UNIVERSITY OF PUNE
DEPARTMENT OF GEOGRAPHY

Credit System (M.Sc. Geoinformatics): Details of the Courses and Credits – 2014

COURSE CODE	COURSE TITLE	CREDITS per Course	Credits to be completed	
			Course-wise	semester-wise
	SEMESTER I			
	Concepts in Geography (Non-credit course)			
GE 101	Introduction to Remote Sensing	4	**4**	
GE 102	Introduction to Geographic Information System	4	**4**	
GE 103	Cartography and Map Interpretation	4	**4**	
GE 104	Spatial Data Processing	4	**4**	
GE 105	Aerial Photo and Image Interpretation	4	**4**	
GE 106	Programming in C and C++	4	**4**	
	Total credits in semester I	**24**	**24**	**24**
	SEMESTER II			
GE 201	Digital Image Processing	4	**4**	
GE 202	Spatial Analysis	4	**4**	
GE 203	Statistical Methods	4	**4**	
GE 204	Image Data Processing	5	**5**	
GE 205	Geospatial Data Processing	5	**5**	
GE 206	Programming in .NET and ArcObject	4	**4**	
	Pilot Project (Non-credit course)			
	Total credits in semester II	**26**	**26**	**26**
	SEMESTER III			
GE 301	Advances in Remote Sensing	5	**5**	
GE 302	Advances in GIS	5	**5**	
GE 303	Advance Techniques in Spatial Data Processing	5	**5**	
GE 304	Database Management System	5	**5**	
GE 305	Application of GIS and RS Techniques – I	5	**5**	
Any one of the following				
GE 306	Programming in HTML, Java and Python	5	**5**	
GE 307	Application of GIS and RS Techniques – II	5		
	Total credits in semester III	**35**	**30**	**30**
	SEMESTER IV			
GE 401	Project Work	20	**20**	**20**
	Total credits in semester IV	20	**20**	**20**
	TOTAL CREDITS	**OFFERED**		**REQUIRED**
		105		**100**

Semester I

Code No: GE: 101	Title: Introduction to Remote Sensing		
No. of Credits: 4			No. of Periods: 60

Sr. No.	Topics	Sub-topics	Lectures
1	Introduction to Remote Sensing	Concepts Definition, History Development, Stages in RS-EMR, EMR Spectrum, Theories of EMR, Types of RS and Laws of Radiation	15
2	Interaction of EMR	Interaction with Earth's atmosphere	12
3	Spectral Signature	Interaction with soil, water and vegetation	8
4	Platforms, Sensors, Orbits	Types of platform, types of sensors, cameras and satellite orbits	10
5	Aerial photography	Introduction to aerial photography and basic photogrammetry	12
6	Data products	Satellite Data Generation, formats and Aerial photography products	3

Books:
1. Joseph, G. (2004): Fundamentals of Remote Sensing, Universities Press, Hyderabad, India
2. Lillesand, T. M., Kiefer, R. W. and Chipman, J. W. (2008): Remote Sensing and Image Interpretation, John Wiley & Sons, New Delhi
3. Sabins, F. F. (1996): Remote Sensing: Principles and Interpretation, W. H. Freeman and Company, San Francisco
4. Jensen, J. R. (2005): Introductory Digital Image Processing, Prentice Hall, New Jersey
5. Drury, S. A. (2001): Image Interpretation in Geology, Blackwell, Oxford
6. Campbell, J. (2002): Introduction to Remote Sensing, Taylor & Francis, London
7. Anji Reddy, M. (2008): Textbook of Remote Sensing and Geographic Information System, B.S. Publication, Hyderabad

Code No: GE: 102		Title: Introduction to Geographic Information System	
No. of Credits: 4			No. of Periods: 60

Sr. No.	Topics	Sub-topics	Lectures
1	Introduction to GIS	Definitions, evolution, components and objectives	6
2	Hardware & Software requirements	Hardware: Basic blocks of computer, processor, memory, Secondary storage devices, input/output devices, Binary numbers. Software: Operating System, application, compliers, editors. Overview of GIS software packages	7
3	Spatial data	Types of geographic data, levels of measurements. Concepts of space and time, layers coverage. Spatial data models, Representation of geographic features in vector, raster data models. Concept of arc, node, vertices and topology. Object oriented models: advantages and disadvantages. Computer representation for storing spatial data: Block code, Run-length encoding, Chain coding, Quadtree. Issues governing choice of models.	12
4	Non-Spatial data	Advantages of Data base Management System. Conceptual implementation models, Hierarchical, Network, Relational models. RDBMS: components, concept, database schema, tables and relationships. Database design Normalization (1NF, 2NF, 3NF forms) Data definition manipulation using SQL, SQL-query processing, operations on tables, integrity constraints, database security, role of database administrator (DBA). Metadata	12
5	Spatial data input	Digitization, error identification. Errors: Types, sources, correction. Editing and topology building	8
6	Concepts of GPS	History, types, navigation systems and applications	15

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

Code No: GE: 103		Title: Cartography and Map Interpretation	
No. of Credits: 4			No. of Periods: 60

Sr. No.	Topics	Sub-topics	Lectures
1	Map scale	Types conversions, vertical exaggeration, enlargement and reduction	5
2	Map projections	Concept, Classification, types and uses	11
3	Representation of statistical data	Choropleth, Isopleths and Dot method. Unimodal, two dimensional and three-dimensional diagrams	15
4	Introduction to Survey of India topographical maps	Numbering, scales, grid reference, signs and symbols, color system	5
5	Relief representation techniques	Profiles, Identification and representation of landforms from toposheets of fluvial, coastal, Aeolian and glacial landscapes	12
6	Interpretation of maps	Study and interpretation: SOI toposheet, cadastral and thematic maps	12

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

Code No: GE: 104		Title: Spatial Data Processing	
No. of Credits: 4			No. of Practicals: 15
Sr. No.	**Topics**	**Sub-topics**	**Practicals**
1	Overview of ArcGIS	Arcmap, ArcCatalog and Arctool box	2
2	Attribute data input	Creation of schema, tables, data definition, data input, data updating, queries on tables, simple-complex query with two or more tables using SQL. Queries using Union, Intersection, Join etc operations. Use of MS-Excel and MS Access	5
3	Spatial data input	Vector data formats with file extensions. Scanning, on-screen digitization, editing, topology creation, line and area measurements, data attribution	5
4	GPS	GPS Survey, data import, processing and mapping	3

(Note: For 4 credits 2 hrs. practicals twice a week)

Books:
1. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York
2. Environmental Systems Research Institute, Inc. (1998): Understanding GIS: The ARC/INFO Method, ESRI Press, Redland
3. Ahmed, E. L., Rabbany (2002): Introduction to Global Positioning System, Artech House, Boston
4. Kresse, W. and Danko, D. (2002): Springer Handbook of Geographic Information, Springer Drecht, London
5. Bao, J., Tsui, Y. (2005): Fundamentals of Global Positioning System Receivers, John Wiley Sons, Inc., Hoboken

Code No: GE: 105	Title: Aerial Photo and Image Interpretation		
No. of Credits: 4			No. of Practicals: 15

Sr. No.	Topics	Sub-topics	Practicals
1	Measurements	Geometry of aerial photographs, determination of scale, height on aerial photograph	4
2	Aerial Photo and image Interpretation	Interpretation of aerial photos: Single, vertical stereo pairs. Interpretation of satellite imagery: derived from PAN, LISS, WiFs, OCM sensors. Study and visual interpretation of satellite images for physical features, urban, forest and agricultural uses	5
3	Introduction to Digital Photogrammetry	Concepts and techniques of Digital Photogrammetry	4
4	Field work	Study tour: Identification of features in the field using aerial photographs and/or satellite images	2

(Note: For 4 credits 2 hrs. practicals twice a week)

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

Code No: GE: 106		Title: Programming in C and C++	

No. of Credits: 4			No. of Periods: 60

Sr. No.	Topics	Sub-topics	Lectures
1	Computer Fundamentals	Characteristics and limitations, Computer Architecture: Computer block diagram, Flow chart, Operating System, data storages. Networking: LAN, MAN, WAN, various topologies like Ring, Bus, Star, Networking devices like hub, repeaters, switch, bridge, router. Web Concepts: OSI Model, URL, Ports, Firewall, DNS, IP address, proxy, Session, cookies. Client and server architecture: Various protocols like Http, https, FTP, SMTP, POP3. Distributed computing: Introduction to Distributed networking and Cloud computing	10
2	C Language	Introduction to C: History of Programming language, importance of computer languages, Understanding Compiler. Input /Output functions: Console input output, Formatted input output. Data types and operators: types and uses of various operators. Control structures: Various looping mechanism, types of loops. Introduction to Array: Understanding Array, Working with Single multidimensional array. Limitations of array, Structure Unions. Introduction to functions: Need of function, defining, calling function, different types of functions. Understanding of pointer. File handling: Reading and writing the data to file	25
3	C++Language	Introduction to OOP: Importance of OOP Understanding Classes, objects, Methods and properties. Characteristic of OOP: Abstraction, Inheritance, Polymorphism, Encapsulation. OOP and POP: Difference between OOP and POP Constructors and destructors: Creating classes and objects. Memory allocation of Objects. Heap and stack memory. Managing input /Output File handling: C++ stream classes, formatted I/O manipulators. Access modifiers: modifying access of Classes, methods using public, private keywords. Functions and Operators: Function overloading and Overriding, Operator precedence, Operator overloading, Friend and virtual function.	25

Books:
1. Kernighan, R. (1998): C Programming Language, (ANSI C Version), Prentice Hall, New Jersey
2. Balagurusamy, E. (2006): Object Oriented Programming with C++, Tata McGraw Hill, New Delhi
3. Balagurusamy, E. (2002): Programming in ANSI C, Tata McGraw Hill, New Delhi
4. Kanetkar, Y. (2000): Let US C++, BPB publications, New Delhi
5. Kanetkar, Y. (2001): Let Us C, BPB Publications, New Delhi

Semester II

Code No: GE: 201		Title: Digital Image Processing	

No. of Credits: 4			No. of Periods: 60
Sr. No.	**Topics**	**Sub-topics**	**Lectures**
1	Introduction to digital image processing	Digital images: Types Sources of errors: Atmospheric, radiometric and geometric. Image rectification: geometric correction, radiometric correction, noise removal	20
2	Image enhancement techniques	Contrast enhancement: Linear, non-linear, logarithmic and exponential, Gaussian stretch, density slicing. Spatial filtering: low frequency, high frequency, edge enhancement, band rationing and band combination	20
3	Digital image classification	Classification scheme: Supervised classification: Training sites selection and statistical information extraction, Discriminate functions. Classifier: Maximum Likelihood, Euclidian distance, Mahalanobis distance, Paralellopiped. Unsupervised classification. Classification accuracy assessment and error matrix	20

Books:
1. Richards, J. A, Jia, X. (1999): Remote Sensing and Digital Image Processing, Springer, Verlag Berlin
2. Cha, B., Dattaa, D., Majumdar (2001): Digital Image Processing Analysis, Prentice-Hall of India, New Delhi
3. Nag, P. Kudrat, M. (1998): Digital Remote Sensing, Concept Publishing Company, New Delhi
4. Jensen, J. R. (2005): Introductory Digital Image Processing, Prentice Hall, New Jersey
5. Lillesand, T. M., Kiefer, R. W. Chipman, J. W.(2008): Remote Sensing and Image Interpretation, John Wiley & Sons, New Delhi
6. Sabins, F. F. (1996): Remote Sensing: Principles an Interpretation, W. H. Freeman Company, New York

Code No: GE: 202	Title: Spatial Analysis

No. of Credits: 4	No. of Periods: 60

Sr. No.	Topics	Sub-topics	Lectures
1	Introduction to Spatial analysis	Significance of spatial analysis. Overview of tools for analysis	5
2	Spatial analysis – Vector based	Overlay operations: Point-in-polygon, Line-in-polygon, polygon-in-polygon. Single layer operations: Feature identification, extraction, classification manipulation. Multilayer operation: Union, intersection, symmetrical difference, update, merge, append and dissolve	10
3	Spatial analysis – Raster based	Map algebra, grid based operations, local, focal, zonal and global functions, cost surface analysis, optimal path and proximity search	10
4	Network analysis	Concepts, evaluation of network complexity using Alpha-gamma indices. C-matrices for evaluating connectivity of the network. Network data model. Path analysis. Linear referencing and segmentation. Types of network analysis: Optimum cyclic path, vehicle routing, path determination and cost-path analysis. Geocoding	10
5	Point pattern analysis	Methods for evaluating point patterns: clustered and random distribution	5
6	Surface analysis	Interpolation methods: Trend surface analysis, IDW, kriging, measures of arrangement and dispersion, autocorrelation, semi-variogram, DEM, TIN, slope, aspect, hillshade and viewshed	10
7	Spatial modeling	Role of spatial model, explanative, predictive and normative models. Correlation-regression analysis in model building. Handling complex spatial query and case studies	10

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

Code No: GE: 203		Title: Statistical Methods	

No. of Credits: 4			No. of Periods: 60

Sr. No.	Topics	Sub-topics	Lectures
1	Geographic data	Sources, types, discrete and continuous series, scales of measurements, population, sample and sampling techniques	12
2	Organization of data	Frequency distribution, moments of distribution	12
3	Matrices	Matrix Algebra: Types and properties of matrices. Addition, subtraction, multiplication and inverse	12
4	Correlation and Regression	Correlation: concepts and methods Regression: bi-variate, linear, exponential, logarithmic, power-law. Multivariate regression and correlation. Principal Component Analysis (PCA)	12
5	Probability	Normal, Binomial and Poison	12

Books:

1. Hammond, R. and McCullagh, P. (1991): Quantitative Techniques in Geography, Clarendon Press, Oxford
2. Gregory, S. (1978): Statistical Methods for Geographers, Longman, London
3. Frank, H. and Althoen, S. C. (1994): Statistics: Concepts Applications, Cambridge University Press, Cambridge
4. Ebdon, D. (1977): Statistics in Geography, Basil Blackwell, Oxford
5. Rogerson, P. A. (2010): Statistical Methods for Geography, Sage Publications, London

Code No: GE: 204		Title: Image Data Processing	

No. of Credits: 5			No. of Practicals: 15
Sr. No.	**Topics**	**Sub-topics**	**Practicals**
1	Familiarization with image processing system	Loading of image data, identification of objects on visual display, study of histograms and layer information	1
2	Image enhancement techniques	Linear and non- linear contrast enhancement, Band rationing, edge enhancement, high and low pass filtering, density slicing	3
3	Image registration	Registration of bases map/ topomap, image to map, image to image	3
4	Image Classification	Classification : Supervised, unsupervised and use of different algorithms	3
5	Accuracy analysis	Producer, user accuracy, overall and mapping accuracy, Kappa Coefficient	2
6	Vector layers	Generation of Vector layer, editing and topology building, area and perimeter estimation	2
7	Presentation	Map composition	1

(Note: For 5 credits 5 hrs. practicals a week)

Books:
1. ERDAS (2010): ERDAS field Guide, ERDAS incorporation, Norcross, GA, USA
2. http://geospatial.intergraph.com/Libraries/Tech_Docs/Erdas_Field_Guide.sflb.ashx
3. Gupta, R. P. (2003): Remote Sensing Geology, Springer, Verlag Berlin

Code No: GE: 205		Title: Geospatial Data Processing	

No. of Credits: 5			No. of Practicals: 15

Sr. No.	Topics	Sub-topics	Practicals
1	Geodatabase in ArcCatalog and ArcMap	Feature dataset, feature classes, Import of data, spatial data formats, shape/coverage files and layers, data frames, maps, managing TOC	2
2	Georeferencing Data	Coordinate systems, datum conversions, Map projections, types, storing- viewing projection information	2
3	Working with layers in ArcMap	Building templates, classification, displaying qualitative and quantitative values, labeling features and map creation.	2
4	Editing data	Selecting features, simple editing functions, creating new features, modifying, schema changes	1
5	Spatial and non-spatial data	Spatial: linking features attributes, ways to view data, metadata Non-spatial : understanding tables, field types, table manipulations, table relationship, joins, relates, creation of graphs and reports	3
6	Spatial Analysis	Query by attribute and location, identifying spatial and non-spatial data, geoprocessing wizard, spatial analysis functions, Multi Criteria Analysis using Boolean logic	3
7	Network analysis	Network utility, creating network model, shortest path, geocoding	1
8	Presenting data	Map design, map composition	1
9	Project work		*

(Note: For 5 credits 5 hrs. practicals a week)

Books:
1. Mitchell, A. (1999): The ESRI guide to GIS analysis, Redlands
2. Zeiler, M. (1999): The ESRI guide to Geodatabase design, Redlands
3. ESRI (2003): Introduction to ArcGIS- I, Course Lectures, GIS Education Solutions
4. Booth, B., Shaner, J., MacDonald, A., Sanchez, P. Pfaff, R. (2004): ArcGIS, Geodatabase Workbook, Redlands
5. Melania, H. M., Rhonda, P., Minami, M., Hatakeyama, A. M. (2004): ArcGIS, Using ArcMap, ESRI Press, Redlands
6. Environmental Systems Research Institute, Inc. (1998): Understanding GIS: The Arc/Info Method, ESRI Press, Redlands

Code No: GE: 206		Title: Programming in .NET and ArcObject	
No. of Credits: 4			No. of Periods: 60

Sr. No.	Topics	Sub-topics	Lectures
1	.NET Language	Introduction: .Net architecture. CLR, CLS, CTS, JIT compiler C # .net: Introduction to C# .net. Syntax used in defining classes, methods, variables Interface abstract class: Understanding abstract classes, access modifiers and interface. Creating and using Custom interfaces, Sample programs Implementing OOP: Introduction to classes used in .net, Implementing OOPs characteristics, Working with windows forms application, console application, building logic in the sample application. Event handling: handling various events in Windows forms application Exception handling: Usage of Try, catch and finally block. .Net interoperability: Working with managed and unmanaged code	35
2	ArcObject	SDK development environment, basic customizations, deploying and sharing customizations, Maps and layers, workspaces, geometry operators, graphic elements, Cursors, geoprocessing and Engine SDK	25

Books:
1. Evjen, B., Hollis, B., Rockford, L. (2006): Professional VB.NET (2003), Wiley Publishing Inc. USA
2. Holzner, S. (2010): Visual Basics.NET Programming Black Book, Paraglyph Press USA Dreamtech Press
3. http://www.ebooksdownloadfree.com/Miscellaneous/C-Black-Book-BI20346.html
4. http://www.tutorialspoint.com/csharp/csharp_tutorial.pdf
5. www.completecsharptutorial.com
6. http://help.arcgis.com/en/sdk/10.0/arcobjects_net/conceptualhelp/index.html
7. https://www.dur.ac.uk/resources/its/info/guides/93AMLGIS.pdf
8. http://ebookily.org/pdf/arcobject-c

Semester III

Code No: GE: 301	Title: Advances in Remote Sensing

No. of Credits: 5	No. of Periods: 75

Sr. No.	Topics	Sub-topics	Lectures
1	Advance techniques of digital image processing	Principal Component Analysis, Fourier transformation, IHS, texture, sub-pixel, and image fusion, image segmentation	15
2	Thermal Imaging System	Concept, IR region of the EMR, Atmospheric transmission, Thermal properties of materials. Characteristics and Advantages of IR images	15
3	Digital Photogrammetry	Concept and techniques, data generation and Research application of Cartosat-1 data	9
4	Microwave, Hyperspectral Remote sensing	Concept, sensors, radar operating principles, synthetic aperture radar, INSAR and POLSAR and radar interferometry radar, image characteristics. Concept of hyperspectral remote sensing, sensors, multispectral vs. hyperspectral	20
5	LiDAR	Concepts, LiDAR sensor system, Accuracy of LiDAR measurements	16

Books:
1. Richards, J. A., Jia, X. (2000): Remote Sensing and Digital Image Processing, Springer, Verlag Berlin
2. Chand, B., Majumdar, D. D. (2001): Digital Image Processing Analysis Prentice- Hall of India, New Delhi
3. Jensen, J. R. (2005): Introductory Digital Image Processing, Prentice Hall, New Jersey
4. Lillesand, T. M., Kiefer, R. W., Chipman, J. W. (2008): Remote Sensing and Image Interpretation, John Wiley & Sons, New Delhi
5. Sabins, F. F. (1996): Remote Sensing: Principles Interpretation, W.H. Freeman Company, New York
6. Navalgund, R. R. Ray, S. S. (2011): Hyperspectral Data, Analysis Techniques Application, Indian Society of Remote Sensing, Dehradun

Code No: GE: 302	Title: Advances in GIS

No. of Credits: 5	No. of Periods: 75

Sr. No.	Topics	Sub-topics	Lectures
1	Spatial data mining	Methods for knowledge discovery spatial in databases, methods of clustering, exploring, spatial association, mining in raster database	15
2	Customization of geoinformation	Customization: Process, uses and advantages. National spatial database infrastructure	13
3	Spatial decision Analysis and fuzzy logic	Multi-criteria decision analysis, estimation of weights. Fuzzy logic, operations on fuzzy sets, fuzzy vs. Boolean, basic rules for inference Artificial neural network	13
4	Decision support systems	Types of problems, efficiency effectiveness of decision making, architecture of DSS tools, significance of DSS DSS experts systems	8
5	Recent trend in GIS	Basic concepts, conventional vs. database modeling with OOGIS, history of network technology, interoperability specifications, open source GIS- Cloud computing, crowd sourcing and open geospatial consortium. Mobile GIS	13
6	ArcGIS Server ArcSDE	GIS server, ArcGIS Server and architecture, web application functionality, GIS web service. ArcSDE: Introduction, SDE connection, configuration options. SDE for developers Data storage: SDE geodatabase. ArcSDE Architecture	13

Books:
1. Demers, M. N. (2000): Fundamentals of Geographic Information Systems, John Wiley & Sons, New Delhi
2. Burrough, P. A. and McDonnell, R. A. (2000): Principles of Geographical Information Systems, Oxford University Press, New York
3. Malczewski, J. (1999): GIS Multi-criteria Analysis, John Wiley & Sons, New York
4. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York
5. Williams, J. (1995): Geographic Information from Space: Processing Applications of Geocoded Satellite Images, John & Wiley Sons, New Delhi
6. Environmental Systems Research Institute, Inc. (1998): Understanding GIS: The ARC/INFO Method, ESRI Press, Redlands

Code No: GE: 303		Title: Advance Techniques in Spatial Data Processing	

No. of Credits: 5			No. of Practicals: 15
Sr. No.	**Topics**	**Sub-topics**	**Practicals**
1	Advanced image enhancement techniques	Principal component analysis, Fourier transformation, IHS, texture and Image fusion	3
2	Interpretation of images	Visual interpretation of thermal, radar and hyperspectral images	3
3	Ground radiometry	Principle working of ground radiometer, data collection, data integration and analysis	3
4	Advance spatial analysis	Multi-criteria analysis in ArcGIS using fuzzy logic. Classification: Fuzzy, decision tree	3
5	Customization	Customizing ArcGIS interface	2
6	Application	Case studies	1

(Note: For 5 credits 2 hrs. practicals twice a week)

Books:
1. ESRI (2003): Introduction to ArcGIS – II, Course Lectures, GIS Education Solutions, Redlands
2. Bratt, S., Booth, B. (2004): ArcGIS, Using 3D Analyst, ESRI Press, Redlands
3. McCoy, J., Johnston, K., Kopp, S., Borup, B., Willison, J., Payne, B. (2002): ArcGIS, Using Arc GIS Spatial Analyst, Redlands
4. Hodson, T. Clark, K. (2003): Using ArcGIS Spatial Analyst, Redlands
5. Environmental Systems Research Institute, InC.(1998) Understanding GIS: The ARC/INFO Method, ESRI Press, Redlands

Code No: GE: 304		Title: Database Management System	

No. of Credits: 5			No. of Periods: 75

Sr. No.	Topics	Sub-topics	Lectures
1	Introduction	Introduction: DBMS, RDBMS, SQL and Oracle architecture Data base security concept and advantages of RDBMS and ER modeling	8
2	Controlling user access	Control database access, Privileges, creating user, concept of Role, creating, granting privileges to role, revoking privileges. Changing password	10
3	Managing schema object	Data types, DDL, DML, DCL Constraints: types of constraints, Primary key, foreign key, check constraint, Not Null, Altering constraint, concept of backup recovery. Overview of Index, view	10
4	Manipulating dataset using SQL statement	Basic select statement, selecting specific column, using arithmetic expressions, defining column alias, Using where clause	10
5	Restricting & Sorting data	Using comparison condition (=,<=,>=etc), using logical operator: AND, OR, NOT, using BETWEEN, LIKE conditions Rule of Precedence. Using order by clause	10
6	SQL Function displaying data from multiple tables, Sub-query	Concept of function, types, group functions, use of group by, having clause. Types of joins, concept of sub-query, types of sub queries	9
7	PL/SQL	Introduction to PL/SQL, variables and types declaration in PL/SQL. Simple program in PL/SQL: Assignment operator, output statement, accepting input from user. Simple program in PL/SQL using table: syntax of using 'select' statement in PL/SQL, 'If' statement and Loops in PL/SQL. Creating procedure, function, cursor, trigger packages	18

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

Code No: GE: 305		Title: Application of GIS and RS Techniques – I	

No. of Credits: 5			No. of Periods: 75

Sr. No.	Topics	Sub-topics	Lectures
1	Geosciences	Geosciences: Concepts of geomorphology, landform analysis, drainage basin morphometry, slope mapping, integrated approach for landslide hazard zonation models and mapping. Aerial photo and satellite data interpretation	20
2	Water resources	Watershed hydrology, physical processes in watershed, principles of remote sensing in water resource assessment, river valley project, planning, organization and design of spatial and non-spatial data in water resource engineering. Hydrological modelling	20
3	Forest	Forest: Image processing for forest, vegetation classification mapping, forest inventory, sampling techniques, Growing stock estimation, biomass estimation, forest management, fire risk zonation, land evaluation for forestry, RS of forest ecosystem	15
4	Marine and atmospheric sciences	Fundamentals of Marine Ecology, Bio-resource monitoring and mapping, coastal bathymetry. Ocean Color mapping, SST mapping, potential fishing zone mapping. Fundamental principles of climatology, structure, chemical composition of the atmosphere, aerosols, general circulation, climate modelling, meteorological satellites. Forecasting of natural calamities. Air Pollution Modeling	20

Books:

1. SPRS Technical Commission VII (2002): Symposium on Resource Environmental Monitoring, ISRS Annual Convention, IIRS, Dehradun
2. Deekshatulu, B. L. (1990): Description and use of Land use/Landcover, NRSA, Hyedrabad
3. Sudershana, R. Mitra, D. Mishra, Roy, P.S., Rao, D. P. (2000): Subtle Issues in Coastal Management, IIRS, Dehradun
4. Harris, J. E. (1990): Earthwatch – The Climate from space, Ellishorwood Ltd., Midsower Norton
5. Lal, D. S. (1998): Climatology, Chaitanya Publishing House, Allahabad
6. Escalante, R. B. (2012): Remote Sensing- Advances techniques and Plateforms, Intech, Rijeka Croatia
7. Escalante, R. B. (2012): Remote Sensing Application, Intech, Rijeka Croatia
8. Roy, P.S., Dwivedi, R. S. (2010): Remote Sensing Application www.nrsc.gov.in/Learning- Center, E Book. html

Code No: GE: 306		Title: Programming in HTML, Java and Python	

No. of Credits: 5			No. of Periods: 75

Sr. No.	Topics	Sub-topics	Lectures
1	HTML	Introduction: HTML, various HTML tags like image, Text, Color, Frames and Tables Working with tables: Creating Tables, Introduction to frames CSS: Cascading Styling sheets, Introduction to DHTML	15
2	Java script	Introduction to java script, importance of Java script, creating sample program. Data type operators: Various Data type and its importance. Understanding and using various types of operators. Iterative mechanisms: Various looping mechanism, Understanding loops. If else and Switch case Binding: Creating dynamic web pages Understanding DOM API, Dojo Framework and Digits. Debugging in web application: working with developer tools in browser. Layout engines used in various browsers	30
3	Python	Introduction to python, python vs. .NET vs. JAVA. Data type operators: Data types, Basic sample programming control flow, arrays, list and strings. Classes modules: Creating modules and classes, implementing OOP. Script Windows Application: Creating script Working with windows forms. Event handling: Handling various events in Windows forms application. Exception handling: Usage of Try, catch block. Debugging: debugging script for windows forms based application	30

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

Code No: GE: 307		Title: Application of GIS and RS Techniques – II	

No. of Credits: 5			No. of Periods: 75
Sr. No.	**Topics**	**Sub-topics**	**Lectures**
1	Disaster management	Natural and man-made disasters. Types, zoning and preparedness	15
2	Urban planning and development	Large scale mapping for cadastral database, traffic and parking surveys, urban land use classification, monitoring, change detection analysis, utility planning, integrated development planning, urban conservation, transportation planning and Land Information System	20
3	Agriculture and soils	Spectral characteristics of crop, crop inventory, crop yield modelling, physiographic, soil mapping, crop water management, agro-ecological zoning, land evaluation	20
4	Biodiversity	Concept of ecology and biodiversity, biodiversity management and conservation using geospatial technology. Biodiversity mapping, assessment of biodiversity hotspots, anthropogenic disturbance and modeling species distribution. Landscape analysis, wildlife habitat suitability analysis, species inventory	20

Books:

1. NRSA (2002): Symposium Tutorial on Sustainable Agriculture (Volume of Lectures), Hyedrabad
2. NRSA (2001): National Agricultural Drought Assessment Monitoring System, India, Summary Report, Hyedrabad
3. Roy, P. S. (2000): Natural Disaster their Mitigation, IIRS, Dehradun
4. ISRS and IARI (1990): Proceedings of National Symposium on RS for Agricultural Application, New Delhi
5. Roy, P. S. (2002): Biodiversity Characteristics at Landscape Level in North East using satellite Remote Geographical Information System, IIRS, Dehradun
6. Roy, P. S. (2000): Biodiversity Environment by, IIRS, Dehradun
7. ISRS (2000): National Symposium on Spatial Technologies for Natural Hazards Management, IIT, Kanpur
8. Nirupama, (2002): Role of Remote Sensing in Disaster Management, ICIR Research Paper Series N0. 21, Institute for catastrophic loss reduction, University of Western Ontario, Ontario
9. Escalante, R. B. (2012): Remote Sensing- Advances techniques and Plateforms, Intech, Rijeka Croatia
10. Escalante, R. B. (2012): Remote Sensing Application, Intech, Rijeka Croatia
11. Roy, P.S., Dwivedi, R. S. (2010): Remote Sensing Application
www.nrsc.gov.in/Learning- Center, E Book. html

Semester IV

Code No: GE: 401	Title: Project Work

No. of Credits: 20

Sr. No.	Topics to be covered
1	Problem identification and literature review
2	Data acquisition / collection
3	Field work
4	Data processing
5	Results and interpretation
6	Report writing
7	Presentation