SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Scheme of Teaching and Examination M.Sc. (GEOINFORMATICS)

SEMESTER PATTERN SEMESTER: THIRD

SN	Subject Code	Name of Subject	Hrs/Week		Credits		Examination Scheme								
							Theory					Practical			
			T	P/TU	Theory	Practical	Paper Hrs	Max Theory	Max Internal	Total	Min Passing Grade Points	Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points
1	3 GNF1C	Research Methodology	05	-	05	--	3	80	20	100	40 4.0	--	--	--	--
2	3 GNF2C	GIS Development and Open Source GIS	05	-	05	--	3	80	20	100	40 4.0	--	--	--	--
3	3 GNF3C	Geoinformatics Applications in Natural Resources Management	05	-	05	--	3	80	20	100	40 4.0	--	--	--	--
4	3 GNF4C	Urban Planning and Rural Development	05	-	05	--	3	80	20	100	40 4.0	--	--	--	--
5	3 GNF5C	Open sources GIS-Lab	--	P 06		04	04	--	--	--	--	80	20	100	4.0
6	3 GNF6C	GIS Applications in Natural Resources and Agriculture-Lab	--	P 06		04	04	--	--	--	--	80	20	100	4.0
7	3GNF1GIC (For Other Discipline Students)	Application of GIS for Disaster Management	05	-	01	--	--	--	--	--	--	--	--	--	--
Total			**20 and (or) 5 (GIC)**	**12**	**20 and (or) 5 (GIC)**	**08**									

T:Lectures, P:Practical,TU:Tutorial/Assignment

Scheme of Teaching and Examination M.Sc. (GEOINFORMATICS)

SEMESTE RPATTERN SEMESTER: FOURTH

T:Lectures, P:Practical, TU:Tutorial/Assignment

SN	SubjectCode	Name of Subject	Hrs/ Week		Credits		Examination Scheme									
							Theory						Practical			
			T	P/ TU	Theory	Practical	PaperHrs	MaxTheory	MaxInternal	Total	MinPassing Grade Points		MaxMarksPractical	MaxMarksInt.Ass	Total	MinPassingGrade Points
1	4 GNF1C	Database Management System	05	-	05	--	3	80	20	100	40	4.0	--	--	--	--
2	4 GNF2C	Web Mapping and Web GIS	05	-	05	--	3	80	20	100	40	4.0	--	--	--	--
3	4 GNF3C	Geoinformatics Applications in Agricultural Management	05	-	05	--	3	80	20	100	40	4.0	--	--	--	--
4	4 GNF4C	Geoinformatics Application in Water Resources Management	05	-	05	--	3	80	20	100	40	4.0	--	--	--	--
5	4 GNF5C	Advanced Geospatial data Processing GIS -Lab	--	P 06		04	04	--	--	--	--		80	20	100	4.0
6	4 GNF6C	Project/ Dissertation-Lab	--	P 06		04	04	--	--	--	--		80	20	100	4.0
7	4 GNF1GIC (For OtherDiscipline Students)	Application of GPS	05	-	01	-	--	--	--	--	--		--	--	--	--
Total			20 and(or)5(GIC)	12	20 and(or) 5(GIC)	08										

Syllabus Prescribed for 2023-2024 Year **PG Programme**
Programme: M.Sc. Geoinformatics

M.Sc. PART II (M.Sc. Geoinformatics) EXAMINATION (Semester –III)
Examination scheme under CBCS for the subject Geoinformatics

Part B
Syllabus Prescribed for First Year 2023-24
PG Programme : M.Sc. Geoinformatics
Semester- III

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
3 GNF1C	Research Methodology	60
3 GNF2C	GIS Development and Open Source GIS	60
3 GNF3C	Geoinformatics Applications in Natural Resources Management	60
3 GNF4C	GIS for Urban Planning and Infrastructure Development	60
3 GNF5C	Open sources GIS - Lab	60
3 GNF6C	GIS Applications in Natural Resources and Agriculture-Lab	60
3GNF1GIC (For Other Discipline Students)	Application of GIS for Disaster Management.	15hrs

3GNF-1C: Research Methodology

COs (Course Outcomes)
After successfully completing the course, the students will be able to

Course outcome:

1. Students learn about research concepts and research methodology.
2. The students learn about the data needed to solve the stated issue.
3. Students who successfully finish this course will be able to comprehend and apply the fundamentals of research technique in projects and research.
4. To provide students with a solid foundation of research-oriented knowledge that will prepare them for both the workplace and academic study.
5. The training will also give them the skills necessary to gather data, modify it correctly, and do appropriate analyses. As a result, it will support students' success in higher education.

Unit 1 : Research Problem Concept: Meaning of research problem, Sources of research problem, Criteria / Characteristics of good research, Qualitative research and Quantitative research, Review of the literature. 12 Periods

Unit 2 : Tools and techniques for data collection include tables, graphs, and histograms, pictures taken in the field and in the lab, and the presentation and interpretation of experimental results. Data Gathering and Analysis in Research 12 Periods

Unit 3 : Sampling: Sampling and Population, Techniques sampling selection, Characteristics of a good sample, Sampling errors and how to reduce them. 12 Periods

Scientific writing: research article, dissertation, review, abstract, synopsis, technical report, etc.

Unit 4 : Creating a research proposal, including research plans (minor and major), Individual research proposal format, institutional proposal, and research proposal format. Definition and types of hypotheses. 12 Periods

Unit 5 : Research Report: Format, Writing Style, References, and Bibliography - Research Report Evaluation: Research Report Evaluation Criteria. Journals of Science (Impact Factor, Citation), introduction to Google Scholar, Mendeley, and EBSCO. Scientific Research Ethics. 12 Periods

Text Books:

1. Alan Bryman (2018): Social Research Methods, London: OUP
2. B A Prasad Sharma and P. Satyanarayan. Ed.(1983): Research Methods in Social Sciences, New Delhi: Sterling
3. C. R Kothari (2004): Research Methodology: Methods and Techniques. New Delhi: New Age International.

Reference Books:

1. Bridget Somek and Cathy Lewin (2005): Research Methods in the Social Sciences, New Delhi: Sage.
2. Gomez, B. and Jones, J. P. III (2010): Research Methods in Geography: A Critica Introduction, John Wiley and Sons.
3. Montello, D. and Sutton, P. (2013): An Introduction to Scientific Research Methods in Geography and Environmental Studies, SAGE Publications.

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3GNF-2C: GIS Development and Open Source GIS

COs(Course Outcomes)

After successfully completing the course, the students will be able to

1. Acquire knowledge of database fundamentals, data flow, algorithms, and problem-solving methods.
2. Through Python programming, students learn the object-oriented programming methodology.
3. To fulfill the time constraints, students learn how to integrate GIS procedures with Python scripting.
4. Students acquire the skills necessary to develop a spatial visualization of such datasets and deliver it in browsers using cloud computing and Web-based GIS languages.
5. Students will be able to develop C++ programs that comprehend the fundamentals of OOP.

Unit 1: Customization of GIS: Overview-programming for GIS applications - the expansion of GIS through customization and related capabilities - Automation of redundant processes - Data development/update automation - user tool development. 12 Periods

Unit2 : Introduction to Open source GIS. Advantages of Open source. Open source operating systems: LINUX: Introduction – Kernel Mode and user mode – Process – Advanced Concepts. Open source Software- Introduction to Open source tool kit - Openjump – GRASS –ILWIS – Openstreet map - QGIS - SagaGIS - Map window-cloud GIS system. Google Earth Pro-Engine. Use of Bhuvan Portal, Open Geo-spatial Consortium. 2 Periods

Unit3 :	Java Review: Write, debug and repair java code for GIS- Integration of code in GIS environment. Introduction to Python- Variables - control structures - looping statements – functions Strings- Data structures - classes – objects - Inheritance – polymorphism,	12 Periods
Unit 4 :	Introduction to .NET. Application of Python, JAVA and .NET in GIS development. Basics of C# Programming. Python Geo and data sciences packages and Jupyter notebook. GIS data access and manipulation with python.	12 Periods
Unit 5 :	Introduction to Arc Objects: Introduction to Arc GIS family of products-Programming Arc GIS using Arc Objects- understanding Component Object Model (COM). Components of Arc Object-Understanding Object Model Diagrams-Fundamental Object Model Diagram components-Object Model Diagram symbols- different types of class relationships-working with events- Accessing and Rendering Data-Querying and selecting data-working with geometry-creating and editing data	12 Periods

Text Books

1. Balagurusamy E., (2001): Object Oriented Programming with C++, Tata McGraw Hill Jo Wood, 2002. Java programming for spatial sciences, CRC Press.
2. Lutz, M. (2010): Programming Python, O'Relly Media California
3. Robert Burke, Andrew Arana, Thad Tilton (2003). Getting to Know About ArcObjects: Ingram Publisher Services.

Reference Books

1. Stuart Dabbs Halloway (2002): Component Development for the Java platform: Addison-Wesley
2. Mark Summerfield, Programming in Python 3, Pearson Education Inc, South Asia, 2009
3. Michael Zeiler, 2001. Exploring ArcObjects: ESRI

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3GNF-3C: GIS Applications in Natural Resources Management

COs(Course Outcomes)
After successfully completing the course, the students will be able to

1. Students will able to understand the earth natural recourses.
2. Students can distinguish between distinct land use and land cover systems using a variety of GIS based platform to delineate natural resources.
3. To understand rock types, minerals, economic minerals and their occurrence.
4. Students are able to use of geological skills with GIS domain for natural resources inventory
5. Students can understand the utility management with respect to Natural recourses.

Unit 1:	Natural Resource Evaluation: Need – objectives – sources of data – limitations – need for evaluation in development planning. Land Evaluation: Objectives – principles – procedures – approaches – land use requirements and land quality parameters – layer creation – matching – classification – case studies.	12 Periods

Unit2 :	Geosciences and Geology: Mineral resources and their varieties, Geomorphology concepts, landform analysis, slope mapping, and an integrated method for zonation models and mapping of landslide hazards.	12 Periods
Unit3 :	Water Resources: Surface water: precipitation – space time analysis – overland flow – storage – groundwater: potential – quality – layer creation – overlay analysis – integrated watershed development – case studies.	12 Periods
Unit 4 :	Basics of Marine Ecology, Bio-Resource Monitoring and Mapping, and Coastal Bathymetry are some marine resources. SST mapping, potential fishing zone mapping, and ocean colour mapping.	12 Periods
Unit 5 :	Natural Vegetation: Forests – classification (NRSA) – grasslands – layer creation overlay – management – case studies. Wastelands: Types – identification – management – eroded lands – types – layer creation – case studies.	12 Periods

Text Books

1 Fischer, M., H.J. Scholten, and D. Unwin, (1996): Spatial Analytical Perspectives on GIS, Taylor & Francis, London, UK.
2. H.S. and Binda P.R (2007): Modeling In Resource Management and Environment through Geomatics
3. Jensen J.R. (2000) : Remote Sensing of the Environment: An Earth Resource Perspective.
4. Michael F. Goodchild, Louis T. Steyaert, Bradley O. Parks (1996): GIS and Environmental Modeling: Progress and Research Issues. Fort Collins, CO 80525: GIS World Inc.

Reference Books

01. Fotheringham, S., and P. Rogerson, Ed. (1995): Spatial Analysis and GIS , Taylor & Francis, London, UK.
2. Ripple, William J. (ed.). (1994): The GIS Applications Book: Examples in Natural Resources: A Compendium , American Society for Photogrametry and Remote Sensing, Bethesda, Maryland.
3. Young, Haines, David Green, and Steven Cousins (eds.), (1994): Landscape Ecology and GIS.

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3 GNF-4C: GIS for Urban Planning and Infrastructure Development

COs(Course Outcomes)
After successfully completing the course, the students will be able to

1. Students learn about urban land use models and their organization for planning
2. Students learns the flow of information through the networks in Geography
3. Students prepares a model for network and its interconnectedness to solve the problems in micro-level planning of amenities as well as infrastructure .
4. Students will learn through practical application of the water, sewage, social network, electrical, and telecommunication networks models.
5. Using GIS tools, students learn about the human, socio-economic, environmental, and mapping status.

Unit 1:	Urban and regional planning, Traffic and Parking Surveys, Urban Land Use Classification and Monitoring, GIS data modeling for urban design, Utility Planning, Integrated Development Planning, Urban Conservation, Transportation Planning and Land Information System	12 Periods

Unit2 :	GIS applications in Networks and Utility Management: Data representation, analysis and modeling (multi-dimensional GIS-T models), Applications and issues include spatial interaction models, the traveling salesman problem	12 Periods
Unit 3 :	GIS applications for managing urban environments include: air quality indexing and mapping, monitoring atmospheric haze, smoke, and toxic gas movement and identifying vulnerable zones, noise pollution zonation, natural resource inventory and management, vegetation and soil conservation, site suitability for groundwater recharge and rainwater harvesting, and urban area heat budgeting.	12 Periods
Unit 4 :	Utility Networks: Water and Electricity communications, sewage lines, and distribution. Environmental Impact Assessment (EIA) and management. GIS applications in Automated Mapping (AM) and Facility Management. Integrated development planning. Urban land conservation, transportation Planning.	12 Periods
Unit 5 :	The vehicle routing challenge, and the positioning of facilities. implication of Urban Form and Size on Services, Norms and Standards, National and Local guidelines – Demand Strategy, Issues and tasks, Sewerage / Drainage, Solid Waste Management, roads and Street Lightings management . Effective System Analysis by using GIS – Private and Public partnership and innovative concepts and practices in infrastructure Development	12 Periods

Text Books:

1. Charles Redman, Maik Netzband, William L. Stefanov (2007): Applied Remote Sensing for Urban Planning, Governance and Sustainability.
2. Qihao Weng, Dale Quattrochi, Paolo Gamba (2018): Urban Remote Sensing.
3. Soergel Uwe (2010): Radar Remote Sensing of Urban Areas.

Reference Books:

1. Basudeb Bhatta (2010): Analysis of Urban Growth and Sprawl from Remote Sensing Data.
2. M. S. Nathawat, Arvind Chandra Pandey (2008): Geoinformatics for Decentralized Planning and Governance.
3. Nabeel Hamdi , Reinhard Goethert (1997): Action Planning for Cities: A Guide to Community Practice.

3 GNF-1 GIC: Application of GIS for Disaster Management

COs(Course Outcomes)
After successfully completing the course, the students will be able to

1. Students learn about the dynamics of the earth's systems over time and space.
2. Students distinguish between natural and man-made disasters.
3. Students prepares a model for disaster management.
4. Students will learn disaster management at various scales.
5. Using GIS tools, students learn to adopt the remote sensing and GIS tools for managing the pre-event and post-events of disasters.

Unit 1:	Disaster preparedness with regard to various disasters, definition, categories of disasters, importance of RS and GIS for disaster management, prediction, forewarning system, Disaster management using spatial data infrastructure and a GIS-based decision support system management and satellite observation to prevent disasters.	07Hours
Unit2 :	Drought types, causes, GIS based drought analysis, Forest Fire – causes, management using GIS, risk zonation mapping, forecasting system. Causes, types, effects and mitigation measures, RS and GIS in earthquake, Flood and Cyclone hazard zone mapping. Landslides: RS and GIS for zonation, monitoring and management; Soil erosion: RS and GIS for soil erosion and sediment estimation.	08Hours

Text Books:

1. ISRS (2000): National Symposium on Spatial Technologies for Natural Hazards Management, IIT, Kanpur.
2. 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.
3. Roy, P. S. (2000):Natural Disaster their Mitigation, IIRS, Dehradun

Reference Books:

1. Jenson, J.R. 2000, Remote Sensing of the environment – An Earth Resource Perspective, Prentice Hall Inc.
2. Schultz, G. A. and Engman, E. T., 2000, Remote Sensing in Hydrology and Water Management, Springer-Verlag, Berlin, Germany.
3. Spatial Technologies for Natural Hazard Management. Proceedings of ISRS National Symposium, Nov. 21-22, 2000, IIT, Kharagpur.

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Programme: M.Sc. Geoinformatics (Semester-III)

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
3 GNF 5C	Open sources GIS-Lab	**09**
3 GNF 6C	GIS Applications in Natural Resources and Agriculture-Lab	**09**

3 GNF 5C: Open sources GIS-Lab

COs(Course Outcomes)

Upon completion of the course successfully, Students would be able to:

1. Learn about the Concepts and protocols used in Open Source GIS handling of advanced GIS tools.
2. students will be able to Introduction to Open source tool kit
3. Students will be able to work Open source database management.
4. Understand the multiple aspects of GIS software in Desktop and Web based environment.

***List of Practical/Laboratory Experiments/Activities etc.**

It's necessary to perform at least seven experiments from the list given below.

1. Perform with Open source tool kit –Bhuvan
2. Perform with Open source tool kit – USGS
3. Perform with Open source tool kit – Openstreet map
4. Image -processing in Q-GIS Software
5. To preparation of thematic layers-onscreen from Satellite imagery-Road
6. To preparation of thematic layers-onscreen from Google imagery- Settlement, LULC.
7. To make network analysis for road features.
8. Layer creation on Google Earth Pro.
9. Spatiotemporal analysis.
10. Generating Map layer to KML
11. Generating KML to Shapefile
12. Problems of practicals based on Python/ HTML/ XML/JavaScript/ VBScript

Reference Books

1. Markus Neteler, Helena Mitasova (2007): Open Source GIS: A GRASS GIS Approach, Edition, Springer.
2. Neteler, M and H.Mitasova (2008) Open Source GIS. A GRASS GIS Approach, Kluwer Academic Publishers, Bostan, USA/London, UK.
3. Qgis: https://www.packtpub.com/application-development/mastering-qgis.

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3 GNF 6C: GIS Applications in Natural Resources and Agriculture-Lab

COs(Course Outcomes)

Upon completion of the course successfully, Students would be able to:

1. Students will be able to map earth natural resources.
2. Students can perform GIS based analysis for Agricultural management
3. Students can understand the utility management with respect to Natural recourses.
4. Students are able to use of geological skills with GIS domain for natural resources inventory

***List of Practical/Laboratory Experiments/Activities etc.**

It's necessary to perform at least seven experiments from the list given below.

1. Preparation of theme based map layers (of Soil, water and land) and integration, classification using standard color and symbol codes.
2. Spectro-radiometric survey of agriculture crops.
3. Determination of agricultural land acreage from the image data.
4. Delineation of watershed in different types.
5. To generation of natural resource maps for sustainable management.
6. Morphometric analysis
7. To prepare of water table map.
8. To prepare of Geomorphological map.
9. To prepare geological map.
10. To prepare Mineral recourses maps.
11. To prepare forest resources maps
12. Crop Pattern/ Crop yield/Crop Health estimation.

Reference Books

1. Fotheringham, S., and P. Rogerson, Ed. (1995): Spatial Analysis and GIS , Taylor & Francis, London, UK.
2. Sharon A. Clay (2019): GIS Applications in Agriculture, Volume Three Invasive Species
3. Ripple, William J. (ed.). (1994): The GIS Applications Book: Examples in Natural Resources: A Compendium , American Society for Photogrametry and Remote Sensing, Bethesda, Maryland.

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Syllabus Prescribed for 2023-2024 Year **PG Programme**
Programme: M.Sc. Geoinformatics

M.Sc. PART II (M.Sc. Geoinformatics) EXAMINATION (Semester –IV)
Examination scheme under CBCS for the subject Geoinformatics

Part B
Syllabus Prescribed for First Year 2023-24
PG Programme : M.Sc. Geoinformatics
Semester- IV

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
4 GNF1C	Database Management System	60
4 GNF2C	Web Mapping and Web GIS	60
4 GNF3C	Geoinformatics Applications in Agriculture	60
4 GNF4C	Geoinformatics Applications in Water Resources Management	60
4 GNF5C	Advanced Geospatial data Processing GIS – Lab	60
4 GNF6C	Project/ Dissertation- Lab	60
4 GNF1GIC (For Other Discipline Students)	Application of GPS	15hrs

4 GNF-1C: Database Management System

COs(Course Outcomes)
After successfully completing the course, the students will be able to

1. Students learn about understand the importance of Data Base
2. Students understand the concepts of problem solving, data flow, algorithms, schemas of various problems and database.
3. Students know the Normalization and Denormalization concepts of Data Base.
4. Students will understand about the SQL queries and its application for GIS.
5. Students are able to perform the applications of Database in GIS.

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Unit 1: Introduction to Database Management Systems: Data, Information, Database, Transaction and its desired properties, File Server Model, Client Server Model, Advantages of using DBMS over conventional methods, DBMS Features, Components of DBMS, Data Abstraction, Data Independence. 12 Periods

Unit2 : Data Modeling: Logical and Physical Data Models, E-R Modeling, Record Based Models, Relational Model An overview, Relational Concepts, Tables, Keys, Constraints, Data Integrity and Constraints, Integrity Rules. 12 Periods

Unit 3 :	Introduction to SQL: Introduction to SQL, SQL Features, SQL Operators, SQL Datatypes, SQL Parsing, Types of SQL Commands, Querying Data from the database, Correlated Sub-queries, Joins, Hierarchical Queries, PL/SQL Introduction.	12 Periods
Unit 4 :	Emerging trends Object Oriented databases, Object oriented queries Active databases Deductive databases concepts of next generation databases, XML, Data Warehouses Data Mining.	12 Periods
Unit 5 :	Control Database access. 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.	12 Periods

Text Books

1. Abraham Silberschatz; Henry F Korth, (2002): Database System Concepts.
2. B.C. Desai (2005): An Introduction to Database Systems, Galgotia Publications, New Delhi.
3. Won Kim (1990): Introduction to Object-Oriented Databases.,

Reference Books

1. Elmasri,Ramez; Navathe, Shamkant B (2000): Fundamentals of Database Systems, Pearson,
2. Jan L Harrington (2000): Object Oriented Database Design Clearly Explained, Harcour.
3. Stefano Ceri; Giuseppe Pelagatti, Distributed Databases (2000): Principles and Systems, Universities Press.

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4 GNF-2C: Web Mapping and Web GIS

COs(Course Outcomes)
After successfully completing the course, the students will be able to

1. Learning cloud computing and Web-based GIS languages allows students to spatially visualize such datasets and present them in browsers.
2. Students can recognize current mechanisms for data dissemination and use online services to download the relevant geographic and non-spatial data.
3. Students will learn about the customize GIS software in ArcObjects, WebGIS and Image Processing.
4. Students will understand about the binding and creating Web Pages with GIS.
5. Students are able to perform the applications of Web based mapping.

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Unit 1:	Fundamentals of computer networking – network environment – network communication models – protocols – TCP/IP. Web GIS: Distributed GIS services and Internet GIS, Internet GIS networking foundations, web mapping's technical development, and commercial web mapping software The Google Earth Engine is introduced.	12 Periods

Unit2 :	Web mapping – static and interactive web mapping, collaborative web mapping. System and generic architecture of mobile geographic information systems Mobile GIS operating systems, wireless web, examples of mobile GIS applications, real-time applications, and mobile GIS customization.	12 Periods
Unit 3 :	Distributed geographic information services – principle – components – logic and data components. Server for ArcGIS ArcSDE: GIS Web Service, Web Application Functionality, and ArcGIS Server. Introduced, SDE Connection, Configuration Options for ArcSDE. Data storage for developers using SDE, SDE Geodatabase, Architecture for ArcSDE.	12 Periods
Unit 4 :	Open Geospatial Consortium- Web Map Servers- WMS-, interoperable systems and non-interoperable systems- Web Feature Servers- Metadata standard, XML, Geographic Markup Language.	12 Periods
Unit 5 :	Client/server computing– client/server system partition – layered architecture – advantages and disadvantages of client and server side architecture. Distributed component framework – Web GIS Implementation: Web Map servers and Data servers, Configuration, layering, design of interfaces, Quality of Service and Security Issues in the Development of Web GIS - Performance, Security, Scalability	12 Periods

Text Books:

1. Korte,G. B., (2001): The GIS book: 5th Edition, Onward press, Australia. Cartwright, W., M.P. Peterson, G. Gartner (Eds) Multimedia Cartography, Berlm: Springer.
2. Kraak,M., and A.Brown (2001): Web Cartography: Development and Prospects, London: Taylor and Francies.
3. Roland Billen, Elsa Joao, David Forrest (2006): Dynamic and Mobile GIS: Investigating Changes in Space and Time, CRC Pres

Reference Books:

1. Zhong-Ren Peng, Ming-Hsiang Tsou, Peng (2003): Internet GIS: Distributed Geographic Information Services for the Internet and Wireless Networks, John Wiley & Sons.
2. Jonathan Raper (2008): Mobile GIS: The Arcpad Way, Esri Pr; Illustrated edition
3. Kraak, M. and F. Ormeling (2003) Cartography: Visualization of Geospatial Data, Delhi: Pearson Education.

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4 GNF-3C: Geoinformatics Applications in Agriculture

COs(Course Outcomes)
After successfully completing the course, the students will be able to

1. Students are able to understand Remote Sensing and GIS applications in Agriculture.
2. Students will able to perform agriculture water demand estimation.
3. Students will learn about the social framework of agriculture sector.
4. Students will understand about the Crop Yield Modeling.
5. Students are able to perform Agro-Ecological Zone based mapping.

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Unit 1: Crops: Introduction - Agriculture Ecosystems, Yield parameters, spectral properties of crops, identification of crops and acreage estimation, vegetation indices, production forecasting through digital analysis, monitoring and condition assessment - case studies . 12 Periods

Unit2 : Soils: introduction - Soil survey methods, soil classification, Land evaluation, Saline, alkaline soils, soil mapping, soil identification and mapping of problem soils, sedimentation and erosion, soil conservation - case studies. 12 Periods

Unit 3 : Field-scale applications of RS and GIS: soil moisture content assessment, crop phenologic stage identification, crop biomass and yield production estimation, crop disease, weed and insect infestation detection and monitoring, farms mapping, cropping system analysis, agro-ecological zoning. 12 Periods

Unit 4 : Retrieval of agrometeorological parameters from satellites, floods and droughts assessment and monitoring, water and wind induced soil erosion assessment and monitoring. 12 Periods

Unit 5 : Precision Agriculture: Definition and rationale: agronomy, environment, economics, Tools: variable rate technology (VRT), GPS, GIS, Yield monitoring and mapping, Developing prescriptive maps for VRT management, Applications. 12 Periods

Text Books:

1. Pierce J. Francis and Clay David (2007): GIS Applications in Agriculture, Taylor & Francis Group.
2. Steven, M.D. and Clark, J.A., Butterworths, (1990): Application of Remote Sensing in Agriculture, London.
3. Roland Billen, Elsa Joao, David Forrest (2006): Dynamic and Mobile GIS: Investigating Changes in Space and Time, CRC Pres

Reference Books:

1. J.V.S. Murty (2007): "Watershed Management", New Age International, New Delhi.
2. Sharon A. Clay (2019): GIS Applications in Agriculture, Volume Three Invasive Species
3. Ripple, William J. (ed.). (1994): The GIS Applications Book: Examples in Natural Resources: A Compendium , American Society for Photogrametry and Remote Sensing, Bethesda, Maryland.
4. Roy, P. S.(2002): Biodiversity Characteristics at Landscape Level in North East using satellite Remote Geographical Information System, IIRS, Dehradun.

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4 GNF-4C: Geoinformatics Applications in Water Resources Management

COs(Course Outcomes)
After successfully completing the course, the students will be able to

1. Students are able to Understand local, State and regional policies as they apply to integrated water resource management by using GIS.
2. Students will able to perform water resources utilization by GIS techniques.
3. Students will learn about the impact of anthropogenic activities on water bodies.
4. Students will perform the groundwater quality and quantity based mapping.

5. Students are able to perform micro level planning for enhancement of water resources. .

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Unit 1:	Introduction: Hydrologic cycle, components of hydrologic cycle - processing and parameterization in hydrology; Water resource scenario in India, Hydrological modeling. GIS applications in water resources development and management.	12 Periods
Unit2 :	Spectral properties of water. Floods types; causes and mitigation measures, flooding potential zonation mapping, flood hazard assessment, flood risk analysis using RS and GIS, RS and GIS in Cyclone mapping and mitigation, digital surface modeling and flood hazard simulation.	12 Periods
Unit 3 :	Groundwater, hydro geomorphology, Ground water potential assessment, groundwater prospect zones mapping, ground water modeling, ground water information system, planning and management of ground water. Groundwater quality mapping. Ground and surface water interactions	12 Periods
Unit 4 :	Irrigation management: Mapping and monitoring of catchments and command areas, land irrigability, soil irrigability mapping, irrigation canal alignment, crop norm violation, agriculture water demand estimation for different crops, tank information system, wet land mapping, siltation mapping, optimum usage planning and management of irrigation water	12 Periods
Unit 5 :	Watershed management: Watershed- Drainage and water body mapping, morphometric analysis, classification, delineation and coding of watersheds, reservoirsedimentation - watershed development planning, watershed prioritization, Watershed Information System; mapping drought-prone areas.	12 Periods

Text Books:

1. John G Lyon (2003): GIS for Water Resources and Watershed Management,CRC Press LLC.
2. K.Kovar & H.P. Nachtnebel, (1996): Application of Geographic Information Systems in Hydrology and Water Resources Management, International Association of Hydrological Sciences.
3. N.D. Mani (2005): Watershed Management: Principles, Parameters and Programmes, Dominant Publishers and Distributors, New Delhi.

Reference Books:

1. Lynn E.Johnson [2002] Geographic Information Systems in Water Resources Engineering, CRC Press LLC
2. Jain S.K and Singh V.P., 2003, Developments In Water Science – Water Resources Systems Planning and Management, Antony Rowe Ltd
3. U.M.Shamsi, 2002, Water, Waste water and Storm Water Systems, American Society of Civil Engineers.

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4 GNF-1 GIC: Application of GPS

COs(Course Outcomes)
After successfully completing the course, the students will be able to

1. To become familiar with GPS basics.
2. To be familiar with various GPS satellites and systems.
3. To comprehend various GPS sorts and their methodologies.
4. To calculate error and learn the fundamentals of LASS and WASS.

5. To use GPS in a variety of fields.

Unit 1: The GPS's History - Benefits and drawbacks of GPS - GPS segments: three segments: control, space, and user. Geographic placement: Point positioning; relative positioning. Kinematics positioning, static positioning, and GPS applications. Basic modes of GPS surveying: Differential GPS surveying vs static GPS surveying. NAVSTAR GPS – GALILEO – GLONAAS – IRNSS – MTSAT - Beidou - Compass. 07Hours

Unit2 : Rapid static positioning technique -Reoccupation technique- Stop & go technique Kinematic positioning technique - Relative advantages and disadvantages- Data transfer and analysis. Ionospheric and atmospheric delays - satellite and receiver clock error - anti spoofing selective availability - multi path - dilution of precision - Error correction - Number and geometry of visible satellites - location of GPS receive 08Hours

Text Books:

1. Satheesh Gopi(2005): Global Positioning System Principles and Applications. Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Ahmed el Rabbany,(2002): Engineer\'s Guide to GPS (Mobile Communications Library) (English) 1st Edition, Artech House Publishers.
3. Leick Alfred, GPS Satellite Surveying, Third Edition, John Wiley & Sons, Inc., Hoboken, New Jersey, 2004.

Reference Books:

1. Hofmann-Wellwnhof.B, Lichtenegger.H, and Collins.J (2007): GPS theory and Practice, Spinger (India) Private Limited, New Delhi.
2. Michael Kennedy (2002) 'The Global Positioning System and GIS: An Introduction', Taylor and Francis Inc. New York.

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Programme: M.Sc. Geoinformatics (Semester-IV)

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
4 GNF 5C	Advanced Geospatial data Processing GIS -Lab	**09**
4 GNF 6C	Project/ Dissertation- Lab	**09**

4 GNF 5C: Advanced Geospatial data Processing GIS -Lab

COs(Course Outcomes)

Upon completion of the course successfully, Students would be able to:

1. Learn about the handling of advanced GIS tools.
2. Interpret various satellite imageries with advanced tools.
3. Students will be able to work with Web GIS tools.
4. Understand the multiple aspects of Geospatial analysis..

***List of Practical/Laboratory Experiments/Activities etc.**

It's necessary to perform at least seven experiments from the list given below.

1. Perform on Google Earth Engine
2. Perform on Internet GIS
3. Perform for web mapping
4. Perform on Mobile GIS
5. Handling of ArcGIS Server
6. Web Application Functionality
7. Handling of ArcGIS online
8. Principal Component Analysis
9. Fourier Transformation
10. Texture and Image Fusion
11. Advance Spatial Analysis-Multi-Criteria Analysis
12. Ground Radiometry-Data Collection, Data Integration and Analysis

Reference Books

1. ESRI (2003):Introduction to ArcGIS – II, Course Lectures, GIS Education Solutions, RedlandsPress
2. Jonathan Raper (2008): Mobile GIS: The Arcpad Way, Esri Pr; Illustrated edition
3. Roland Billen, Elsa Joao, David Forrest (2006): Dynamic and Mobile GIS: Investigating Changes in Space and Time, CRC.
3. Zhong-Ren Peng, Ming-Hsiang Tsou, Peng (2003): Internet GIS: Distributed Geographic Information Services for the Internet and Wireless Networks, John Wiley & Sons.

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4 GNF 6C: Project/ Dissertation- Lab

COs(Course Outcomes)

On completion of the course successfully, students would be able to perform his skills in the multiple domain of Remote Sensing and GIS.

1. Students may carry out their internship project in an industry or any reputed academic/research institutes.
2. The internship project aims at giving the student an opportunity to participate and work in a substantive project activity.
3. Typically, the project helps the student to learn about work culture, business processes, technologies, marketing strategies, etc.
4. Under the institute project, the student takes up a research topic or participates in an Institute project under the guidance of a faculty member or project coordinator in respective departments. .
5. The dissertation should be submitted both in print form and digital form.

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