies, Choropleth, Isopleths and Chorochromatic maps. Cartography as a science of human communication. Map-making process: Elements of generalization. Thematic and composite mapping. Measurement of Geographical variables: Nominal, Ordinal, Interval and Ratio. Map symbolization. 13 hrs

**Unit 2**

Shape of the Earth: Spheroid, Ellipsoid and Geoid. Geographic Coordinates: Latitude and Longitude. Datum, Map projections: Properties, Distance, Direction and Angle, Selection of appropriate map projection and types. 13 hrs

**Unit 3**

Scope and objectives of map design, controls of map design and constrains in map design. Map Scale: Statement, Representative Fraction and Geographical Scales, Determining map scale. Ground Survey and Positioning: Measuring distance, and direction, Traditional Survey methods, Automated Survey System. 13 hrs

**Unit 4**

Types of Maps – Perception and Designing, Color and Pattern Creation, Typography and Lettering the map, Map compilation and map layout, Future Cartography. Mapping organization and services in India: SOI, NATMO and NRSC. 13 hrs

**References:**

1. **Alaxender Okada & Simon J.** 2<sup>nd</sup> Edition (2016), Knowledge Cartography, Publisher Springer.
2. **Harwell J. D. & M. D. Newson** (1973). Techniques in Physical Geography, Macmillan Edn, Ltd., London.
3. **Mark Monmonier**, (2015), The History of Cartography, Volume 6, University of Chicago press.
4. **Meena-Ja Kraak & Ferjan Ormeling** (2013) —Cartography Visulaization of Glospatial Data', 4<sup>nd</sup> Edn., Pearson Edn., Pvt. Ltd., (Singapore) New Delhi.
5. **Michael Wood** (2016), Cartography the way ahead, Royal Scottish Geographical Sociery.
6. **Mishra R.P & Ramesh A.** 2<sup>nd</sup> edition (2014) Fundamentals of Cartography, Prasaranga, University of Mysore.
7. **Monkhuse F. J & H. R Wilkinson** (1952) Maps and Diagrams, their complication and Concentration, Methuen & Co., London.
8. **N.D.Mani** ( 2015), Perceptional cartography and district planning, published by concept.pub.co
9. **Paul Bolstad**, (2016) GIS Fundamentals: A First Text on Geographic Information Systems, 4<sup>th</sup> edition
10. **Robinson & Morrison** 6<sup>th</sup> Edition (2011) Elements of Cartography, Library of Congress Catology, USA.

**Web resources**

11. <http://www.fes.uwaterloo.ca/crs/geog165/cart.htm>
12. [http://www.colorado.edu/geography/gcraft/notes/cartocom/cartocom\\_ftoc.html#3.0](http://www.colorado.edu/geography/gcraft/notes/cartocom/cartocom_ftoc.html#3.0)
13. <http://www.earthsensing.com/cart/resources/carthelp.html>
14. <https://www.loc.gov/rr/geogmap/refweb.html>
15. <https://www.lib.uiowa.edu/maps/cartog>

## I Semester

### Paper: 1.3 Fundamentals of Geographical Information Systems

Teaching Hour: 52 hrs

#### Unit 1

**Basic Spatial Perspective and GIS Concepts:** GIS definitions, concept of spaces, approaches and components, history and development of GIS. **Spatial & Non-spatial Data:** Data information, data type, data sources, characteristics of spatial and non-spatial data, raster and vector data models, geographical matrix, data stream. 13 hrs

#### Unit 2

**Data Collection:** Data Capture & geo-processing sources, input methods for spatial & non-spatial data, editing, re-projection, geometric transformation, geo-referencing, display. Map scale precision & accuracy. **Database Management System:** Characteristics, components, Data Quality: Definition, components of geographic data quality. Accuracy, precision, error and Uncertainty. Data Assessment and Evaluation. Linking spatial & non-spatial data. Database Types: Hierarchical, network, relational and object oriented. 13 hrs

#### Unit 3

**Manipulation and Analysis of Data:** Measurement of lengths, perimeter and areas, queries, buffer analysis, topology, neighborhood operations, network operations, overlay analysis, location-allocation analysis problems and surface analysis. Interpolation and its methods. 13 hrs

#### Unit 4

Global Positioning System: Concept, GPS reference Systems, Components-Space segment, Control segment, User segment. GPS Signal Propagation and Quality, GPS Observations: Pseudo ranges, Differential GPS, Relative Positioning, Errors in GPS Observations, GPS observing Techniques- Static, Rapid Static, Pseudokinematic, kinematic, Real time Kinematic (RTK). 13 hrs

#### References:

1. **Anji Reddy M.** (2012), Textbooks of Remote Sensing and Geographical Information Systems, B.S. Publications.
2. **Bernhardsen,** (2016), Geographical Information System : AN Introduction 3<sup>rd</sup> Edition, Published by Wiley India.
3. **David J Maguire, Michael F Goodchild & David W Rhind** (Ed.), (1991), Geographic Information Systems, Longman Scientific & Technical co-published in the USA with John Wiley & Sons, Inc. New York.
4. **Ian Heywood, Sarah Cornelius & Steve Carver,** (2000), An Introduction to Geographic Information Systems, Addition Wesley Longman Limited, New York.
5. **Jatin Pandey & Darshana Pathak** (2013), Geographical Information System, The Energy and Resources Institute, TERI
6. **John A. Dutton** E-Education Institute, GIS Application Development (2013) Online course material - GEOG 489, The Pennsylvania State University, USA
7. **Kang-stung Chang,** (2002), Introduction to Geographical Information Systems, Tata McGraw-Hill Publishing Company Limited, New Delhi.
8. **K. Elangovan** 2<sup>nd</sup> Edition (2013), GIS: Fundamental ,Applications and Implementations, New India Publishing Agency
9. **Peter M. Atkinson & Nicholas Tate** (2015), Advances in Remote Sensing and GIS Analysis, Published by Wiley India.
10. **Stat J & JE Estes,** (1990), Geographic Information Systems: An Introduction, New Jersey, Prentice-Hall.

#### Web resources

11. <https://www.gislounge.com/open-source-gis-applications>
12. [www.gisgeography.com › Data Sources](http://www.gisgeography.com/Data_Sources)
13. [www.webgis.com/](http://www.webgis.com/)
14. <https://www.lib.ncsu.edu/gis/dataweb.html>
15. <https://www.mapbox.com/blog/turf-gis-for-web-maps>



**I Semester**  
**Paper: 1.4 Basics of Remote Sensing**

**Teaching Hour: 52 hrs**

**Unit 1**

**Remote Sensing: Development of Remote Sensing:** Definition – types – chronological development; international remote sensing centres; Indian remote sensing centres and their activities – new satellite programs of India. Electro Magnetic Radiation (EMR) and Electro Magnetic Spectrum, Interaction of EMR with the atmosphere & with the surface feature. Atmospheric window; spectral signature of common land covers (minerals, rocks, water, vegetation and urban area) 13 hrs

**Unit 2**

**Fundamentals of Aerial Photography:** Classification of Aerial Photographs on the basis of Height and Tilt, Components of the Camera, Film, Aerial Platforms. Elements of Aerial photo interpretation: Formats of Imageries: Digital and Analog data. 13 hrs

**Unit 3**

**Sensor & Platforms:** Sensors: Active and passive Sensors, Electro mechanical and optical sensors. Platforms: Types, Characteristics, Payload of launch vehicles, -SLV, PSLV, GSLV, AGSLV, Orbit positioning issues. Scanning methods; FOV and IFOV; hyper-spectral sensors and imaging. Resolution: spatial, spectral, radiometric and temporal. 13 hrs

**Unit 4**

**Applications Satellites:** GOES, NOAA, METEOSAT & INSAT. Land observation Satellites: LANDSAT, SPOT, IRS, IKONOS, GEOEYE & WORLDVIEW. Marine Observation Satellites: Sea-Sat, Nimbus, CZCS, MOS, SeaStar, SeaWiFS & Oceansat. 13 hrs

**References:**

1. **Basudeb Bhatta**, 2<sup>nd</sup> Edition,(2013),Remote Sensing and GIS,Published by Oxford University Press,USA.
2. **George Joseph**,2<sup>nd</sup> edition (2014),Fundamentals of Remote Sensing.Published by orientblackswan.
3. **Jenson R. Jhon**, (2003), Remote Sensing of the Environment-An Earth Resource Perspective, Pearson Education Pvt. Ltd., Indian Branch, Patparganj, Delhi, India.
4. **Kumar S.**,(2013),Basics of Remote Sensing and GIS,published by Springer.
5. **Lillisand T.M and Keifer R.W**, 7<sup>th</sup> Edition (2015), Remote Sensing and Image Interpretation, Jhon Willey & sons, New York.
6. **LRA Narayanan**, Remote sensing and its Applications, (1999), Universities Press (India) Ltd., Hyderabad.
7. **Peter M. Atkinson & Nicholas Tate** ,(2012),Advances in Remote Sensing and GIS Analysis, Wiley India Pvt Ltd
8. **Rampall, K.K.** (1999), hand book of Aerial Photography and Interpretation, Concept Publishing Co., New Delhi.
9. **Richard,John A.**5<sup>th</sup> Edition (2014),Remote Sensing Digital Image Analysis,published by Springer.
10. **Sabins, F.F. Jr**, (1987), Remote Sensing; Principles and Interpretation, W.h. Freeman & Co., New York.

**Web resources**

11. <http://rst.gsfc.nasa.gov/Front/tofc.html>
12. <http://earthobservatory.nasa.gov/Library/RemoteSensing>
13. [remotesensing.usgs.gov/](http://remotesensing.usgs.gov/)
14. [grindgis.com/what-is-remote-sensing/know-basics-of-remote-sensing](http://grindgis.com/what-is-remote-sensing/know-basics-of-remote-sensing)
15. [www.wamis.org/agm/pubs/agm8/Paper-2.pdf](http://www.wamis.org/agm/pubs/agm8/Paper-2.pdf)

**I Semester  
Practical: 1.5 Remote Sensing Lab: 1**

**Teaching Hour: 52 hrs**

Exercise No	Title of the Exercise
1	An introduction of Aerial Photographs
2	Elements of Aerial photo interpretation
3	Determining the scale of Aerial Photographs and construction methods
4	Stereographic view obtaining methods
5	Interpretation of aerial photographs and fringe information
6	Extracting physical features from aerial photo preparing layers and interpretation
7	Extracting cultural features from aerial photo preparing layers and interpretation
8	An introduction of Satellite images and fringe information
9	Comparison features in Toposheet, aerial photographs and satellite imageries
10	Identification of features through signatures, color identifications
11	Elements of Satellite image interpretation
12	Preparing land use map from satellite imageries and interpretations
13	Preparation of thematic maps from the satellite imagery
14	Understating the pixel values in satellite image
15	Understanding the difference between the panchromatic and multi spectral images

**References:**

1. **Averte and GL. Berrin** 2<sup>nd</sup> Edition (2011) Fundamentals of Remote Sensing and Aerial Photo interpretation Mc Millan, New York.
2. **George Joseph** (2002) Fundamentals of Remote Sensing, University press Pvt. Ltd. Hyderabad-29
3. **Paul R. Wolf** 3<sup>rd</sup> Edition (2010) Elements of photogrammetry, Mc. Grawhill, International Book Company, New Delhi.
4. **Singh and Sharma** (2004) Introduction of Remote Sensing, Rawath Publications, New Delhi
5. **Lillisand T.M and Keifer R.W**, 7<sup>th</sup> Edition (2015), Remote Sensing and Image Interpretation, Jhon Willey & sons, New York.
6. **LRA Narayanan**, Remote sensing and its Applications, (1999), Universities Press (India) Ltd., Hyderabad.
7. **Peter M. Atkinson & Nicholas Tate** ,(2012),Advances in Remote Sensing and GIS Analysis, Wiley India Pvt Ltd
8. **Rampall, K.K.** (1999), hand book of Aerial Photography and Interpretation, Concept Publishing Co., New Delhi.
9. **Richard,John A.**5<sup>th</sup> Edition (2014),Remote Sensing Digital Image Analysis,published by Springer.
10. **Sabins, F.F. Jr.** (1987), Remote Sensing; Principles and Interpretation, W.h. Freeman & Co., New York.

**Web resources**

11. <http://rst.gsfc.nasa.gov/Front/tofc.html>
12. <http://earthobsevatory.nasa.gov/Library/RemoteSensing>
13. [remotesensing.usgs.gov/](http://remotesensing.usgs.gov/)
14. [bhuvan.nrsc.gov.in/](http://bhuvan.nrsc.gov.in/)
15. [www.isro.gov.in/](http://www.isro.gov.in/)

**I Semester**  
**Practical: 1.6 Techniques of Mapping and Analysis**

**Teaching Hour: 52 hrs**

Exercise No	Title of the Exercise
1	An introduction to Cartographic Appreciation
2	Proportional Symbols
3	Representation of Data by applying Mono Dot Method
4	Representation of Data by applying Multiple Dot Method
5	Representation of Data by applying Circle Method
6	Representation of Data by applying Sphere Method
7	Representation of Data by applying Cube Method
8	Construction of Choropleth Map for the selected data
9	Construction of Isopleth Map for the selected data
10	Construction of Gray Scale Map for the selected data
11	Construction of Choro-chromatic Method for the selected data
12	Construction of Choro-schematic maps for the selected data
13	Preparing Block Pile Diagrams for the datasets
14	Preparing Pie Diagrams for the datasets
15	Preparing Flow diagrams for the datasets

**References:**

1. **A. Wood.** (2016), Cartography, Kluwer Academic Publisher .
2. **Cartright C.** (2014). Cartography and Art , Springer-Verlag Berlin and Heidelberg GmbH Co. KG.
3. **Mark Monmonier,**(2015), The History of Cartography, Volume 6, University of Chicago press.
4. **Meena-Ja Kraak & Ferjan Ormeling** (2013) —Cartography Visualization of Geospatial Data', 4th Edn., Pearson Edn., Pvt. Ltd., (Singapore) New Delhi.
5. **Michael Wood** (2016), Cartography the way ahead, Royal Scottish Geographical Society.
6. **Mishra R.P & Ramesh A.** 2<sup>nd</sup> edition (2014) Fundamentals of Cartography, Prasaranga, University of Mysore.
7. **Monkhouse F. J & H. R Wilkinson** (1952) Maps and Diagrams, their complication and Concentration, Methuen & Co., London
8. **N.D.Mani** ( 2015), Perceptual cartography and district planning, published by concept.pub.co
9. **Paul Bolstad,** 4th edition (2016) GIS Fundamentals: A First Text on Geographic Information Systems,
10. **R.W.Ampson** 7<sup>th</sup> Edition (2011) Basics of Cartography, Elsevier Science & Technology.

**Web resources**

11. <http://www.fes.uwaterloo.ca/crs/geog165/cart.htm>
12. [http://www.colorado.edu/geography/gcraft/notes/cartocom/cartocom\\_ftoc.html#3.0](http://www.colorado.edu/geography/gcraft/notes/cartocom/cartocom_ftoc.html#3.0)
13. <http://www.earthsensing.com/cart/resources/carthelp.html>)
14. <https://www.loc.gov/rr/geogmap/refweb.html>
15. <https://www.lib.uiowa.edu/maps/cartographic/>

**I Semester  
Practical: 1.7 Open Source GIS**

**Teaching Hour: 52 hrs**

Exercise No	Title of the Exercise
1	Familiarization with Q GIS Software
2	Geo-referencing and Projecting Raster Data
3	Creating Vector Data Model and Projecting
4	Digitizing – Point, Line and Polygon features
5	Special Digitizing features adjoining polygon, split and joining
6	Creating Attributes – Character, Numbers and Float
7	Linking attributes to special features and Labeling
8	Using Symbology and Typography
9	Map Layout and Exporting Map in Different Format
10	Unique Symbol Maps – Dot, Classified, Unique Value
11	Preparation of Cartographic Maps – Choropleth, Bar, Pie and Stacked
12	Query Building and Executing to analysis the data
13	Buffer Analysis
14	Overlay Analysis for the required layers for interpretation
15	Interpreting Spatial Analysis Maps

**References:**

1. **Burrough P.A. and R. A. McDonnell**, Principles of Geographical Information System, 2010, Oxford University Press.
2. **C.P.Lo and Albert K. W. Yeung**, Concepts and Techniques of Geographic Information System, 2002 Prentice –Hall, India.
3. **George Joseph**, Fundamentals of Remote Sensing, 2004, Universities Press Pvt. Ltd., Hyderabad.
4. **Glan Moody, 5<sup>th</sup> Edition (2013)**, An History of Open Source Softwares, by Willey.
5. **Heywood I**, (el.) An Introduction to Geographical Information Systems , Pearson (2011 )
6. **Kang – Tsung – Chang**, Introduction to Geographical Information System, 2002, McGraw Hill, John Wiley and Sons Ltd
7. **Karl Forg,(2015)**, Producing Open Source Softwares, By Sharoff Publishers & Imb.
8. **Lillesand T.M. and Kiefer R.W.**, 2002, Remote Sensing and Image Interpretation, John Wiley and Sons, New Delhi.
9. **Mohini Bherwani,(2012)**, Metadata in context to opean source softwares, Published by Dattsons.
10. **Sam Ockman, Chris DiBona & Mark Stone** ,7th edition (2013), Opean Source: Vocises from the Open Source Revolution, Published by O'Reilly Media.

**Web resources**

11. <https://www.gislounge.com/open-source-gis-applications/>
12. [www.bhuvan.nrsc.gov.in/](http://www.bhuvan.nrsc.gov.in/)
13. [www.qgis.org/](http://www.qgis.org/)
14. [www.gisgeography.com](http://www.gisgeography.com) › Software
15. <https://grass.osgeo.org/>

**I Semester  
Practical: 1.8 GIS Lab-1**

**Teaching Hour: 52 hrs**

Exercise No	Title of the Exercise
1	An Introduction to GIS
2	Measurement of Scales: Nominal, Ordinal and Ratio methods
3	Identification of Objects
4	Extraction of Physical features from toposheets
5	Extraction of Cultural features from toposheets
6	Creating Vector Data Model
7	Creating Raster Data Model
8	Creating Cartesian Coordinates System
9	Construction of Spagathi Model
10	Creating TIN to understand the surface elevation
11	Creating Buffering
12	Overlay analysis for different identification based on requirement
13	Creating Rainfall Variability and Intensity Map
14	Creating Tourism Interest Maps
15	Creating a Simple Model

**References:**

1. **Burrough P.A. and R. A. McDonnell**, Principles of Geographical Information System, 2010, Oxford University Press.
2. **C.P.Lo and Albert K. W. Yeung**, Concepts and Techniques of Geographic Information System, 2002 Prentice –Hall, India.
3. **George Joseph**, Fundamentals of Remote Sensing, 2004, Universities Press Pvt. Ltd., Hyderabad.
4. **Glan Moody, 5<sup>th</sup> Edition (2013)**, An History of Open Source Softwares, by Willey.
5. **Heywood I**, (el.) An Introduction to Geographical Information Systems , Pearson (2011 )
6. **Kang – Tsung – Chang**, Introduction to Geographical Information System, 2002, McGraw Hill, John Wiley and Sons Ltd
7. **Karl Forg,(2015)**, Producing Open Source Softwares, By Sharoff Publishers & Imb.
8. **Lillesand T.M. and Kiefer R.W.**, 2002, Remote Sensing and Image Interpretation, John Wiley and Sons, New Delhi.
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10. **Sam Ockman, Chris DiBona & Mark Stone** ,7th edition (2013), Open Source: Vocises from the Open Source Revolution, Published by O'Reilly Media.

**Web resources**

11. <https://www.gislounge.com/open-source-gis-applications/>
12. [www.bhuvan.nrsc.gov.in/](http://www.bhuvan.nrsc.gov.in/)
13. [www.qgis.org/](http://www.qgis.org/)
14. [www.gisgeography.com](http://www.gisgeography.com) › Software
15. <https://grass.osgeo.org/>

**I Semester**  
**Paper: 1.9 Programming Languages**

**Teaching Hour: 52 hrs**

**UNIT I :**

**Preliminary Concepts:** Why and how to study programming languages; Examples of languages with brief case studies; History and evolution; Programming paradigms; Good, bad, and successful languages. Overview of selected languages: Tours of [Ruby | Python], JavaScript, [Clojure | Haskell | Scala | ML], [Go | Rust | Swift], highlighting interesting and unique features; Comparisons with popular languages such as Java, C, and C++. **Syntax and Semantics:** general Problem of describing Syntax and Semantics, formal methods of describing syntax - BNF, EBNF for common programming languages features, parse trees, ambiguous grammars, attribute grammars, denotational semantics and axiomatic semantics for common programming language features. **13hours**

**UNIT II :**

**Data types:** Introduction, primitive, character, user defined, array, associative, record, union, pointer and reference types, design and implementation uses related to these types. Names, Variable, concept of binding, type checking, strong typing, type compatibility, named constants, variable initialization. **Expressions and Statements:** Arithmetic relational and Boolean expressions, Short circuit evaluation mixed mode assignment, Assignment Statements, Control Structures – Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, guarded commands. **13 hours**

**UNIT III:**

**Subprograms and Blocks:** Fundamentals of sub-programs, Scope of life time of variables, static and dynamic scope, design issues of subprograms and operations, local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, parameters that are sub-program names, design issues for functions user defined overloaded operators. **13 hours**

**UNIT IV:**

**Abstract Data types:** Abstractions and encapsulation, introductions to data abstraction, design issues, language examples, C++ parameterized ADT, object oriented programming in small talk, C++. **Exception Handling:** Exceptions, exception Propagation, Exception handler in C++ and Java **logic Programming Language:** Introduction and overview of logic programming, basic elements of prolog, application of logic programming. **Functional Programming Languages:** Introduction, fundamentals of FPL, LISP, ML, Haskell, application of Functional Programming Languages and comparison of functional and imperative Languages. **Scripting Language:** Pragmatics, Key Concepts, Python- Values and Types, Variables, Storage and Control, Bindings and Scope, Procedural Abstraction, Separate Compilation, Module Library. **13 hours**

## References:

1. Concepts of Programming Languages Robert .W. Sebesta 8/e, Pearson Education, 2008.
2. Programming Language Design Concepts, D. A. Watt, Wiley dreamtech, rp-2007.
3. Robert W. Sebesta, "Concepts of Programming Languages", Tenth Edition, Addison Wesley, 2012.
4. Michael L. Scott, "Programming Language Pragmatics", Third Edition, Morgan Kaufmann, 2009.
5. Jeffrey D. Ullman, "Elements of ML programming", Second Edition, Prentice Hall, 1998.
6. Richard A. O'Keefe, "The craft of Prolog", MIT Press, 2009.
7. W. F. Clocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.
8. LISP Patric Henry Winston and Paul Horn Pearson Education.
9. Programming in Prolog, W. F. Clocksin & C. S. Mellish, 5th Edition, Springer.
10. Programming Python, M. Lutz, 3rd Edition, O'reilly, SPD, rp-2007.
11. Core Python Programming, Chun, II Edition, Pearson Education, 2007.
12. Guide to Programming with Python, Michel Dawson, Thomson, 2008
13. Programming Languages, 2nd Edition, A. B. Tucker, R. E. Noonan, TMH.

### Web resources

1. <https://www.cleverism.com/programming-languages-web-development/>
2. <https://www.cleverism.com/programming-languages-web-development/>
3. [https://en.wikipedia.org/.../Programming\\_languages\\_used\\_in\\_most\\_popular\\_websites](https://en.wikipedia.org/.../Programming_languages_used_in_most_popular_websites)
4. <https://www.quora.com/What-programming-languages-should-I-learn-for-web-devel...>
5. <https://www.devsaran.com/.../10-best-programming-languages-2015-you-should-kno..>

**II Semester**  
**Paper: 2.1 Photogrammetry**

**Teaching Hour: 52 hrs**

**Unit 1**

**Basics of Aerial Photographs:** Historical development, principles aerial of photographs, types and uses. Films used, flight planning for aerial survey, aerial camera and photographic products: Parts of camera: lens, shutter, filter, camera frame. Camera: terrestrial, airborne. Satellite, photographic and digital products, marginal information and content, Ground Control Points. 13 hrs

**Unit 2**

**Photogrammetry :** Errors in aerial photographs, Relief displacement and parallax, scale factors, resolution, coverage. Element of photo interpretation, interpretation keys, plotting methods, radial line, plotting instruments. 13 hrs

**Unit 3**

**Rectification and Orthophotography:** Orientation and projection, geometric correction, aerial triangulation, adjustments, orthophotography, mosaic. 13 hrs

**Unit 4**

**Photogrammetric Modeling and Applications:** Planemetric applications: cadastral, resource management, urban infrastructure. 3D applications: DEM - DSM-nDSM – landscape visualization. Digital Photogrammetry: hardware & software, photogrammetric workflow. LiDAR: concepts and applications. 13 hrs

**References:**

1. **Greve, C.**, 1996, `Digital Photogrammetry-An Addendum to the Manual of Photogrammetry`. American Society for Photogrammetry and Remote Sensing.
2. **James K.(2016),Modern** Photogrammetry,wily.
3. **Kasser, M. and Y.Egels**, 2012, 'Digital Photogrammetry',Taylor & Francis.
4. **Leberl, F.**2<sup>nd</sup> Edition (2008), Radargrammetry for Image Interpreters, 2nd ed., International Institute for Aerial Survey and Earth Sciences, Enschede, The Netherland.
5. **McGlone, J.C.**, 2014, 'Manual of Photogrammetry-Seventh Edition', American Society for Photogrammetry and Remote Sensing.
6. **Mikail, E.M., J.S. Bethel, and J.C. McGlone**, 2011, 'Introduction to Modern Photogrammetry', John Wiley & Sons, Ins.
7. **Paul R. Wolf , Bon A. Dewitt & Benjamin E. Wilkinson**, 4<sup>th</sup> Edition (2014), Elements of Photogrammetry with Applications in GIS, McGraw-Hill Education.
8. **Publication Division (2016), India 2016**, Ministry of Information & Bro
9. **Schenk, T.**, 1999, `Digital Photogrammetry-Vol. 1`, TerraScience. (Main textbook)
10. **Wolf, P.R., and B.A. Dewitt**,(2013), Elements of Photogrammetry: with Applications in GIS, 5rd Ed., McGraw-Hill.

**Web resources**

11. [www.mat.uc.pt/~gil/downloads/IntroPhoto.pdf](http://www.mat.uc.pt/~gil/downloads/IntroPhoto.pdf)
12. <https://en.wikipedia.org/wiki/Photogrammetry>
13. [r-s-c-c.org/rscv/v112.html](http://r-s-c-c.org/rscv/v112.html)
14. [www1.rmit.edu.au/courses/03847](http://www1.rmit.edu.au/courses/03847)
15. [www.isprs.org/](http://www.isprs.org/)



**II Semester**  
**Paper: 2.2 Surveying and GNSS**

**Teaching Hour: 52 hrs**

**Unit 1**

**Surveying:** Introduction, Historical development, overview of GPS: Space, ground control & user segments. Land navigation, marine navigation, survey instruments, Recent trends.

13 hrs

**Unit 2**

Working principles of GPS: Satellite ranging - resection; error sources atmospheric - ionospheric errors – multipath - Selective availability - antispoofing error rectification - atmospheric and ionospheric models –choke ring - differentially corrected positions; Positioning techniques - precise point positioning; - Satellite geometry - mask and azimuth angles.

13 hrs

**Unit 3**

Geodesy and Surveying: Geodesy meaning and application, GNSS – GPS coordinate system, Local Coordinate System, transformations – step wise transformation – seven parameter transformation; Measuring techniques – Static surveys – rapid static survey – kinematic survey – RTK survey – Pre survey preparations – Total Station. GNSS and GIS Integration: Integration techniques - Data focused integration, position focused and technology focused integration; Technology convergence for data use; Methods of integration - NAME, Binary Data control and customization — Active X; Hardware and software platforms; GPS, GIS.

13 hrs

**Unit 4**

GNSS: Location - Navigation - Tracking - Mapping and Tinning - Misuses of GNSS - types of misuses - examples - Intelligence collection augmentation with weapon system, integration into ballistic and cruise missile systems; Future uses – position information society -consumer based GNSS products.

13 hrs

**References:**

1. **Adams, Henry(2014)**, Practical Surveying and Elementary Geodesy, : Scholar's Choice
2. **Agraval, N. K.,** (2011). Essentials of GPS, Geodesy and GPS, 2<sup>nd</sup> edition , publications,Hyderabad.
3. **Ganesh, A.,** (2006). Dimensions of Geomatics, Bharathidasan University, Tiruchirappalli.
4. **Groten, E., Strauss, Robert,(2014)**, GPS-Techniques Applied to Geodesy and Surveying, Springer.
5. **Hofmann – Wellenhof, Lichtenegger, and Wasle,** 2<sup>nd</sup> Edition (2013). Global Navigational Satellite Systems (GNSS) Springer Wien New York.
6. **Jan Van Sickle,** 2<sup>nd</sup> Edition (2013). GPS for Land Surveyors, CRC Press, Taylor & Francis Group, New York.
7. **Lee, Thomas Jefferson(2014)**, Collection of Tables and Formulae Useful in Surveying, Geodesy, and Practical Astronomy, BiblioLife.
8. **Merriman, Mansfield (2013)**, Elements of Precise Surveying and Geodesy, Nabu Press.
9. **Nel Samama,** (2012). Global Positioning Techniques and Performance, John Wiley and Sons, Inc., New Jersey.
10. **Popplewell, William Charles, (2014)**, The Elements of Surveying and Geodesy, Kessinger Publishing.

Web resources:

11. [www.tsa-uk.org.uk/for-clients/guidance-notes/](http://www.tsa-uk.org.uk/for-clients/guidance-notes/)
12. [gpsworld.com/gnss-and-the-real-time-network-the-surveyors/](http://gpsworld.com/gnss-and-the-real-time-network-the-surveyors/)
13. [www.southinstrument.com/](http://www.southinstrument.com/)
14. [www.ngs.noaa.gov/](http://www.ngs.noaa.gov/)
15. <https://www.aagsmo.org/>

**II Semester**  
**Paper: 2.3 Geoinformatics for Water Resource Management**

**Teaching Hour: 52 hrs**

**Unit 1**

**Introduction:** Hydrology, development of scientific hydrology –importance of water –occurrence of water – hydrological cycle, precipitation - variation in precipitation distribution – analysis and interpretation of precipitation data – areal assessment of precipitation.

13 hrs

**Unit 2**

**Evaporation and Evapotranspiration:** Concept of potential evapotranspiration – factors controlling evapotranspiration – measurements of evaporation and evapotranspiration – computation –relationship between actual and potential evapotranspiration – spatial variation - interception process –determination of interception – variations.

13 hrs

**Unit 3**

**Groundwater:** Infiltration process – methods of determining infiltration rate – soil moisture – measurement – variations - groundwater - origin and occurrence - storage – types of aquifers – groundwater movement –groundwater level – groundwater quality–Mapping methods.

13 hrs

**Unit 4**

**Water Resources Management:** Approaches to planning and development of water resources –evaluation of surface water resources and groundwater – assessment of water quality for various uses –water supplies and utilization - problems - policies and management. GIS for surface water modelling-groundwater modelling – flood plain mapping – water quality monitoring – water resource planning and management –Hydrologic Information System.

13 hrs

**References:**

1. **Ayodade, J. O.**, 2<sup>nd</sup> edition (2011) Tropical Hydrology and Water Resources, Macmillan Publishers, London.
2. **Chor Pang Lo**(2011) Concepts and Techniques of Geographic Information Systems, Prentice Hall India Learning Private Limited.
3. **Lyon, J.G.**, (2013) GIS for Water Resource and Watershed Management, Taylor and Francis, New York.
4. **Patel Dhruvesh**(2013) Application of RS and GIS in Water Resources Management, LAP Lambert Academic.
5. **Sewell, W.R.D.**, (1975) Geography of Water Resources, Prentice Hall, New York.
6. **Sharma, Nayan, Flugel**,(2014), Applied Geoinformatics for Sustainable Integrated Land and Water Resources Management (IIWRM) in the Brahmaputra River Basin, Springer India.
7. **Todd, D.K.**, (1959) Groundwater Hydrology, McGraw Hill Book Company, New York
8. **Olson, R. E.**, (2012) A Geography of Water Resources, WMC Brown Company Publishers, Iowa.
9. **Rao, K. L.**, (1975) India's Water Wealth: Its Assessment, Uses and Projections, Orient Longman, New Delhi.
10. **Ward, R.C.**, 6<sup>th</sup> edition (2014) Principles of Hydrology, McGraw-Hill Book Company, London.

Web resources:

11. [www.poverty-action.org/](http://www.poverty-action.org/)
12. [wrmin.nic.in/](http://wrmin.nic.in/)
13. [www.teriin.org/policybrief/docs/persp.pdf](http://www.teriin.org/policybrief/docs/persp.pdf)
14. <http://link.springer.com/journal/11269>
15. <http://www.un.org/waterforlifedecade/iwrm.shtml>

**II SEMESTER**  
**Paper: 2.4 Regional Planning and Development**

**Teaching Hour: 52 hrs**

**Unit 1**

Regional concept in Geography: Types, hierarchy and characteristics of regions, Delineation methods of regions – Formal, Functional and Nodal. Geography and regional planning. Concept and scope of Regional Planning. Regional Approaches. Principles, methods, techniques of regional planning, need for planning. 13 hrs

**Unit 2**

Conceptual and theoretical frame work of regional planning: Growth pole and growth foci. Planning Processes: Sectoral, Multilevel, decentralized planning. Integrated Area Development Planning (IADP). Planning for tribal and hilly areas, drought prone areas, command areas and watershed. Planning for metropolitan region: CDP, satellite towns, urban green belt. 13 hrs

**Unit 3**

Concept of Development, Indicators of development. Regional imbalance. Regional development strategies. Problems and issues in regional planning. Planning for sustainable development. Regionalization of India: Based on natural, economic and administration (macro and meso levels only). Regional policies in Indian five-year plans, experience of regional planning in India; Evolution, nature and scope of town planning with special reference to India; fundamentals of town & country planning. 13 hrs

**Unit 4**

Theories of regional development: Central Place Theory, Diffusion theory (Hegerstand's). The role of locational theories in regional planning process. An evaluation of regional disparities / imbalances – backward regions of India. Identification of backward areas, Planning backward area. Causes and consequences regional of disparities. Measures of disparities. Harnessing the information through GIS, Remote Sensing, GPS for regional planning & development. 13 hrs

**References:**

1. **Mahesh Chand and Viney K. Puri** (1985) Regional Planning in India, Allied Publishers Pvt. Ltd., Bombay
2. **Mishra RP** 3<sup>rd</sup> edition (2000) Regional Planning Concepts Techniques Policies and case studies, Prasaranga, The Mysore University, Mysore.
3. **Mishra R.P.** (1979) Regional Planning and National Development, Vikas Publishing House Pvt. Ltd., New Delhi.
4. **Fulong Wu** (2015), Planning for Growth: Urban and Regional Planning in China (RTPI Library Series), Published by Routledge.
5. **R.C. Chandan** 7<sup>th</sup> Edition (2014), Regional planning and Development, Vikas Publishing House Pvt. Ltd., New Delhi.
6. **Singh Jagadish** (2010) India – A Comprehensive Systematic Geography, Gyanodaya Prakashan, Gorakhpur, U.P.
7. **Tiwari R. C.** (2005) Geography of India, Prayoug Pustak Bhavan, Allahabad
8. **V.K.R.V. Rao** (1978). Planning in Perspective, Allied Publishers Private Limited, Bombay.
9. **V.Nath** 4<sup>th</sup> Edition (2011), Regional development and planning in india, Concept publishing company
10. **V. Laxmidevi** (1997) Planning Development and Regional Disparities, Anmol Publication Pvt. Ltd., New Delhi.

**Web resources**

11. [www.northerntier.org/](http://www.northerntier.org/)
12. [planning.lacounty.gov/](http://planning.lacounty.gov/)
13. [www.kipda.org/](http://www.kipda.org/)
14. [www.stcplanning.org/](http://www.stcplanning.org/)
15. [www.smrpc.org/](http://www.smrpc.org/)

II Semester  
**Practical: 2.5 Surveying**

**Teaching Hour: 52 hrs**

Exercise No	Title of the Exercise
1	Introduction to Traditional and Automated Survey Methods
2	Simple Height measurements through Total Station
3	Measurement of area using Total Station
4	Distance measurement using reflection or without reflection
5	Line Profiling and contouring
6	Contouring
7	Plotting Buildings
8	Components of GPS and working procedure
9	Point Creations using GPS Instruments
10	Creation of Road network using given area
11	Creating Micro Polygons
12	Creating Data Base for Area of Interest
13	Base point extraction from DGPS
14	Transformation of GPS Data to the GIS Software
15	Construction of maps through GPS

**References:**

1. **Mishra, R.P.** (1973): Elements of Cartography. Prasaranga, University of Mysore.
2. **Monkhouse F.JR & Wilkinson H.R.**, 7<sup>th</sup> edition(2001) : Maps and Diagrams, Mathwn & Company, London.
3. **Robinson, A.H & Sale R.D.**, 5th edition (2013).: Elements of Cartography. Johns House & Sons, London.
4. **Sing R. L.** (1996) : Map Work & Practical Geography, Central Book Dept. Allahabad.
5. **Singh & Kanaujia** (1973) : Map Work & Practical Geography, Central Book Dept. Allahabad.
6. **N. N. Basak** (1994): Surveying and Leveling, Tata McGraw Hill Publishing Company LTD., New Delhi.
7. **Lee, Thomas Jefferson(2014)**, Collection of Tables and Formulae Useful in Surveying, Geodesy, and Practical Astronomy, BiblioLife.
8. **Merriman, Mansfield (2013)**, Elements of Precise Surveying and Geodesy, Nabu Press.
9. **Nel Samama**, (2012). Global Positioning Techniques and Performance, John Wiley and Sons, Inc., New Jersey.
10. **Popplewell, William Charles, (2014)**, The Elements of Surveying and Geodesy, Kessinger Publishing.

**Web resources**

11. [www.tsa-uk.org.uk/for-clients/guidance-notes/](http://www.tsa-uk.org.uk/for-clients/guidance-notes/)
12. [gpsworld.com/gnss-and-the-real-time-network-the-surveyors/](http://gpsworld.com/gnss-and-the-real-time-network-the-surveyors/)
13. [www.southinstrument.com/](http://www.southinstrument.com/)
14. [www.ngs.noaa.gov/](http://www.ngs.noaa.gov/)
15. <https://www.aagsmo.org>

**II Semester  
Practical: 2.6 GIS Lab**

**Teaching Hour: 52 hrs**

Exercise No	Title of the Exercise (Total 52 Hrs)
1	Introduction to Arc GIS Software – Map, Catalogue and Toolbox
2	Methods to Adding Data to Arc Map
3	Toposheet Geo-referencing Using 16 Corners and 4 Corners
4	Creation of Data base to manage files in GIS Software – MDB, GDB, Feature Dataset, Feature Class
5	Method Digitations and Trimming
6	Creation of Shape file
7	Method of Merging and Line to Polygon creation
8	Attribute creation to linking spatial features
9	Methods of different types of Labeling, Flow Labeling and others
10	Procedure of using Location Tools and Annotation Tools
11	Preparing Different types of Cartographic Maps
12	Preparation of Isopleths Map or Interpolation
13	Different methods of Query by Location and Attributes
14	Mechanism of Measuring objects in Raster and Vector Layer
15	Creation of Map furniture

**References:**

1. **Ian Heywood, Sarah Cornelius & Steve Carver**, (2000), An Introduction to Geographic Information Systems, Addition Wesley Longman Limited, New York.
2. **Kang-stung Chang**, (2002), Introduction to Geographical Information Systems, Tata McGraw-Hill Publishing Company Limited, New Delhi,
3. **Stat J & JE Estes**, (1990), Geographic Information Systems: An Introduction, New Jersey, Prentice-Hall ,
4. **Kang-stung Chang**,(2002),Introduction to Geographic Information Systems, Tata McGraw Hill, New Delhi,
5. **Gibson, Paul J.** (2000). Introductory Remote Sensing – Principles and Concepts. Rout ledge.
6. **Jensen, John R.** 2000. Remote Sensing of the Environment – An Earth Resource Perspective. Pearson Education (First Indian Edition, 2003).
7. **Hord, R. Michae** I. 1986. Remote Sensing – Methods and Applications. (A Wiley-Interscience Publication). New York: John Wiley & Sons.

**Web resources:**

8. <https://www.gislounge.com/open-source-gis-applications/>
9. [www.bhuvan.nrsc.gov.in/](http://www.bhuvan.nrsc.gov.in/)
10. [www.qgis.org/](http://www.qgis.org/)
11. [www.gisgeography.com](http://www.gisgeography.com) › Software
12. <https://grass.osgeo.org/>

**II Semester**  
**Practical: 2.7 Remote Sensing Lab-2**

**Teaching Hour: 52 hrs**

Exercise No	Title of the Exercise (Total 52 Hrs)
1	Introduction to Image Processing Software
2	Methods of Data input and data storage
3	Displaying an image for image processing
4	Importing Satellite Imageries to different formats
5	Geo-referencing and Projecting: Toposheet
6	Geo-referencing and Projecting India Map
7	Image to Image Geo-referencing
8	Creating AOI for different purposes
9	Sub-setting the image of the interest area
10	Techniques Mosaic raster data model
11	Classification: Unsupervised Classification – Changing Band Combinations
12	Supervised Classification – Recoding, Attribute changing and others
13	Creating vector layer point, line and polygon
14	Using Editing for the development of the layers
15	Map Composer

**References:**

1. **Agarwal, C.S. and Garg, P.K.** 2000. Textbook of Remote Sensing in Natural Resources Monitoring and Management. New Delhi: Wheeler Publishing.
2. **Bakker, Wim H., et al.** 2001. Principles of Remote Sensing – An Introductory Textbook. Enschede, The Netherlands: ITC.
3. **Banerjee, R.K. and Banerjee, B.** 2000. Remote Sensing for Regional Development. New Delhi: Concept Publishing Company.
4. **Campbell, James B.** 1996. Introduction to Remote Sensing (Second Edition). London: Taylor & Francis.
5. **LRA Narayanan**, Remote sensing and its Applications, (1999), Universities Press (India) Ltd., Hyderabad.
6. **Peter M. Atkinson & Nicholas Tate**, (2012), Advances in Remote Sensing and GIS Analysis, Wiley India Pvt Ltd
7. **Rampall, K.K.** (1999), hand book of Aerial Photography and Interpretation, Concept Publishing Co., New Delhi.
8. **Richard, John A.** 5<sup>th</sup> Edition (2014), Remote Sensing Digital Image Analysis, published by Springer.
9. **Sabins, F.F. Jr.** (1987), Remote Sensing; Principles and Interpretation, W.h. Freeman & Co., New York.

**Web resources:**

- 10 <http://rst.gsfc.nasa.gov/Front/tofc.html>
- 11 <http://earthobservatory.nasa.gov/Library/RemoteSensing>
- 12 [remotesensing.usgs.gov/](http://remotesensing.usgs.gov/)
- 13 [bhuvan.nrsc.gov.in/](http://bhuvan.nrsc.gov.in/)
- 14 [www.isro.gov.in/](http://www.isro.gov.in/)

## II Semester Paper: 2.8 Mini-Project

Teaching Hour: 52 hrs

The students of M.Sc GISc 2<sup>nd</sup> Semester may have to be selected a specific area for the Project Work. Like Landuse / Land cover Analysis, Water Sources, Slope Studies, climatic Change, Agriculture Studies, Infrastructure Studies, Vegetation Studies, etc. GIS, GPS & RS methods have to be used with appropriate primary and secondary data. The Mini-Project should not exceed 25 pages including photos, references and tables. Mini-Project work must include quality maps, diagrams and flowcharts. The project report has to be included followings:

- a) Title / theme of the project
- b) Introduction
- c) Review of literature
- d) Study Area
- e) Data sources
- f) Main Objective
- g) Materials and Method
- h) Results and Discussion
- i) Conclusion
- j) Photos

### References

Above work has to be done with the consultation of the staff-in-charge. Viva-Voce would be conducted at the end.

### References:

1. **Clifford, N.J. and G. Valentine** 2003: Key methods in Geography, Sage, London.
2. **DR.S.KARTIKEYAN** (2016), Compatative book of research methodology, BHALANI PUBLISHING HOUSE
3. **Flowerdew, R. and D. Martin** 2005: Methods in Human Geography: A Guide for students doing a research project, Prentice Hall, New York.
4. **Gilbert, N.** 2001: Researching Social Life, Sage, London.
5. **Harshit Dwivedi (2013), Research Method in Social Science, A Viskar Publication.**
6. **Hakim, Catherine,**(2015), Research Design, Taylor & Francis Ltd
7. **Leedy, P.D. & J.E. Ormrod** 2001: Practical Research: Planning & Design.
8. **M.P. Sinha** (2011), Research Methods, Atlantic publishers.
9. **Ntui, Ponsian** (2014), Research Methodology, LAP Lambert Academ.
10. **Panneerselvam R** (2013), Research Methodolog, Prentice Hall India Learning Private Limited.

### Web resource

11. [www.wiley.com](http://www.wiley.com) › Geography › Geographical Methodology & Techniques
12. [www.geo.hua.gr/index.php?option=com\\_content&view=article&id](http://www.geo.hua.gr/index.php?option=com_content&view=article&id).
13. [www. Com. samplesainsburysebooks.co.uk/9781444327731\\_sample\\_384268.pdf](http://www.Com.samplesainsburysebooks.co.uk/9781444327731_sample_384268.pdf)
14. <https://www.goodreads.com/shelf/show/research-methods>
15. [www.ccrm.in](http://www.ccrm.in)

## II SEMESTER

### Paper: 2.9 Research Methodology

Teaching Hour: 52 hrs

#### Unit I

Research: Meaning, definition, objectives, characteristics, types, steps involved in Research, Research ethics, approaches, significance, research and scientific methods, research process, criteria of good research, research problems faced by the researchers in India. Review of literature, need for review of literature. 13 hrs

#### Unit II

Forms of Research: what is research problem, selecting the research problem, necessity of defining the problem, Research paper, article, workshop, Seminars, Conference and Symposia. Research design: Meaning, need, important concepts relating to research design, research design, developing a research plan. 13 hrs

#### Unit III

Research methods versus methodology, research and scientific methods. Sampling methods: Need for sampling, some fundamental definitions, sampling theory. Methods of data collection, Collection of Primary data: observation, interview and questionnaire methods. Collection of secondary data: Selection of appropriate method for data collection. Case study method. 13 hrs

#### Unit IV

Hypothesis, Basic concepts concerning testing of hypothesis, limitations of the tests of hypothesis. Interpretation and report writing: Meaning of interpretation, need of interpretation, techniques of interpretation, interpretation keys, significance of report writing, different steps in report writing, layout of the research report, types of reports, oral presentation, conclusion, findings and suggestions. Bibliography and reference, field photographs. 13 hrs

#### References:

1. **Clifford, N.J. and G. Valentine** 2003: Key methods in Geography, Sage, London.
2. **DR.S.KARTIKEYAN** (2016), Comparative book of research methodology, BHALANI PUBLISHING HOUSE
3. **Flowerdew, R. and D. Martin** 2005: Methods in Human Geography: A Guide for students doing a research project, Prentice Hall, New York.
4. **Gilbert, N.** 2001: Researching Social Life, Sage, London.
5. **Harshit Dwivedi (2013), Research Method in Social Science, A Viskar Publication.**
6. **Hakim, Catherine,**(2015), Research Design, Taylor & Francis Ltd
7. **Leedy, P.D. & J.E. Ormrod** 2001: Practical Research: Planning & Design.
8. **M.P. Sinha** (2011), Research Methods, Atlantic publishers.
9. **Ntui, Ponsian** (2014), Research Methodology, LAP Lambert Academ.
10. **Panneerselvam R** (2013), Research Methodolog, Prentice Hall India Learning Private Limited.

#### Web resource

11. [www.wiley.com](http://www.wiley.com) > Geography > Geographical Methodology & Techniques
12. [www.geo.hua.gr/index.php?option=com\\_content&view=article&id](http://www.geo.hua.gr/index.php?option=com_content&view=article&id).
13. [www. Com. samples.sainsburysebooks.co.uk/9781444327731\\_sample\\_384268.pdf](http://www.Com.samples.sainsburysebooks.co.uk/9781444327731_sample_384268.pdf)
14. <https://www.goodreads.com/shelf/show/research-methods>
15. [www.ccrm.in](http://www.ccrm.in)



**III Semester**  
**Paper: 3.1 Basics of Statistics**

**Teaching Hour: 52 hrs**

**UNIT-I**

Descriptive Statistics: Histograms and Graphs, Measures of Central Tendency: mean, median, mode. Partitioned values: Quartiles and deciles. Comparing the mean, median and mode. Measures of Dispersion: Absolute measures: Range, Quartile Deviation, Mean Deviation, Standard Deviation. Relative measure of dispersion: coefficient of variation.

13 hrs

**UNIT-II**

Bivariate Analysis: Scatter diagram, correlation analysis, Spearman's rank correlation and Karl Pearson's correlation coefficient. Simple Linear Regression Model, Coefficient of determination.

13 hrs

**UNIT-III**

Probability: Definition, Applications of Addition and multiplication theories of probability, Theorem of total probability. Probability distributions: Binomial, Poisson and normal distributions. Simple random sampling stratified random sampling.

13 hrs

**UNIT-IV**

Testing of hypothesis: The problem, Null and alternative hypothesis two types of errors, test and level of significance, Testing for mean and equality of means. One way ANOVA. Multivariate analysis: Correlation matrix, partial and multiple correlations. Distance measure. Euclidean distance, Mahalanobis distance.

13 hrs

**References:**

1. Medhi J(1992), Statistical Methods, Wiley Eastern.
2. Chase,W and Bown.F. (1992) General statics John Wiley and Sons,Inc.
3. **Jack Levin and J.A. Fox** 3<sup>rd</sup> Edition (2014), Elementary Statistics in Social Research, 10<sup>th</sup> edition, Peason Education, New Delhi.
4. **R. J. Johnston** 7<sup>th</sup> Edition (2009) Multivariate Statistical Analysis in Geography, Longman Scientific and Technical, John Wiley & Sons.
5. **Rogerson. P.A.** (2010), Statistical Methods for Geography, (A Student's Guide), 3rd Edition, Sage Publication, New Delhi

**Web resource**

6. [www.journals.elsevier.com/spatial-statistics](http://www.journals.elsevier.com/spatial-statistics)
7. [www.spatial-statistics.com/](http://www.spatial-statistics.com/)
8. [www.spatial-statistics.com/spatial\\_links\\_index.htm](http://www.spatial-statistics.com/spatial_links_index.htm)
9. [www.wiley.com](http://www.wiley.com) › General Applied Probability & Statistics
10. <https://cran.r-project.org/view=Spatial>

**III Semester**  
**Paper: 3.2 Disaster Management**

**Teaching Hour: 52 hrs**

**UNIT – 1**

**Disasters and GIS:** Meaning and types of hazards, disasters and catastrophes – Disaster Management; Earthquakes: causes and effects – measurements - earthquake zones of the world and India – vulnerability and micro zonation; Volcanoes: Causes and effects – volcanic zones of the world and India - volcanic hazards; Landslides: Causes and effects – landslide prone zones in India – GIS case studies for earthquake, volcano and landslide. 13 hrs

**UNIT – 2**

**Emerging approaches to Disaster management:** (1) Pre-disaster stage (Preparedness)-hazard zonation maps-predictability and forecasting, land use zoning, Information, Education & Communication (IEC) Disaster resistance house construction, Population reduction in vulnerable area and awareness. (2) Emergency Stage- Rescue training for search and operation at national and regional level, ground management plan preparation, immediate relief, Assessment surveys. (3) Post disaster stage rehabilitation – Political aspects, social aspects, economic aspect, cultural aspect and environmental aspects. 13 hrs

**UNIT – 3**

**Natural Disaster mitigation:** Relief measure, role of GIS in Relief measures, role of GPS in search and rescue, role of remote sensing in prediction of hazards and disasters, measures of adjustment of natural hazards. 13 hrs

**UNIT – 4**

**Disaster in Indian context:** A regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills, terror attacks, communal clashes, Remedial measures. National & international policies for disaster management. Case Studies. 13 hrs

**References:**

1. **Dr. Satender**, 2nd Edition (2000), Disaster Management in Hills, Concept Publishing Co., New Delhi.
2. **H.K. Gupta** (Ed), (2003), Disaster Management, Universities Press, India.
3. **Kapoor Mukesh** (2015), Disasters management, Saurabh Publishing House
4. **Kates, B.I & White**, 2013, G.F The Environment as Hazards, oxford, New York.
5. **Kumar Asim Mukhopadhyay**, (2012), Crisis and Disaster Management, New Age International Private Limited.
6. **M.C. Gupta**, (2001), Manuals on Natural Disaster management in India, National Centre for Disaster Management, IIPA, New Delhi.
7. **R.B. Singh** (Ed), 2000, Disaster Management, Rawat Publication, New Delhi.
8. **R.B. Singh**, 4<sup>th</sup> Edition (2013), Space Technology for Disaster Mitigation in India (INCED), University of Tokyo.
9. **R.K. Bhandani** (2011), An overview on Natural & Man made Disaster & their Reduction, CSIR, New Delhi
10. **Savinder Singh**, 1997, Environmental Geography, Prayag Pustak Bhawan.

**Web resource**

11. [www.disaster.qld.gov.au](http://www.disaster.qld.gov.au)
12. [rahat.up.nic.in/](http://rahat.up.nic.in/)
13. [asdma.gov.in/](http://asdma.gov.in/)
14. [www.ndmindia.nic.in/](http://www.ndmindia.nic.in/)
15. [www.dmc.gov.lk/](http://www.dmc.gov.lk/)

### III Semester

#### Paper: 3.3 A. Geoinformatics for Environmental Impact Assessment

Teaching Hour: 52 hrs

##### UNIT – 1

Definition and Meaning of environment Nature and Interdisciplinary Aspect of Environmental Geography. Ecological Approaches. Ecological Niche. Bio-sphere and Biodiversity.

13 hrs

##### UNIT – 2

Ecosystem: Structure and Functioning of Ecosystem, Pond as an Ecosystem, Food Chains, Food Webs, Food Pyramid. Biomes – Equatorial to Tundra i.e. 11 types. Man and Environmental Relationships. Resource Use and Ecological Imbalance with reference to Soil, Forests and Energy Resources. Man Made Ecosystem - Urban, Ecotourism, National Parks and Sanctuaries. Depletion of Ozone, Green House Effect and Acid Rain.

13 hrs

##### UNIT – 3

Man Induced Changes on Environment: Environmental Pollution, i.e. Air, Water, Noise and pollution related to Solid Waste with special reference to India. Environmental Hazards, i.e. earth as Warehouses, Flood, Famines, Land Slides, Avalanches, Forest Fires, Impact of Green revolution and Extinction of Species.

13 hrs

##### UNIT – 4

Principles of Environmental Management- Environmental Policy of India, (post 2000AD). Environment Impact Assessment (EIA). Global Summits and Agencies of Environment Conservation. Implementation of Environmental Impact Assessment using Remote Sensing Technology.

13 hrs

##### References:

1. **Amdihun, Ahmed** (2014), GIS and Remote Sensing in Integrated Disaster Management, VDM Verlag
2. **Cheryl Simon Silve and Ruth S. De Fries** (2012) One Earth One Future-Our chaining Globla Environment, National Academy of Sciences, Affiliated to East West Press Pvt. Ltd. New Delhi.
3. **Goldsmith Edward et al.** (2011) The Earth Report – The Essential Guide to Global Issues, Price Stern Solan Inc. California, USA
4. **Healey I.N. and Moore P.D.** (2000) Bio-Geography, Backwell Oxford, U.K.
5. **Paul Selman** (2000) Environmental Planning, Sage Publications, New Delhi
6. **Richard H.B.** (2004) Physical Geography, Heinmann Simple Services, Rupa & company, New Delhi
7. **Robinson H.** (1982) Bio Geography, ELBS, New York.
8. **Savindra Singh** (2004) Environmental Geography, Prayog Pustak Bhawan, Allahabad, India.
9. **Strahler A.N. and Strahler A.H.7<sup>th</sup> Edition** (2015) Environmental Geo Science, Hamilton, California, USA.
10. **Strahler A.N. and Strahler A.H.** 3<sup>rd</sup> Edition (2011) Geography and Man's Environment, John Wiley & Sons, New York

##### Web resource

11. [www.snre.umich.edu/](http://www.snre.umich.edu/)
12. [www.srk.com](http://www.srk.com) › SRK Worldwide › SRK News
13. <https://www.aquabt.com/gis-and-remote-sensing-for-eia>
14. [grindgis.com/blog/gis-applications-uses](http://grindgis.com/blog/gis-applications-uses)
15. [www.isdm.org.in/Impact-Evaluation](http://www.isdm.org.in/Impact-Evaluation)

**III Semester**  
**Paper: 3.3 (B) Geoinformatics for Natural Resource Management**

**Teaching Hour: 52 hrs**

**UNIT – 1**

Introduction: Concepts, models and approaches of natural resource management. Population pressure, resource use and development. Use and misuse of resources: Global and Indian Scenario: historical background and future prospects of various resources: soil, water, minerals and forests. 13 hrs

**UNIT – 2**

Conservation and management of resources: Meaning, principles, philosophy and approaches to conservation; resource conservation and management methods. Resource appraisal and policy making appraisal of land resources, geophysical, geochemical and geo-botanical. Use of GIS and remote sensing in resource appraisal. Institutional managements and policy models towards better management and conservation of resources. Management of natural resources: government–other agencies. 13 hrs

**UNIT – 3**

Resources development: Concept of sustainable resource management, methods and sustainable system; integrated resource development and its application. Land evaluation methods- land classification methods-soil and water conservation- land use and Land cover mapping- land use planning and development. Water resource assessment- watershed analysis and management-coastal and ocean resources and management- fisheries management. 13 hrs

**UNIT – 4**

Risk assessment: Wildlife, forest, recreational, agricultural and rangeland assessment - Ecological Risk Assessments - Natural Resource Damage Assessments- damage of natural resources. Remote sensing and GIS applications: natural resource surveys and monitoring–strategies for natural resource management- millennium eco-system assessment project-resources utilization and conservation in India. 13 hrs

**References:**

1. **Dubey RN. And Negi BS 4<sup>th</sup> Edition** (2012)- Economic Geography of India, Kitabmahal, Allahabad.
2. **Guha J.L. and Chattoraj** (2014), A New approach to economic geography, A study of resources, the world Press pvt. Ltd. Calcutta.
3. **Kali Charan Sahu (2012)**,Textbook of Remote Sensing and Geographical Information Systems,Atlantic Latest edition.
4. **Khanna K.K. and Gupta V.K 3rd Edition** (2000) Economic and Commercial Geography, Sultan Chand, New Delhi.
5. Mekonnen Getahun,(2013),GIS and Water based Disaster Management, LAP Lambert Academ
6. **P. Hagget** (1997), Geography, A Modern Synthesis, Haper and Roo publications, New York.
7. P.Johnson (2011), Disaster management and Analysis, LAP Lambert Academ.
8. **Roy. PR.** (2011) Economic Geography- A study of Resources, New Central Book Agency, (p) ltd..
9. **T.P.Singh,** (2014), GIS for Natural Resource Management, LAP Lambert Academ.
10. **William Lee (2013),Management of Disaster** , LAP Lambert Academ.

**Web resource**

11. [http://www.nationmaster.com/graph/geo\\_nat\\_res-geography-natural-resources](http://www.nationmaster.com/graph/geo_nat_res-geography-natural-resources)
12. <https://www.gislounge.com/gis-and-natural-resource-management>
13. [www.esri.com](http://www.esri.com) › Industries
14. [www.utwente.nl](http://www.utwente.nl) › Education › Master
15. <https://extension.ait.ac.th/course/235>

**III Semester  
Practical: 3.4 Utility Mapping**

**Teaching Hour: 52 hrs**

Exercise No	Title of the Exercise (Total 52 Hrs)
1	Introduction to Auto Desk
2	Anatomy of Auto CAD Mapping
3	Drawing Commands in Auto CAD
4	Special Commands in Auto CAD Mapping
5	2 Dimensional Drawing
6	Image Insert with ortho on, saving image as layer, adjusting map scale, creating layers.
7	Digitization of polygon, line and point feature
8	Clean & build and text insert
9	Editing with Symbols,
10	Topology
11	Offsetting, composing, block building,
12	Database creation. Inserting title, scale, legend, grids, Insert maps, north arrows and exporting to raster.
13	Preparation of Plot Map set
14	Quality Checking (QC)
15	Final output, importing and exporting.

**References:**

1. AutoCad Drafting Package, Autodesk INC, 2003
2. **Agraval, N. K.**, (2011). Essentials of GPS, Geodesy and GPS, 2<sup>nd</sup> edition , publications,Hyderabad.
3. **Ganesh, A.**, (2006). Dimensions of Geomatics, Bharathidasan University, Tiruchirappalli.
4. **Groten, E., Strauss, Robert,(2014)**, GPS-Techniques Applied to Geodesy and Surveying, Springer.
5. **Hofmann – Wellenhof, Lichtenegger, and Wasle**, 2<sup>nd</sup> Edition (2013). Global Navigational Satellite Systems (GNSS) Springer Wien New York.
6. **Jan Van Sickle**, 2<sup>nd</sup> Edition (2013). GPS for Land Surveyors, CRC Press, Taylor & Francis Group, New York.
7. **Lee, Thomas Jefferson(2014)**, Collection of Tables and Formulae Useful in Surveying, Geodesy, and Practical Astronomy, BiblioLife.
8. **Merriman, Mansfield (2013)**, Elements of Precise Surveying and Geodesy, Nabu Press.
9. **Nel Samama**, (2012). Global Positioning Techniques and Performance, John Wiley and Sons, Inc., New Jersey.
10. **Popplewell, William Charles, (2014)**, The Elements of Surveying and Geodesy, Kessinger Publishing.

**Web resources**

11. [www.tsa-uk.org.uk/for-clients/guidance-notes/](http://www.tsa-uk.org.uk/for-clients/guidance-notes/)
12. [gpsworld.com/gnss-and-the-real-time-network-the-surveyors/](http://gpsworld.com/gnss-and-the-real-time-network-the-surveyors/)
13. [www.southinstrument.com/](http://www.southinstrument.com/)
14. [www.ngs.noaa.gov/](http://www.ngs.noaa.gov/)
15. <https://www.aagsmo.org/>

**III SEMESTER**  
**Practical: 3.5 Web GIS**

**Teaching Hour: 52 hrs**

<b>Exercise No</b>	<b>Title of the Exercise(Total 52 Hrs)</b>
1	Introduction Bhuvan ISRO Software
2	Bhuvan 2D and 3D
3	Downloading free data from the server
4	Creating GIS Maps
5	Creating Point, Line and Polygon Layers
6	Creating attributes
7	Labeling the attributes
8	Online line shape file creations
9	Map output
10	Special Applications in Bhuvan
11	Smart Tracking
12	Thematic Services
13	Disasters Services
14	Ocean Services
15	Bhuvan Panchayath Portal

**References:**

1. "Welcome to Bhuvan | ISRO's Geoportal | Gateway to Indian Earth Observation". Bhuvan.nrsc.gov.in. 2013-04-25. Retrieved 2013-05-20.
2. "Bhuvan, Indian Earth Observation Visualization". ISRO. 2009-08-12. Retrieved 2009-08-12.
3. "Bhuvan: India's answer to Google Earth". Jai Bihar. 2009-08-12. Archived from the original on August 15, 2009. Retrieved 2009-08-12.
4. <http://www.medianama.com/2013/01/223-bhuvan-new-datasets/>
5. [bhuvan.nrsc.gov.in/disaster](http://bhuvan.nrsc.gov.in/disaster)
6. <http://www.medianama.com/2014/02/223-bhuvan-upgraded-mapping-tool-2-5d-city-models-better-high-res-imagery-others/>
7. [bhuvan.nrsc.gov.in/data](http://bhuvan.nrsc.gov.in/data)
8. <http://bhuvan3.nrsc.gov.in/applications/bhuvanstore.php>
9. "ISRO's Bhuvan stands up to Google Earth". Merinews.com. 2009-08-13. Retrieved 2013-05-20.

**Web resource**

10. [gis.co.humboldt.ca.us/](http://gis.co.humboldt.ca.us/)
11. <https://www.arcgis.com/home/>
12. [www.webgis.com/](http://www.webgis.com/)
13. <https://www.webgis.net/nc/montgomery/>
14. [www.co.santa-cruz.ca.us](http://www.co.santa-cruz.ca.us) › Departments
15. <https://www.webgis.gov.sc/>

**III Semester**  
**Practical: 3.6 Remote Sensing Lab-3**

**Teaching Hour: 52 hrs**

Exercise No	Title of the Exercise (Total 52 Hrs)
1	Computing Image Statistics Using ERDAS' IMAGINE Model Maker
2	Re-projection the Imagery – Geo-Lat and Long to UTM
3	Resolution Merge
4	Contrast Manipulation, Spatial Feature Manipulation, Multi-image Manipulation
5	<b>Spatial Enhancement</b> -Convolution, Focal Analysis, Adaptive and Statistical Filter
6	<b>Radiometric Enhancement</b> - Histogram Equalization, Histogram Match, Brightness Inversion, Haze Reduction, Noise Reduction
7	<b>Spectral Enhancement</b> – Principal Components, Inverse Principal Components, Indices, Landsat 7 Reflectance
8	Hyper-spectral Image Analysis
9	Change Detection
10	Fourier Analysis
11	DEM - Topographic Analysis – DEM Height Converter
12	Conversions: ASCII, Vector to Raster, Raster to Vector and Others.
13	Vector Utilities
14	Virtual GIS
15	Advanced Map Composer

**References:**

1. **Lillisand T.M and Keifer R.W**, (1994), Remote Sensing and Image Interpretation, Jhon Willey & sons, New York.
2. **Rampall, K.K.** (1999), hand book of Aerial Photography and Interpretation, Concept Publishing Co., New Delhi.
3. **Sabins, F.F. Jr**, (1987), Remote Sensing: Principles and Interpretation, W.h. Freeman & Co., New York.
4. **Jenson R. Jhon**, (2003), Remote Sensing of the Environment-An Earth Resource Perspective, Pearson Education Pvt. Ltd., Indian Branch, Patparganj, Delhi, India.
5. **LRA Narayanan**, Remote sensing and its Applications, (1999), Universities Press (India) Ltd., Hyderabad.
6. **Peter M. Atkinson & Nicholas Tate**, (2012), Advances in Remote Sensing and GIS Analysis, Wiley India Pvt Ltd
7. **Rampall, K.K.** (1999), hand book of Aerial Photography and Interpretation, Concept Publishing Co., New Delhi.
8. **Richard, John A.** 5<sup>th</sup> Edition (2014), Remote Sensing Digital Image Analysis, published by Springer.
9. **Sabins, F.F. Jr**, (1987), Remote Sensing; Principles and Interpretation, W.h. Freeman & Co., New York.

**Web resources**

- 15 <http://rst.gsfc.nasa.gov/Front/tofc.html>
- 16 <http://earthobservatory.nasa.gov/Library/RemoteSensing>
- 17 [remotesensing.usgs.gov/](http://remotesensing.usgs.gov/)
- 18 [bhuvan.nrsc.gov.in/](http://bhuvan.nrsc.gov.in/)
- 19 [www.isro.gov.in/](http://www.isro.gov.in/)

**III Semester  
Practical: 3.7 GIS Lab-3**

**Teaching Hour: 52 hrs**

<b>Exercise No</b>	<b>Title of the Exercise (Total 52 Hrs)</b>
1	Overlay Analysis from Selected Layers
2	TIN from Contour
3	Buffer Analysis and Proximity analysis
4	Calculating Nearest Neighbor Point in GIS
5	Identification of Point and Line Density
6	DEM to understand the Surface elevation
7	Conversions - format change
8	Working with Analysis Tools Clip and Extract
9	Topology Creation for MDB Layers
10	Re-projection – Raster and Vector Layers Class
11	Spatial Adjustments and adjoining features
12	Data Management Tools
13	Hydrology and Water Resources
14	GPS Data Extraction
15	Model Creations using customize software

**References:**

1. **Avery, T.E.** 1985. Interpretation of aerial Photographs. Minneapolis, Minnesota: Burgess Publishing Company.
2. **Bakker, Wim H., et al.** 2001. Principles of Remote Sensing – An Introductory Textbook. Enschede, The Netherlands: ITC.
3. **Banerjee, R.K. and Banerjee, B.** 2000. Remote Sensing for Regional Development. New Delhi: Concept Publishing Company.
4. **Campbell, James B.** 1996. Introduction to Remote Sensing (Second Edition). London: Taylor & Francis.
5. **Gibson, Paul J.** (2000). Introductory Remote Sensing – Principles and Concepts. Rout ledge.
6. **Jensen, John R.** 2000. Remote Sensing of the Environment – An Earth Resource Perspective. Pearson Education (First Indian Edition, 2003).
7. **Hord, R. Michae I.** 1986. Remote Sensing – Methods and Applications. (A Wiley-Interscience Publication). New York: John Wiley & Sons.
8. **Lillesand, T.M., Kiefer, R.W., and Chipman, J.W.** 2004. Remote Sensing and Image

**Web resources**

9. <https://www.gislounge.com/open-source-gis-applications/>
10. [www.bhuvan.nrsc.gov.in/](http://www.bhuvan.nrsc.gov.in/)
11. [www.qgis.org/](http://www.qgis.org/)
12. [www.gisgeography.com](http://www.gisgeography.com) › Software
13. <https://grass.osgeo.or>



**III SEMESTER**  
**Paper 3.8: Geography for All**

**Teaching Hour: 52 hrs**

**Unit 1**

Physical Setting of India: Location, Physiographic Divisions, Natural Drainage Systems and their Distribution. Climate: seasons & climatic regions. Soils: Types, Distribution, Erosion and Conservation. Natural Vegetation: Types & Distribution, Degradation and Conservation. 13 hrs

**Unit 2**

Agriculture: Major Agricultural Crops: Rice, Wheat, Cotton, Sugarcane, Maize, Jowar, Tea, Coffee, Rubber, Mulberry Crops. Green Revolution in India, and Food Security in India. Irrigation: Major River Projects. 13 hrs

**Unit 3**

Distribution, production and trade of important Minerals & Power resources: Iron Ore, Manganese, Mica, Copper, Bauxite, Coal, Petroleum, Natural Gas, Atomic Energy, Hydel and Thermal Power. Growth, Development and Distribution of Major Industries: Iron & Steel, Engineering, Cement, Paper, Fertilizers, Cotton Textiles, Silk, Knowledge-based Industries: Industrial Regions of India. 13 hrs

**Unit 4**

Growth & Development of Transportation Transport System: Roads, Railways, Airways and Inland Water. Population: Growth and Distribution, Composition & Density, Literacy, Sex Ratio, Fertility & Mortality & Health Services. 13 hrs

**References:**

1. **Khullar DR.** (2009): India: A Comprehensive Geography, Kalyani Publishers, New Delhi, Hyderabad, Kolkata.
2. **Alka Gautam** (2009) Geography of India, Sharada pustak bhawan, University Road, Allahabad – UP.
3. **Sharma TC & Coutinho O** (2005) : Economic and Commercial geography of India, Vikas Publishing House Ltd., New Delhi-14
4. **Tiwari RC. (2008)** Geography of India, Prayag pustak Bhavan, 20-A, University Road, Allahabad- UP
5. **King Cuchalaine A.M.** (2012) Oceanography for geographers, Edward Arnold publications, London
6. **Majid Hussain** (2011) Evolution of Geographic Thought, Rawat Publications, New Delhi-02
7. **Siddhartha K** (2011): Atmosphere, weather and climate, Kisalaya Publications Pvt.ltd., C—2, Padma apartment, Mehruli, New Delhi-30.
8. **Strahler A.N.** (1968) The Earth Sciences, Harper & Row Intl. Edn, New York
9. **Thornberry W.D.** (1969) Principles of Geomorphology, 2nd Edition, Wiley Intl. Edn. & Wiley Eastern Reprints 1984.
10. **Woodrige S.W and R.S. Morgan** (2015) An Outline of Geomorphology, The Physical Basis of Geography, Orient Longman, Kolkata.

**Web Resources:**

11. [https://en.wikipedia.org/wiki/Spatial\\_science](https://en.wikipedia.org/wiki/Spatial_science)
12. [www.nsf.gov/sbe/bcs/grs/GSS\\_StrategicPlan\\_2011.pdf](http://www.nsf.gov/sbe/bcs/grs/GSS_StrategicPlan_2011.pdf)
13. [www.roebuckclasses.com](http://www.roebuckclasses.com) › Orientation › Lectures
14. [www.ccrs.nrcan.gc.ca/resource/tutor/fundam/index\\_e.php](http://www.ccrs.nrcan.gc.ca/resource/tutor/fundam/index_e.php)
15. <http://www.crisp.nus.edu.sg/~research/tutorial/rsmain.htm>

## IV SEMESTER Practical: 4.1 Project Work

1. The students of M.Sc GISc 4<sup>th</sup> Semester may have to be selected a specific topic for a Project Work. The students may select some of the following themes for their project.
  - a. Land Evaluation
  - b. Land-use / Land cover Analysis
  - c. Water Sources
  - d. Slope Studies
  - e. Climatic Change
  - f. Settlement Studies
  - g. Agriculture Studies
  - h. Health Studies
  - i. Infrastructure Studies
  - j. Vegetation Studies
2. GIS, GPS & RS methods have to be used with appropriate primary and secondary data.
3. The students should follow the research guidelines by referring **Research Methodology** before taking up the Project Work.
4. The project should not exceed 50 pages including photos, references and tables.
5. Project work must include quality maps, diagrams and flowcharts.
6. The project report has to be included as given below:
  - a) Introduction
  - b) Review of literature
  - c) Study Area
  - d) Data sources
  - e) Main Objectives
  - f) Materials and Method
  - g) Results and Discussion
  - h) Conclusion
  - i) Photos
  - j) References

Above work has to be done with the consultation of the staff-in-charge. Viva-Voce would be conducted at the end.

### References:

1. **Archer J.E. & dalton T.H.** (1968): The fields work in Geography, E.t. Batsford Ltd.,London.
2. **Haring, Lloyd** (1975): Scientific Geographic Research WC.Brow Company USA.
3. **Johnes, P.A.** (2008): Field Work in Geography, Longman.
4. **Kothari C.R.**(1996): Research Methodology, Vishwas Prakashan, New Delhi
5. **Misra R.P.** (1991): Research Methodology in Geography, concept pub. New Delhi.
6. **Hakim, Catherine**,(2015),Research Design, Taylor & Francis Ltd
7. **Leedy, P.D. & J.E. Ormrod** 2001: Practical Research: Planning & Design.
8. **M.P. Sinha** (2011),Research Methods, Atlantic publishers.
9. **Ntui, Ponsian** (2014),Research Methodology, LAP Lambert Academ.
10. **Panneerselvam R** (2013),Research Methodolog, Prentice Hall India Learning Private Limited.

### Web resource:

11. [www.wiley.com](http://www.wiley.com) > Geography > Geographical Methodology & Techniques.
12. [www.geo.hua.gr/index.php?option=com\\_content&view=article&id](http://www.geo.hua.gr/index.php?option=com_content&view=article&id).
13. [www. samples.sainsburysebooks.co.uk/9781444327731\\_sample\\_384268.pdf](http://www.samples.sainsburysebooks.co.uk/9781444327731_sample_384268.pdf)
14. <https://www.goodreads.com/shelf/show/research-methods>
15. [www.ccrm.in](http://www.ccrm.in)

**IV Semester  
Paper: 4.2 Internship**

**Internships** are done in a Government, research and implementation institution and / or a Private, Corporate institution of repute with specialization on the technologies of Cartography, Remote Sensing, GIS and GPS, including Computer work in a prestigious lab.

**IV Semester  
Practical: 4.3 Field Study Tour**

Field Study Tour is a part of curricula in M.Sc. IV Semester. Study tour is compulsory and to be conducted between end of the III Semester and in the beginning of the IV Semester for a duration of two weeks. Study tour report submission is compulsory. Students are required to go to the Field Study Tour which is an exploratory topic of geographic importance based on empirical evidences.

At least five places of geographical importance in India like **Western Ghats, Aravali Range, Coastal Area, Northwestern Desert, Northern Plain and Himalyan Region and cities located in these regions** have to be selected and visited. The detailed geographical, geological, environmental factors for these regions have to be explained. Students need to study environmental impacts of major cities located in these regions. The tour report has to be done with the consultation of the staff-in-charge and has to be submitted to the department at the time of 4<sup>th</sup> semester examination. Viva-Voice based on study tour report would be conducted at the end.

**References:**

1. Ahuja (2004) Research Methods, R.K. Books, New Delhi
2. Kothari (1990) Research Methodology – Wiley Eastern Ltd. New Delhi.
3. Gopal M.H. (1970) Introduction to Research Procedure in Social Science, Asia Publishing House, Bombay.
4. Young Pauline V. (1980) Scientific Survey and Research, Prentice Hall, New Delhi.
5. Limb (2001) Quantitative Methodologies for Geographer R.K. Books, New Delhi.
6. Mishra R.P. (2001) Research Methods in Geography, R.K. Books, New Delhi.
7. Pal (2005). Computing Techniques in Geography, R.K. Books, New Delhi.