Sant Gadge Baba Amravati University, Amravati
FACULTY : Science
Scheme of Teaching, Learning, Examination & Evaluation leading to Two Years PG Degree Master of Science (Geoinformatics) following Three Years UG Programme wef 2023-24
(Two Years- Four Semesters Master's Degree Programme- NEPv23 with Exit and Entry Option
M.Sc. I First Year Semester- I

S.N.	Subject	Type of Course	Subject Code	Teaching & Learning Scheme							Duration Of Exam Hours	Examination & Evaluation Scheme							
				Teaching Period Per Week				Credits				Maximum Marks					Minimum Passing		
												Theory		Practical		Total Marks			
				L	T	P	Total	L/T	Practical	Total		Theory Internal	Theory +MCQ External	Internal	External		Marks Internal	Marks External	Grade
0	*Pre-Requisite Course(s) if applicable/MOOC/Internship/FieldWork cumulatively If students wish to opt Minor Course ofUG as Major for PG, **balance 12 Credits** Course will have to be completed **(As and when applicable)**	Th-Prq		0	0	0	0	Additional Credits to be earned = (1) minus (2) (1). Credits from Major DSC Courses in UG (minus) (2).The Credits already earned from the Course as Minor at UG, now to be opted as Major at PG			35			50	06	14	P	0	*Pre-Requisite Course(s) if applicable/MOOC/Internship/FieldWork cumulativelyIf students wish to opt Minor Course ofUG as Major for PG, balance 12 Credits Course will have to be completed (As and when applicable)
1	Research Methodology and IPR	Th-Major	1 GNF 1C	4			4	4		4	3	30	70			100	12	28	P
2	DSC I.1 Principles of Remote Sensing	Th-Major	1 GNF 2C	4			4	4		4	3	30	70			100	12	28	P

3	DSC II.1 Introduction to GIS	**Th-Major**	1 GNF 3C	**4**			**4**	**4**		**4**	**3**	**30**	**70**			**100**	**12**	**28**	**P**
4	DSC III.1 Photogrammetry	**Th-Major**	1 GNF 4C	**3**			**3**	**3**		**3**	**3**	**30**	**70**			**100**	**12**	**28**	**P**
5	DSE I 1. Geodesy and GPS-I **OR** 2. Introduction to IT and Data Science ï I	**Th-Major Elective**	1 GNF 5A OR 1 GNF 5B	**3**			**3**	**3**		**3**	**3**	**30**	**70**			**100**	**12**	**28**	**P**
																	Minimum Passing Marks		**Grade**
6	Lab-I (Remote Sensing Lab)	**Pr-Major**	1 GNF 6C			**6**	**6**		**3**	**3**	**3**			**50**	**50**	**100**	**50**		**P**
7	Lab ï II (GIS Lab)	**Pr-Major**	1 GNF 7C			**2**	**2**		**1**	**1**	**3**			**25**	**25**	**50**	**25**		**P**
8	# On Job Training, Internship/ Apprenticeship; Field projects/tour report **Related to Major @ during vacations cumulatively**	**Related toDSC**		**120 Hours cumulatively during vacations of Semester Iand Semester II**						**4***									**P***
9	**Co-curricular Courses: Health andwellness, Yoga Education, Sports and Fitness, Cultural Activities, NSS/NCC, Fine/Applied/Visual/Performing Arts During Semester I, II, III and IV**	Generic **Optional**		**90 Hours Cumulatively From Sem I to Sem IV**															
	TOTAL									**22**						**650+50***			

L: Lecture, T: Tutorial, P: Practical/Practicum

Pre-requisite Course mandatory if applicable: **Prq**, Theory : **Th**, Pracstical/Practicum: **Pr**, Faculty Specific Core: **FSC**, Discipline Specific Core: **DSC**, Discipline Specific Elective: **DSE**, Laboratory: **Lab**, **OJT:** On Job Training: Internship/ Apprenticeship; Field projects: **FP**; **RM:** Research

Methodology; Research Project: **RP, Co-curricular Courses: CC**
Note : # On Job Training, Internship/ Apprenticeship; Field projects **Related to Major (During vacations of Semester I and Semester II) for duration of 120 hours mandatory to all the students, to be completed during vacations of Semester I and/or II. This will carry 4 Credits for learning of 120 hours. Its credits and grades will be reflected in Semester II credit grade report.**

Note: **Co-curricular Courses:** In addition to the above, CC also include but not limited to Academic activities like paper presentations in conferences, Aavishkar, start-ups, Hackathon, Quiz competitions, Article published, Participation in Summer school/ Winter School / Short term course, Scientific Surveys, Societal Surveys, Field Visits, Study tours, Industrial Visits, online/offline Courses on Yoga (Yoga for IQ development, Yoga for Ego development, Yoga for Anger Management, Yoga for Eyesight Improvement, Yoga for Physical Stamina, Yoga for Stress Management, etc.). These can be completed cumulatively during **Semester I, II, III and IV. Its credits and grades will be reflected in semester IV credit grade report.**

Sant Gadge Baba Amravati University, Amravati

FACULTY : Science

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(Two Years- Four Semesters Master's Degree Programme- NEPv23 with Exit and Entry Option

M. S c (I) First Year Semester- II [Level 6.0]

S. N.	Subject	Type of Course	Subject Code	Teaching & Learning Scheme							Duration Of Exam Hours	Examination & Evaluation Scheme							
				Teaching Period Per Week				Credits				Maximum Marks					Minimum Passing		
												Theory		Practical		Total Marks			
				L	T	P	Total	L/T	Practical	Total		Theory Internal	Theory +MCQ External	Internal	External		Marks Internal	Marks External	Grade
1	DSC- I (Fundamentals of Cartography)	Th-Major	2 GNF 1C	4			4	4		4	3	30	70			100	12	28	P
2	DSC-II (Digital Image Processing)	Th-Major	2 GNF 2C	4			4	4		4	3	30	70			100	12	28	P
3	DSC-III (Spatial Modeling & Analysis)	Th-Major	2 GNF 3C	3			3	3		3	3	30	70			100	12	28	P
4	DSE I 1. Geostatistics **OR** 2. Fundamentals of Geomorphology	Th-Major Elective	2 GNF 4A **OR** 2 GNF 4B	3			3	3		3	3	30	70			100	12	28	P
																	Minimum Passing Marks		
5	Lab-I- Digital Image Processing Lab	Pr-Major	2 GNF 5C			6	6		3	3	3			50	50	100	50		P
6	Lab-II -Spatial Modeling & Analysis Lab	Pr-Major	2 GNF 6C			2	2		1	1	3			25	25	50	25		P

7	# On Job Training, Internship/ Apprenticeship; Field projects/tour report **Related to Major @ during vacations cumulatively**	**Related to Major**		**120 Hours cumulatively during vacations of Semester I and Semester II**					**4***									**P***
8	**Co-curricular Courses: Health and wellness, Yoga Education, Sports and Fitness, Cultural Activities, NSS/NCC, Fine/Applied/Visual/Performing Arts During Semester I, II, III and IV**	Generic **Optional**		**90 Hours Cumulatively From Sem I to Sem IV**														
				Exit Option with a PG Diploma with 4 Credits On-the-job training/internship in the respective Major subject • **Student has to earn Total minimum 4 Credits cumulatively during Vacations of Semester I and Semester II from internship in order to exit after First Year with PG Diploma (42-44 Credits) after Three Year UG Degree**													
	TOTAL									**18+4***						**550**			

L: Lecture, T: Tutorial, P: Practical/Practicum

Pre-requisite Course mandatory if applicable: **Prq**, Theory : **Th**, Practical/Practicum: **Pr**, Faculty Specific Core: **FSC**, Discipline Specific Core: **DSC**, Discipline Specific Elective: **DSE**, Laboratory: **Lab**, **OJT:** On Job Training: Internship/ Apprenticeship; Field projects: **FP**; **RM:** Research Methodology; Research Project: **RP, Co-curricular Courses: CC**

Note : # On Job Training, Internship/ Apprenticeship; Field projects **Related to Major (During vacations of Semester I and Semester II) for duration of 120 hours mandatory to all the students, to be completed during vacations of Semester I and/or II.**

This will carry 4 Credits for learning of 120 hours. Its credits and grades will be reflected in Semester II credit grade report.

Note: **Co-curricular Courses:** In addition to the above, CC also include but not limited to Academic activities like paper presentations in conferences, Aavishkar, start-ups, Hackathon, Quiz competitions, Article published, Participation in Summer school/ Winter School / Short term course, Scientific Surveys, Societal Surveys, Field Visits, Study tours, Industrial Visits, online/offline Courses on Yoga (Yoga for IQ development, Yoga for Ego development, Yoga for Anger Management, Yoga for Eyesight Improvement, Yoga for Physical Stamina, Yoga for Stress Management, etc.). These can be completed cumulatively during **Semester I, II, III and IV. Its credits and grades will be reflected in semester IV credit grade report.**

Sant Gadge Baba Amravati University Amravati

FACULTY : Science

Scheme of Teaching, Learning, Examination & Evaluation leading to Two Years PG Degree Master of Science (Geoinformatics) following Three Years UG Programme wef 2023-24

(Two Years- Four Semesters Master's Degree Programme- NEPv23 with Exit and Entry Option

M.S c (II) Second Year Semester- III

S. N.	Subject	Type of Course	Subject Code	Teaching & Learning Scheme						Duration Of Exam Hours	Examination & Evaluation Scheme							
				Teaching Period Per Week			Credits				Maximum Marks							
											Theory		Practical		Total Marks			
				L	T	P				L	T	P	Internal	External		Marks Internal	L	T
1	Research Methodology	Th-Major	3 GNF1C	4			4	4	4	3	30	70			100	12	28	P
2	GIS Development and Open Source GIS	Th-Major	3 GNF2C	4			4	4	4	3	30	70			100	12	28	P
3	Geoinformatics Applications in Natural Resources Management	Th-Major	3 GNF3C	3			3	3	3	3	30	70			100	12	28	P
4	DSE I 1. GIS for Urban Planning and Infrastructure Development **OR** 2. GIS for Coastal Management	Th-Major Elective	3 GNF4C	3			3	3	3	3	30	70			100	12	28	P

																	Minimum Passing Marks		
5	Open sources GIS - Lab	**Pr-Major**	3 GNF5C			**8**	**8**		**4**	**4**	**3**			**50**	**50**	**100**	**50**		**P**
6	GIS Applications in Natural Resources and Agriculture-Lab	**Major**	3 GNF6C		**2**	**4**	**6**	**2**	**2**	**4**				**50**	**--**	**50**	**25**		**P**
7	**Co-curricular Courses: Health and wellness, Yoga Education, Sports and Fitness, Cultural Activities, NSS/NCC, Fine/Applied/Visual/Performing Arts During Semester I, II, III and IV**	Generic **Optional**		**90 Hours Cumulatively From Sem I to Sem IV**															
	TOTAL									**22**						**550**			

L: Lecture, T: Tutorial, P: Practical/Practicum

Pre-requisite Course mandatory if applicable: **Prq**, Theory : **Th**, Practical/Practicum: **Pr**, Faculty Specific Core: **FSC**, Discipline Specific Core: **DSC**, Discipline Specific Elective: **DSE**, Laboratory: **Lab**, **OJT:** On Job Training: Internship/ Apprenticeship; Field projects: **FP**; **RM:** Research Methodology; Research Project: **RP, Co-curricular Courses: CC**

Note: **Co-curricular Courses:** In addition to the above, CC also include but not limited to Academic activities like paper presentations in conferences, Aavishkar, start-ups, Hackathon, Quiz competitions, Article published, Participation in Summer school/ Winter School / Short term course, Scientific Surveys, Societal Surveys, Field Visits, Study tours, Industrial Visits, online/offline Courses on Yoga (Yoga for IQ development, Yoga for Ego development, Yoga for Anger Management, Yoga for Eyesight Improvement, Yoga for Physical Stamina, Yoga for Stress Management, etc.). These can be completed cumulatively during **Semester I, II, III and IV. Its credits and grades will be reflected in semester IV credit grade report.**

Sant Gadge Baba Amravati University, Amravati

FACULTY : Science

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M.S c (II) Second Year Semester- IV

S. N.	Subject	Type of Course	Subject Code	Teaching & Learning Scheme							Duration Of Exam Hours	Examination & Evaluation Scheme							
				Teaching Period Per Week				Credits				Maximum Marks					Minimum Passing		
												Theory		Practical		Total Marks			
				L	T	P	Total	L/T	Practical	Total		Theory Internal	Theory +MCQ External	Internal	External		Marks Internal	Marks External	Grade
1	Database Management System	Th-Major	4 GNF1C	4			4	4		4	3	30	70			100	12	28	P
2	Web Mapping and Web GIS	Th-Major	4 GNF2C	4			4	4		4	3	30	70			100	12	28	P
3	Geoinformatics Applications in Agriculture	Th-Major	4 GNF3C	3			3	3		3	3	30	70			100	12	28	P
4	DSE I 1. Geoinformatics Applications in Water Resources Management **OR** 2. Surveying Technologies and Data Processing	Th-Major Elective	4 GNF4C	3			3	3		3	3	30	70			100	12	28	P

																	Minimum Passing Marks	
5	Database Management System-Lab	**Pr-Major**	4 GNF5C			**6**	**6**		**3**	**3**	**3**			**50**	**50**	**100**	**50**	**P**
6	Advanced Geospatial data Processing GIS ï Lab	**Pr-Major**	4 GNF6C			**2**	**2**		**1**	**1**	**3**			**25**	**25**	**50**	**25**	**P**
7	**Research Project Phase-II and Field tour report**	**Major**			**2**	**8**	**10**	**2**	**4**	**6**	**3**			**75**	**75**	**150**	**75**	**P**
8	**Co-curricular Courses: Health and wellness, Yoga Education, Sports and Fitness, Cultural Activities, NSS/NCC, Fine/Applied/Visual/Performing Arts During Semester I, II, III and IV**	Generic **Optional**		**90 Hours Cumulatively From Sem I to Sem IV**														
	TOTAL									**24**						**700**		

L: Lecture, T: Tutorial, P: Practical/Practicum

Pre-requisite Course mandatory if applicable: **Prq**, Theory : **Th**, Practical/Practicum: **Pr**, Faculty Specific Core: **FSC**, Discipline Specific Core: **DSC**, Discipline Specific Elective: **DSE**, Laboratory: **Lab**, **OJT:** On Job Training: Internship/ Apprenticeship; Field projects: **FP**; **RM:** Research Methodology; Research Project: **RP, Co-curricular Courses: CC**

Note: **Co-curricular Courses:** In addition to the above, CC also include but not limited to Academic activities like paper presentations in conferences, Aavishkar, start-ups, Hackathon, Quiz competitions, Article published, Participation in Summer school/ Winter School / Short term course, Scientific Surveys, Societal Surveys, Field Visits, Study tours, Industrial Visits, online/offline Courses on Yoga (Yoga for IQ development, Yoga for Ego development, Yoga for Anger Management, Yoga for Eyesight Improvement, Yoga for Physical Stamina, Yoga for Stress Management, etc.). These can be completed cumulatively during **Semester I, II, III and IV. Its credits and grades will be reflected in semester IV credit grade report.**

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty: of Science and Technology

Programme: M.Sc. Geoinformatics

POs:

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

1. develop extensive knowledge in 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. Identify, formulate, research literature, and analyses arts, science and engineering, natural resource problems using the GIS tools.
4. develop the skills required to cater to the needs of global Remote Sensing and GIS industry.
5. Introduce the Science and technologies involved in Geoinformatics.
6. explain the earth and various mapping principles
7. Impart knowledge on traditional, conventional and advance surveying technologies

PSOs:

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.

Employability Potential of the Programme:

This programme includes understanding of fundamentals, acquiring practical training and application of the subject knowledge in diversified areas of Geoinformatics. This is multidisciplinary field that brings together science, technology, Computer Science, geography, and geology. GIS (geographic information science) and remote sensing are dynamic, ever-evolving field with greater job potential as the world becomes more connected. The current advancements in spatial analysis, such as crowd-sourced location data and drone technology, have paved the way for extraordinary nuance and specificity, making city planning, conservation, transportation, and other areas easier and more complete which enhance the job opportunities for Geoinformatics students.

The students of Geoinformatics use the applications of electronics and communication technology, like that of RADAR, GPS, remote sensing and GIS, and apply the same in the study of the geographical conditions of the earth. Hence, it led to the development of a number of branches like cartography, hydrology and climatology, meteorological, agricultural sector, Traffic management, National Security, Infrastructure development, Automobile Industry, Disaster Mitigation Agencies.

Geoinformatics or geographic information science is ever evolving large field at global level, there are several job prospects. The student with M.Sc Geoinformatics degree has tremendous scope of

employment both in the government and private sector.

In Government Sector, Central and State government departments are using Geoinformatics application. Central government agencies that are working under the Department of Space, National Remote Sensing Centre (NRSC Hyderabad), North East Space Application Centre, (NESAC Shillong), Regional Remote Sensing Centres (RRSC Kharagpur, Dehradun, Jodhpur, Nagpur and Bangalore), Indian Space Research Organization, (ISRO Bangalore), Advanced Data Processing Research Institute (ADRIN Hyderabad) and Space Application Centre (SAC Ahmedabad), Environmental Agencies, Defense Research and Development organization (DRDO), Department of Science and technology, Ministry of Environment , Ministry of Agriculture forest and Climate Change, Ministry of Earth Science, Geological Survey of India, Central Groundwater Board (CGWB), Indian Agriculture Research Institute (IARI) and Indian Council of Agriculture Research (ICAR), Groundwater Survey and Development Agency (GSDA), Land Survey and Record departments apart of these many public sector unit have Geospatial Departments of various state central and various national space research and survey departments.

In private sector HCL, Google, Tech Mahindra, TCS, Reliance, Lavasa Corp, L&T, Suzlon, Acenture, iGate, ESRI Inc., Intergraph, Nokia, Tom Tom, Webonise, WILLIS RE, SWISS RE, Cognizant, Genesys etc are using Geospatial technology on broad scale. These organizations offer variety of job opportunities as Geoinformatics Manager, GIS Engineer, Scientist, GIS Analysts / consultant, GIS Business Consultant / Development, GIS Programmer, GIS Executive, GIS Developer, GIS Administrator, GIS Officer, GIS technician, Land surveyor, Cartographer, Urban planner etc.

Through the present curriculum attempt has been made to generate enough interest among students so thatthey can pursue higher education or can peruse research work in research institutes or universities by qualifying various exams for research fellowships in Geoinformatics.

Student of Geoinformatics with such potential has great opportunities in terms of both societalbenefits and individual careers.

Syllabus Prescribed for 2023-2024 Year **PG Programme**

Programme: M.Sc. Geoinformatics

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

Part B
Syllabus Prescribed for First Year 2022-23
PG Programme : MSc Geoinformatics
Semester- I

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
1 GNF 1C	Research Methodology	60
1 GNF 2C	DSC- I (Principles of Remote Sensing)	60
1 GNF 3C	DSC-II (Introduction to GIS)	60
1 GNF 4C	DSC-III (Photogrammetry)	60
1 GNF 5A OR 1 GNF 5B	DSE I 1. Geodesy and GPS **OR** 2. Introduction to IT and Data Science	60
1 GNF 6C	Lab-I (Remote Sensing Lab)	60
1 GNF 7C	Lab ï II (GIS Lab)	

1 GNF 1C: Research Methodology and IPR

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. 10 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 10 Periods

Unit 3 : Definition and types of hypotheses. Sampling: Sampling and Population, Techniques sampling selection, Characteristics of a good sample, Sampling 10 Periods

errors and how to reduce them.

Unit 4 : Research Report: Format, Writing Style, References, and Bibliography. Scientific writing: research article, dissertation, review, abstract, synopsis, technical report, etc. 10 Periods

Unit 5 : Research Report Evaluation: Research Report Evaluation Criteria. Journals of Science (Impact Factor, Citation), introduction to Google Scholar, Mendeley, and EBSCO. Scientific Research Ethics. 10 Periods

Unit 6 : Creating a research proposal, including research plans (minor and major), Individual research proposal format, institutional proposal, and research proposal format. 10 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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1 GNF 2C: DSC- I (Principles of Remote Sensing)

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

1. Learn basic level fundamental physical principles of remote sensing, including the electromagneticspectrum; the emission, scattering, reflection, and absorption of electromagnetic (EM) radiation.
2. Apply the concepts of data acquisition in remote sensing through various platforms such as airborneand space-borne.
3. Apply various image interpretation techniques to satellite images.
4. Develop understanding to data preparation, mosaicking and geo-referencing.
5. Demonstrate ability to process and interpret hyperspectral, microwave and LIDAR data.

Unit 1 : Fundamentals: Definition ï Scope ï Energy sources ï Electro Magnetic Radiation ï energy interaction in the atmosphere ï atmospheric windows ï energy interaction with earth surface features ï spectral reflectance patterns fordifferent regions of EMR-Platforms. 10 Periods

Unit 2 :	Data capture types and systems ï Sensors- Resolution: spatial, spectral, radiometric and temporal resolution. Satellites and its types ï environmental, resource survey satellites, weather and communication satellites, GPS satellites and Shuttle Mission.	10 Periods
Unit 3 :	Indian Remote Sensing (IRS) Satellite system. Worldôs Major satellite systems: Sensors and data products of, LANDSAT, SPOT, ERS, IKONOS, Quick Bird, ORBVIEW, ASTER, MODIS, WORLD VIEW.	10 Periods
Unit 4 :	Thermal Remote Sensing: Principles of thermal remote sensing, black body, radiant temperature, radiation from Earthôs objects, thermal conductivity, thermal capacity, thermal inertia, thermal diffusivity, Thermal Radiometers, scanners, calibration of scanners, mapping with Thermal scanners, Imaging Spectrometer, Application of Thermal Remote Sensing.	10 Periods
Unit 5 :	Microwave Remote Sensing: Microwave band designation, Microwave interaction with atmospheric constituents, Earth's surface, vegetation, and ocean, Radar; Real and synthetic aperture radars, Imaging radar principles, Elements of RADAR image, Effects of terrain and image geometry, SLAR, SAR, resolution considerations, polarimetry, Interferometry.	10 Periods
Unit 6 :	Hyperspectral Remote Sensing: Concept of hyperspectral imagery, data collection systems, calibration and processing techniques, Hyperspectral image cube, Applications of hyperspectral data. LiDAR system and applications, Nature of LiDAR data, LiDAR data processing, Process of 3D visualization and analysis using LiDAR.	10 Periods

Text Books:

1. Lillis and T.M. , R.W.Kiefer and Chipman (2015) 7th edition. Remote sensing and image interpretation,John Wiley & Sons, New York.
2. James B. Campbell & Randolph H. Wynne.,(2011) Fifth Edition, Introductionto Remote Sensing, The Guildford Press.
3. George Joseph & C Jeganathan (2017). Fundamentals of Remote Sensing 3rdedition, Universities Press, India.

Reference Books:

1. Arthur P. Cracknell, (2007) 2nd edition. Introduction to Remote Sensing, Taylor and FransisPublication, London.
2. Henderson, F. M., and Anthony J. Lewis (1998) 3rd edition, Manual of Remote Sensing, Volume 2,Principles and Application of Imaging Radar, 3rd Edition, John Wiley and Sonc Inc, Canada, USA.
3. Sabins F.F Jr.(2007) Remote Sensing: Principles and Interpretation, W.H.Freeman & Co., New York.

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1 GNF 3C: DSC-II (Introduction to GIS)

COs (Course Outcomes)

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

1. Apply basic concepts of Geographic Information Systems to spatial data.
2. Compare and analyze different GIS data formats including raster, vector and triangulated irregular networks.

3. Understand Map Projections
4. Understand Map Reading and Alignment
5. Construct different analytical tool to utilized overlay function
6. construct and analyze spatial data

Unit 1 :	Definition - maps and spatial information - components of GIS, maps and spatial data - thematic characteristics of spatial data - other sources of spatial data: census, survey data, air photos, satellite images, field data.	10 Periods
Unit 2 :	Spatial and attributes data Spatial entities - Raster and Vector spatial data structures - comparison of Vector and Raster Methods - Acquisition of spatial data for terrain modeling -Raster and Vector approach to digital terrain modeling	10 Periods
Unit 3 :	Modeling network - layered approach and object database management system - linking spatial and attribute data. Data Input and Editing: Integrated GIS database - Encoding methods of data input: keyboard, manual digitizing scanning and automatic digitizing methods.	10 Periods
Unit 4 :	Electronic data transfer -data editing: methods of developing and correcting errors in attributes and spatial data. Data Analyzing Operation in GIS: Terminologies - Measurements of lengths, perimeter and area in GIS - queries - reclassification - buffering and neighbourhood functions - integrated data.	10 Periods
Unit 5 :	Raster and Vector overlay method: point-in-polygon, line-in-polygon and polygon- on-polygon - problems of Raster and Vector overlays - spatial interpolation - GIS for surface analysis - network analysis.	10 Periods
Unit 6 :	Models of spatial processes: - conceptual models - models of physical and environmental processes - problems related to using GIS to model spatial processes. Maps as output - alternative cartographic outputs - non-cartographic outputs maps as decision tools.	10 Periods

Text Books:

1. Ian Heywood, Sarah Cornelivs and Steve Carver (2010), An Introduction to Geographical Information System, Pearson Education Pvt .Ltd., New Delhi.
2. Burroughs PA., PA McDonnell & Christopher D. Lloyd (2015) 3rd edition. Principles of Geographical Information systems, London: Oxford University Press..

Reference Books:

1. Lo.C.P., Yeung. K.W. Albert (2002) Concepts and Techniques of Geographic Information Systems, Prentice-Hall of India Pvt ltd, New Delhi
2. Longley, P.A., Goodchild, M.F., Maguire, D.J. and Rhind, D.W. (2005) Geographic Information Systems and Science. Chichester: Wiley. 2nd edition
3. Burgh P.A (1986) Principles of geographical Information System for Land Resources Assessment, Clarendon Press, Oxford.

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1 GNF 4C: DSC-III (Photogrammetry)

COs (Course Outcomes)

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

1. Understand concepts of photogrammetric, aerial photography and mapping from aerial photographs using different types of stereo plotters. Learn photo interpretation for usein environmental monitoring, and measurements of structural parameters.
2. Learn Digital Map using stereoscopic frame camera images or satellite scenes.
3. Learn to take measurements, digital mapping products and solutions.
4. Understand properties and characteristics of aerial photographs.
5. Demonstrate knowledge and understanding of Digital Photogrammetry .
6. Illustrate the various types of Photogrammetric techniques and measurements .

Unit 1 : History of Aerial Photography, principles of photography, Types of óPhotographs, Elements of Photograph, Aerial Cameras, Stereoscopic Viewing. Unmanned Aerial Systems, Ground based Systems, Camera calibrations. 10 Periods

Unit 2 : Acquisition of Vertical and Horizontal Images, Conversion of Images. Stereoscopic Plotting Procedures and Instruments: Direct optical projection plotters projection system, viewing system, measuring and tracing system. 10 Periods

Unit 3 : Orientation of photography ï stereo plotters with mechanical or optical ï mechanical projection. Flight Planning: Flight map ï end lap and side lap ï scale ï flight altitude - base height ratio ï ground coverage and stereoscopic model ï flight line spacing. 10 Periods

Unit 4 : Photo Mosaic : Mosaics ï Ground Control point ï Mosaic types and characteristics. Number of photos and film roll ï exposure time and interval ï drift angle- seasons and weather conditions. 10 Periods

Unit 5 : Digital Photogrammetry: Concept and techniques, Data Generation and Research Application of Cartosat-1 Data Lidar-altimeter, creation of digital images, automatic measurements, automatic surface modelling, aerial triangulations, digital photogrammetric workstation. 10 Periods

Unit 6 : Orthophotography : Meaning, need, procedure, characteristics, uses and problems ï Digital Photogrammetry. Generation of Tie points, building mesh textures, draping images, scaling model and aligning 3D models to real-world locations and other case studies. 10 Periods

Text Books:

1. Kraus Kn,d 2007: Photogrammetry:geometry from images and laser scans, 2nd edition, Walter deGruyter, Germany.
2. Mikhail M, bethel S, McGlone C.(2001), Introduction to Modern Photogrammetry, John Wiley andSons, Inc.

Reference Books:

1. Moffit H.F. And Edward, M.M, 1980 : Photogrammetry, 3rd Edition, Harper and Row Publishers,New York.
2. Burside, C.D., 1985 : Mapping From Aerial Photographs, Collins Publishers.
3. Kasser M, Egels Y (2002) Digital Photogrammetry, Taylor & Francis.

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1 GNF 5A : (DSE I- 1. Geodesy and GPS)

COs (Course Outcomes)

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

1. Work on the satellite navigation system process
2. Understand the ñpositioningò science
3. Errors and their solution
4. GNSS and survey
5. Data management of GNSS data.
6. Use of GNSS receiver and data acquisition

Unit 1 :	Definition and scope of Geodesy, Earth, Geoid, and Ellipsoid of rotation, Reference surfaces and coordinate systems in Geodesy, Indian Geodetic System and Everest Spheroid, World Geodetic System 84(WGS 84).	10 Periods
Unit 2 :	Geometry of Ellipsoid of rotation, Normal sections, Principal radii of curvature, Geodetic coordinates and Natural coordinates, Classification of control survey, 1st and 2nd order horizontal control by triangulation, Trilateration, surfaces and plumb lines, Fundamental equation of Physical Geodesy.	10 Periods
Unit 3 :	Fundamentals of GPS: Introduction, Space segment, User segment and Control segment, Working principles and application of GPS, GLONASS, GALILEO, COMPASS. Observation principle and signal structure, Intentional limitation of system accuracy, Accuracy of GPS measurement.	10 Periods
Unit 4 :	Point positioning and relative positioning, GPS Observations and Data Processing: Code and carrier phase observables, Linear combinations and derived observables.	10 Periods
Unit 5 :	GPS Receivers: Receiver Concepts and main receiver components, Examples of GPS receivers, Classical receivers, Examples of currently available geodetic receivers, Navigational receivers.	10 Periods
Unit 6:	Planning and Realization of GPS Observations: Methods of surveying with GPS, Static, and Kinematic positioning, Navigation with GPS, Differential GPS. DGPS Surveys- application of DGPS surveys and the associated limitations.	10 Periods

Text Books:

1. Torge, Wolfgang. 1991 Geodesy, 2nd Edition, New York: deGruyter.
2. B. Hofmann-Wellenhof and H. Moritz, Physical Geodesy, Springer- Verlag Wien, 2005.

Reference Books:

1. P. Misra and P. Enge. 2001, Global Positioning System Signals, Measurements, and Performance. Lincoln, Massachusetts: Ganga- Jamuna Press.
2. Kaplan, Understanding GPS: principles and applications, 1996, 1 ed. Norwood, MA 02062, USA: Artech House, Inc.
3. Gopi Satheesh, Sathikumar.R., Madhu N., 2007, Advanced Surveying, Total Station, GIS and Remote Sensing, Dorling Kindersley (India) Pvt. Ltd.

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1 GNF 5B: (DSE I- 2 Introduction to IT and Data Science)

COs (Course Outcomes)

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

1. Students are able to work on basics of information technology.
2. Students are able to understand the fundamentals of operating system.
3. Understand basic concepts and components of IT and Data Sciences.
4. To develop skills for GIS based modelling with computers software and Hardware networks.
5. To introduce the basic of information technologies for Geoinformatics

Unit 1 :	Introduction to Computer System: Hardware and Software - Hardware Components of a Computer - Processor - Main memory - Secondary Memory - Input Devices - Output devices - Storage and Backup Devices.	10 Periods
Unit 2 :	Software Component - Software/Program - Operating System - Application Software/Program - Software for e Governance.	10 Periods
Unit 3 :	Operating System: OS Functions - OS Services - Types of OS ï Windows - Unix/Linux - Solaris - Real Time OS .	10 Periods
Unit 4 :	Programming: Assemblers ï Compilers ï Interpreters - Machine Code - Assembly Language - High Level Languages - Systematic Programming - Object-Oriented Programming.	10 Periods
Unit 5 :	Computer Network: Communication Between Computers ï LAN ï WAN ï INTERNET - World Wide Web - Repeater - Hub - Switch - Router - Gateway - Communication Protocols.	10 Periods
Unit 6:	Uses of Microsoft programmes- Microsoft World-Microsoft Excel-Power Point Presentation-Operating Computer using GUI based operating system.	10 Periods

Text Books

1. John L. Hennesy, David A. Patterson Computer Organization and Design: The Hardware / Software Interface (Third Edition), Morgan Kaufmann, 2004
2. Harold Abelson and Gerald Jay Sussman, with Julie Sussman (1996) Structure and Interpretation of Computer Programs, MIT Press, 2nd ed.

Reference Books

1. Doublas E. Comer, Internetworking with TCP/IP Vol.1: Principles, Protocols, and Architecture (4th Edition)
Prentice Hall, 4th Edition.
2. Pressman R.S, Software Engineering: A Practitionerôs Approach (6th Edition), McGraw Hill, 2005.
3. Gary Nutt, Operating Systems: A Modern Perspective, Pearson Education Asia 2nd Edition 2000.

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Syllabus Prescribed for
2023-24 YearPG
Programme

Programme: MSc Geoinformatics(Semester-I)

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
1 GNF 6C	Lab ï I Remote Sensing Lab	09
1 GNF 7C	Lab ï II GIS Lab	09

1 GNF 6C: (Lab –I Remote Sensing Lab)

COs

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

1. To learn about the handling of satellite products.
2. To interpret various satellite imageries.
3. To extract the geographical information and learns how to interpret the information.
4. prepare the model to create the Spatio-temporal changes of the earth and to forecast thephenomenal change.
5. To develop the quantitative and qualitative information system of the earth.

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

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

1. Familiarization with stereoscopes, Stereovision Test and Anatomy of pocket & Mirror Stereoscopes.
2. Marginal Information of aerial photograph
3. Decoding, Marking & Transfer of Principal Points, Base line drawing, Flight line marking,3D Observation, Tracing details, Transfer the details to base map.
4. Computing photo scale using known objects
5. Visual Interpretation of Satellite images-Keys of Interpretation
6. Familiarizing various satellite image formats
7. Loading Digital images in Remote Sensing software
8. Familiarizing Digital Satellite Images-Spectral Reflectance values, Resolution
9. Interpretation of Thermal images, Radar Images and Hyperspectral Image.
10. Study of various visual Remote Sensing Equipmentôs
11. Transfer of thematic information from satellite Imagery to Base map
12. Interpretation of Black & White and false color multi band imagery

Reference Books

1. Sharma V.K., Remote Sensing for Land Resources Planning, Concept Publishing Company, New Delhi,1991.
2. Paul J. Curran, Principles of Remote Sensing, English Language Book Society, Longman, 1985.
3. Paul J. Gibson, Introductory Remote Sensing: Principles and Concepts,

Routledge, London,2000.

4. Jensen R. John, Remote Sensing of the Environment: An Earth Resource Perspective,Pearson Education Pvt. Ltd., Delhi, 2006.
5. Gottfried Konency, Geoinformation: Remote Sensing, Photogrammetry and GeographicInformationSystems, Second Edition, CRC, 2nd edition 2009
6. Paul R. Wolf, Elements of Photogrammetry, Mc Graw ï Hill Science, 2001.
7. Singh, R.L and Dutt. P.K. (2008). Elements of Practical geography, Students Friends, Allahabad.
8. Gunter Seeber (2003). Satellite Geodesy Foundations-Methods and Applications.

1 GNF 7C: (Lab –II GIS Lab)

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

1. To differentiate GIS and cartography, normal vs. spatial data Georeference the spatial data and handle spatial and non-spatial database.
2. Students will acquire skills create and manage spatial data in GIS.
3. To perform on various GIS tools and techniques within spatial analytical framework
4. To visualize GIS outputs in different dimensions
5. Students are able to apply the different type of spatial data analysis to solve natural, environmental and societal problems and challenges.

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

1. Georeferencing scanned map
2. Creating layers; point, polyline and polygon
3. Managing Projection & Datumôs
4. Managing attribute table
5. Managing Dimension; area and length
6. Symbolizing layers
7. Converting XY Data to GIS format
8. Designing Cartographic Output
9. Digitization, coverage editing, topology, annotations
10. Field calculation and query by attribute
11. Attribute data ï joining
12. Thematic mapping and output.

Reference Books

1. Satheesh Gopi, Global Positioning System Principles and Applications. Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. Magwire, D. J., Goodchild, M.F. and Rhind, D. M. (2005).Geographical Information Systems: Principles and Applications, Longman Group, U.K
3. Ahmed el Rabbany, Engineer\'s Guide to GPS (Mobile Communications Library) (English) 1st Edition, Artech House Publishers , 2002
4. Hofmann-Wellwnhof.B, Lichtenegger.H, and Collins.J, GPS theory and Practice, Spinger (India)Private Limited, New Delhi, 2007.
5. Michael Kennedy, ôThe Global Positioning System and GIS: An Introductionô, Taylor and Francis Inc. New York, 2002.
6. Leick Alfred, GPS Satellite Surveying, Third Edition, John Wiley & Sons, Inc., Hoboken, New Jersey, 2004.
7. Terry-Karen Steede (2002). Integrating GIS and the Global Positioning System, ESRI Press.

Weblink to Equivalent Virtual Lab if relevant:

1. http://www.palowireless.com/gps/
2. http://www.maps-gps-info.com/ed-resources.html
3. http://www.gisdevelopment.net/tutorials/tuman004.htm
4. http://www.colorado.edu/geography/gcraft/notes/gps/gps_f.html

Syllabus Prescribed for First Year 2023-24

PG Programme : MSc Geoinformatics Semester- II

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
2 GNF 1C	DSC- I (Fundamentals of Cartography)	60
2 GNF 2C	DSC-II (Digital Image Processing)	60
2 GNF 3C	DSC-III (Spatial Modeling & Analysis)	60
2 GNF 4A **OR** 2 GNF 4B	DSE I 1. Geostatistics **OR** 2. Fundamentals of Geomorphology	60
2 GNF 5C	Lab-I- Digital Image Processing Lab	60
2 GNF 6C	Lab-II -Spatial Modeling & Analysis Lab	60

2 GNF 1C: (DSC- I Fundamentals of Cartography)

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

1. To Understand the fundamentals of Cartography
2. Learn methods for analog and digital visualization of geographical data.
3. To study the various maps projection and co-ordinate systems.
4. To learn the different aspects of design in cartography.
5. To learn the generalization and designing aspects of cartography.
6. To study the different techniques of map production and reproduction

Unit 1 : History of cartography (Ancient Period to Recent period), Terms and definition, Map projection, and references, spheroids, Map numbering system, Base map and Thematic maps, Map legend symbols and border information. Designing and layouts of the maps. — 10 Periods

Unit 2 : Types of map- Small scale, medium scale and large scales maps. Choropleth map, Socioeconomic map, Water resources map, Geologic map, Forest map, Agriculture map, Water resource map, Water quality map, Soil survey map, Map for hot spots and Maps published the Survey of India. — 10 Periods

Unit 3 : Mapping Algorithms - Contouring algorithms, Surfaces and surface interpolation algorithms; 3D Visualization with stereo anaglyph images. Scales and their functions and map projections. Graphics scale, Plain scales, Diagonal scale. Classification of projections, Choice of projections, Orthographic projections, Projections Lambeda. — 10 Periods

Unit 4 :	Mercator projection, Lambert cylindrical projections, Polyconic and UTM projections, Global projections, Conic projections, Definition, methods of representing scale.	10 Periods
Unit 5 :	Map design, Symbolization and colors of patterns, Building Templates, Color gradients, Color type correlation, Point, line and polygon patterns map, Design concept layout of topographical maps, Basic elements of placement in maps. Map and legend and its importance in large layout map point line area.	10 Periods
Unit 6 :	Thematic mapping- Cadastral maps, Topographical maps, Agricultural maps, Population maps, Cultural maps, Structural and statistical graphs related to data, Agricultural data, Pollution, Cultural and Cadastral data. Types of Graphs- Application of graphs for Geographical data.	10 Periods

Text Books:

1. Michael Scott, Morgan, Programming Language Pragmatics. Kaufmann, 2000.
2. Daniel P. Friedman, Mitchell Wand, Christopher T. Haynes Essentials of Programming Languages. MIT Press, 2nd Edn. 2001.
3. Robinson, A.H. and Morrison, J.L.(1995). Elements of Cartography, John Wiley and Sons.
4. Ramesh, P. A. (2000). Fundamentals of Cartography, Concept Publishing Co., New Delhi.

Reference Books :

1. Peter Van-Roy, Seif Haridi, Concepts, techniques, and models of computer programming, MIT Press, 2004.
2. Matthias Felleisen, How to design programs: an introduction to programming and computing, MIT Press, 2001.
3. Friedman, Wand and Haynes, Essentials of Programming Languages. Prentice-Hall International (PHI), 1998.
4. Anson, R.W. and Ormeling, F.J. (2008). Basic Cartography, Vol. 1, 2nd ed., Elsevier Applied Science Publishers, London.

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2GNF-2C: (DSC-II Digital Image Processing)

COs (Course Outcomes)

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

1. Apply basic of Image classification techniques to satellite Image
2. Demonstrate ability to apply various spectral as well as spatial algorithms such as filtering, histogram matching etc.
3. Apply various spectral indices such as normalize differential vegetation index to enhance remotely sensed data.
4. Compare and analyze Kappa accuracy, Regression and overall accuracy.
5. Analyse different classification algorithm
6. Construct Knowledge based and artificial intelligence algorithms to classify digital Image.

Unit 1 :	Fundamental of Image Processing System: stages in digital image processing and pre-processing. Loading of Image Data, Identification of Objects on Visual Display. The Geometric correction, atmospheric correction and radiometric correction in Image.	10 Periods
Unit 2 :	Data encoding and decoding - digital image formats - band sequential and	10 Periods

band interleaved - characteristic features. Software - raster and vector files. Image Rectification and Restoration: geometric correction, radiometric correction -image enhancement: contrast manipulation ï gray level threshold, level slicing, and contrast stretching.

Unit 3 : Single Band Enhancement (Image reduction & Magnification, Contrast Stretching, Filtering & Edge enhancement) - Multiband Enhancement (Band ratioing, colour composite generation, Principal Component Analysis, NDVI). Spectral indices: different vegetation, soil, water, cryospheric and salinity indices. 10 Periods

Unit 4 : Histogram equalization ï Image subtraction ï Image averaging ï Spatial filtering: Smoothing, sharpening filtersï Laplacian filters ï Frequency domain filters: Smoothing ï Sharpening filters ï Homomorphic filtering. Principal components. 10 Periods

Unit 5 : Soft Classification Techniques: Hybrid classification, Knowledge engineer, Fuzzy classification, Object oriented classification. Vegetation components - intensity - hue - saturation colour space transformation. Pattern Resolution: concepts - linear and non- linear discriminate function. 10 Periods

Unit 6 : Image Classification: Supervised classification - classification stage - minimum distance to Means classifier- parallelepiped classifier - Gauss maximum likelihood classifier - training stage - Unsupervised classification - output stage - post classification smoothing. Validation of Image Classification: Kappa accuracy, Overall accuracy, etc. 10 Periods

Text Books:

1. Lillisand T.M. , R.W.Kiefer and Chipman (2004) 5th edition. Remote sensing and image interpretation, John Wiley & Sons, New York.
2. American Society of Photogrammetry, (1983). Manual of Remote Sensing, (2nd edition), ASP, Falls Church, Virginia.
3. Soergel Uwe (2010) Radar Remote Sensing of Urban Areas, Remote Sensing and Digital Image Processing.
4. Jensen, John R (2017) Digital Image Processing: A Remote Sensing Perspective . Pearson Education; Fourth edition.

Reference Books:

1. Ekstrom, M. P. 1984, Digital image processing techniques. New York, Academic Press.
2. Harris,R. 1987, Satellite Remote Sensing - An Introduction. London, Routledge.
3. Moffit, H.F., and Edward, M.M., (1980). Photogrammetry, Harperand Row Publishers, New York.

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2GNF-3C: (DSC-III Spatial Modeling & Analysis)

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

1. Develop Mathematical Model and GIS linking
2. Validate and asses different Models in Geospatial Field
3. Able to Validate geospatial model to find out the sensitivity of the model
4. Analyzed and calculate Raster data for extraction of information
5. Develop predictive modelling using Geostastical techniques
6. Evaluate and Construct Digital Elevation Model and their liking.

Unit 1 : Modelling Spatial Problems: Introduction - need for spatial models ï conceptual model for solving spatial problems - steps involved. 10 Periods

Types of spatial models ï descriptive and process models ï types of process models ï creating conceptual models.

Unit 2 :	Raster Modelling : Understanding raster data set - composition of raster dataset coordinate space and raster data set ï discrete and continuous data ï resolution ï raster encoding ï representing features in raster data set ï assigning attributes.	10 Periods
Unit 3 :	Spatial Analysis: Understanding spatial analysis - operators and functions ï local, focal, zonal, global and application functions ï surface analysis: slope, hill shade, contour, watershed analysis, aspect and hydrologic analysis ï mapping distance:	10 Periods
Unit 4 :	Demarcation of shortest path ï mapping density ï cell statistics ï neighbourhood statistics ï reclassification. Indices modelling - DVI, NDVI, SAVI, MSI, NDBI, NDWI; building of model using model maker ï Tasseled Cap Transformation.	10 Periods
Unit 5 :	Network analysis: Geometric Network, Logical Network, Network distribution, Component of Network, Hierarchical Network, Network Matrix.	10 Periods
Unit 6 :	Interpolation Methods: Trend Surface Analysis, IDW, Kriging, Measures of Arrangement and Dispersion, Autocorrelation, Semi-Variogram, DEM, TIN, spatial variation map, etc.	10 Periods

Text Books:

1. Heywood.L, Comelius.S and S. Carver (2006) An Introduction to Geographical Information Systems, Dorling Kinderseley (India) Pvt. Ltd.
2. Heywood, Cornellius and Carver, 2001, 2nd Indian Reprint. A n Introduction to Geographical Information Systems Parsian Education (Singapore) Pte. Ltd., Indian Branch, Delhi ï 110 092, India.

Reference Books:

1. Tsung Chang ï Kang, 2002, Introduction to Geographic Information Systems, Tata McGraw -Hill Publishing Comp any Limited, New Delhi.
2. Zeiler Michael, 2002, Modeling Our World, The ESRI Guide to Geodatabase Design, Environmental Systems Research Institute, Inc., Red Lands, California. USA- 92373 -8100.
3. Mitchell, A., , 1999, The ESRI Guide to GIS Analysis Volume 1: Geographical Patterns and Relationships, Environmental Systems Research Institute, Inc., Red Lands, California. USA 92373 ï 8100.

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2GNF-4A: (DSE-I Geostatistics)

COs (Course Outcomes)

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

1. Understand concepts and algorithms for geostatistical modelling.
2. Demonstrate Geostatistical application in the Geoinformatics study.
3. Learn to validate and evaluate appropriate geo-statistical approaches to characterize and quantify Spatial and spatiotemporal distributions of variables of interest.
4. Students are able to understand geographic information systems to integrate geostatistical techniques in the wider spatial sciences discipline.
5. Students are able to design different statistical modeling related to spatial analysis.

Unit 1 :	Fundamental concepts -Histogram ï univariate and bivariate, estimation	10 Periods

of basic statistical parameters, viz., mean, standard deviation, variance, correlation, covariance. Introduction to probability theory. Kinds of probability ï classical or apriority probability.

Unit 2 : Random variables, Distribution functions and expectation: Introduction and summary, Cumulative distribution function, Density function, Expectations and moments. 10 Periods

Unit 3 : Estimation theory: Introduction and summary, methods of finding estimators, properties of point estimators, unbiased estimation, Sampling and sampling distribution, sample mean, sampling from normal distribution. 10 Periods

Unit 4 : Testing of hypothesis: Introduction and summary, simple hypothesis testing, composite hypothesis, tests of hypotheses ï sampling from normal distribution, chi-square tests, tests of hypotheses and confidence intervals, sequential test of hypotheses. 10 Periods

Unit 5 : Geostatistics ï introduction, The variogram ï calculation, interpretation, Variances, covariances, Krigeôs volumevariance relationship. Geographic Data: Sources, Types, Discrete and Continuous Series, Scales of Measurements, Population, Sample and Sampling Techniques. 10 Periods

Unit 6 : . Extension variances and estimation variances ï simple calculations in one and two dimensions.Optimal estimation ï introduction to kriging, Linear, Nonlinear and Multivariate Geostatistics, 10 Periods

Text Books:

1. Noel Cressie, 1991.Statistics for Spatial Data, John Wiley & Sons.
2. Isaaks, E. H. and R. M. Srivastava. 1989. An Introduction to Applied Geostatistics. Oxford Univ. Press, New York, Oxford.

Reference Books:

1. Yang, X. S., 2009, Introductory Mathematics for Earth Scientists, Dunedin Academic Press
2. Volk, W, 1980, Applied Statistics for Engineers, Krieger Publishing Company, Huntington, New York.
3. Wackernagel, H. 2003. Multivariate geostatistics, Third edition, Springer-Verlag, Berlin

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2GNF-4B: (DSE-II Fundamentals of Geomorphology)

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

1. Students are able to understand the different geomorphological processes.
2. Students study the ideas behind and development of landforms.
3. Students learn about the numerous mechanisms by which different agents cause morphological changes in the landform.
4. Using remote sensing and GIS principles, students learn about hazardous events and their underlying causes.

Unit 1 :	Dynamics of geomorphology; geomorphic processes and resulting landform geomorphic features of Maharashtra and geomorphology of Indian sub continents;	10 Periods
Unit 2 :	Role of geomorphology in identification of natural hazards - Soil erosion by water and wind, floods and its associated landforms , ground surface subsidence, volcanoes-types and earthquakes-its types.	10 Periods
Unit 3 :	Mass Movement- Slope instability ï landslides-types of Mass movements, Coastal Landforms- GIS for Coastal management.	10 Periods
Unit 4 :	Geological survey, geologic mapping and cartographic standards for different scale, mapping geological structures ï fold, faults, joints and lineaments,	10 Periods
Unit 5 :	Geomorpholoical structural analysis with respect to different lithounits, fracture analysis, Landforms ï Deltaic, fluvial, coastal, glacial, tectonic, volcanic- karst/lakes.	10 Periods
Unit 6 :	Geomorphological mapping based on genesis of landforms; morphometric analysis and modeling terrain evaluation for strategic purpose; principles and applications of Geographic Information System.	10 Periods

Text Books:

1. Introduction to Environmental Remote Sensing – Barrett E C
2. Geomorphology and Engineering - Coates, D.R.
3. Geomorphology in Environmental Management - Cooke, R.U. and J.C. Doorn Kamp.
4. Summerfield (2000): - Geomorphology and Global Tectonics

Reference Books:

1. Geomorphology and Environment Sustainability - SC. Kalwar et.al
2. Indian Geomorphology - Sharma, H.S.
3. Geomorphology - Savindra Singh.
4. Thornbury: - Principles in Geomorphology

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Syllabus Prescribed for 2023-24
YearPG Programme

Programme: MSc Geoinformatics(Semester-II)

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
2 GNF 5C	Lab-I- Digital Image Processing Lab	09
2 GNF 6C	Lab-II -Spatial Modeling & Analysis Lab	09

2 GNF 5C- Lab-I - Digital Image Processing Lab

COs:

Upon completion of the course successfully, Students would be able toperform/demonstrate/accomplish the following

1. Understand Fundamentals, Image Transformations and Enhancement
2. Learn mathematical transforms necessary for image processing.
3. Learn the image enhancement techniques, restoration procedures.
4. Learn algorithms that perform basic image processing & advanced image analysis.

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

1. Radiometric correction and Geometric Correction
2. Histogram construction for digital data
3. Outputs of linear and non-linear stretch.
4. Filtered outputs
5. Ratio images
6. Change detection analysis
7. Image classification based on digital values
8. Unsupervised classification
9. Supervised classification.
10. Accuracy Analysis: Producer, User Accuracy, Overall and Mapping
11. Accuracy, Kappa Coefficient.
12. Image Registration: Registration of Bases Map/ Topomap, Image to Map, Image to Image.

Text Books

1. Lillisand T.M. , R.W.Kiefer and Chipman (2004) 5th edition. Remote sensing and image interpretation, John Wiley & Sons, New York.
2. American Society of Photogrammetry, (1983). Manual of Remote Sensing, (2nd edition), ASP, Falls Church, Virginia.
3. Soergel Uwe (2010) Radar Remote Sensing of Urban Areas, Remote Sensing and Digital Image Processing -
4. Jensen, John R (2017) Digital Image Processing: A Remote Sensing Perspective . Pearson Education; Fourth edition.

Reference Books:

1. Ekstrom, M. P. 1984, Digital image processing techniques. New York, Academic Press.
2. Harris,R. 1987, Satellite Remote Sensing - An Introduction. London, Routledge.
3. Moffit, H.F., and Edward, M.M., (1980). Photogrammetry, Harperand Row Publishers, New York.

2 GNF 6C- Lab-II - Spatial Modeling & Analysis Lab

COs:

Upon completion of the course successfully, Students would be able toperform/demonstrate/accomplish the following

1. Learn fundamental aspects of spatial data modeling specifically to enhance the capability of spatial modelling, spatial database analysis
2. Understand fundamental aspects of spatial data modeling.
3. Understand the natural and social resource assessment, planning and monitoring for National development process.

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

1. Spatial and tabular query
2. Overlay analysis
3. Extract analysis
4. Proximity analysis
5. Spatial Interpolation: IDW and Kriging
6. Spatial Autocorrelation
7. Network analysis
8. Generating TIN
9. Generating DEM
10. 3D and Volume analysis
11. Correlation-Regression Analysis in Model Building.
12. Handling Complex Spatial Query and case Studies

Text Books

1. Makrewski, J. (1999):GIS Multi-criteria Analysis, John Wiley and Sons, New York.
2. Chang, K. T. (2008): Introduction to Geographic Information Systems, Avenue of the Americas, McGraw-Hill, New York.
3. Longley, P. A., Goodchild, M. F., Maguire, D. J. Rhind, D. W. (2002):Geographical Information Systems and Science, John Wiley & Sons, Chichester.

Reference Books:

1. Lo, C. P.Yeung, A. W.(2002): ConceptsTechniques of Geographical Information Systems, Prentice- Hall of India, New Delhi.
2. Demers, M. N.(2000):Fundamentals of Geographic Information Systems, John Wiley and Sons.
3. Burrough, P. A. and McDonnell, R.A. (2000): Principles of Geographical Information Systems, University Press, New York.