PARVATIBAI CHOWGULE COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)
MARGAO – GOA 403601

POSTGRADUATE DEPARTMENT OF GEOGRAPHY AND RESEARCH CENTRE

POST GRADUATE DIPLOMA
In
GEOINFORMATICS

SYLLABUS
TO BE IMPLEMENTED FROM 2015-16

The objective of this diploma course is to impart instruction and training to candidates in specialized field of techniques and resources and also intended to develop capacity building for employment, teaching and research.

POST GRADUATE DIPLOMA IN GEOINFORMATICS

Course Structure of the Programme

Course Code	Course Title	Marks Theory and Practical components 50+50
Semester I		
GC-101	Basics of Geo informatics	**100**
GC-102	Principles of Computer and Computer Programming	**100**
GO-101	Geostatistics	**100**
GO-102	Basics of Cartography & Photogrammetry	**100**
GO-103	Mathematical Applications in Geoinformatics	**100**
Semester II		
GC-201	Spatial Analysis & Modeling	**100**
GC-202	Advanced Remote Sensing and GIS	**100**
GO-201	Digital Image Processing	**100**
GO-202	Enterprise GIS techniques	**100**
GO-203	GIS for Business and Service Planning (Theory 50 + Project 50)	**100**
GO-204	GIS for Urban and Regional Planning (Theory 50 + Project 50)	**100**
GO 205	GIS for Environmental Management (Theory 50 + Practical 50)	**100**

Note:

1) Duration – 1 lecture of One hour each and One practical/ Laboratory session is equivalent to one contact hour in class room.
2) Each paper will have four instructional contact hours consisting three theory and one practical
3) Total Marks: 800 (entire course is divided into 8 papers consisting 100 marks each.
4) GC 101, GC 102 of Semester I and GC 201 and GC 202 of Semester II are compulsory courses
5) GO 101, GO 102 and GO 103 of Semester I and GO 201, GO 202, GO 203, GO 204 and GO 205 of Semester II are optional courses.
6) Student can select any two courses from the given optional paper list for Sem. I
7) Student can select any one course from GO201 and GO202 of Sem. II
8) Student can select any one subject from GO 203, GO 204 and GO 205.
9) Project is the part of the optional paper GO 203, GO 204 and GO 205.

POST GRADUATE DIPLOMA IN GEOINFORMATICS

No: **GC-101**
Course title: **Basics of Geoinformatics**
No. of lectures and practicals: 50

Course outline
The course focuses on the fundamentals of Remote Sensing, Geographical Information System, and Global Positioning System by introducing the concept, techniques, hardware and software used in collection, processing and analysis of geospatial data.

Details of course contents and allotted time

No.	Topic	Allotted time (hours)	
		L	P
1.	Introduction to Remote Sensing, definition, development and recent trends	1	
2.	Concept of black body, EMR and Sources of EMR interaction with matter, law of radiation, reflectance, transmittance and absorption, atmospheric window Spectral Signatures	2	
3.	Remote Sensing Systems, Sensors and Platforms, and applications	2	1
4.	Introduction to photo products and digital products Image quality, Resolutions	2	
5.	Elements of Image Interpretation, Interpretation of Satellite images Ground Truth Collection, Visual Interpretation, Accuracy Assessment	2	4
6.	Introduction to GIS and History and development, Components and Applications trends of GIS	2	5
7.	Data type, structure, Spatial and attribute, point, line, polygon- arc, nodes, vertices, and topology. Attribute data, sources and types	4	5
8.	Data processing systems, input and output devices, editing and attributing and linking	4	3
9.	Introduction to GPS, History of Positioning System GPS System Description, Error Sources & Receiver	2	3
10.	Introduction to DGPS and Total Station, GPS Performance and Policy Applications	2	2
11.	Functionality, uses and errors rectification Mapping with GPS and TPS, data linking and transformation	2	2
	Total	**25**	**25**

Reference Books:

1. Bolstad, P. (2005) GIS Fundamentals: A first text on Geographic Information Systems, Second Edition. White Bear Lake, MN: Eider Press, 543 pp.
2. Chang, K. (2007) Introduction to Geographic Information System, 4th Edition. McGraw Hill.
3. Curran Paul J Principles of Remote Sensing UK: ELBS.
4. Elangovan,K (2006) GIS: Fundamentals, Applications and Implementations. New India Publishing Agency, New Delhi"208 pp.
5. Heywood, I., Cornelius, S., and Carver, S. (2006) An Introduction to Geographical Information Systems. Prentice Hall. 3rd edition.
6. Longley, P.A., Goodchild, M.F., Maguire, D.J. and Rhind, D.W. (2005) Geographic Information Systems and Science. Chichester: Wiley. 2nd edition.
7. Richards, J.A.; and X. Jia (2006). Remote sensing digital image analysis: an introduction, 4th ed., Springer. ISBN 3-540-25128-6.

POST GRADUATE DIPLOMA IN GEOINFORMATICS

Course No: **GC-102**
Course title: **Principles of Computers and Computer programming**
No. of lectures and practicals: 50

Course outline

The course will explore the fundamentals of computer science, RDBMS and programming for GIS customization. It include: introduction to computers; R/DBMS; programming languages etc.

Details of course contents and allotted time

No.	Topic	Allotted time (hours)	
		L	P
1	Introduction to Computers, Hardware and Software, System requirement, configuration and operating systems and Computer Applications	2	
2	Introduction to Algorithms and Programming in Computers	2	2
3	Introduction to Data Base Management System, (DBMS) and Resource Data Base Management System (RDBMS)	4	4
4	Introduction to MS ACCESS and applications	2	3
5	Introduction to simple programming in C	5	6
6	Developing programming techniques and solutions for spatial algorithms and problem-solving using VB	3	6
7	Getting started with HTML, flash	4	2
8	Introduction to Python	3	2
	Total	25	25

Reference Books:

1. Benjamin C. Pierce (2002). Types and Programming Languages, The MIT Press.
2. Daniel P. Friedman and Mitchell Wand (2001). Christopher Thomas Haynes: Essentials of Programming Languages, The MIT Press.
3. John C. Mitchell (2002). Concepts in Programming Languages, Cambridge University Press.
4. Michael L. Scott (2005). Programming Language Pragmatics, Morgan Kaufmann Publishers.

POST GRADUATE DIPLOMA IN GEOINFORMATICS

Course Code **GO 101**
Course title: **Geostatistics**
No. of lectures and practicals: 50

Course outline

The course is designed to develop the skills required to understand, organize, interpolate, analyze and interpret the geospatial information and to develop the firm foundation to apply it in various fields.

Details of course contents and allotted time

No.	Topic	Allotted time (hours)	
		L	P
1	Introduction, the concept of spatially related statistics, integrated approach, advantages and disadvantages	2	
2	Data type and structure: hole, point, volume data geometry and association, 3D grid data geometry and association	3	2
3	Basic statistics: measurement and summary, distribution, covariance and correlation, transformations, data analysis, display and sampling	3	4
4	Prediction and interpolation : spatial interpolation, spatial classification, Kriging types and application, prediction and validation, normalization	2	5
5	Spatial processes: covariance, variogram and semivariogram	2	4
6	Modeling the variogram, experimental variogram and nested sampling	2	2
7	Spectral analysis: linear sequences, Gilgai transect, power spectra and Caragabal transact(bandwidth and confidence interval)	4	3
8	Geostatistical uncertainty, probability and reliability	3	2
9	Data management for Geostatistics	2	3
10	Applications of Geostatistics	2	
	Total	25	25

Reference Books:

1 Richard Webstar and Margaret A. Oliver : Geostatistics for Environmental Scientists, Statistics in Practice (2nd ed) J. Wiley
2 Ott, T. and Swiaczny, F. (2001). Time-integrative GIS. Management and analysis of spatio-temporal data. Berlin / Heidelberg / New York: Springer.
3 Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003). Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
4 Roy, P.S. (2006). Geoinformatics for Tropical Ecosystems Bishen Singh Mahendra Pal Singh, Dehradun

POST GRADUATE DIPLOMA IN GEOINFORMATICS

Course No: **GO 102**
Course title: **Basics of Cartography & Photogrammetry**
No. of lectures and practicals: 50

Course outline

The course gives emphasis on the art, science, and technologies of cartography and Photogrammetry. It develops the user's ability to understand how maps are created and used to represent and communicate spatial phenomena and their relationships through photogrammetric perspective.

Details of course contents and allotted time

No.	Topic	Allotted time (hours)	
		L	P
1.	Introduction to Cartography, Basics of Map, Fundamentals of direction, scale, types, sources	2	3
2.	Elementary geodesy: Coordinate systems and transformations. Spheroid and Geoid. Geocentric Datum, datum and map projections. 3D coordinates transformations.	3	3
3.	Thematic Cartography Characteristics of geographical phenomena – Symbolizing spatial data, Visual Graphics, Cartograms and maps.	3	4
4.	Principles of colour perception, models and methods. Colour scheme for Univariate choropleth and Isorithmic maps, proportional symbol mapping	3	4
5.	Interpolation methods for smooth continuous phenomena symbolizing smooth continuous phenomena. Dot and asymmetric mapping.	2	3
6.	Introduction to Photogrammetry, History of Aerial Photographs	2	2
7.	Aerial Cameras and Photographs, Geometry of Aerial Photograph, Types, acquisition, scanning, quality	2	2
8.	Planning Aerial Photography and elements of aerial photograph measurement and calculation of scale, coverage, area, and parallax	3	2
9.	Stereoscopic photographs and Parallax, parallax measurement	3	2
10	Applications and limitation of Aerial Photography	2	
	Total	25	25

Reference Books:

1. ESRI. 2004. ESRI Cartography: Capabilities and Trends. Redlands, CA. White Paper
2. Pickles, John (2003). A History of Spaces: Cartographic Reason, Mapping, and the Geo-Coded World. Taylor & Francis. ISBN 0-415-14497-3.
3. Slocum, T. (2003). Thematic Cartography and Geographic Visualization. Upper Saddle River, New Jersey: Prentice Hall. ISBN 0-130-35123-7. Wilford, John Noble (2000). The Mapmakers. Vintage Books. ISBN 0-375-70850-2**.**
4. MJ Kraak, F Ormeling - 2003 - Cartography**:** visualization of geospatial data Addison-Wesley Longman Ltd
5. Joseph, George (2007) Fundamentals of Remote Sensing Universities Press India

6. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2007). *Remote sensing and image interpretation*, 5th ed., Wiley. ISBN 0-471-15227-7.

Course No: **GO 103**
Course title: **Mathematical Applications in Geoinformatics**
No. of lectures and practicals: 50

Course outline
The course is designed to serve as a foundation course in order to meet the requirement of mathematical knowledge in various subsequent courses offered in the master's degree program of Environmental Studies and Natural Resource Management.

Details of course content and allotted time

No.	Topic	Allotted time (hours)	
		L	P
1	Introduction Concepts and development **Sets:** Sets and their representation	3	2
2	Introduction to Scaling **Linear, Non linear, exponential, Logarithmic** Gaussian	2	3
3	**Complex Numbers** Representation of Complex numbers in rectangular and polar coordinates, graphical representation,	2	3
4	**Quadratic Equations** Solution of quadratic equations, relation between roots and coefficients,	2	2
5	**Functions,** Concept, Domain and Range, Types of functions and their graphs	2	2
6	**Limits and Continuity**, Fundamental theorem of limits and proofs of standard limits,	4	2
7	**Differentiation :** logarithmic, trigonometric, exponential, inverse trigonometric, implicit, Applications of derivatives,	5	3
8	**Introduction to integrals Indefinite Integrals & Definite Integral**	3	3
9	Applications in Geoinformatics Some case Studies	2	5
	Total	25	25

Textbooks

1. Graeme Bonham-Carter, Qiuming Cheng (2008) Progress in Geomathematics. Springer, New York
2. Parkhurst, D.F. (2006). Introduction to Applied Mathematics for Environmental Science. Springer, USA.
3. Prasad, G. (2004). Differential Calculus. Pothishala Pvt. Ltd., Allahabad.
5. Prasad, G. (2004). Integral Calculus. Pothishala Pvt. Ltd., Allahabad.

POST GRADUATE DIPLOMA IN GEOINFORMATICS

Course No: **GC-201**
Course title: **Spatial Analysis & Modeling**
No. of lectures and practicals: 50

Course outline

The course covers fundamental aspects of spatial data modeling specifically on the aspect of three-dimensional (3D) modeling, structuring, raster and vector analysis etc. It also looks into integration of non-spatial data and its application.

Details of course contents and allotted time

No.	Topic	Allotted time (hours)	
		L	P
1.	Introduction to analysis- Significance of spatial analysis, overview of tools for analysis	4	4
2.	Spatial analysis Vector Based- Overlay operations: point in polygon, line polygon, polygon in polygon, Single layer operations, features identification, extraction, classification and manipulation, Multilayer operations: union, Intersection, difference	3	4
3.	Spatial analysis raster based- Map algebra, grid based operations, local, focal, zonal and global functions, cost surface analysis, optimal path and proximity search	3	3
4.	Network Analysis- Concept of network analysis, Types of network analysis, Evaluation of network complexity using Alpha, Gama indices, Network data model	4	4
5.	Point pattern analysis -Method for evaluating point patterns, Clustered and random distribution	3	4
6.	Surface Analysis- Interpolation method, DEM, TIN, variance filter, slope and aspect, relief and hill shading	4	3
7.	Spatial modeling - Role of spatial model, explanative, predictive and normative models, Handling complex spatial query, case studies.	4	3
	Total	25	25

Reference Books:

1. Alias A. Rahman and Morakot Pilouk (2008)Spatial Data Modeling for 3D GIS, Springer New York
2. Longley, P.A., Goodchild, M.F., Maguire, D.J. and Rhind, D.W. (2005). Geographic Information Systems and Science. Chichester: Wiley. 2nd edition.
3. Ott, T. and Swiaczny, F. (2001). Time-integrative GIS. Management and analysis of spatio-temporal data. Berlin / Heidelberg / New York: Springer.
4. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003). Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
5. M Goodrich (2000). Data Structures and Algorithms in Java, 2nd Edition Wiley.

POST GRADUATE DIPLOMA IN GEOINFORMATICS

Course Code: **GC 202**
Course title: **Advanced Remote Sensing and GIS**
No. of lectures and practicals: 50

Course outline

The course will provide latest state of art in remote sensing and GIS technology. It will provide an opportunity to understand and work with latest developments remote sensing data base and GIS technology.

Details of course contents and allotted time

No.	Topic	Allotted time (hours)	
		L	P
1	Microwave Remote Sensing (SAR, SLAR, Radar, INSAR, SRTM and interpretations & applications)	3	4
2	Thermal Remote Sensing: Interpretation and Applications	2	2
3	LiDAR: introduction and applications	1	2
4	Hyperspectral Remote Sensing: interpretation, processing and classification	3	2
5	ISRO/ESO Missions	1	
6	New trends in GIS – smart city and cloud computing	2	2
7	Participatory GIS and Mobile GIS	1	4
8	WebGIS (ArcIMS, MapServer, Geomedia, MapGuide	3	3
9	GIS servers, Intermediate softwares and Distributed GIS systems	2	2
10	Applications	2	
	Total	25	25

Reference Books:

1. Asrar Ghassem (2004) Theory and applications of optical remote sensing New York: John Wiley and Sons
2. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2003). Remote sensing and image interpretation, 5th ed., Wiley. ISBN 0-471-15227-7.
3. Mitchel, Tyler (2005): WebMapping Illustrated, O'Reilly, Sebastopol, 350 pages, ISBN 0-569-00865-1. This book discusses various Open Source WebMapping projects and provides hints and tricks as well as examples.
4. Peterson, Michael P. (ed.) (2003): Maps and the Internet, Elsevier, ISBN 0-08-044201-3.
5. Thurston, J., Poiker, T.K. and J. Patrick Moore. (2003) Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. Hoboken, New Jersey: Wiley.
6. Worboys, Michael, and Matt Duckham. (2004) GIS: a computing perspective. Boca Raton: CRC Press.

POST GRADUATE DIPLOMA IN GEOINFORMATICS

Course No: **GO-201**
Course title: **Digital Image Processing**
(Theory 50 + Practical 50)
No. of lectures and practicals: 50

Course outline

This course will introduce fundamental technologies of digital image processing i.e. compression, information extraction and analysis. Students will also gain understanding of algorithm, analytical tools, and practical implementations of various digital image applications.

Details of course contents and allotted time

No.	Topic	Allotted time (hours)	
		L	P
1.	Introduction to Digital Image Processing & Information Extraction Visual perception, Image sensing and acquisition,	2	
2.	Digital Data Formats Image sampling and Quantization. Basic relationship between pixels – linear and non-linear operations, Image statistics display and pre-processing	3	3
3.	Development, scope and fundamental steps involved in Digital Image Processing, components of Image Processing	2	1
4.	Image Rectification Radiometric and Atmospheric Correction	3	1
5.	Geometric Correction, Ortho-rectification, calibration and rectification of photo and images,	3	5
6.	Image enhancement in spatial domain and frequency domain, Filtering, Fourier Transform, Noise removal	2	5
7.	Multispectral Image Processing: Colour Image processing, slicing, Image compression, dilation, Segmentation, Spectral rationing, density slicing and image fusion	5	5
8.	Object recognition, classification, object recognition, feature extraction, accuracy, assessment, change detection Accuracy Assessment and integration with GIS	5	5
	Total	25	25

Reference Books:

1. Burger, Wilhelm; Mark J. Burge (2007). Digital Image Processing: An Algorithmic Approach Using Java. Springer. ISBN 1846283795.
2. Campbell, J.B. (2002). Introduction to remote sensing, 3rd ed., The Guilford Press. ISBN 1-57230-640-8.
3. Damen MCJ, Sicco Smith G and Kerstappen(Ed) (). Remote Sensing for Resources Development and Environmental Management 3rd.volume Set Netherlands: Balkema
4. Jensen John R (2007). Introductory Digital Image processing: Remote Sensing Perspective New Jersey: Prentice Hall
5. Joseph, George (2007). Fundamentals of Remote Sensing Universities Press India

6. Lillesand, T.M.; R.W. Kiefer, and J.W. Chipman (2007). Remote sensing and image interpretation, 5th ed., Wiley. ISBN 0-471-15227-7.
7. Umbaugh, Scott E (2005). Computer Imaging: Digital Image Analysis and Processing. ISBN 0-84-932919-1.

Course Code: **GO-202**
Course title: **Enterprise GIS Techniques**
(Theory 50 + Practical 50)
No. of lectures and practicals: 50

Course outline
The course is designed to develop the enterprise skill required in recent GIS trend including MapObjects and ArcObjects.

Details of course contents and allotted time

No.	Topic	Allotted time (hours)	
		L	P
1.	Introduction to MapObjects	1	3
2.	Introduction to VBA and Visual studio 200#	2	2
3.	Getting Started with ArcObjects	1	2
4.	Visual Basic code: How, where, and when?	2	2
5.	Using variables, Programming with class	2	2
6.	COM,OMD, Maps and layers, Data access and creation	2	2
7.	Geometry and Geoprocessing	3	2
8.	Working with subsets and selections	3	2
9.	Symbolizing elements and layers	3	2
10.	Working with layout elements, Data management	3	2
11.	ArcObjects beyond VBA	3	2
	Total	25	25

Reference Book

1. Kang-Tsung Chang, Programming ArcObjects with VBA: a task-oriented approach, 2, illustrated, CRC Press, 2007, ISBN 0849392837, 9780849392832
2. Robert Burke (2003) ,Getting to know ArcObjects, programming ArcGIS with VBA, Esri Pr,ISBN-10: 158948018X,ISBN-13: 9781589480186
3. Rick Leinecker, Vanessa L. Williams,Visual Studio 2008 All-In-One Desk ,For Dummies 2008, ISBN0 470191082, 9780470191088
4. Bruce Ralston,Developing GIS Solutions With MapObjects and Visual Basic, OnWord Press; 1 edition (October 31, 2001), ISBN-10: 0766854388 ,ISBN-13: 978-0766854383

POST GRADUATE DIPLOMA IN GEOINFORMATICS

Course Code: **GO-203**
Course title: **GIS for Business and Service Planning**
(Theory 50 + Project 50)
No. of lectures and practicals: 50

Course outline

The course is designed to develop the skills required to develop the data base for business and service planning. It also highlights the various applications of Geoinformatics in business decision making process.

Details of course contents and allotted time

No.	Topic	Allotted time (hours)	
		L	P
1	Geography ad business link , GIS for Business Services, Planning and management, Developments and prospects Micro and macro economics Organizational structures,	2	
2	Geodemographics: Population data sources, availability, measurement and modeling. and their geographical integration	2	
3	Human resources management	1	
4	Geodemographics and lifestyle approaches, Geolifestyles	3	
5	Marketing spatial analysis, spatial decision support systems 'business geographics'	3	5
6	Business censuses and the modeling of customer targeting,	2	5
7	Manipulation and merging business application databases	2	
8	Customized versus proprietary solutions to business application	2	5
9	Databases consultancy applications of GIS, Enterprise resource planning	2	5
10	Internet platform for GIS Customer facing GIS : web , eCommerce and mobile solutions, Online mapping	2	3
11	Applications Supporting business decision, Enterprise applications, Customized spatial decision support systems	2	2
12	Ethical Legal and Security issues of spatial technology	2	
	Total	25	25

Reference Book

1. David Boyles (2002): GIS Means Business, Vol. 2 , ESRI Press.
2. James B. Pick (2008) Geo-Business in the Digital Organization, John Wiley and Sons, New York
3. Ravi Kalakota et al.: Electronic Commerce: A Managers Guide Pearsons Education 2004

POST GRADUATE DIPLOMA IN GEOINFORMATICS

Course Code: **GO 204**
Course title: **GIS for Urban and Regional Planning**
(Theory 50 + Project 50)
No. of lectures and practicals: 50

Course outline
The course is aimed to introduce the concept of urban and regional planning and applications of GIS in it. It consists of collection, processing, analysis and development of solution fro urban and regional problems.

Details of course contents and allotted time

No.	Topic	Allotted time (hours)	
		L	P
1	Basics concepts of geotechnologies and recent developments	2	
2	Data classification methods and data exploration , Sources of Urban data, Mapping database, Attribute data and relational database management systems	3	4
3	Methods of spatial data analysis, System analysis of the urban planning process, Planning and urban design	3	4
4	Data acquisition in an urban environment, Quality control and multisource updating of urban databases, Design methodologies for information system,	3	3
5	Data visualization and mapping design, Visualization for displaying and accessing urban information	2	4
6	Groupware in urban planning, Hypermaps and web sites for urban planning	2	1
7	GIS strategic planning and public out reach Applications in profit and non profit organizations	3	4
8	Computer system for public participation, Advocacy planning and public information, Computer architecture for urban planning	2	1
9	Real time information systems for urban environment and risk monitoring	2	1
10	The spatial investigation capacities of neural networks Land use dynamics through artificial intelligence tools Multi-agent systems interactions among actors and their behaviors	2	3
11	Ethical issues in GIS and Urban planning GIS project development and institutional issues	1	
	Total	25	25

Reference Book

1. Ayse Pamuk (2008) Mapping Global Cities, GIS Methods In Urban Analysis. ESRI Press. New York
2. Frederick R Steiner and Kent Butter (ed) (2007) Planning and Urban Design Standards, John Wiley and Sons New Jersey, Canada.
3. Lidia Diappia (2004): Evolving Cities Geocomputation in Territorial Planning, Urban and Regional Planning and Developmental Series, Ashgate Publishing Company, USA
4. Robert Laurini (2001) Information System for Urban Planning: A Hyper Media Cooperative Approach(Geographical Information System Workshop)Taylor & Francis, London

POST GRADUATE DIPLOMA IN GEOINFORMATICS

Course Code: **GO-205**
Course title: **GIS for Environmental Management**
(Theory 50 + Project 50)
No. of lectures and practicals: 50

Course Outline:

The course designed to understand the fundamentals of environment and the application of GIS in the monitoring, assessment and planning.

Details of course contents and allotted time

No.	Topic	Allotted time (hours)	
		L	P
1	Introduction to the Field of Natural Resources.	1	
2	Biodiversity- Biodiversity characterization at landscape level using remote sensing and GIS	2	3
3	Geosciences- Concept geomorphology land form analysis aerial and satellite data, interpretation, drainage basin, morphometry and slope mapping	3	3
4	Water resources -Watershed hydrology and physical process in watershed, principle of RS in water resources, assessment, River Valley project planning, organization and design of spatial and non-spatial data in water resources in engineering, ground water	2	3
5	Forest- Forest resource, forest types, identification and mapping	2	
6	Soil resources- Soil mapping, Land evaluation, degraded land mapping and Hyper spectral RS in soil properties mapping	3	4
7	Disaster management	2	
8	Agriculture- Crops identification, crop inventory, production estimation and water shed management	2	6
9	Atmospheric and marine environment- Color, temperature, slope length and roughness	4	
10	Coastal zone management- Coastal Management :Introduction, Coastal and Marine environment, Coastal Processes, Satellite Oceanography, Chlorophyll detection, Hazard mapping, PFZ mapping	4	6
	Total	25	25

Reference Books:

1. Jensen, J.R. (2000). Remote sensing of the environment: an Earth resource perspective. Prentice Hall. ISBN 0-13-489733-1.
2. Kondratyev K Ya, Buznitov AA and Pokrovoky OM (2000). Global Change and Remote Sensing: John Wiley and Sons.
3. Roy, P.S. Geoinformatics for Tropical Ecosystems Bishen Singh Mahendra Pal Singh, Dehradun
4. P. Castro and M.E. Huber, Marine Biology,McGraw-Hill
5. Richard A Geyer ,Marine Environmental Pollution, , Elsevier Oceanography Series