Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2022
'B^{++}' Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

(As per New Education Policy 2020)

Syllabus: Geoinformatics

Name of the Course: M. Sc. II (Sem. – III & IV)

(Syllabus to be implemented from June 2024)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science and Technology
Proposed structure as per NEP-2020
Proposed structure for Two Year PG Program (M.Sc.) GEOINFORMATICS

Level / Difficulty	S E M	Major					**Field Project/ RP/CC/Internship/ Apprenticeship / Community Engagement &Services**	Credits	Cumulative Credits
		Mandatory	Practical	Elective	Practical Elective	Minor			
4.5 100-200	III	**DSC 1-5** Advanced Techniques In Remote Sensing (4 credits) 2331301 **DSC 1-6** Advanced Techniques In GIS (4 credits) 2331302	**Practical DSC 1-5** Advanced Techniques In Remote Sensing (2 credits) 2331304 **Practical DSC 1-6** Advanced Techniques In GIS (2 credits) 2331305	**DSE 1-3 (4 credits)** 1) Web GIS & Mobile GIS 2331306 2) Programming Language "C" 2331307 3) Atmospheric and planetary sciences 2331308	**Practical based on DSE 1-3 (2 credits)** 1) 2331309 2) 2331310 3) 2331311		**RP (04)- Field Project** 2331303	22	**44 PG diploma in Discipline**
Exit option: Award of PG Diploma in Discipline with 44 credits OR Continue with Discipline									
5.0/200	IV	**DSC 1-7** Natural Resource Management (4 credits) 2331401 **DSC 1-8** Applications of Rs & GIS in Disaster Management (4 credits) 2331402	**Practical DSC 1-8** Applications of Rs & GIS in Disaster Management (2 credits) 2331404	**DSE 1-4 (4 credits)** 1) Land Evaluation 2331405 2) Python Programming 2331405 2) Application in Hydrology and Agriculture 2331405	**Practical based on DSE 4-1 (2credits)** **1) 2331408** **2) 2331409** **3) 2331410**		**RP (06)** Dissertation 2331403	22	**88 PG degree in discipline**

Fieldwork of 15-21 Days is Compulsory. The Field Work May Be Stretch or Divided Into Parts in the Academic Year

Abbreviations:

Generic/ Open Electives: OE; Vocational Skill and Skill Enhancement Courses: VSEC; Vocational Skill Courses: VSC;Skill Enhancement Courses: SEC; Ability Enhancement Courses: AEC; Indian Knowledge System: IKS; Value Education Courses: VEC; OJT: On Job Training: Internship/

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M. Sc. Applied Geology

PREAMBLE:

Department of Geoinformatics of Punyashlok Ahilydevi Holkar Solapur University is one of the well known Departments in the Solapur district. The Department of Geoinformatics at Punyashlok Ahilydevi Holkar Solapur University offers the Master of Geoinformatics (M.Sc.) program. This program is designed to provide deep knowledge and develop necessary skills to acquire good jobs in various Industries such as NRSA, IIRS, MRSAC or NEERI, Exploration, Mining and in Government sector. Over the past 16 years, the faculty members of department have been committed to improving curriculum, increasing experiential learning, and identifying best practices in teaching through rigorous assessment and review of our programs.

PROGRAM OBJECTIVES:

At the time of completion of the programme, the student would be able to

1. Gain knowledge about various areas of Remote Sensing and GIS.
2. Apply the knowledge of Remote Sensing and GIS, basic sciences, engineering fundamentals for the solution of Remote sensing and GIS world problems.
3. GIS tool help to Identify, formulate, research literature, and analyses arts, science and engineering, natural resource problems.
4. Students can trained to fulfill needs of global Remote Sensing and GIS industry.
5. Introduce the Science and technologies involved in Geoinformatics. Explain the earth and various mapping principles

PROGRAM SPECIFIC OUTCOME:

Upon successful completion of the programme, the student would be able to

PSO1: understand and identify, analyze and solve geospatial problems

PSO2: develop the ability to independently carry out research /investigation and development work to solve real life Remote Sensing and GIS world problems.

PSO3: get training in developing practical and executable solutions to the challenges of growing field of Geospatial technology.

PSO4: develop a Skill by undertaking supervised projects by students with sensitivity towards ethics, public policies and their responsibilities towards the society during internship and project work

SEMESTER III

DSC 1-5 : ADVANCED TECHNIQUES IN REMOTE SENSING

Marks: External 60 **Internal 40**

Course objective

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

Course Outcome

After successful completion of a course in student will be able

1. Students will be able to apply mathematical relationships (at a pre-calculus level) describing fundamental physical, geometric, and computational principles relevant to remote sensing and GIS.
2. They will create Remote sensing application
3. Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management

Sr. No.	Title	Content	Contact hrs	Weightage marks	Credits
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	15 hrs	15	1
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	15 hrs	15	1
3	**Advanced Techniques in Digital Image Processing**	Principal Component Analysis (PCA), Colour Transformation and Image Fusion techniques related to Digital image processing.	15 hrs	15	1
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	15 hrs	15	1

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.

PRACTICAL DSC 1-5 : ADVANCED TECHNIQUES IN REMOTE SENSING

1	ENVI: Georeferencing
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

DSC 1-6 : ADVANCED TECHNIQUES IN GIS

Marks: External 60 **Internal 40**

Course Objectives:

Advanced GIS analysis courses may cover topics such as:

1. Surface analysis and DBMS : these include interpolation methods. Slope, aspects, relief, and network analysis
2. In a recent trends in GIS students learn about advanced GIS techniques used in solving Earth science problems.
3. Students also llearn about decision support system (DSS); its types, classification and charactristics.
4. Demonstrate the spatial data mining

Course Outcome:

Upon successful completion of this course, students will be able to:

1. understand advanced spatial analysis techniques: spatial interpolation, network analysis, spatial statistics etc.;
2. identify key concepts related to GIS/Remote Sensing and explore how to apply them to solve real-world problems;
3. formulate research objectives and research questions, and search for background information;
4. identify required data sources, design data preparation and advanced techniques in order to achieve a geospatial solution;

Sr. No.	Title	Content	Contact hrs	Weightage marks	Credits
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.	15 hrs	15	1
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)**	15 hrs	15	1
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.	15 hrs	15	1
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	15 hrs	15	1

Reference Books:

1 GIS and Multi-criteria Analysis by Makrewski Jacek, USA, 1999.
2 Principals of GIS by Burrough P.A. Mac Donneli 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, Geroge 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.

PRACTICAL DSC 1-6 : ADVANCED TECHNIQUES IN GIS

Marks: External 30

Internal 10

1	Overview of Q GIS software (Open source)
2	Geostatistical Analysis :Interpolation: IDW, Kriging
3	Surface Analysis: DEM, Slope, Aspect, Contour, Hillshade, Viewshade, TIN
4	Site suitability Analysis using Multi Criteria Analysis In Arc GIS
5	Hydrological Analysis: Basin, Stream, Flow Accumulation, Flow Direction etc.

DSE 1-3 : Web GIS and Mobile GIS

Marks: External 60 **Internal 40**

Course Objective:

1. Provide students with a comprehensive and up-to-date overview of Web GIS, including the basic concepts, principles, related fields (e.g. mobile GIS) and frontiers.
2. Provide students with the state-of-art technical skills to build Web GIS applications and the knowledge needed to choose from various Web GIS development options.

Course Learning Outcome:

After Successful completion of the course, students will be

1. Critically assess the organizational benefits and challenges of developing Web GIS applications;
2. Explain the difference between Web GIS, geospatial web services, mashups, mobile GIS solutions, geoportals, and how these are applicable to e-business and e-government;
3. Evaluate current technologies or architectures that support Web GIS;
4. Design and implement an independent Web GIS application.

Sr. No.	Title	Content	Contact hrs	Weightage marks	Credits
1	**Basics**	Internet, web and internet GIS - Fundamentals of computer networking – network environment – network communication models – protocols – TCP/IP.	15 hrs	15	1
2	**Trends in Data Management and Mobile GIS**	Database servers - Data mining concepts and applications- Dataware housing-indexing and catalysing services-metadata concepts and design.. Introduction to Google Earth Engine	15 hrs	15	1
3	**Internet Technology in GIS, Geographic Mark-up Language and Mobile GIS**	Networking environment-data communication and Protocols- Principle – characteristics - commercial web mapping programs - mobile GIS. Distributed GIS in data warehousing and data sharing. Mobile GIS: system and generic architecture of Mobile GIS, Operating systems for Mobile GIS, Wireless web, Samples of programs used in Mobile GIS, real-time applications, customization of Mobile GIS.	15 hrs	15	1
4	**Applications of Web GIS Technology**	Intelligent transportation system, planning and resource management. Comparison of web GIG-client-side framework and web Browser server-side framework and web server-WLS, WMS, WFS services-web protection server-Map server and Geo Server relations-web GIS engineer-scripting type and main GIS: Java script, Ajax, PHP, Python scripting-on line GIS-mobile GIS.	15 hrs	15	1

References:

1. Korte,G. B., (2001) The GIS book: 5th Edition, Onward Press, Melbourne.
2. Cartwright, W., M.P. Peterson, G. Gartner (Eds)., (2004) Multimedia Cartography, Springer, Berlin.
5. Pinde Fu (2020). Getting to Know Web GIS, Taylor and Francies, ESRI, U.S.A
6. https://foss4g.org/
7. https://mapserver.org/
8. http://webgis.pub/
9. https://libguides.utk.edu/c.php?g=1020425&p=7391962
10. https://www.qgis.org/en/site/

PRACTICAL DSE 1-3 : Web GIS & Mobile GIS **Marks: External 30**
Internal 10

1	Creating KML file and display in Google earth
2	Adding a KML to a map
3	Making dynamic Layouts
4	Setting layer Symbology
5	Creating Map file - Viewing and display the shape file in web browser using map server

DSE 1-3 : PROGRAMMING LANGUAGE "C"

Marks: External 60 **Internal 40**

Course Objectives:

After completing a 'C' programming course, students should be able to:

1. Learn object oriented concepts. Students should able to develop programs: Write, compile, and debug C programs
2. Mathematical and logical operations
3. Using if statement and loops
4. Arranging data in arrays
5. Implementing pointers

Course outcome

1. Exploring C Programming
2. Classifying Data using Data types in C Programming
3. Managing Input and Output Operations
4. Performing Mathematical and Logical functions: Operators and Expressions
5. Controlling the Program Order: Decision Making

Sr. No.	Title	Content	Contact hrs	Weightage marks	Credits
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++	15 hrs	15	1
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	15 hrs	15	1
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.	**15 hrs**	15	**1**

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.	15 hrs	15	1

Books :

1. Ira Pohl (2003). Object–Oriented Programming Using C++, Pearson Education, New Delhi.
2. Bjarne Stroustrup (2004). The C++ Programming Language, Pearson Education, New Delhi.
3. Bjarne Stroustrup (2014). Programming Principles and Practice Using C++, Pearson Education.
4. Stanley B. Lippman and Josee Lajoie (2003). C++ Primer, Pearson Education, New Delhi.
5. Venugopal, K. R., Rajkumar Buyya, and Ravishankar, T. (2003). Mastering C++, TMH, New Delhi.
6. Balagurusamy E. (2008). C++ Programming, Tata McGraw–Hill Education.
7. Scott Meyers (2014). Effective Modern C++, O'Reilly Media.
8. Andrew Koenig (2000). Accelerated C++: Practical Programming by Example, Addison-Wesley.
9. Alexandrescu (2001). Modern C++ Design: Generic Programming and Design Patterns Applied, Pearson Education.
10. Marc Gregoire, (2021). Professional C++, Wiley, U.S.A

PRACTICAL DSE 1-3 : PROGRAMMING LANGUAGE "C"

Marks: External 30 **Internal 10**

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 organization and containers

DSE 1-3 : ATMOSPHERIC AND PLANETARY SCIENCES

Marks: External 60 **Internal 40**

Course Objectives:

1. To impart the basic and advanced knowledge of various processes and phenomena of Atmosphere Science and planetary science.
2. To provide skills in theory, numerical modelling of Atmospheric processes and their applications in weather forecasting and development of early warning systems for extreme weather events.
3. To train the students with quantitative and scientific reasoning skills for operational organizations, academia, research & development organizations.
4. To gain knowledge about solar systems.

Course outcome ;

After completion of course students able to;

1. Develop deeper insights in multiple aspects of Atmospheric Science for better scientific understanding and interpretation of various atmospheric phenomena.
2. They can use modern tool usage: Apply mathematical and computational tools and techniques to study atmospheric processes
3. Conduct investigation of complex problems: Demonstrate quantitative skills for interpreting atmospheric observations to numerical modeling and forecasting of weather systems.
4. Analytical skill: Demonstrate critical and analytical skills to interpret and predict weather systems using different products (model results, maps, satellite imagery, etc.).

Sr. No.	Title	Contact hrs	Weightage marks	Credits
1	**Solar system:** major concepts, planets, satellites, asteroids, meoteorites and comets; formation and internal differentiation of the planets; general features of terrestrial and Jovian planets. Planetary atmosphere; exogenic and endogenic processes association with origin and internal evolution of planets – Planetary volcanism, craters, impact cratering processes, elemental composition, mineralogy and petrology; thermal, seismic and magnetic properties and chronological techniques.	**15 hrs**	15	**1**
2	Planetary surfaces, atmospheres, interiors, magnetic fields, and ring systems and their associated origins. The Sun and its effects on the planets. The moon and its terrestrial analog IO, Phobos and Deimos, minor bodies such as asteroids, comets, meteorites. Past, present and future planetary exploration mission.	**15 hrs**	15	**1**
3	**Earth's atmosphere:** evolution, structure and chemical composition, Solar radiation and terrestrial radiation: electromagnetic spectrum, latitude and seasonal variations, effect of atmosphere, greenhouse effect and heat budget, Temperature measurements and controls, lapse rate and inversion of temperature.	**15 hrs**	15	**1**
4	**Atmospheric pressure and winds:** pressure measurement and distribution, wind observation and measurement, factor affecting wind, geostrophic wind and gradient wind, local winds, models of general circulation of the atmosphere, Jet stream, Atmospheric moisture: forms of condensation and precipitation, hydrological cycle, Stable and unstable atmosphere: environmental lapse rate, dry and wet adiabatic lapse rate and atmospheric stability, Air masses: classification and modification, Fronts: characteristics and types, Classification of climates : Thornthwaite's and Koppen's classification.	**15 hrs**	15	**1**

Reference books:

1. Foure G., and Mensing T.M., Introduction to Planetary Science

2. Taylor and Francis, Introduction to Planetary Geology

PRACTICAL DSE 1-3 : ATMOSPHERIC AND PLANETARY SCIENCES

Marks: External 30
Internal 10

1	Study of Planetary images
2	Construction of geological maps
3	Study of Meteorites
4	Wind rose diagram
5	Line graphs, Dispersion diagram etc

RP (04)- Field Project

Course Objectives :

Field Work: Fieldwork/visits is compulsory (amounting to 4 credits). The field visit/work will be from 10 to 15 days. During the field visit/work students visits various Institutes, universities. Evaluation of marks will be based on the performance of the student in the field (Punctuality, enthusiasm, and aptitude).

Course outcome:

1) Students will understand the geological concepts.
2) Field surveys helps students to identify rocks in the field, and how to make geologic maps and cross-sections.
3) Field trips can help students understand rocks in their natural environment and their natural relationship to one another
4) Field trips can help students foster a deeper appreciation and understanding of the Earth's geology.

SEMESTER IV

DSC 1-7 : APPLICATION OF RS & GIS IN NATURAL RESOURCE MANAGEMENT

Marks: External 60 **Internal 40**

Course objective

1. The course is aimed to introduce the concept of land, water and coastal management. Taxation and to learn how GIS can be applied in resource management sector.

Course Outcome:

After successfully completion of the course, students will be able to

1. Understanding importance of nature resources and its categorizes
2. To be able use these skills to identify and analyzed real world problem and preparing them for a successful career in geospatial industry and research institute
3. Acquire of fundamental and advanced knowledge of the different aspect in Geoinformatics with the means ability to specialize in a specific field.
4. Develop a tendency towards research through the compulsory internship in industry /research/ academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with multidisciplinary approach

Sr. No.	Title	content	Contact hrs	Weightage marks	Credits
1	**Forest**	Forest classification and mapping forest inventory, sampling techniques, growing stock estimation, forest management, wildlife habit suitability analysis	15 hrs	15	1
2	**Water resources**	Basic concept of water resources, Hydrological cycle, Sustainable watershed management, water pollution detection, Salinity and waterlogged area mapping	15 hrs	15	1
3	**Soil**	Physiographic soil mapping , soil type identification, soil moisture mapping	15 hrs	15	1
4	**Marine resources**	Fundamental of marine ecology, Bio resources, mapping, monitoring, coastal Bathymetry, ocean colour mapping, SST mapping, potential fishing zone mapping	15 hrs	15	1

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

PRACTICAL 1-7 : APPLICATION OF RS & GIS IN NATURAL RESOURCE MANAGEMENT

Marks: External 30
Internal 10

1	Land use land cover change analysis
2	Morphometric Analysis
3	Prioritirization of watershed
4	Geostatistical Analyses
5	3D analysis of small projects in Arc map
6	Surface analysis

DSC 1-8 APPLICATIONS OF RS & GIS IN DISASTER MANAGEMENT

Marks: External 60 **Internal 40**

Course objectives:

1. Provide students with the state-of-art technical skills to build disaster and hazard applications.
2. This course helpful in mitigation strategies and preparedness plans. Real time geographic data can improve the allocation of resources for response. A GIS technology is much useful in modelling of disaster risks and human adaptations to hazards.

Course outcome:

After completion of this course, students will be able to:

1. Be equipped with practical skills and the ability to apply their theoretical concept to design, perform experiments, analyze and interpret data and thus develop proficiency in lab management.
2. It is provides decision support system in disaster management and making model reduce risk and Hazard. Students will handle different disaster project like Flood, landslideing, fire and drought.
3. To be able use these skills to identify and analyzedDisaster and preparing them for a successful career in geospatial industry and research institute.
4. Acquire of fundamental and advanced knowledge of the different aspect in Geoinformatics with the means ability to specialize in a specific field.

Sr. No.	Title	content	Contact hrs	Weightage marks	Credits
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.	15 hrs	15	1

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.	15 hrs	15	1
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.	15 hrs	15	1
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.	15 hrs	15	1

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. Skeil, 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.

Nagarajan, R., (2004) Landslide Disaster Assessment and Monitoring, Anmol Publications, New Delhi.

DSC 1-8 APPLICATIONS OF RS & GIS IN DISASTER MANAGEMENT **Marks: External 30**
Internal 10

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

DSE 1-4 LAND EVALUATION

Marks: External 60 **Internal 40**

Course objectives:

1. Nature, Principles and Processes of Land Evaluation: Students learn about land evaluation methods, including the FAO framework for land evaluation, qualitative and quantitative methods, and physical land use planning.
2. The course proposes land capability, Soil survey and groundwater suitability
3. Land use planning: Students learn how to integrate soil survey and land evaluation into land use planning.
4. Land resource evaluation: Students learn about land resource evaluation and land use planning for non agricultural purposes.

Course outcome:

After this introductory course, students should have an understanding of:
1) terminology and concepts in land evaluation,
2) use of soil survey information for the assessment of land quality,
3) the various methods available for land suitability assessment,
4) use of land quality assessment as an input to decision making on optimization of sustainable land use and management.

Sr. No.	Title	content	Contact hrs	Weightage marks	Credits
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	15 hrs	15	1
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.	15 hrs	15	1
3	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.	15 hrs	15	1
4	Non – Agricultural	Wildlife conservation, Tourism development, Urban fringe development: Database - Thematic layers – Weightage, Ranking and Rating scale - Integration – Suitability classification, Decision making.	15 hrs	15	1

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.

PRACTICAL DSE 1-4 : LAND EVALUATION **Marks: External 30**
Internal 10

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

DSE 1-4 : PYTHON PROGRAMMING

Marks: External 60 **Internal 40**

Course Objectives:

The Objective of the course is to:

1. Train students for basic writing and running Python scripts.
2. Teach students advanced features such as File operations, regular expressions, working with binary data and using the extensive functionality of Python programming with GUI interface.

Course Outcome:

On successful completion of this course the learner will

1. Understand the basics of writing and running Python scripts.
2. Learn advanced features such as File operations, regular expressions, working with binary data and using the extensive functionality of Python programming with GUI interface.

Sr. No.	Title	content	Contact hrs	Weightage marks	Credits
1	Introduction	Jupyter notebook environment: code and markdown • object types (numbers, strings, Boolean) and conversions • lists, tuples, dictionaries • mathematical and logical operations	15 hrs	15	1
2	Working with modules, flow control, and input/output	modules (math, random, numpy, etc.) • flow control: if, while, for, def • input/output	15 hrs	15	1
3	Geo-processing methods, Data management, Cursors for Processing Records	Describe • Exists • Messages Data management tools • Cursors: Search, Insert, Update	15 hrs	15	1
4	Introduction to Python Geoprocessing with arcpy/	• Intro ArcPy • ArcPy list methods • Syntax of geo-processing tools	15 hrs	15	1

1. https://gis.sfsu.edu/arcgis-pro-installation-instructions
2. https://sfsu.box.com/s/7i3319kej7f8qlxuhnnbk0pxuw959s6q

DSE 1-4 : PRACTICAL OF PYTHON PROGRAMMING **Marks: External 30**
Internal 10

1	**Functions and modules**
2	**Pythons Dictionaries**
3	**Writing Geometrics**
4	**Running any tool in the box**
5	**Limitations of python scripting with Arc GIS**

DSE 1-4 : Application in Hydrology and Agriculture

Marks: External 60 **Internal 40**

Course objective

1. The course is aimed to introduce the concept of Agriculture, Soil and land management. Develop model and decision support system for different Agriculture system. It also aim to study water resources.

Course Learning Outcome: After successfully completion of the course, students will be able to

1. Understanding importance of Agriculture resources and its categories.
2. To be able use these skills to identify land use and land cover problem.
3. Develop and built application in agriculture sector.
4. Critically think geospatial technology aspect

Sr. No.	Title and content	Contact hrs	Weightage marks	Credits
1	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 Modeling, Water budget, Hydrolocigal cycle, ground water management	15 hrs	15	1
2	Marine Sciences: Fundamentals of Marine Ecology, Bio-Resource Monitoring and Mapping, Coastal Bathymetry. Ocean Color Mapping, SST Mapping, Potential Fishing Zone Mapping.	15 hrs	15	1
3	Agriculture and Soils: Spectral Characteristics of Crop, Crop Inventory, Crop Yield Modeling, Physiographic, Soil Mapping, Crop Water Management, Agro-Ecological Zoning, Land Evaluation, calculation of various indices, Site-Suitability for agriculture	15 hrs	15	1
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.	15 hrs	15	1

	Landscape Analysis, Wildlife Habitat Suitability Analysis, Species Inventory			

References :

1) Sudershana, R. Mitra, D. Mishra, Roy, P.S., Rao, D. P.(2000): Subtle Issues in Coastal Management, IIRS, Dehradun
2) Harris, J. E. (1990): Earthwatch – The Climate from space, Ellishorwood Ltd., Midsower Norton
3) Lal, D. S. (1998): Climatology, Chaitanya Publishing House, Allahabad
4) Escalante, R. B. (2012): Remote Sensing- Advances techniques and Platforms, Intech, Rijeka Croatia
5) Escalante, R. B. (2012): Remote Sensing Application, Intech, Rijeka Croatia

Practical DSE 1-4 : Application in Hydrology and Agriculture **Marks: External 30**
Internal 10

1) Study of hydrological cycle
2) Water budget
3) Study of soil profile, texture, types
4) Agricultural site suitability analysis
5) Wildlife Habitat Suitability Analysis

Research Project (RP) – Dissertation

Course objectives

Students has to do project work on allotted topics;

1. The purpose of a thesis is to enable the student to develop deeper knowledge, understanding, capabilities and attitudes in the context of the programme of study.
2. The thesis should be written at the end of the programme and offers the opportunity to delve more deeply into and synthesize knowledge acquired in previous studies.
3. The overall goal of the thesis is for the student to display the knowledge and capability required for independent work as a Master of Science in Geology.

Course Outcome

1. Considerably more in-depth knowledge of the major subject/field of study, including deeper insight into current research and development work.
2. Deeper knowledge of methods in the major subject/field of study.
3. A capability to contribute to research and development work.
4. The capability to use a holistic view to critically, independently and creatively identify, formulate and deal with complex issues.