



Solapur University, Solapur

Choice Based Credit System (CBCS)

Syllabus

M.Sc. Part II Geoinformatics

To be implemented from the year 2016 onwards

School of Earth Sciences

Solapur University, Solapur

M.Sc Geoinformatics

Semester III

Sr.no	Subject	Paper code	Title of the paper	Load /week	Total load	Credits
Compulsory papers						
1	Geoinformatics	GIT 301	Spatial Analyses	04	56	04
2	Geoinformatics	GIT 302	Advanced Tech in Remote sensing	04	56	04
3	Geoinformatics	GIT 303	Advanced Tech in G I S	04	56	04
4	Geoinformatics	GIT 306	Practicals related to GIT 301 & GIT 302	04	56	04
5	Geoinformatics	GIT 307	Practicals related to GIT 303 & GIT 304 or 305	04	56	04
6	Geoinformatics	GIT 308	Soft skill ICT, Scientific English, Tour Report, Seminar	01	14	1
<ul style="list-style-type: none"> • A 15 – 21 days educational tour is compulsory in a academic year 						
Optional papers (any one)						
7	Geoinformatics	GIT 304	Introduction to Statistical Methods	04	56	04
8	Geoinformatics	GIT 305	C++ Programming	04	56	04
	Total				350	25

GIT 301: SPATIAL ANALYSES**(Marks: External 70)
Internal 30**

1	Introduction to Analysis	Introduction and Significance of Spatial Analysis, its utilization Overview of various tools used for analysis: spatial, network, surface. Geostatistics	14
2	Spatial Analysis Vector and Raster Based	Single Layer Operations: Erase, Split, Update, Dissolve, Eliminate, Proximity analysis, Features Identification, Features Classification Multilayer Operations, Overlay Operations: Point In Polygon, Line in Polygon, Polygon In Polygon, Union, Intersection, Difference, Clip, Spatial join Map Algebra: Grid Based Operations: Local, Focal, Zonal and Global Functions, Cost Surface Analysis, Optimal Path and Proximity Search.	14
3	Network Analysis	Concept of Network Analysis, Network Structure, Evaluation Of Network Complexity Using Alpha, Gama Indices, Network Connectivity: C, C1, C2, C3 Matrix, Network Accessibility	14
4	Point Pattern Analysis & Spatial Modeling	Method For Evaluating Point Patterns: Clustered And Random Distribution Role Of Spatial Model, Types of Spatial Model: Descriptive, Explanatory, Predictive and Normative Models, Handling Complex Spatial Query, Case Studies	14

**INTERNAL EVALUATION
(seminar+Term paper+Test)****30 MARKS****Reference Books:**

- 1 GIS and Multi-criteria Analysis by Makreowski Jacek, USA, 1999.
- 2 Principals of GIS by Burrough P.A. MacDonneli R.A. published by Oxford University Press, 2000.
- 3 Geographical Information Science, vol. I by Roy P.S. Published by IIRS, 2000.
- 4 Fundamentals of Geographic Information Systems, 2nd Edition by Demers M.N. published by John Wiley & Sons 2000.
- 5 Introduction to Geographic Information System, Knag, Tsung, Chang 5th edition

GIP 301: (PRACTICAL OF SPATIAL ANALYSIS)**(Marks: External 35)
Internal 15**

1	Overview Of Arc GIS: Arc map, Arc catlog, Arc toolbox
2	Georefrencing
3	Digitization: Point, Line, Polygon Topology: Point, Line, Polygon
4	Data Attachment: Internal Data Attachment, External Data Attachment
5	Data preparation Operation: Clip, Erase, Split, Update, Spatial join, Dissolve, Eliminate, Proximity analysis(Buffer), Map Creation, Layout of Map

GIT 302: ADVANCED TECHNIQUES IN REMOTE SENSING**(Marks: External 70)
Internal 30**

1	Microwave Remote sensing	Introduction: Sensors, Radiometers, Scatterometer, Altimeter, Rain Mapping Radar. Side Looking Radar: Radar Operating Principles, Definitions, Spatial Resolution in Radar, Synthetic Aperture Radar. Radar Return and Image Signature: System Properties, Terrain Properties Radar Image Characteristics: Slant Range Distortion, Relief Displacement, Parallax and Stereo Capability, Speckle. Interpretation of Radar Imagery	14
2	Spaceborne SAR	Description and importance of various Synthetic Aperture Radar data related to SEASAT, SHUTTLE (SIR-A, SIR-B), ALMAZ, ERS-1, JERS-1	14
3	Advanced Techniques in Digital Image Processing	Principal Component Analysis (PCA), Colour Transformation and Image Fusion techniques related to Digital image processing.	14
4	Thermal Infrared Remote sensing	Introduction: Wavelength, Atmospheric Transmission, Emitted Energy, Atmospheric effect. Thermal Radiation Laws: Planck Radiation (Blackbody) Law, Wien's Displacement Law, Stefan-Boltzmann Law, Kirchhoff radiation law. Basic Thermal Radiation Principles, Thermal Properties of Materials, Important Thermal IR Sensors, Interpreting Thermal Scanner Imagery	14

**INTERNAL EVALUATION
(seminar+term paper+test)****30 MARKS****Reference Books:**

- 1 Remote Sensing: Principles and application by Panda.
- 2 Satellite Remote Sensing in Climatology, Studies in Climatology series CBS publication by Andrew Carleton.
- 3 Remote Sensing & Image Interpretation, Wiley publication by Thomas M.Lillesand, Ralph W.Kiefer and Jonathan W. Chipman.
- 4 Digital Image Processing Prithvish Nag, Concept publishing
- 5 Technique and application of hyperspectral and map analysis by Hans Grahn, Niley publication.

GIP 302 PRACTICAL OF ADVANCED TECHNIQUES IN REMOTE SENSING**(Marks: External 35)
Internal 15**

1	ENVI: Georeferancing
2	Classification: supervised and unsupervised
3	Advanced Techniques in Digital Image Processing: Principle Component Analysis, IHS to RGB, RGB to IHS, Image Fusion: Resolution Merge, Wavelet Fusion, Ehlers Fusion
4	Spectroradiometer: data collection and spectral signatures.
5	Image Interpretation Techniques: RADAR, Hyper spectral

INTERNAL EVALUATION**(viva-voce+journal + data evaluation)****30 MARKS**

GIT 303: ADVANCED TECHNIQUES IN GIS**(Marks: External 70)****Internal 30**

1	Surface Analysis & decision making models	Interpolation Method, DEM, TIN, Variance Filter, Slope and Aspect, Relief and Hill Shading. Fuzzy Logic, Operation On Fuzzy Set Fuzzy Vs. Boolean, Basic Rules of Inference, Artificial Neural Network.	14
2	Recent Trends In GIS	Recent Trends: Location Based Services, Virtual Globe, Enterprise Resource Planning, SAP ERP. Internet and GIS: Introduction, History, Services, Open Geospatial Consortium (OGC), Geographic Markup Language (GML), Keyhole Markup Language (KML), Web Map Services. WEB GIS. Open source GIS (Geoserver)	14
3	Spatial Decision Support System (DSS)	Introduction, Process of spatial Decision Making, Types of Problems, Characteristics of spatial DSS, Efficiency and Effectiveness of Decision Making, Architecture of A DSS, Spatial DSS and Expert System.	14
4	Spatial Multicriteria Decision Analysis	Introduction, Components, Estimation of Weights: Trade off Method, Rating Method, Ranking Method, Weighted Summation, Paired Comparison. Spatial Data Mining : Method of Knowledge Discovery in Spatial Database, Spatial Mining Tasks: Spatial Classification, Spatial Clustering, Association Rules	14

**INTERNAL EVALUATION
(Seminar+Term paper+Test)****30 MARKS****Reference Books:**

- 1 GIS and Multi-criteria Analysis by Makreowski Jacek, USA, 1999.
- 2 Principals of GIS by Burrough P.A. MacDonneli R.A. published by Oxford University Press, 2000.
- 3 Expert Systems and Applied Artificial Intelligence, E. Turban, Macmillan, 1992
- 4 Introduction to Expert Systems, Peter Jackson, Harlow, England: Addison Wesley Longman, 1999.
- 5 Neural networks: A comprehensive Foundation, Simon Haykins, Prentice Hall Inc., 1999.
- 6 Fuzzy sets, uncertainty and information, Gerge J. Klir, Tina A. Folger, Prentice Hall inc., 2000.
- 7 Genetic Algorithms in Search, Optimization, and Machine Learning, Goldberg, David Edward, Addison-Wesley Pub. Co., 1989
- 8 Genetic Programming: On the Programming of Computers by Means of Natural Selection, J. Koza, The MIT Press, 1992.

GIP 303 PRACTICAL OF ADVANCED TECHNIQUES IN G I S**(Marks: External 35)****Internal 15**

1	Overview of Q GIS software (Open source)
2	Interpolation: IDW, Kriging
3	Surface Analysis: DEM, Slope, Aspect, Contour, Hillshade, Viewshade, TIN
4	Google Earth: Layer creation : Point, Line, Polygon
5	Site suitability Analysis using Multi Criteria Analysis In Arc GIS

INTERNAL EVALUATION**30 MARKS**

(viva-voce+journal + data evaluation)

GIT 304: INTRODUCTION TO STATISTICAL METHODS**(Marks: External 70)****Internal 30**

1	Geographical data and Statistical methods	Sampling, Types of data, Methods of collection and Recording. Measures of central tendency: Mean, Median, Mode.	14
2	Measures of Dispersion	Range and Deviations: a) Mean Deviation b) Quartile Deviation and c) Standard Deviation Absolute and Relative measures of dispersion, skewness and kurtosis	14
3	Correlation and Regression	Types of correlation, methods of studying correlation, Karl Pearson coefficient of correlation, T-test, F-Test, Chi-Square test, Lines of regression and properties.	14
4	Probability	Sample space, events, types of events, algebra of events, and probability of an event.	14

INTERNAL EVALUATION**30 MARKS****(Seminar+Term paper+Test)****Reference Books**

- 1 Quantitative Techniques in Geography by Hammond, R. and McCullough. P. Clarendon oxford 1991.
- 2 Statistical Methods for Geographers by Gregory, S, Longman 1978
- 3 Statistical: Concept and Applications by frank, Hand Alt S.L. Cambridge University Press 1994.
- 4 Statistics in Geography by Ebdon, D. Basil Blackwell, 1977.
- 5 A text book of agricultural Statistics R. Rangaswamy Statistical Method, for Environmental & Agricultural Science Bidgelli Hossien

GIP 304 PRACTICAL OF INTRODUCTION TO STATISTICAL METHODS**(Marks: External 35)****Internal 15**

1	Data collection and their types.
2	Measure of central tendency – Mean, Mode and Median
3	Dispersion
4	Correlation and Regression analysis

INTERNAL EVALUATION**30 MARKS****(viva-voce+journal + data evaluation)**

1	Object oriented concepts	Difference between object oriented and procedural oriented programming, the object oriented approach, Object oriented design, Concept of OOP's –Data abstraction, Encapsulation , Inheritance , Polymorphism Introduction to C++ : Introduction, Terminology –Tokens, keywords, Identifiers, Basic Data types, Operators, Input –Output streams, Structure of C++	14
2	Classes and objects	Concept of Class and Object, Simple class, Member function, private, public & protected member, Array of objects, Nested class, Passing objects as parameter, Inline function, reference arguments Constructor and Destructor : Introduction of constructor and destructor, Default constructor, Copy constructor, Parameterized constructor, Multiple Constructor in class, Friend function	14
3	Inheritance and Polymorphism	Inheritance Concept of inheritance, defining base and derived classes, Behavior of constructor and destructor in inheritance, Types of Inheritance, Concepts, Types of polymorphism, Overloading of function, Virtual function Operator overloading and type conversions : Concept of operator overloading, Rules for overloading operators, Overloading of Unary, Binary and Special operators, Type conversion, Dynamic memory allocation (New and Delete) , this pointer, Dynamic Initialization of variable, reference variable	14
4	File and Streams	Introduction, C++ Streams, C++ stream classes, Unformatted I/O Operations, Managing output with manipulators, Opening and closing a file, Detecting end of file, More about open () : File modes, file pointers and their manipulations, sequential input and output operations, Updating a file :Random access, Error handling During file Operations. Exception handling	14

INTERNAL EVALUATION
(Seminar+Term paper+Test)

30 MARKS

References:

1. Object oriented programming by E. Balgurusamy
2. Mastering C++ by Venugopal
3. Mastering C++ by Ravichandran
4. Object oriented programming in C++ by Robert Lafore.
5. Object oriented programming in C++ by M. P. Bhawe

GIP 305 PRACTICAL OF C++ PROGRAMMING

(Marks: External 35)
Internal 15

1	OOP Concepts, C++ Programming basics, objects and classes, Array of objects, constructors destructors, types of constructors (2)
2	Functions : Reference arguments, overloaded functions, inline functions, default arguments, returning by reference, friend functions and static functions (3)
3	Operator Over loading : Overloading unary and binary operators, Overloading extraction and insertion operators, data Conversion. (3)
4	Inheritance : Derived class and base class, derived class constructors, over riding member functions, public and private inheritance, multiple inheritance (3)
5	Advanced C++ features : Files, Exception handling, Library organisation and containers

INTERNAL EVALUATION
(viva-voce+journal + data evaluation)

30 MARKS

Semester IV

Sr.no	Subject	Paper code	Title of the paper	Load /week	Total load	Credits
Compulsory papers						
1	Geoinformatics	GIT 401	Geoinformatic Approach For Natural Resource Management	04	56	04
2	Geoinformatics	GIT 402	Application of Remote Sensing and G I S in Disaster Management	04	56	04
3	Geoinformatics	GIT 403	IT and Management (VB.NET)	04	56	04
4	Geoinformatics	GIT 406	Practicals related to GIT 401 & GIT 402	04	56	04
5	Geoinformatics	GIT 407	Practicals related to GIT 403 & GIT 404 or 405	04	56	04
6	Geoinformatics	GIT 408	Soft skill ICT, Scientific English, Tour Report, Seminar	01	14	1
<ul style="list-style-type: none"> • A 15 – 21 days educational tour is compulsory in a academic year 						
Optional papers (any one)						
7	Geoinformatics	GIT 404	Dissertation	04	56	04
8	Geoinformatics	GIT 405	Application of Remote Sensing and G I S in Land Evaluation	04	56	04
	Total				350	25

**GIT 401: APPLICATION OF REMOTE SENSING AND G I S IN NATURAL RESOURCE
MANAGEMENT**

(Marks: External 70)

Internal 30

1	Forest	Forest classification and mapping forest inventory, sampling techniques, growing stock estimation, forest management, wildlife habit suitability analysis	14
2	Water resources	Basic concept of water resources, Hydrological cycle, Sustainable watershed management, water pollution detection, Salinity and waterlogged area mapping	14
3	Soil	Physiographic soil mapping , soil type identification, soil moisture mapping	14
4	Marine resources	Fundamental of marine ecology, Bio resources, mapping, monitoring, coastal Bathymetry, ocean colour mapping, SST mapping, potential fishing zone mapping	14

INTERNAL EVALUATION

30 MARKS

(Seminar+Term paper+Test

References:

- 1 Remote Sensing of the Environment Earth Resource Perspectives, 2nd Edition, by John R. Jensen.
- 2 Geoinformatics for Environmental Management, B.S. Publication, by M. Anji Reddy.
- 3 Remote Sensing: Principles and application by Panda.
- 4 Biodiversity characteristics at Landscape level in North East using satellite Remote and GIS by Roy P.S., IIRS, 2002.

**GIP 401 PRACTICAL OF APPLICATION OF REMOTE AND G I S IN NATURAL RESOURCE
MANAGEMENT**

(Marks: External 35)

Internal 15

1	Spatial Analyses, Land use land cover change analysis
2	Morphometric Analysis
3	Prioritization of watershed
4	Geostatistical Analyses
5	3D analysis of small projects in Arc map

INTERNAL EVALUATION

30 MARKS

(viva-voce+journal + data evaluation)

GIT 402: APPLICATION OF REMOTE SENSING AND G I S IN DISASTER MANAGEMENT**(Marks: External 70)****Internal 30**

1	Disasters	Meaning and types of hazards, disasters and catastrophes – Disaster Management; Earthquakes: Causes and effects – measurements - earthquake zones of the world and India – vulnerability and microzonation; Volcanoes: Causes and effects – volcanic zones of the world and in India - volcanic hazards; Landslides : Causes and effects – landslide prone zones in India – GIS case studies for earthquake, volcano and landslide.	14
2	Drought and Desertification	Drought : Types – factors influencing drought – variable identification – vegetation index – land use / ground water level changes – soil erosion – delimiting drought prone areas – short term and long term effects; Desertification: Processes – over utilization of water and land resources – GIS based management strategies – GIS case studies for drought and desertification.	14
3	Cyclones and Flooding	Cyclone: Origin and types - effects on land and sea – damage assessment; Flooding: Topography, land use and flooding – Space-time integration – GIS based parameters and layers – flood prone area analysis and management – risk assessment – GIS case studies for cyclones and floods.	14
4	Anthropogenic Disasters	Atmospheric Disasters: Ozone layer depletion – green house / global warming – acid rain – snow melt – sea level rise – related problems; Nuclear, Chemical / Industrial and Mining Disasters: Types – consequences – major disasters of the world and India; Marine Disasters: Oil spill and chemical pollution – coastal zone management strategies – GIS case studies.	14

INTERNAL EVALUATION**30 MARKS****(Seminar+Term paper+Test)****References:**

1. National Disaster Management Division (2004) Disaster Management in India - A Status Report, Ministry of Home Affairs, Government of India, New Delhi.
2. Matthews , J.A., (2002) Natural Hazards and Environmental Change, Bill McGuire, Ian Mason.
3. Skel, A (2002) Environmental Modeling with GIS and Remote sensing, John Wiley and sons, New York.
4. Singh, R.B (Ed.) (1996) Disasters, Environment and Development, Oxford & IBH, New Delhi.
5. Barrett E.C., and L. F. Curtis, (1992) Introduction to Environmental Remote Sensing, Chapman and Hall, London.
6. UNDRO (1995) Guidelines for Hazard Evaluation Procedures, United Nations Disasters Relief Organization, Vienna.
7. Nagarajan, R., (2004) Landslide Disaster Assessment and Monitoring, Anmol Publications, New Delhi.

GIP 402 PRACTICAL OF APPLICATION OF REMOTE SENSING AND G I S IN NATURAL RESOURCE MANAGEMENT**(Marks: External 35)****Internal 15**

1	Drought Assessment
2	Cyclone Track Analysis
3	Flood Damage Assessment
4	Land sliding susceptibility mapping
5	Earthquake hazard zonation mapping

INTERNAL EVALUATION**30 MARKS****(viva-voce + journal + data evaluation)**

GIT 403: IT AND MANAGEMENT (VB.NET)**(Marks: External 70)****Internal 30**

1	Introduction	Variables, types, control structures, and input/output, basic steps in developing a program, Design, implementation and validation. Structure of VB application Projects, Forms, Property Window, menus, tool bars	14
2	Introduction to the Integrated development environment.	ActiveX control, use of ActiveX controls and their properties, methods and events of basic controls. Expressions (logical, relational and arithmetic). Control structures and arrays, Error handling. Procedures, Modules and Strings:- manipulation and matching.	14
3	Database Management	Data Control, DAO, ADO, RDO. File Processing Sequential file processing with file system controls. Random access files.	14
4	Creating user defined ActiveX Controls, DLLS	Crystal Reports	14

INTERNAL EVALUATION**30 MARKS****(Seminar+Term paper+Test)****TextBooks:**

1. The Complete Reference Visual Basic 6.0 by Noel Jerke
2. Mastering Visual Basic by Evangelos Petrououts

Reference Books:

1. Database Developers' Guide with Visual Basic 6.0 by Rojer Jennings
2. Visual Basic 2005 for Beginners by Ivan Bayross, Sharanam Shah

GIP 403 PRACTICAL OF IT AND MANAGEMENT (VB.NET)**(Marks: External 35)****Internal 15**

1	Introduction of VB.NET Editor, Implementation of Project, Forms, Menus, Design various forms using various active x controls
2	Assignment covering string manipulations, Assignment on file handling, Create user defined active x control, Create your own dynamic linked library defining few functions (e.g. addition, subtraction & multiplication of numbers)
3	Creating an ESRI add in buttons
4	Programming with objects
5	Understanding Arc objects

INTERNAL EVALUATION**30 MARKS**

(viva-voce+journal + data evaluation)

GIT 305: APPLICATION OF REMOTE SENSING AND G I S IN LAND EVALUATION**(Marks: External 70)****Internal 30**

1	Nature, Principles and Processes of Land Evaluation	Land Evaluation Definition, Actors, need, aim, objectives, Land evaluation and Land use planning, Principles, Land Evaluation process, approaches, Levels of detail: Frame work, Guidelines, Evaluations	14
2	Geomorphology	Land capability, Physical Land Suitability, Soil Erosion Model, Groundwater Suitability, Watershed and Land Use Planning: Database - Thematic layers – Weightage, Ranking and Rating scale - Integration – Suitability classification, Decision making.	14
3	Application for Agricultural	Crop suitability for Irrigated and Rainfed agriculture (Rice, Banana, Groundnut and Cotton), Agroclimatic Land Suitability, Forestry and Grazing: Database - Thematic layers – Weightage, Ranking and Rating scale - Integration – Suitability classification, Decision making.	14
4	Applications For Non – Agricultural	Wildlife conservation, Tourism development, Urban fringe development: Database - Thematic layers – Weightage, Ranking and Rating scale - Integration – Suitability classification, Decision making.	14

INTERNAL EVALUATION**30 MARKS****(Seminar+Term paper+Test)****References:**

1. Christian, C.S., (1957). The Concept of Land Units and Land System, Proc. 9th Pacific Science Congress, 20: 74 – 81.
2. David G. Rossiter, (1994). Land Evaluation Lecture Notes, Department of Soils, Crop & Atmospheric Sciences, College of Agriculture & Life Sciences, Cornell University.
3. Davidson, Donald A. (1992). The Evaluation of Land Resources, Longman Scientific, London.
4. Dent, D.L. and R.B. Ridgway, 1986. A Landuse Planning Handbook for Sri Lanka, Landuse Policy Planning Division, Ministry of Lands and Land Development, Colombo.
5. FAO (1976). A Framework for Land Evaluation, Soils Bulletin 32, FAO, Rome.
6. FAO (1983). Land Evaluation for Rainfed Agriculture, FAO Soils Bulletin 52, FAO, Rome.
7. FAO, (1984). Land Evaluation for Forestry, FAO Forestry Paper 48, FAO, Rome.
8. FAO. (1985). Land Evaluation for Irrigated Agriculture, Soils Bulletin 55, FAO, Rome.
9. FAO, (1991). Land Evaluation for Extensive Grazing, FAO Soils Bulletin 58, . FAO, Rome.
10. FAO/UNEP, (1993). Agro-ecological Assessments for National Planning: the Example of Kenya, FAO Soils Bulletin, 67, FAO, Rome.
11. FAO (1996). Guidelines for Land-use Planning, FAO Development Series 1, FAO, Rome.
12. FAO (1996). Land Evaluation for Development, FAO Development Series, FAO, Rome.
13. Mitchell, C.W., (1973). Terrain Evaluation, Longman, London.

GIP 305 PRACTICAL OF APPLICATIONS OF REMOTE SENSING AND G I S IN LAND EVALUATION**(Marks: External 35)****Internal 15**

1	Data collection for resources analysis
2	Land surface temperature mapping
3	Parcel Editing
4	NDVI change Analysis
5	Crop suitability for rain fed agriculture

INTERNAL EVALUATION**30 MARKS****(viva-voce+journal + data evaluation)****TOTAL DURATION OF THE COURSE: 2 YEARS**

Each semester will have 1 credit (25 marks) for- field training for long tour/ in plant training/remote sensing institute visit or field work, data acquisition related to dissertation.

