UNIVERSITY OF PUNE
DEPARTMENT OF GEOGRAPHY

Credit System (P. G. B. Sc. (Applied) in GIS and Remote Sensing): Details of the Subjects and Credits – 2018

SEMESTER I				
Core Courses				
Subject Code	**Subject Title**	**Credits Per Subject**	**Credits To Be Completed**	
			Subject-Wise	**Semester-Wise**
GR 101	Introduction to Remote Sensing	3	3	
GR 102	Introduction to Geographic Information System	3	3	
GR 103	Spatial Data Processing: Practicals.	4	4	
GR 104	Aerial Photo and Image Interpretation.	3	3	
	Concepts of Geography (Non-credit SUBJECT)			
Elective Courses				
Subject Code	**Subject Title**	**Credits Per Subject**	**Credits To Be Completed**	
			Subject-Wise	**Semester-Wise**
	Any one of the following courses			
GR 105	Methods of Data Representation	3	**3**	
GR 106	Cartographic Techniques	3	**3**	
	Any one of the following courses			
GR 107	Basics of ‘C’ Programming	2	2	
GR 108	Topographical Map Interpretation	2	2	
	Total credits in the semester	**18**	**18**	**18**

SEMESTER II				
Core Courses				
Subject Code	**Subject Title**	**Credits Per Subject**	**Credits To Be Completed**	
			Subject-Wise	**Semester- Wise**
GR 201	Digital Image Processing: Theory	3	**3**	
GR 202	Spatial Analysis: Theory	3	**3**	
GR 203	Digital Image Processing: Practicals	4	**4**	
GR 204	Spatial Analysis: Practicals	4	**4**	
GR 205	Project Assignments	3	**3**	
Elective Courses				
Subject Code	**Subject Title**	**Credits Per Subject**	**Credits To Be Completed**	
			Subject-Wise	**Semester- Wise**
	Any one of the following courses			
GR 206	Statistical Methods	3	**3**	
GR 207	Programming in 'C++'	3	**3**	
	Any one of the following courses			
GR 208	Application of GIS and RS Techniques	2	**2**	
GR 209	Advance Surveying	2	**2**	
	Total credits in the semester	**22**	**22**	**22**

Semester I

Code: GR 101	**Introduction to Remote Sensing**	
No. of Credits: 03		**No. of Lectures: 45**
Sr. No.	**Topic**	**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	8
2	Interaction of EMR: Interaction with Earth's Atmosphere	10
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	9

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: GR 102 Introduction to Geographic Information System		
No. of Credits: 03		**No. of Lectures: 45**
Sr. No.	**Topic**	**Lectures**
1	Introduction to GIS: Definitions, Evolution, Components and Objectives	3
3	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	2
2	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.	13
13	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
12	Spatial Data Input: Digitization, Error Identification. Errors: Types, Sources, Correction. Editing and Topology Building	5
5	Concepts of GPS:History, Types, Navigation Systems and Applications	10

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: GR 103	**Spatial Data Processing: Practicals**	
No. of Credits: 04		**No. of Practicals: 15**
Sr. No.	**Topic**	**Practicals**
1	Overview of Arcgis:Arcmap, Arccatalog and ArctoolBox	2
2	Attribute Data Input:Creation of Schema, Tables, Data Definition, and 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: a) For 4 credits 4 hours practical per week.
b) The concerned teacher may add some points related to the subject.

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: GR 104	**Aerial Photo and Image Interpretation**	
No. of Credits: 03		**No. of Practicals: 15**
Sr. No.	**Topic**	**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, OCMSensors. 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: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

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: GR105	**Methods of Data Representation**	
No. of Credits: 03		**No. of Lectures: 45**
Sr. No.	**Topic**	**Lectures**
1	Data and Data Types: Nominal, Ordinal, Interval, Ratio Representation of Statistical Data: Choropleths, Isopleths, Dots Unimodal, Two-Dimensional and Three dimensional diagrams	10
2	Map Generalization: Recent Development in Map Visualization, Animation, Multimedia, Interactive Map	5
3	Representation of Natural Features: Profiles, Identification and Representation of Different. Natural Features Like fluvial, Coastal, Aeolian and Glacial Landforms	20
4	Representation of Different Manmade Features: Settlement, Transportation, Landuse	10

Books:

1. Singh, R. L.(1979): Elements of Practical Geography, KalyaniPublishers,New Delhi
2. Croxton, F. E., Cowden, D. J., Klein, S. (1975): Applied General Statistics, Prentice-Hall of India, New Delhi
3. Frank, H. Althoen, S. C.(1994): Statistics Concepts and Applications, Cambridge University Press
4. Yeates, M.(1974): An Introduction to Quantitative Analysis in Human Geography, McGraw-Hill, New York

Code: GR 106	**Cartographic Techniques**	
No. of Credits: 03		**No. of Lectures: 45**
Sr. No.	**Topic**	**Lectures**
1	Map Scale: Types and Conversion	10
2	Vertical Exaggeration, Enlargement and Reduction	10
3	Map Projection: Concept, Classification, Uses	10
4	Types of Projection: Polyconic Projection, Mercator Projection(UTM)	15

Books:

1. Elements of Practical Geography by R. L Singh, Published by Kalyani Publishers, 1979
2. Applied General Statistics by Croxton F. E., Cowden, D. J. and Klein, S. Pretice- Hall of India 1975.
3. Frank, H. and Althoen, S.C., statistics Cocepts and Applications, Cambridge University Press, 1994.
4. Understanding Map Projection, GIS by ESRI, 2003-2004, USA
5. Robinson, A. H., Morrison, J. L., Muehrcke, P. C., Kimerling, A. J. Guptill, S. C. (1995): Elements of Cartography, Wiley, New York
6. Understanding Map Projection (2003-2004): GIS by ESRI, Redlands

Code No: GE: 107	**Programming in 'C'**	
No. of Credits: 2		**No. of Practicals: 15**
Sr. No.	**Topic**	**Practicals**
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	5
2	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	10

Note: a) For 2 credits 2 hours practical per week.

b) The concerned teacher may add some points related to the subject.

Books:

1. Kernighan, R. (1998): C Programming Language, (ANSI C Version), Prentice Hall, New Jersey
2. Balagurusamy, E. (2002): Programming in ANSI C, Tata McGraw Hill, New Delhi
3. Kanetkar, Y. (2001): Let Us C, BPB Publications, New Delhi

Code: GR 108	**Topographical Map Interpretation**	
No. of Credits: 03		**No. of Practicals: 15**
Sr. No.	**Topic**	**Practicals**
1	Introduction to Survey of India Topographical Maps	5
2	Numbering, Scales, Grid Reference, Signs and Symbols, Color System	5
3	Interpretation of Maps: Study and Interpretation: SOI Toposheet, Cadastral and Thematic Maps	5

Note: a) For 2 credits 2 hours practical per week.
b) The concerned teacher may add some points related to the subject.

Books:

1. Tamaskar, B. G.,Deshmukh, V. M. (1974): Geographical Interpretation of Indian Topographical Maps, Orient Longman Ltd., Bombay
2. Ramamurthy, K. (1982): Map Interpretation, Rex Printers, Madras
3. 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
4. Gupta, K. K. Tyagi, (1992): Working with maps, Survey of India Publication, DST, New Delhi

Code No: GR: Concepts of Geography		
No. of Credits: Non- credits course		**No. of Lectures: 8**
Sr. No.	**Topics**	**Lectures**
1	Introduction: Geography as a discipline: Nature and scope	**2**
2	Natural Resources: Nature and distribution of Biotic and Abiotic resources	**2**
3	Human Resources: Quantitative and Qualitative	**2**
4	Sustainable Development: Resources and development with special reference to India	**2**

Books:

1. Elements of Cartography, Sixth Edition by Robinson A. H. Morrison J. L., Muehacke P.C., Published By John Wiley & sons, 1995.
2. A Complete Course of Certificate Geography, Part I by Nigam V. N., Published by pitambat Publication Comp., 1983
3. Geographical Interpretation of Indian Topographical Maps by Tamaskar B. G., Deshmukh V. M., Orient Longman Ltd, 1974
4. John R. Weeks (1999) : Population- An Introduction to Concepts and Issues, Wadsworth Pub. Co. Ca USA.
5. Knowled R. and Wareing J. (1998): 'Economic and Social Geography', Rupa and Co., N. Delhi
6. Sundaram, K. P. and Dutta, Rudra (2001), Indian Economy.
7. Population Reference Bureau:' World Population data Sheet, 2000', Washington DC.
8. Hudson, R. S. (1970):'A Geography of Settlements', McDonald and Sons, London.
9. Chisholm, M. (1962):' Rural Settlements and Landuse' London.
10. Short, John R. (1984) : ' An Introduction to Urban Geography', Routledge and Regan Paul, London.

Semester II

Code: GR 201	**Digital Image Processing: Theory**	
No. of Credits: 03		**No. of Lectures: 45**
Sr. No.	**Topic**	**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	15
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	15
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	15

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: GR 202	**Spatial Analysis: Theory**	
No. of Credits: 03		**No. of Lectures: 45**
Sr. No.	**Topic**	**Lectures**
1	Introduction to Spatial Analysis: Significance of Spatial Analysis. Overview of Tools For Analysis	2
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	5
3	Spatial Analysis - Raster Based: Map Algebra, Grid Based Operations, Local, Focal, Zonal and Global Functions, Cost Surface Analysis, Optimal Path and Proximity Search	5
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	8
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: GR 203	**Digital Image Processing: Practicals**	
No. of Credits: 04		**No. of Practicals: 15**
Sr. No.	**Topic**	**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: a) For 4 credits 4 hours practical per week.

b) The concerned teacher may add some points related to the subject.

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: GR 204	**Spatial Analysis: Practicals**	
No. of Credits: 04		**No. of Practicals: 15**
Sr. No.	**Topic**	**Practicals**
1	Geodatabase in Arc catalog 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: a) For 4 credits 4 hours practical per week.
b) The concerned teacher may add some points related to the subject.

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: GR 205	**Project Assignment**
No. of Credits: 03	**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 and presentation

Code: GR 206	**Statistical Methods**	
No. of Credits: 03		**No. of Practicals: 15**
Sr. No.	**Topic**	**Practicals**
1	Geographic Data: Sources, Types, Discrete and Continuous Series, Scales Of Measurements, Population, Sample and Sampling Techniques	2
2	Organization of Data: Frequency Distribution, Moments of Distribution, Measures of Central Tendency, Dispersion and Kurtosis	3
3	Matrices: Matrix Algebra: Types and Properties of Matrices. Addition, Subtraction, Multiplication and Inverse	3
4	Correlation and Regression: Correlation: Concepts and Methods Regression: Bi-Variate, Linear, Exponential, Logarithmic, Power-Law.	5
5	Probability: Normal, Binomial and Poison	2

Books:

1. Hammond, R. and McCullagh, P.(1991):Quantitative Techniques in Geography,ClarendonPress,Oxford
2.Gregory, S.(1978):Statistical Methods for Geographers, Longman, London
3.Frank, H. andAlthoen, 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: GR:207	**Programming in C++**	
No. of Credits: 3		**No. of Practicals: 15**
Sr. No.	**Topics**	**Practicals**
1	Introduction to OOP Classes and Objects: 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	8
2	Access modifiers, Functions and operators: Modifying access of Classes, methods using public, private keywords. Functions and Operators: Function overloading and Overriding, Operator precedence, Operator overloading, Friend and virtual function.	7

Note: a) For 3 credits 3 hours practical per week.
b) The concerned teacher may add some points related to the subject

Books:

1. Balagurusamy, E. (2006): Object Oriented Programming with C++, Tata McGraw Hill, New Delhi
2. Kanetkar, Y. (2000): Let US C++, BPB publications, New Delhi

Code: GR 208	**Application of GIS and RS Techniques**	
No. of Credits: 02		**No. of Lectures: 30**
Sr. No.	**Topic**	**Lectures**
1	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	5
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	5
3	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	5
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	10
5	Agriculture and Soils: Spectral Characteristics of Crop, Crop Inventory, Crop Yield Modelling, Physiographic, Soil Mapping, Crop Water Management, Agro-Ecological Zoning, Land Evaluation	5

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, Hyderabad
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 Platforms, 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
9. NRSA (2002): Symposium Tutorial on Sustainable Agriculture (Volume of Lectures), Hyderabad

Code: GR 209	**Advanced Surveying: Concepts and Methods**	
No. of Credits: 02		**No. of Lectures: 30**
Sr. No.	**Topic**	**Lectures**
1	Introduction to Total Station: Principle and Function	5
2	Use of Total Station in Topographical Survey, Application of Total Station in Various Fields	5
3	Introduction to Differential GPS (Dgps) and UAV: Principle and Function	5
4	Use of dGPS in Topographical Survey.	10
5	Application of dDGPS Points in DEM Generation from Stereo Images.	5

Books:

1. Jeff, H. (1995): Differential GPS Explained, Trimble Navigation
2. Satheesh, G., Sathikumar, R. and Madhu, N. (2007): Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson Education, Delhi
3. Mohinder, S. G., Lawrence, R. W. and Angus, P. A. (2001): Global Positioning Systems, Inertial Navigation and Integration, John Wiley and Sons Inc., New York
4. Lawrence, L. and Alex, L. (2008): GPS Made Easy: Using Global Positioning Systems in the Outdoors, Rocky Mountain Books, Calgary
5. Stinespring, B. M. (2000): The Experimental Evaluation of a DGPS Based Navigational System for the ARIES AUV, Monterey, California: Naval Postgraduate School; Springfield