ACADEMIC CURRICULA

POST GRADUATE DEGREE PROGRAMMES

Master of Science

(NEP based Flexible Credit System)

Syllabus for M Sc in Geoinformatics

Professional Core and Elective Courses

BIRLA INSTITUTE OF TECHNOLOGY, MESRA

(Deemed to be university)

Mesra, Ranchi, Jharkhand, 835215, India

Institute Vision

To become a Globally Recognized Academic Institution in consonance with the social, economic and ecological environment, striving continuously for excellence in education, research and technological service to the National needs.

Institute Mission

- To educate students at Undergraduate, Post Graduate Doctoral and Post-Doctoral levels to perform challenging engineering and managerial jobs in industry.
- To provide excellent research and development facilities to take up Ph.D. programmes and research projects.
- To develop effective teaching and learning skills and state of art research potential of the faculty.
- To build national capabilities in technology, education and research in emerging areas.
- To provide excellent technological services to satisfy the requirements of industry and over all academic needs of society.

Department Vision

Be a center of excellence in the field of Geospatial Technology education and research in the areas of Earth Resources, Environment & Climate to meet the needs of ever-increasing requirement of human resources in these fields and to cater to the larger interest of Society and Nation.

Department Mission

- Impart quality education and equip the students with strong foundation that could make them capable of handling challenges of the ever-advancing geo-spatial technologies.
- Maintain state-of-the-art in research and outreach facilities in phase with the premier institutes for sustained improvement in the quality of education and research.

Programme Educational Objectives (PEOs)	Programme Outcomes (POs)
1. To prepare the students for identifying, analysing and solving geospatial problems.	1. An ability to independently carry out research/ investigation and development work to solve real life geospatial problems.
2. To train the students in developing practical and executable solutions to the challenges of growing field of Remote Sensing and GIS.	2. An ability to write and present a substantial technical report/document and publish international level research articles.
3. To impart students with strong base of knowledge that makes them suitable both for industries as well as for teaching and research.	3. Students should be able to demonstrate a degree of mastery over the areas of Remote Sensing and GIS technology. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
4. To inculcate the students with the sensitivity towards ethics, public policies and their responsibilities towards the society.	4. An ability to share theoretical and practical knowledge in both teaching and research as well as in industries.
	5. An ability to apply professional ethics, accountability and equity.

M Sc (Geoinformatics)

PROGRAMME SCHEME - SEMESTER WISE DISTRIBUTION

S. No	Semester	Course Category	Credits	Total
1	FIRST	3 Programme Core (PC)	9	20
		1 Progamme Elective (PE)	3	
		3 LABS (PC)	6	
		Skill development I	2	
2	SECOND	3 Programme Core (PC)	11	20
		1 Progamme Elective (PE)	3	
		2 LABS (2 PC)	4	
		Skill development II	2	
3	THIRD	Research Project - Thesis (Part – I)	6	20
		1 Programme Core (PC)	4	
		1 Progamme Elective (PE)	3	
		2 LABS (1 PC + 1 PE)	2+2=4	
		1 Open Elective (OE)/ MOOC	3	
4	FOURTH	Research Project - Thesis (Part – II)	20	20
TOTAL				**80**

COURSE STRUCTURE

SEMESTER – I

	Course Category	Course Code	Subjects	Mode of Delivery L – Lecture; T – Tutorial; P - Practical			Credits
				L	T	P	
SEMESTER- I	PC	MG26501	Principles of Remote Sensing	3	0	0	3
		MG26503	Geographic Information System	3	0	0	3
		MG26505	Digital Cartography and Satellite Navigation System	3	0	0	3
		MG26502	Remote Sensing & Geographic Information System Laboratory	0	0	4	2
		MG26504	Digital Cartography and Satellite Navigation System Laboratory	0	0	4	2
		MG26530	FIELD-WORK	0	0	4	2
		MG26506	Skill development I	0	0	4	2
	PE	MG26*	ELECTIVE – I	2	1	0	3
	Total Credits (1st Semester)						**20.0**

SEMESTER – II

	Course Category	Course Code	Subjects	L	T	P	Credits
SEMESTER- II	PC	MG26509	Satellite Image Processing	3	1	0	4
		MG26511	Research Methods and Statistics in Geoinformatics	3	0	0	3
		MG26513	Spatial data handling through programming	3	1	0	4
		MG26508	Satellite Image Processing Laboratory	0	0	4	2
		MG26510	Spatial data handling through programming Laboratory	0	0	4	2
		MG26512	Skill development II	0	0	4	2
	PE	MG26*	ELECTIVE – II	3	0	0	3
	Total Credits (2nd Semester)						**20.0**

SEMESTER – III

	Course Category	Course Code	Subjects	L	T	P	Credits
SEMESTER- III	PC	MG26601	Project (Part - I)				6
		MG26603	Aerial & Satellite based Photogrammetry and GEO AI Modelling	3	1	0	4
		MG26602	Aerial & Satellite based Photogrammetry and GEO AI Modelling Laboratory	0	0	4	2
	PE	MG26**	ELECTIVE – III	3	1	0	3
		MG26**	ELECTIVE – III Laboratory	0	0	4	2
	OE	**OPEN ELECTIVE/MOOC**		3	0	0	3
	Total Credits (3rd Semester)						**20**

SEMESTER – IV

	Course Category	Course Code	Subjects	L	T	P	Credits
SEMESTER- IV	PC	MG2626609	Project (Part – II)				20
	Total Credits (4th Semester)						**20**

Grand TOTAL =80 credits

*ELECTIVES

Course No.	Course Title
ELECTIVE-I* (Monsoon Session Semester I)	
MG26507	Advance Image Acquisition: UAV and LiDAR

ELECTIVE-II* (Spring Session Semester II)

MG26515	Geoinformatics for Hydrology & Water Resources
MG26517	Geoinformatics for Climate Change and Environmental Impact Assessment

ELECTIVE-III (Monsoon Session Semester III)**

MG26605	Geoinformatics for Natural Resource Management
MG26604	Geoinformatics for Natural Resource Management Laboratory
MG26607	Geoinformatics for Disaster Management
MG26606	Geoinformatics for Disaster Management Laboratory

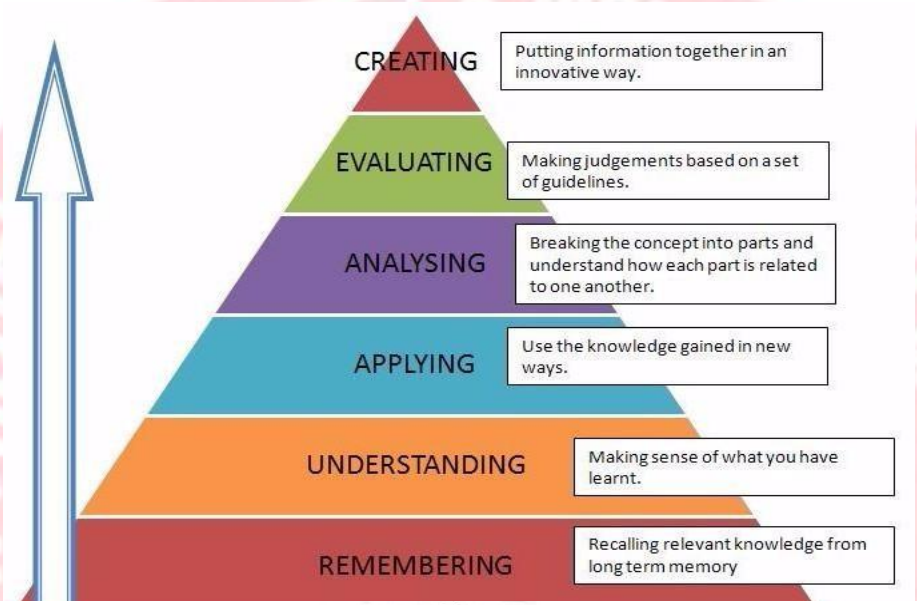
MG26601 Project (Part – I) – Focus on Problem definition, Literature Review, Data Collection, Objectives and Research Questions Formulation and Detailed Work Plan, and partial fulfillment of initial objectives.
MG26609 Project (Part – II) – Focus on systematic execution of work plan, data processing, analysis, interpretation, inferences and fulfillment of objectives and research questions, and report preparation, and finally leading to a research publication.

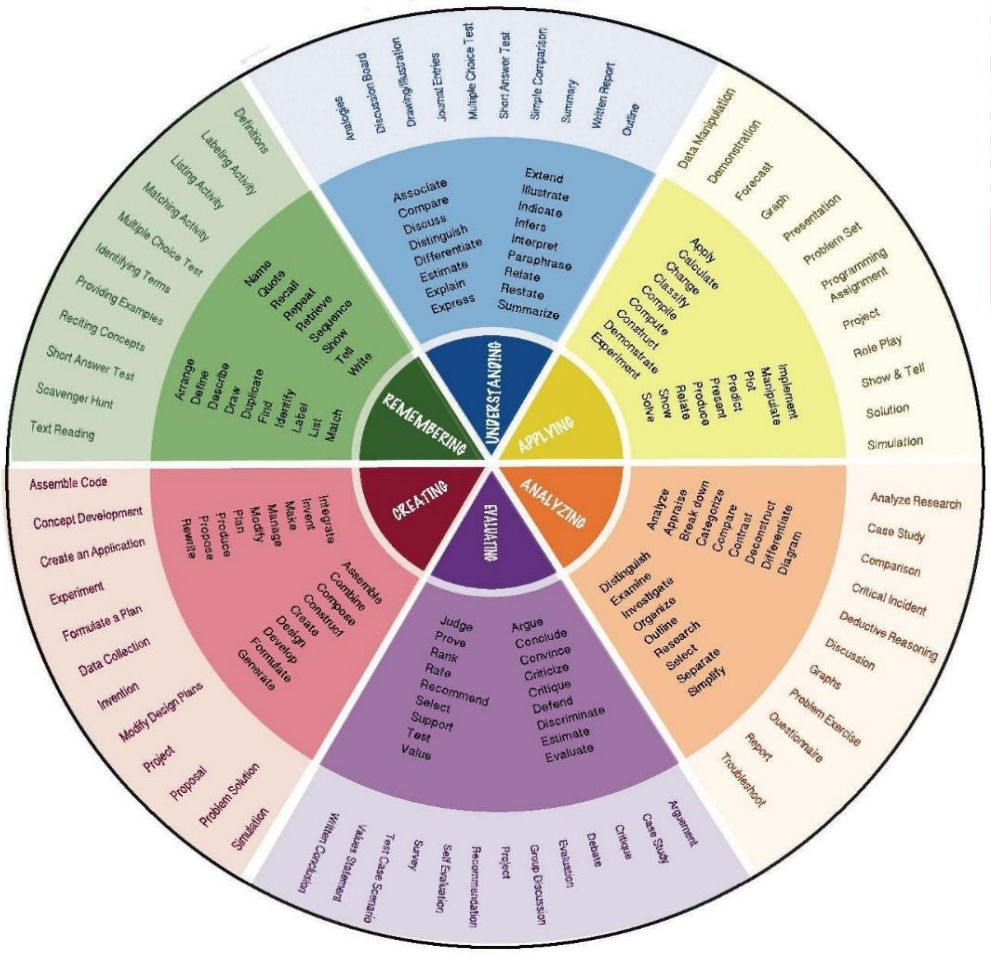
OE^{+} OPEN ELECTIVE / MGMC 26611– To be opted as offered by other Departments/ SWAYAM or NPTEL

BLOOM'STAXONOMYFORCURRICULUMDESIGNANDASSESSMENT:

Preamble

The design of curriculum and assessment is based on Bloom's Taxonomy. A comprehensive guideline for using Bloom's Taxonomy is given below for reference.





COURSE INFORMATION
SEMESTER – I
Course Information Sheets

Course code	**MG26501**
Course title	PRINCIPLES OF REMOTE SENSING
Pre-requisite(s)	Basic Sciences
Co-requisite	
Credits	L: T: P: C: 3 0 0 3
Class schedule per week	3
Class	M.Sc
Semester / Level	01/05 (Monsoon)
Branch	GEOINFORMATICS
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	Concepts of remote sensing imaging, energy balance, data acquisition platforms, sensors and their characteristics
2.	Fundamental knowledge of Optical, Thermal, Hyperspectral and Microwave-based Remote Sensing and their major applications

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Understand electromagnetic radiation, principles of satellite imaging and sensing processes.
CO2	Describe different types of sensors, their characteristics and principles of various imaging and non-imaging scanners, spectroscopy.
CO3	Understand image characteristics and image correction techniques.
CO4	Explain thermal imaging mechanism and hyperspectral imaging and potential applications
CO5	Explain principles of microwave remote sensing, associated concepts and major applications

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	CONCEPTS	Remote Sensing: History, Development, Definition, Concept and Principles, Electromagnetic Radiation (EMR) and its Characteristics, Wavelength Regions and their Significance, Energy Balance Equation, Interaction of EMR with Atmosphere and Earth's Surface: Absorption, Reflectance and Scattering, Atmospheric Windows, Spectral Response and Spectral Signature, Spectral, Spatial, Radiometric and Temporal resolution.	7
2	DATA ACQUISITION	Platforms: Balloon, Rocket, Helicopter, Aircraft and Spacecraft, UAV, Aerial vs. Satellite Remote Sensing, Satellites for earth observation (Indian and international missions LANDSAT, SPOT, ENVISAT, RADARSAT, IRS, IKONOS), Satellites for planetary observations (CHANDRAYAAN MISSIONS), Sensors and their Specifications: MSS, TM, LISS (,III,IV), PAN, WiFS, AWiFS, MODIS, Weather and Communication Satellites.	5
3	OPTICAL REMOTE SENSING	Imaging and Non-Imaging, Multispectral, Superspectral and, Hyperspectral. Electro-Optical Systems, Opto-Mechanical Scanners, Infrared Scanners, Scatterometer. Fundamentals of spectroscopy. Applications of optical remote sensing.	7
4	HYPERSPECTRAL AND THERMAL REMOTE SENSING	Hyperspectral Sensors and data characteristics; Thermal Imaging System: Basic principles and laws; Space-based thermal imaging systems; Thermal properties and Diurnal temperature of common materials; Emissivity, Characteristics and interpretation of thermal images; Land surface temperature estimation; Major applications of thermal remote sensing.	8
5	MICROWAVE REMOTE SENSING	Microwave Remote sensing concepts: Backscattering, Range Direction, Azimuth Direction, Incident Angle, Depression Angle, Polarization, Dielectric Properties, Surface Roughness and Interpretation, Resolutions.	8

Learning Resources	
Text Books	***Reference Books***
1. Joseph,George and Jeganathan, C. (2017). "Fundamentals of Remote Sensing", 3rd Edition, Universities press (India) Pvt. Ltd., Hyderabad. 2. Jensen, J.R. (2015). "Remote Sensing of the Environment – An Earth Resources Perspective", Pearson Education, Inc. (Singapore) Pvt. Ltd., 3rd edition. 3. Jensen, J.R. (1996). Introductory Digital Image Processing A remote sensing perspective. Prentice Hall Series in GIS, USA 4. Lillesand, Thomas M. and Kiefer, Ralph, W. (2015). "Remote Sensing and Image Interpretation", 7th Edition, John Wiley and Sons, New York.	1. Sabins, F.F. Jr. (2007). 'Remote Sensing – Principles and Interpretation", W.H. Freeman & Co. 2. Reeves, Robert G. (1991), "Manual of Remote Sensing, Vol. I, American Society of Photogrammetry and Remote Sensing, Falls Church, Virginia, USA 3. Dimitris G. Manolakis, Ronald B. Lockwood, Thomas W. Cooley(2016). Hyperspectral Imaging Remote Sensing. Cambridge Press. ISBN: 9781316017876. 4. Iain H. Woodhouse (2005). Introduction to Microwave Remote Sensing. CRC Pr I Llc .ISBN- 0415271231. 5. Ruiliang Pu, Qiuyan Yu (2026). Thermal Infrared Remote Sensing-Principles and Applications. CRC Press. ISBN 9781032231808

Gaps in the Syllabus (to meet Industry/Profession requirements)	
Pos met through Gaps in the Syllabus	
Topics beyond syllabus/Advanced topics/Design	Advance Geovisualisation
Pos met through Topics beyond syllabus/Advanced topics/Design	

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***				
	Continuous Internal Assessment	50%				
	Semester End Examination	50%				
	Continuous Internal Assessment	***% Distribution***				
	Best 2 Quiz marks out of 3 Quizzes of 15 marks each.	30%				
	Assignment(s)	10%				
	Seminar before a Committee	10%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Assig	Q1+Q2+Assig	Q2+Assig	Q2+Q3+Assig	Q3+Assig
	Semester End Examination	End Sem	End Sem	End Sem	End Sem	End Sem

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1		3	2	-
CO2	1	1	3	2	-
CO3	2	1	3	2	-
CO4	2	1	3	2	-
CO5	3	2	3	3	1
Low = 1, Medium = 2, High= 3					

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning (SL) such as use of NPTEL materials and internets
CD7	Simulation

Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**
CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3
CO3	CD1, CD2, CD3
CO4	CD1, CD2, CD3, CD6
CO5	CD1, CD2, CD3, CD5, CD6

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION SHEET

Course code	**MG26503**
Course title	GEOGRAPHIC INFORMATION SYSTEM
Pre-requisite(s)	Basic physical laws of nature, Geography
Co-requisite	
Credits	L:3; T:0; P:0;C:3
Class schedule per week	3
Class	M.Sc
Semester / Level	01/05 (Monsoon)
Branch	GEOINFORMATICS
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	Introduce the students to the basic concepts of GIS and making the students familiar with spatial data and spatial data creation and organisation.
2.	Teach various GIS based approaches and techniques to visualise and solve real life natural, environmental and societal problems.

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Understand various GIS data models, Geodatabase and data structures.
CO2	Describe data sources, data acquisition, coordinate systems and data quality.
CO3	Elucidate integrated geospatial techniques and apply them in solving real world problems.
CO4	Explain different interpolation and network analysis techniques for applying in solving real-world applications
CO5	Do ethical use of various data visualization models and decision support system for real-world applications

Syllabus

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	BASIC CONCEPTS OF GIS	Definition, Historical evolution of GIS, Spatial vs. Non-spatial data, Components of GIS, Spatial data models – Raster and Vector; advantages & disadvantages, Raster Data: Data Structure& File format, Data Compression (block code, chain code, run length code, quadtree, MrSID), Vector: Data Structure& File format, Topology, DBMS: Relational and Object Oriented. Basics of Geodatabase Model.	7
2	DATA INPUT AND GEO-CORRECTION	Sources of Spatial Data (Raster and Vector), Data Acquisition, Types of Co-ordinate Systems and Projections, Geometric Transformations of Raster and Vector Data (Affine Transformation and Transformation Coefficients), RMS Error, Sources of Errors, Spatial Data Quality: Accuracy, Precision, Error and uncertainty.	6
3	SPATIAL ANALYSIS AND VISUALIZATION	Spatial Analysis: Definition, Steps and classification, Raster Data Analysis Tools – Local, Focal, Zonal and Global, Vector Data Analysis – Buffering, Overlay Analysis, Distance Measurements, Spatial Auto Correlation, Introduction to Geo-AI and its application.	8
4	GEOSTATISTICAL TECHNIQUES AND NETWORK ANALYSIS	Spatial Interpolation: Introduction, Different Interpolation Techniques. Network Analysis: Structure (Alpha and Gamma Index) and Applications (Location- allocation, Linear Referencing), DEM Generation Surface Representation & Analysis, Difference between DTM, DSM and TIN.	8
5	GEOSPATIAL MODELS AND DECISION SUPPORT SYSTEM	Difference between 2D,2.5D, 3D and 4D GIS, Current issues and trends in GIS. Introduction to decision making process and decision support systems, Introduction of a framework for planning and decision making, Different types of DSS, Components of DSS, GIS and Spatial Decision Making, Difference between DSS & SDSS.	6

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

	Assessment Tool	***% Contribution during CO Assessment***
Direct Assessment	Continuous Internal Assessment	50%
	Semester End Examination	50%

	Continuous Internal Assessment	***% Distribution***				
	Best 2 Quiz marks out of 3 Quizzes of 15 marks each.	30%				
	Assignment(s)	10%				
	Seminar before a Committee	10%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Assig	Q1+Q2+Assig	Q2+Assig	Q2+Q3+Assig	Q3+Assig
	Semester End Examination	End Sem	End Sem	End Sem	End Sem	End Sem
Indirect Assessment	**Student Feedback on Course Outcome**					

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	1	3	3	-
CO2	2	1	3	2	-
CO3	2	1	3	3	-
CO4	2	-	3	3	-
CO5	3	2	3	3	2

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning (SL) such as use of NPTEL materials and internets
CD7	Simulation
Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**
CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3
CO3	CD1, CD2, CD3
CO4	CD1, CD2, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD5, CD6

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION SHEET

Course code	**MG26505**
Course title	DIGITAL CARTOGRAPHY AND SATELLITE NAVIGATION SYSTEM
Pre-requisite(s)	Basic Science & Computer Knowledge
Co-requisite	
Credits	L: T: P: C: 3 0 0 3
Class schedule per week	3
Class	M.Sc
Semester / Level	01/05 (Monsoon)
Branch	GEOINFORMATICS
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	Teach the students the basic concepts behind conventional cartography and latest digital developments.
2.	Teach various digital techniques to aesthetically visualise qualitative, quantitative data with appropriate spatial resolution, and projections.
3.	Impart fundamental principles behind utilisation and analysis of data acquired using Satellite based Positioning System for surveying and navigation purposes.

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Understand concept behind conventional and modern map making process.
CO2	Understand the scale and spatial resolution relationship and Create digital maps with appropriate projections.
CO3	Explain the fundamental principles of GNSS positioning
CO4	Explain various datums, coordinate systems, Differential positioning concepts
CO5	Describe surveying techniques and avoid misrepresentations of facts

Syllabus

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	CONVENTIONAL AND DIGITAL CARTOGRAPHY	Introduction to cartography – Nature, scope and its role, Basic characteristics of a map, different types of map and scale, Basic Geodesy, Map projections, Digital Cartography: its comparisons with conventional cartography and GIS Scale, Pixel size.	7
2	PERCEPTION AND MAP DESIGN	Cartographic design, Color theory and models, Map design, Map lettering and its placement in map compilation, Graphic symbology and visual variables, GIS and Maps, Visualisation process, strategy, Overall Map Cosmetics, Mapping qualitative and quantitative data, Bertins cartographic variables and its association with data types. AI-based thematic mapping concepts	8
3	GNSS FOUNDATIONS, GEODESY, AND ERROR MODELING	Introduction to Global Navigation Positioning Systems: NAVSTAR GPS, GLONASS, IRNSS, BeiDou. Geo-positioning basic concepts, Pseudo Range Measurement, Phase Difference Measurement, Sources of GNSS errors, and DOP; Geoid, Datum/Ellipsoid (definition and basic concepts), Global Datum vs. Indian Geodetic Datum, Coordinate Systems, and Transformation of coordinates.	8
4	ADVANCED NAVIGATION, AUGMENTATION, AND AI SYSTEMS	Site characteristics of Reference Station, Reference Station Equipment. Basic concepts of Augmentation Systems (GAGAN, WAAS, LAAS, etc.; Differential Global Positioning System (DGPS) concept, Various Surveying Methods, Data Processing, Smart Station, and Applications. GNSS Remote Sensing. AI-based tracking systems and Navigation.	10
5	CONVENTIONAL SURVEYING TECHNIQUES	Various levels, Levelling methods, Compass, Theodolite, and Total Station and their uses. Tachometer, Trigonometric levelling, Traversing, Triangulation, and Trilateration.	7

Learning Resources	
Text Books	***Reference Books***
1. Robinson, A.H. and Morrison, J.L. (1995). Elements of Cartography, John Wiley and Sons. 2. Gopi, Satish (2005). Global Positioning System: Principles and Applications, Tata Mac-Grow Hill. 3. Agrawal, N.K. (2004). Essentials of GPS, Spatial Network Pvt. Ltd. 4. Sathish Gopi (2000). GPS and Surveying using GPS.	1. Anson, R.W. and Ormeling, F.J. (2008). Basic Cartography, Vol. 1, 2nd ed., Elsevier Applied Science Publishers, London. 2. Gunter Seeber (2003). Satellite Geodesy Foundations-Methods and Applications. 3. Hofmann W.B & Lichtenegger, H. Collins (2001). Global Positioning System – Theory and Practice, Springer-Verlag Wein, New York. 4. Paul, J. C. (2005). Geographical Information Systems and computer Cartography, Longman. 5. Keates, J.S. (2008). Cartographic Design and production, London, Longman.

Gaps in the Syllabus (to meet Industry/Profession requirements)	
Pos met through Gaps in the Syllabus	
Topics beyond syllabus/Advanced topics/Design	Introduction to AI-assisted digital cartography
Pos met through Topics beyond syllabus/Advanced topics/Design	

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***
	Continuous Internal Assessment	50%
	Semester End Examination	50%
	Continuous Internal Assessment	***% Distribution***
	Best 2 Quiz marks out of 3	30%

	Quizzes of 15 marks each.					
	Assignment(s)	10%				
	Seminar before a Committee	10%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Assig	Q1+Q2+Assig	Q2+Assig	Q2+Q3+Assig	Q3+Assig
	Semester End Examination	End Sem	End Sem	End Sem	End Sem	End Sem

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	1	3	2	-
CO2	2	-	3	2	-
CO3	2	1	3	3	-
CO4	2	-	3	3	-
CO5	3	1	3	2	3

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning (SL) such as use of NPTEL materials and internets
CD7	Simulation
Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**

CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3
CO3	CD1, CD2, CD3, CD5
CO4	CD1, CD2, CD3, CD6
CO5	CD1, CD2, CD3, CD6

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION SHEET

Electives

Course code	**MG26507**
Course title	ADVANCE IMAGE ACQUISITION: UAV AND LiDAR
Pre-requisite(s)	Basic Science & Computer Knowledge
Co-requisite	
Credits	L: T: P: C: 3 0 0 3
Class schedule per week	3
Class	M.Sc
Semester / Level	01/05 (Monsoon)
Branch	GEOINFORMATICS
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	Teach students the advanced concepts of image and terrain data acquisition using UAV, LiDAR and integrated geospatial sensors.
2.	Enable students to integrate UAV imagery and LiDAR-derived products with GIS for environmental, urban, infrastructure and natural resource mapping.

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Understand the principles of advanced image acquisition using UAV, LiDAR and GNSS-supported platforms.
CO2	Design UAV-based flight plans considering altitude, overlap, ground sampling distance, GCPs and mission objectives.
CO3	Describe LiDAR system components, laser ranging principles, point cloud structure, errors and accuracy issues
CO4	Process UAV imagery and LiDAR point cloud data for orthomosaic, DSM, DEM, DTM and 3D feature extraction
CO5	Apply UAV and LiDAR datasets for environmental mapping, terrain modelling, urban mapping, vegetation analysis, infrastructure monitoring and disaster assessment

Syllabus

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	FUNDAMENTALS OF UAV	Introduction to UAV/drone; types of UAVs; UAV components; UAV sensors; flight planning; field data acquisition, UAV data formats; data transfer and metadata documentation; satellite, and aerial data vs. UAV data.	6
2	UAV PHOTOGRAMMETRY AND IMAGE PROCESSING WORKFLOW	Principles of Structure-from - Motion and multi-view stereo photogrammetry; camera calibration and image orientation; tie points and bundle block adjustment; use of GCPs and checkpoints; generation of orthomosaic, dense point cloud, DSM, DTM and contour products; radiometric and geometric correction; mosaicking and quality assessment; processing software; Applications and future trends of UAVs in Geospatial studies.	7
3	LIDAR PRINCIPLES, SYSTEMS AND POINT CLOUD PROCESSING	Introduction to laser ranging and LiDAR remote sensing; principles of time-of-flight and phase-based measurement; LiDAR system components; types of LiDAR; LiDAR data characteristics; LiDAR error sources and accuracy; point cloud classification: ground, vegetation, buildings, water and noise; generation of DEM, DSM, DTM; Integration of UAV and LiDAR data with GIS.	7
4	INTEGRATED UAV–LIDAR APPLICATIONS AND EMERGING TRENDS	Fusion of different UAV payload images: multispectral and Elevation; Applications in Geospatial domain; legal, ethical and safety aspects of UAV data acquisition; DGCA guidelines, privacy and field permissions; AI-based point cloud classification, digital twins.	6
5	ADVANCED UAV DATA PROCESSING AND ANALYTICS	Flight Planning and Field Data Acquisition for UAV Imagery, UAV Photogrammetry Workflow – Generating Orthomosaics and Elevation Models, UAV Photogrammetry Workflow – Generating Orthomosaics and Elevation Models, UAV Photogrammetry Workflow – Generating Orthomosaics and Elevation Models , Advanced Data Fusion and AI-Based Point Cloud Classification	7

Learning Resources	
Text Books	***Reference Books***
1. Introduction to UAV Systems – Paul G. Fahlstrom & Thomas J. Gleason 2. Small Unmanned Aircraft: Theory and Practice – Randal W. Beard & Timothy W. McLain 3. Introduction to Modern Photogrammetry – Edward M. Mikhail, James S. Bethel & J. Chris McGlone 4. Elements of Photogrammetry with Applications in GIS – Paul R. Wolf, Bon A. Dewitt & Benjamin E. Wilkinson 5. Topographic Laser Ranging and Scanning: Principles and Processing – Jie Shan & Charles K. Toth	1) Manual of Photogrammetry – American Society for Photogrammetry and Remote Sensing 2) Airborne and Terrestrial Laser Scanning – George Vosselman & Hans-Gerd Maas 3) UAV or Drones for Remote Sensing Applications – Felipe Gonzalez Toro & Antonios Tsourdos 4) Remote Sensing and Image Interpretation – Thomas M. Lillesand, Ralph W. Kiefer & Jonathan W. Chipman 5) Digital Photogrammetry: A Practical Course – Wilfried Linder

Gaps in the Syllabus (to meet Industry/Profession requirements)	
Pos met through Gaps in the Syllabus	
Topics beyond syllabus/Advanced topics/Design	Bathymetric LiDAR; Dual-wavelength green laser for underwater mapping; Edge AI for UAV-based real-time processing; Digital twin generation from UAV–LiDAR data.
Pos met through Topics beyond syllabus/Advanced topics/Design	

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***
	Continuous Internal Assessment	50%
	Semester End Examination	50%
	Continuous Internal Assessment	***% Distribution***

	Best 2 Quiz marks out of 3 Quizzes of 15 marks each.	30%				
	Assignment(s)	10%				
	Seminar before a Committee	10%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Assig	Q1+Q2+Assig	Q2+Assig	Q2+Q3+Assig	Q3+Assig
	Semester End Examination	End Sem	End Sem	End Sem	End Sem	End Sem

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	1	3	2	
CO2	2	1	3	3	
CO3	2	1	3	3	1
CO4	2	1	3	3	1
CO5	3	2	3	3	2

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning (SL) such as use of NPTEL materials and internets
CD7	Simulation
Mapping Between Course Outcomes and Course Delivery Method	

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3
CO3	CD1, CD2, CD3
CO4	CD1, CD2, CD3, CD4
CO5	CD1, CD2, CD3, CD4, CD6

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

Laboratory Related Subjects
COURSE INFORMATION SHEET

Course code	**MG26502**
Course title	REMOTE SENSING &GEOGRAPHIC INFORMATION LABORATORY
Pre-requisite(s)	Basic theoretical knowledge of Remote Sensing and Digital Cartography.
Co-requisite	
Credits	L: T: P: C: 0 0 4 2
Class schedule per week	4
Class	M.Sc
Semester / Level	01/05 (Monsoon)
Branch	GEOINFORMATICS
Name of Teacher	

Course Objectives *This course aims to provide students with:*	
Sl No.	Objectives
1	To understand satellite image display, spectral signatures, and reflectance analysis
2	To develop skills in GIS data creation, georeferencing, topology, and map layout
3	To perform basic raster, vector, DEM, thermal, and microwave data analysis.

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Understand the effect of different resolutions of satellite image on identifying different terrestrial features, able to display in FCC and TCC and Generate field spectra for various land cover features
CO2	Georeference the spatial data and handle huge spatial and non-spatial database
CO3	Remove topological errors in spatial data and apply spatial data analysis ethically to solve natural, environmental and societal problems and challenges.

Sl.No.	Name of the Laboratories
Lab 1	Downloadingand displaying satellite image in different colour composites.
Lab 2	Familiarization with Spectro Radiometer andField Spectra Collection: vegetation, bare soil, and concrete and analyse it with satellite data.
Lab 3	Compare reflectance values from MODIS satellite image and field collected spectra for same land feature
Lab 4	Thermal &Microwavedata exploration
Lab 5	Discriminate Land surface features using spectral, thermal and microwave satellite images
Lab 6	Familiarization with the GIS software and creation of Geodatabase with importing vector/raster /table in it.
Lab 7	Creation of Spatial data from Non-spatial data and Georeferencing of raster data in GIS software
Lab 8	Creation of spatial database in File Geodatabase and extraction of point, line and polygon features from already georeferenced raster
Lab 9	Topology creation of spatial data and removing topological error
Lab 10	Attribute data Integration with spatial data and Map Designing (layout creation)
Lab 11	Performing vector analysis: Attribute query, buffering, overlay
Lab 12	Generation of Digital Elevation Model from spot height
Lab 13	Performing raster analysis

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***		
	Continuous Internal Assessment	60%		
	Semester End Examination	40%		
	Continuous Internal Assessment	***% Distribution***		
	2 Quizzes	20 % (2 × 10%)		
	Day to Day Performance & Lab File	30%		
	Viva	20%		
	Final Exam	30%		
	Assessment Components	***CO1***	***CO2***	***CO3***
	Continuous Internal Assessment	Q1+Lab file	Q1+Lab file	Q1+Lab file
	Semester End Examination	Final exam+viva	Final exam+viva	Final exam+viva

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	-	3	2	
CO2	2	-	3	3	
CO3	3	2	3	3	3

Course Delivery Methods	
CD1	Laboratory experiments

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION SHEET

Course code	**MG26504**
Course title	**DIGITAL CARTOGRAPHY AND GNSS LABORATORY**
Pre-requisite(s)	Basic theoretical knowledge of Remote Sensing and Digital Cartography.
Co-requisite	
Credits	L: T: P: C: 0 0 4 4
Class schedule per week	4
Class	M.Sc
Semester / Level	01/05 (Monsoon)
Branch	GEOINFORMATICS
Name of Teacher	

Course Objectives *This course aims to provide students with:*	
Sl No.	Objectives
1	To understand topographical sheets, UTM grids, scales, projections, and projection distortions and develop skills in digital cartography, thematic map preparation
2	To gain hands-on experience in GNSS data collection, receiver settings, differential positioning, and post-processing

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Understand Indian and international numbering systems of Maps and thematic map preparation with cartographic conventions
CO2	Collect GNSS data in different survey modes and post process them to generate output
CO3	Handle integrated geospatial techniques and apply them in solving real world problems

Sl.No.	**Name of the Laboratories**
Lab 1	Familiarization with SOI topographical sheets and UTM Grids
Lab 2	Familiarization with different types of scale (Simple, comparative, Diagonal)
Lab 3	Familiarization with Projections(Conical, Polyconic, Cylinderical with 1 or 2 standard parallels).

Lab 4	Conversion of data from Analog to Digital form
Lab 5	Visualization of Distortions due to change in projections
Lab 6	Study of Bertin variables
Lab 7	Digital Cartography, Output Generation and Thematic map composition: eg Tourism/Geologic/Geomorphologic
Lab 8	Introduction to GNSS receivers and initial settings
Lab 9	Creating codes and attribute table in GNSS receiver
Lab 10	Data collection in Point and Line mode using GNSS with different datum
Lab 11	Data collection in Area mode using GNSS with different datum
Lab 12	GNSS Data collection in differential positioning mode
Lab 13	Post processing of the GNSS data

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***		
	Continuous Internal Assessment	60%		
	Semester End Examination	40%		
	Continuous Internal Assessment	***% Distribution***		
	2 Quizzes	20 % (2 × 10%)		
	Day to Day Performance & Lab File	30%		
	Viva	20%		
	Final Exam	30%		
	Assessment Components	***CO1***	***CO2***	***CO3***
	Continuous Internal Assessment	Q1+Lab file	Q1+Lab file	Q1+Lab file
	Semester End Examination	Final exam+viva	Final exam+viva	Final exam+viva

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	-	3	2	-
CO2	2	-	3	3	-
CO3	3	2	3	3	1

Course Delivery Methods	
CD1	Laboratory experiments

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION

Course code	**MG26506**
Course title	Skill Development- I
Pre-requisite(s)	Basic Sciences
Co-requisite	Basic Computing
Credits	L:0; T:0; P:4; SL:
Class schedule per week	4
Class	M. Sc.
Semester / Level	01/05 (Monsoon)
Branch	Geoinformatics
Name of Teacher	

Course Objectives

This course aims to provide students with:

Sl No.	Objectives
1	Knowledge and Concepts C programming
2	Concepts of Technical Writing and Structing

Course Outcomes (COs)

Upon successful completion of the course, students will be able to

CO	Course Outcomes
CO1	Understand the Basic Concept of C programming along with
CO2	Understand the concepts of functions and recursion in C programming
CO3	Use AI writing assistants ethically
CO4	Attain skills on writing research paper with unique referencing style
CO5	Write technical documents on Latex

Syllabus

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	BASICS OF C PROGRAMMING	Syntax, and constructs of C; variables, assignment, declarations, expressions, statements, input/output, conditionals, branching, iteration. Arrays, pointers, static and dynamic structures, dynamic allocation, file structures.	8
2	BASICS OF C PROGRAMMING	Functions and recursion: Parameter passing in a function, procedure call, call by value and reference, function prototypes; recursion; library functions, static functions.	7
3	FUNDAMENTALS OF TECHNICAL WRITING	Structure of reports, papers, thesis and documentation, Clarity and formatting; avoiding plagiarism and using AI writing assistants ethically. Paragraph writing, one idea per sentence, avoiding repetition. Using simple plain language, reducing adjectives and adverbs, avoiding unnecessary words	7
4	STRUCTURED DOCUMENTATION	Rewriting in smaller number of words/sentences. Precise writing through meticulous editing, proofreading. Writing abstracts and conclusions. Drafting reports, research papers, thesis, understanding document structure and Referencing styles (APA/IEEE basics) and tools	7
5	INTRODUCTION TO LATEX	Setting up environments (Overleaf/MiKTeX); document classes, Formatting text, equations, tables, figures, Bibliography and citations	6

Learning Resources

Text Books	*Reference Books*
1. Reema Thareja (2015). Introduction to C Programming. 2nd Ed. ISBN-10 : 9780199452057. Oxford University Press 2. Suzan Last (2019). Technical Writing Essentials Creative Commons Attribution 4.0. International License	1. Darrel L. Graham (2016)C Programming: Language: A Step by Step Beginner's Guide to Learn. ISBN- 978-1534679702.

Gaps in the Syllabus (to meet Industry/Profession requirements)	
Pos met through Gaps in the Syllabus	
Topics beyond syllabus/Advanced topics/Design	*Sample Writing Exercises*
Pos met through Topics beyond syllabus/Advanced topics/Design	*CO3*

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***%Contribution during CO Assessment***				
	Continuous Internal Assessment	60%				
	Semester End Examination	40%				
	Continuous Internal Assessment	***%Distribution***				
	2 Quizs	30%				
	Assignment file (AF)	20%				
	Technical Report Writing(TRW)	10%				
	Semester End Examination					
	LaTex Document Preparation(LDP)	20%				
	Viva	20%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Assignment file	Q2+ Assignment file	Q1+ TRW	Q2 +TRW	AF_ TRW
	Semester End Examination	LDP +viva	LDP +viva	LDP +viva	LDP +viva	LDP +viva

Indirect Assessment	**Student Feedback on Faculty**
	Student Feedback on Course Outcome

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	-	2	3	-
CO2	1	-	2	3	-
CO3	1	3	2	1	3
CO4	1	3	1	2	-
CO5	1	3	1	1	-

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self-learning (SL) such as use of NPTEL materials and internets
CD7	Simulation

Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**
CO1	
CO2	
CO3	
CO4	
CO5	

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION
SEMESTER – II
Course Information Sheets

Course code	MG26509
Course title	SATELLITE IMAGE PROCESSING
Pre-requisite(s)	Basic concept of remote sensing
Co-requisite	Knowledge of RS & GIS
Credits	L: 3 T: 1 P: 0 C: 4
Class schedule per week	4
Class	M.Sc
Semester / Level	02/05 (Spring)
Branch	GEOINFORMATICS
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	Teach the students about the Digital processing concepts and techniques for importing, georeferencing and rectifying satellite derived remote sensing images.
2.	Enhance the students' knowledge about advanced satellite image processing techniques for deriving diverse proxy indices revealing information about various land cover features, and their usability in real-life natural resource management and monitoring related applications.

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Describe different image enhancements techniques.
CO2	Characterize spectral pattern in image and explain different image classification approaches with respect to diverse applications
CO3	Explain various AI based image classification techniques
CO4	Explain preprocessing of hyperspectral images and link these data to real life applications
CO5	Explain preprocessing of microwave images and understand deriving of backscattering.

Syllabus

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	IMAGE CHARACTERISTICS AND CORRECTION TECHNIQUES	Concepts about digital image and its characteristics, Image data storage and retrieval. Sources of image degradation, Radiometric correction techniques, Geometrical errors and its rectification. Sources of image degradation - Image restoration and Noise Abatement, Radiometric and Geometric correction technique, linear and nonlinear transformation for geometric corrections, Look-up Tables (LUT) and Types of image displays and FCC,	7
2	IMAGE ENHANCEMENT TECHNIQUES	Radiometric enhancement techniques, Spatial enhancement techniques, Contrast stretching: Linear and non-linear methods. Band ratio, Types of Vegetation indices, Principal Component Analysis, Multi dated data analysis and Change detection, Image fusion techniques. Low Pass Filtering: Image smoothing, High Pass Filtering: Edge enhancement and Edge detection, Gradient filters, Directional and non-directional filtering	7
3	PATTERN RECOGNITION	Concept of Pattern Recognition, Multi-spectral pattern recognition, Spectral discrimination, Signature bank, Parametric and Non-Parametric classifiers, Unsupervised classification methods. Supervised classification techniques, Limitations of standard classifiers.	6
4	AI/ML AND IMAGE CLASSIFICATION	Concepts of AI, Techniques and Algorithms; Advanced Classification Techniques, Random Forest, Support Vector Machine, XGBoost.	7
5	MICROWAVE AND HYPERSPECTRAL IMAGE PROCESSING	Microwave: SAR Image Processing software - Measurement and discrimination, Backscatter Extraction - Preprocessing and speckle filtering, Hyperspectral Data pre-processing: atmospheric correction, noise reduction; data reduction - MNF transformation, spectral library, End member extraction, Classification methods, Spectral Angle mapper. Major applications with hyperspectral data.	8

Learning Resources	
Text Books	***Reference Books***
1. Joseph,George and Jeganathan, C. (2017). "Fundamentals of Remote Sensing", 3rd Edition, Universities press (India) Pvt. Ltd., Hyderabad. 2. Jensen, J.R. (2006). "Remote Sensing of the Environment – An Earth Resources Perspective", Pearson Education, Inc. (Singapore) Pvt. Ltd., Indian edition, Delhi. 3. Jensen, J.R. (1996). Introductory Digital Image Processing A remote sensing perspective. Prentice Hall Seies in GIS, USA 4. Lillesand, Thomas M. and Kiefer, Ralph, W. (2007). "Remote Sensing and Image Interpretation", 4th Edition, John Wiley and Sons, New York.	1. Sabins, F.F. Jr. (2007). 'Remote Sensing – Principles and Interpretation", W.H. Freeman & Co. 2. Reeves, Robert G. (1991), "Manual of Remote Sensing, Vol. I, American Society of Photogrammetry and Remote Sensing, Falls Church, Virginia, USA. 3. Dimitris G. Manolakis, Ronald B. Lockwood, Thomas W. Cooley(2016). Hyperspectral Imaging Remote Sensing. Cambridge Press. ISBN: 9781316017876. 4. Iain H. Woodhouse (2005). Introduction to Microwave Remote Sensing. CRC Pr I Llc .ISBN- 0415271231. 5. Ruiliang Pu, Qiuyan Yu (2026). Thermal Infrared Remote Sensing-Principles and Applications. CRC Press. ISBN 9781032231808 .

Gaps in the Syllabus (to meet Industry/Profession requirements)	
Pos met through Gaps in the Syllabus	
Topics beyond syllabus/Advanced topics/Design	Advanced AI techniques for satellite image classification
Pos met through Topics beyond syllabus/Advanced topics/Design	

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***				
	Continuous Internal Assessment	50%				
	Semester End Examination	50%				
	Continuous Internal Assessment	***% Distribution***				
	Best 2 Quiz marks out of 3 Quizzes of 15 marks each.	30%				
	Assignment(s)	10%				
	Seminar before a Committee	10%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Assig	Q1+Q2+Assig	Q2+Assig	Q2+Q3+Assig	Q3+Assig
	Semester End Examination	End Sem	End Sem	End Sem	End Sem	End Sem

Indirect ssessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	1	3	2	-
CO2	2	-	3	3	-
CO3	3	-	3	3	-
CO4	2	1	3	3	-
CO5	3	2	3	3	2

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning (SL) such as use of NPTEL materials and internets
CD7	Simulation

Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**
CO1	CD1, CD2, CD3, CD8
CO2	CD1, CD2, CD3, CD8
CO3	CD1, CD2, CD3, CD5, CD8
CO4	CD1, CD2, CD3, CD5, CD6, CD8
CO5	CD1, CD2, CD3, CD5, CD6, CD8

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION SHEET

Course code	MG26511
Course title	RESEARCH METHODS AND STATISTICS IN GEOINFORMATICS
Pre-requisite(s)	Knowledge of statistics
Co-requisite	Knowledge of RS & MG26S
Credits	**L: 3 T: 0 P: 0 C: 3**
Class schedule per week	3
Class	M.Sc
Semester / Level	02/05 (Spring)
Branch	GEOINFORMATICS
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	Teach students about fundamentals of research process and diverse research possibilities in Geoinformatics domain.
2.	Enhance the students' knowledge about various steps involved in carrying out proper research and its effective communication
3.	Maintain quality standards in research

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Understand the formulation of various schemes in Geoinformatics domain
CO2	Explain concepts behind Project management,
CO3	Prepare field report and write research proposals
CO4	Apply sampling techniques, tools and associated Geoinformatics research methods to extract quantitative and qualitative information about the real-life geoinformatics problem.
CO5	Use the National / Global quality standards, ethics of research.

Syllabus

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	RESEARCH IN GEOINFORMATICS	Research Problems in Geoinformatics domain. Identification of problems at reMG26onal and Local level, National and International Geoinformatics projects: Past and Recent, Geographic data sources and different types of data requirement, Formulation of research schemes.	7
2	FIELD AND PROJECT REQUIREMENTS	Need for Field Visit and Preparation of field reports, Research proposal, Literature review, Project/Report Writing, Components of Research Thesis/Project Report, Project Administrator and project management, Classification of Projects/thesis, Problems and opportunities in Projects.	8
3	SAMPLING AND STATISTICS	Statistical Concepts: Population, Sample, Random, Bias, Percentile, Standard Score, Distribution, Correlation, Regression (loMG26stic, linear). Analysis of variance, Need for sampling, types of sampling, sample size estimation and accuracy evaluation. Hypotheses and its testing, chi-square test, t-test, Calculation and Evaluation of Confidence Intervals.	8
4	METHODS IN GEOINFORMATICS	Types of Research Methods: Quantitative and Qualitative, Research Techniques and Tools: Questionnaire, Interview, Observation, etc., Analytical methods in Geoinformatics, Different models in various Natural Resources Monitoring.	10
5	TOOLS, QUALITY AND ETHICS	Tools & Methods: Project Communications and Presentation, Intellectual property Right, PlaMG26arism and associated softwares, Evaluating Quality of Research paper/journal: Citation Index, Impact Factor, National/Global standards, SCI, SCOPUS, etc., Referencing/Citation methods, Reference management software.	

Learning Resources	
Text Books	***Text Books***
1. Deborah Rumsey (2003). Statistics for Dummies, Wiley Publishing, Inc.,New Jersey.	1. Deborah Rumsey (2003). Statistics for Dummies, Wiley Publishing, Inc.,New Jersey.
2. Huxold, W.E. and Levinsohn A.G. (1995). ManaMG26ng Geographic Information Projects. Oxford University Press, New York.	2. Huxold, W.E. and Levinsohn A.G. (1995). ManaMG26ng Geographic Information Projects. Oxford University Press, New York.
3. Earickson, R. and Harlin, J. (1994). Geographic Measurement & Quantitative Analysis, Macmillan, New York.	3. Earickson, R. and Harlin, J. (1994). Geographic Measurement & Quantitative Analysis, Macmillan, New York.

Gaps in the Syllabus (to meet Industry/Profession requirements)	
Pos met through Gaps in the Syllabus	
Topics beyond syllabus/Advanced topics/Design	Ethical use of AI in writing research articles
Pos met through Topics beyond syllabus/Advanced topics/Design	

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***				
	Continuous Internal Assessment	50%				
	Semester End Examination	50%				
	Continuous Internal Assessment	***% Distribution***				
	Best 2 Quiz marks out of 3 Quizzes of 15 marks each.	30%				
	Assignment(s)	10%				
	Seminar before a Committee	10%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Assig	Q1+Q2+Assig	Q2+Assig	Q2+Q3+Assig	Q3+Assig
	Semester End Examination	End Sem	End Sem	End Sem	End Sem	End Sem

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	-	3	2	-
CO2	2	1	3	2	-
CO3	2	3	3	3	-
CO4	2	1	3	2	3
CO5	1	1	1	2	3

Course Delivery Methods	
CD1	Lecture by use of Boards/LCD Projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Mini Projects/Projects
CD5	Laboratory Experiments/Teaching Aids
CD6	Industrial/Guest Lectures
CD7	Industrial Visits/In-plant Training
CD8	Self- learning such as use of NPTEL Materials and Internets
CD9	Simulation
Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**
CO1	CD1, CD2, CD3, CD8
CO2	CD1, CD2, CD3, CD8
CO3	CD1, CD2, CD3, CD5, CD8
CO4	CD1, CD2, CD3, CD5, CD6, CD8

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION SHEET

Course code	MG26513
Course title	SPATIAL DATA HANDLING THROUGH PROGRAMMING
Pre-requisite(s)	i) Knowledge of Basic Sciences ii) Student must have undergone MG26 501, MG26 502
Co-requisite	Knowledge of RS & MG26S
Credits	L: 3 T: 1 P: 0 C: 4
Class schedule per week	4
Class	M.Sc
Semester / Level	02/05 (Spring)
Branch	GEOINFORMATICS
Name of Teacher	

Course Objectives
This course aims to:

Sl No.	Objectives
1.	Enhance the student's understanding of logic development and its transformation into programs
2.	Make the student learn to solving simple problems through Python and GEE

Course Outcomes (COs)
Upon successful completion of the course, students will be able to

CO	Course Outcomes
CO1	To Develop algorithms for arithmetic and logical problems in Python
CO2	Handle Spatial data in Python
CO3	Make use of Python for deployment of programs to process spatial data
CO4	Utilise Python tools for digital image processing
CO5	Make computations using Images in Google Earth Engine for ethical use of this advanced tool

Syllabus

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	BASICS OF PYTHON	Introduction to Python, Basics of Python Syntax, Data Types of Pythons, Basic Operations of Python, Functions: Recursion, Scope of Variable, Standard Library Functions; Modules, and Packages of Python, Extension: Building a Python Environment, conditions, range, Loops, break, continue, and else in Loops	9
2	PREPARING DATA FOR SPATIAL MODELING	Understanding Classes and Objects (essential for working with APIs like ArcPy or PyQGIS, NumPy: Multi-dimensional arrays (the basis for Raster data);Pandas: Handling attribute tables, DataFrames, cleaning CSVs, and time-series analysis; Scientific plotting and statistical visualization;interactive geospatial visualisation with Folium and Plotly to create web-based maps and dashboards	7
3	VECTOR DATA PROCESSING USING PYTHON	GeoPandas: The industry standard for vector data manipulation; Shapely: Geometric operations (Buffering, Union, Intersection); Fiona &Pyproj: Reading/writing spatial formats and handling Coordinate Reference Systems (CRS) transformations; Introduction to PyQGIS for GIS workflow automation and scripting	9
4	PYTHON LIBRARIES FOR RASTER DATA HANDLING	Rasterio: Reading and writing GeoTIFFs, band math (NDVI, NDWI calculation);Xarray: Working with multi-dimensional "Data Cubes" (NetCDF files);WhiteboxTools: Advanced terrain analysis and hydrological modeling via Python;OpenCV: Basic image processing for feature extraction; Basic machine learning concepts for raster classification	7

5	GOOGLE EARTH ENGINE WITH PYTHON	Introduction to Google Earth Engine, Earth Engine Objects and Methods, Functional Programming Concepts, Introduction to the Earth Engine API Authentication: Setting up Google Cloud Projects, installing libraries; Jupyter& Google Colab: Setting up notebooks for interactive geospatial development, Understanding the "Server-side" vs. "Client-side" distinction, Exploring raster data, bands, and metadata; Handling vector data; Introduction to GeoAI and machine learning for spatial data analysis using Scikit-learn and Earth Engine datasets.	9

Learning Resources	
Text Books	***Reference Books***
1. Mark Lutz: Learning Python 2. Applied Geospatial Data Science with Python by David S. 3. Lalit Kumar, Onisimo Mutanga: Google Earth Engine Applications	1. Wes McKinney: Python for Data Analysis 2. Python for Geospatial Data Analysis: Theory, Tools, and Practice for Location Intelligence by Bonny P. McClain

Gaps in the Syllabus (to meet Industry/Profession requirements)	
Pos met through Gaps in the Syllabus	
Topics beyond syllabus/Advanced topics/Design	Ethical use of AI in writing codes
Pos met through Topics beyond syllabus/Advanced topics/Design	

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***				
	Continuous Internal Assessment	50%				
	Semester End Examination	50%				
	Continuous Internal Assessment	***% Distribution***				
	Best 2 Quiz marks out of 3 Quizzes of 15 marks each.	30%				
	Assignment(s)	10%				
	Seminar before a Committee	10%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Assig	Q1+Q2+Assig	Q2+Assig	Q2+Q3+Assig	Q3+Assig
	Semester End Examination	End Sem	End Sem	End Sem	End Sem	End Sem

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	-	1	3	-
CO2	2	-	3	3	-
CO3	3	-	2	3	-
CO4	3	-	2	3	-
CO5	2	1	2	2	3

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/institutional visits/field visit
CD6	Self- learning such as use of NPTEL materials and internets
Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**
CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3
CO3	CD1, CD2, CD3, CD5
CO4	CD1, CD2, CD3, CD5, CD6
CO5	CD1, CD2, CD3, CD5, CD6

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

Laboratory Related Subjects
COURSE INFORMATION SHEET

Course code	MG26508
Course title	SATELLITE IMAGE PROCESSING LABORATORY
Pre-requisite(s)	Basic theoretical knowledge of RS, MG26S and GPS
Co-requisite	
Credits	L: 0 T: 0 P: 4 C: 2
Class schedule per week	4
Class	M.Sc
Semester / Level	02/05 (Spring)
Branch	GEOINFORMATICS
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	To develop skills in satellite image preprocessing, correction, enhancement, PCA, and image merging.
2.	To perform image classification, accuracy assessment, AI-based classification, and automatic feature extraction

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Download and Georeference satellite data from various sources.
CO2	Apply different image enhancement techniques.
CO3	Classify satellite images for generating land use / land cover and implement AI based classification technique

Sl.No.	Name of the Laboratories
Lab 1	Importing raw satellite data into image processing software and sub-setting the image
Lab 2	Geo-referencing of image with the help of georeferenced topographic sheet
Lab 3	Radiometric Correction of satellite images: DN to Radiance conversion
Lab 4	Radiometric Correction of satellite images: Radiance to reflectance conversion
Lab 5	Study of the various contrast enhancement techniques
Lab 6	Applications of Low Pass and High Pass Filters to the satellite data
Lab 7	Spectral Enhancement (Ratio images, Vegetation Indices) techniques
Lab 8	Principal Component Analysis (PCA)
Lab 9	Multi-Resolution image merging
Lab 10	Unsupervised classification
Lab 11	Supervised Classification & Accuracy assessment
Lab 12	AI based Advanced Classifications
Lab 13	AI based automatic feature extraction

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***		
	Continuous Internal Assessment	60%		
	Semester End Examination	40%		
	Continuous Internal Assessment	***% Distribution***		
	2 Quizzes	20 % (2 × 10%)		
	Day to Day Performance & Lab File	30%		
	Viva	20%		
	Final Exam	30%		
	Assessment Components	***CO1***	***CO2***	***CO3***
	Continuous Internal Assessment	Q1+Lab file	Q1+Lab file	Q1+Lab file
	Semester End Examination	Final exam+viva	Final exam+viva	Final exam+viva

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	-	3	3	-
CO2	2	1	3	3	-
CO3	2	1	3	3	1

Course Delivery Methods	
CD1	Lecture by use of Boards/LCD Projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Mini Projects/Projects
CD5	Laboratory Experiments/Teaching Aids
CD6	Industrial/Guest Lectures
CD7	Industrial Visits/In-plant Training
CD8	Self- learning such as use of NPTEL Materials and Internets
CD9	Simulation

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION SHEET

Course code	MG26510
Course title	Spatial data handling through programming Laboratory
Pre-requisite(s)	Basic theoretical knowledge of RS, GIS and GPS
Co-requisite	
Credits	L: T: P: C: 0 0 4 2
Class schedule per week	4
Class	M.Sc
Semester / Level	02/05 (Spring)
Branch	GEOINFORMATICS
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	To develop Python programming skills for geospatial data handling, statistical analysis, and visualization
2.	To perform vector, raster, NetCDF, and climate data processing using Python libraries such as NumPy, Pandas, GeoPandas, Rasterio, and Xarray

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Understand and Use Compiler programming Environment
CO2	Understand and use various libraries, Fuction and Syntaxes.
CO3	Write a simple to complicated Programming Codes in C, R and Python.

List of Laboratories

Sl.No.	Name of the Laboratories
Lab 1	Set up a Python environment (Anaconda/VS Code). Practice basic syntax, loops (for, while)
Lab 2	Work with Python lists, dictionaries, and tuples. Build a basic script to read data from a standard text file and parse its contents.
Lab 3	Create multi-dimensional arrays to mimic raster grids using NumPy. Load, clean, and filter a CSV-based attribute table using Pandas DataFrames
Lab 4	Generate statistical plots, histograms, and trend visualizations from tabular datasets using Matplotlib and Seaborn
Lab 5	Read and write common vector formats (Shapefiles, GeoJSON). Explore coordinate reference systems (CRS) and perform re-projections using Pyproj; vector data visualization and thematic mapping
Lab 6	Perform programmatic spatial queries and geometric operations (buffering and unions/intersections)
Lab 7	Open multi-band GeoTIFF images. Perform programmatic raster algebra to calculate remote sensing indices like NDVI, NDWI and clip using vector boundaries.
Lab 8	Load and manipulate NetCDF files using Xarray; Analyse real-world climate datasets for spatio-temporal studies
Lab 9	Extract time-series data and slice multi-dimensional climate datasets.
Lab 10	Set up a Google Cloud Project and authenticate the Earth Engine Python API (ee) within a Google Colab notebook
Lab 11	Import a Sentinel-2 or Landsat 8 Image Collection and filter it by a specific date range and maximum cloud cover percentage; Image classification and change detection
Lab 12	Create or upload a vector dataset (ee.FeatureCollection) representing a specific region or set of study points
Lab 13	Introduction of Python based GeoAI libraries and tools for performing basic operations : land-use/land-cover classification exercise using Scikit-learn.

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***		
	Continuous Internal Assessment	60%		
	Semester End Examination	40%		
	Continuous Internal Assessment	***% Distribution***		
	2 Quizzes	20 % (2 × 10%)		
	Day to Day Performance & Lab File	30%		
	Viva	20%		
	Final Exam	30%		
	Assessment Components	***CO1***	***CO2***	***CO3***
	Continuous Internal Assessment	Q1+Lab file	Q1+Lab file	Q1+Lab file
	Semester End Examination	Final exam+viva	Final exam+viva	Final exam+viva

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	-	3	2	-
CO2	2	1	3	3	-
CO3	2	1	3	3	1

Course Delivery Methods	
CD1	Lecture by use of Boards/LCD Projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Mini Projects/Projects
CD5	Laboratory Experiments/Teaching Aids
CD6	Industrial/Guest Lectures
CD7	Industrial Visits/In-plant Training
CD8	Self- learning such as use of NPTEL Materials and Internets
CD9	Simulation

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION SHEET

Course code	MG26512
Course title	Skill Develeopment II
Pre-requisite(s)	Skill Development I
Co-requisite	Nil
Credits	L:0 T:0 P: 4 C:2
Class schedule per week	
Class	4
Semester / Level	PG
Branch	M.Sc
Name of Teacher	

Course Objectives *This course aims to provide students with:*	
Sl No.	Objectives
1	To demonstrate the contents of various interview rounds and understand the importance of company profile while applying for a job.
2	To develop background knowledge and prerequisites for efficient operations of software.
3	Participate effectively in groups, emphasizing listening, critical and reflective thinking, and responding and developing the ability to conduct technical research and presentations.

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Acquire knowledge about various interview sessions and readiness.
CO2	Develop know-hows about domain specific industries and companies.
CO3	Understand the basics of hardware requirement and lab development.
CO4	Well-groomed candidates able to address the real-world.
CO5	Develop Contents and ability to present ideas.

Syllabus

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	PERSONALITY DEVELOPMENT AND SOCIAL BEHAVIOURS	Speaking, Reading, Writing and Presenting. Innovative Thinking in Hobbies. Linking technical subjects with innovative thinking. Developing Managerial skills- Team and Single workforce, social perception, attitudes, and stereotypes, Leadership styles and influence, Conformity, persuasion, and social norm. Professional grooming and etiquette, Workplace ethics and values, Time management and productivity, Conflict resolution and negotiation	7
2	WORKPLACE KNOWLEDGE AND CAREER ALIGNMENT	Learn about RS and GIS companies, their HR, contact Id, Scope of work. Aligning CV and Interview. CV writing. Technical skills and Knowledge. Production managers; Listening to staff complaints and demands; Listening to a talk on risk in business.	7
3	PROFESSIONAL & ACADEMIC	Technical knowledge about Software-hardware; development of laboratories, new course contents. Writing research articles (Review paper, short communication, full length paper); Exposure to emerging trends in geospatial domain, GEO AI etc.	7
4	LISTENING AND SPEAKING SESSIONS	Ideas sharing, content development in power point, Oral display. Technical Presentations. Advanced Interview Rounds.	8
5	INTERVIEW READINESS	Conducting Mock Interview with experts of various domains: HR, Technical, Finance, challenges, weaknesses. Domain specific interactions.	6

Learning Resources	
Text Books	***Reference Books***
1. Personality Development and Communication Skills. Dr. Anubhuti Dubey, Prof. Aradhna Shukla (2023). Laxmi Pub.	1. Business Communication Today" by Courtland L. Bovée and John V.Thill 2. Organizational Behavior by Stephen P. Robbins and Timothy A. Judge 3. Soft Skills: An Integrated Approach to Maximise Personality by S. Hariharan, N. Suryanarayana, and S.P. Shanmugapriya

Gaps in the Syllabus (to meet Industry/Profession requirements)
Pos met through Gaps in the Syllabus
Topics beyond syllabus/Advanced topics/Design

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***				
	Continuous Internal Assessment	60%				
	Semester End Examination	40%				
	Continuous Internal Assessment	***%Distribution***				
	2 Quizzes	30 % (2 × 15%)				
	Group Assignment I(writing review article)	20%				
	Presentation Design and Poster Making (Clarity, Visual appeal, tool usage)	10%				
	Semester End Examination					
	Presentation (fluency, confidence, voice modulation, body language), Handling Q & A	20%				
	Mock interview cum Viva	20%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Group Assig	Q2+Group Assig	Q2+Poster making	Q1+Poster making	Q1+Q2+Postermaking
	Semester End Examination	Presentation+ viva	Presentation+ viva	Presentation+ viva	Presentation+ viva	Presentation+ viva

Indirect Assessment	**Student Feedback on Faculty**
	Student Feedback on Course Outcome

CO	PO1	PO2	PO3	PO4	PO5
CO1	0	1	1	2	-
CO2	1	2	2	3	-
CO3	1	1	2	2	-
CO4	0	1	0	2	-
CO5	1	3	1	3	1

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self-learning (SL) such as use of NPTEL materials and internets
CD7	Simulation

Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**
CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3, CD5
CO3	CD1, CD2, CD3
CO4	CD1, CD2, CD3, CD5, CD6
CO5	CD1,CD2,CD6

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

Course Information Sheets

Electives

Course code	MG26515
Course title	Geoinformatics for Hydrology and Water Resources
Pre-requisite(s)	GI 501, GI 502
Co-requisite	
Credits	L: 3 T: 0 P: 0 C: 3
Class schedule per week	3
Class	M.Sc
Semester / Level	02/05 (Spring)
Branch	GEOINFORMATICS
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	Introduce students about hydrologic cycle, Precipitation, Aquifer & Aquifer coefficients, ground water movement and understand the data required for various hydrological studies.
2.	Make them understand river basin and watershed concepts, parameters and management strategies.
3	Disseminate knowledge about water resource estimation, evaluation, and modelling.

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Describe hydrologic cycle, data requirement for hydrological studies and characterise aquifers and ground water movement.
CO2	Evaluate basins and drainages to infer surface and near surface characteristics of the area.
CO3	Describe ground water regimes of India and determine water quality and ground water prospects zones with the use of satellite data.
CO4	Design suitable watershed management strategy by characterising watersheds for sustainable development of water resources including site suitability analysis for water recharge structures and reservoir sediment estimation.
CO5	Estimate and model surface runoff, flood, drought, snowmelt runoff and soil erosion.

SYLLABUS

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	BASIC CONCEPTS	Hydrologic cycle, Precipitation, Aquifers, Geological materials as aquifers and Aquifer parameters - Porosity, Specific yield, Storage coefficient. Ground water movement - Darcy's Law, Permeability, Hydraulic Conductivity, Transmissivity	7
2	GROUND-WATER EXPLORATION AND EVALUATION	Ground water regimes in India, Geophysical techniques for groundwater prospecting. Remote sensing in hydro-geomorphology and ground water prospect mapping, Remote sensing in water quality mapping and monitoring.	7
3	RIVER BASINS & WATERSHED	Classification of streams and rivers, Drainage pattern, Interlinking of river basins. Remote sensing-based site selection for river valley projects. Watershed Morphometric analysis, Watershed problems and management strategy. Ground water recharge structures and their site suitability analysis.	7
4	WATER RESOURCES MODELLING	Satellite image-based surface runoff modeling, Flood and drought- mapping and modeling, Reservoir sediment estimation, Snow and Glacier Hydrology, Snowmelt runoff modeling, Soil erosion modeling.	8
5	OPERATIONAL APPLICATIONS	Satellite data-based indices for drought, flood, snow and glaciers. Watershed delineation and characterization. Lineaments and Landform mapping. Surface water quality assessment.	6

Learning Resources	
Text Books	***Reference Books***
1. Schultz, G. A. and Engman, E. T. (2000).Remote Sensing in Hydrology and Water Management, Springer-Verlag, Berlin, Germany. 2. Murthy, J. V. S. (1994). Watershed Management in India. Wiley Eastern Ltd., New Delhi. 3. Todd David Keith (2005). Groundwater Hydrology, John Wiley & Sons, New York, Second Edition.	1. H. M. Raghunath, (2000). Hydrology-principles, Analysis, Design, New Age International, New Delhi. 2. P. Singh, Vijay P. Singh, (2000). "Snow and Glacier Hydrology". **3.** P. Singh, (2001). "Snow and Glacier Hydrology", Springer.

Gaps in the Syllabus (to meet Industry/Profession requirements)	
Pos met through Gaps in the Syllabus	
Topics beyond syllabus/Advanced topics/Design	
Pos met through Topics beyond syllabus/Advanced topics/Design	

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***				
	Continuous Internal Assessment	50%				
	Semester End Examination	50%				
	Continuous Internal Assessment	***% Distribution***				
	Best 2 Quiz marks out of 3 Quizzes of 15 marks each.	30%				
	Assignment(s)	10%				
	Seminar before a Committee	10%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Assig	Q1+Q2+Assig	Q2+Assig	Q2+Q3+Assig	Q3+Assig
	Semester End Examination	End Sem	End Sem	End Sem	End Sem	End Sem

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	3	2	-
CO2	2	-	3	3	-
CO3	2	-	3	3	-
CO4	2	1	3	2	-
CO5	3	2	3	3	1

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning (SL) such as use of NPTEL materials and internets
CD7	Simulation
Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**
CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3, CD5
CO3	CD1, CD2, CD3, CD6
CO4	CD1, CD2, CD3, CD5, CD6
CO5	CD1,CD2,CD6

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

Course Information Sheets

Elective

Course code	MG26517
Course title	GEOINFORMATICS FOR CLIMATE CHANGE AND ENVIRONMENTAL IMPACT ASSESSMENT
Pre-requisite(s)	MG26 501, MG26 502
Co-requisite	Knowledge of RS & GIS
Credits	L: 3 T: 0 P: 0 C: 3
Class schedule per week	3
Class	M.Sc
Semester / Level	02/05 (Spring)
Branch	GEOINFORMATICS
Name of Teacher	

	Course Objectives *This course aims to:*
Sl No.	Objectives
1.	Enhance student's understanding about climatic system of earth and its changes over time.
2.	Teach the fundamental concepts about global warming, climatic dependence of various ecosystems (agriculture, forest and glaciers) and associated mapping methods using remote sensing.
3.	Disseminate information about various global initiatives, environmental impact assessment methods and modelling using remote sensing and MG26S.

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Explain weather and climate, local to global climatic variations, and El Nino vs La Nino.
CO2	Analyse relationship between different ecosystems (forest, agriculture and glacier) and climatic parameters such as rainfall, temperature, etc.
CO3	Assess the impact of global warming on these systems using RS and GIS technology
CO4	Map and monitor surface water bodies, glaciers, and drought using different satellite data
CO5	Perform EIA and its report writing

SYLLABUS

Learning Resources

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	**INTRODUCTION TO WEATHER AND CLIMATE**	Fundamentals of Weather and Climate; Land breeze and Sea breeze. Weather variations and associated effects – El Nino, La Nino, and associated Southern Oscillation, Local, Regional, Continental and global weather Pattern; Drought and Flood.	7
2	**FOREST, AGRICULTURE AND CLIMATE**	Vegetation growth rhythm and climatic interaction; Carbon accounting with climate change scenario; Time-Series Satellite data; space-time dynamics; Phenology of Vegetation; Forest Fire and climate change. Weather dependence of Agriculture; Climate change impact on agriculture economy.	7
3	**SNOW, GLACIER WATER AND CLIMATE**	Surface water mapping and monitoring; snow cover mapping; snowmelt runoff forecasting; Glaciers Inventory; Glacial Mass Balance and Glacial retreat with changing climate using remote sensing with a focus on Himalaya.	7
4	**ATMOSPHERE AND GLOBAL WARMING**	Atmospheric structure and composition; Greenhouse effect and Global Warming; Role of aerosols, Aerosol retrieval from space; Climate forcing; Remote Sensing missions for weather monitoring; Intergovernmental Panel on Climate Change (IPCC), Indian National Policies on Natural resources monitoring and climate change.	7
5	**ENVIRONMENTAL IMPACT ASSESSMENT**	Scope of EIA; EIA Methods and Mitigation; EC and EIA reports; Evaluation of atmospheric dynamics, Simple climate model and its application in different scenarios to understand future climate	7

Text Books	***Reference Books***
1. ECA (Economics of Climate Adaptation),(2009). Shaping climate resilient development: a framework for decision making. ClimateWorks Foundation, Global Environment Facility, European Commission, McKinsey & Company, The Rockefeller Foundation, Standard Chartered Bank and Swiss Re. 164pp. 2. Morris, P. and Therivel, R.(2008). Methods of Environmental Impact Assessment, 2nd edition, Spon Press, London (2001 reprint). 3. Roy, P.S., Dwivedi, R.S., and Vijayan, D. (2010). Book on Remote Sensing Applications. National Remote Sensing Centre, ISRO, Hyderabad. ISBN: 9788190946001. 4. Milly, P.C.D., R.T. Wetherald, K.A. Dunne and T.L. Delworth(2002). Increasing risk of great floods in a chanMG26ng climate. Nature Vol 415: 514–517.	1. FAO (2011). Climate Change, Water and Food Security. Compiled by Hugh Turral, Jacob Burke and Jean-Marc Faures, Rome. ISBN: 9789251067956 2. FAO(2016). Planning, implementing and evaluating Climate-Smart Agriculture in Smallholder Farming Systems. Job Number 15805. Report under Mitigation of Climate Change in Agriculture (MICCA) Programme of FAO. ISBN: 978925109305. 3. IPCC (2014). IPCC Assessment Report. UNFCCC. 4. Kulkarni, A., I.M. Bahuguna, B.P. Rathore, S.K. Singh, S.S. Randhawa, R.K. Sood and S. Dhar (2007). Glacial retreat in Himalaya using Indian Remote Sensing satellite data. Current Science, Vol. 92, No. 1. 5. Lal, M., T. Nozawa, S. Emori, H. Harasawa, K. Taka, A. Abe-Ouchi, T. Nakajima, T. Takemura and A. Numaguti(2001). Future climate change: Implications for Indian summer monsoon and its variability. Current Science, Vol. 81, No. 9, 10. 6. Rees, H.G. and D.N. Collins(2006). ReMG26onal differences in response of flow in glacier-fed Himalayan rivers to climatic warming. HydroloMG26cal Processes, 20 (10). 2157–2169. 10.1002/hyp.6209. 7. Schmidhuber, J. and F. Tubiello(2007). Global food security under climate change. PNAS 104 (50) 19703–19708. 8. Thenkabail, P.S., J.G. Lyon, H. Turral and C. Biradar(2009). Remote Sensing of Croplands for Food Security. 476p. CRC Press. Taylor and Francis, New York. ISBN 978-1-4200-9009-3. 9. World Bank(2010). Economics of Adaptation to Climate Change: Synthesis Report. Washington DC. 100pp. 10. World Bank. (2009). Water and Climate Change: Impacts on groundwater resources and adaptation options. Water Unit Energy, Transport, and Water Department. Washington DC. 98pp.

Gaps in the Syllabus (to meet Industry/Profession requirements)	
Pos met through Gaps in the Syllabus	
Topics beyond syllabus/Advanced topics/Design	Modern UAV Dynamics & Edge Computing, Cloud-Native Geospatial Processing
Pos met through Topics beyond syllabus/Advanced topics/Design	

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***				
	Continuous Internal Assessment	50%				
	Semester End Examination	50%				
	Continuous Internal Assessment	***% Distribution***				
	Best 2 Quiz marks out of 3 Quizzes of 15 marks each.	30%				
	Assignment(s)	10%				
	Seminar before a Committee	10%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Assig	Q1+Q2+Assig	Q2+Assig	Q2+Q3+Assig	Q3+Assig
	Semester End Examination	End Sem	End Sem	End Sem	End Sem	End Sem

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	1	2	3	-
CO2	2	-	2	3	-
CO3	2	-	2	3	-
CO4	2	1	1	2	-
CO5	2	1	1	2	2

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning (SL) such as use of NPTEL materials and internets
CD7	Simulation
Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**
CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3, CD5
CO3	CD1, CD2, CD3
CO4	CD1, CD2, CD3, CD5, CD6

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION
SEMESTER – III
Course Information Sheets

Course code	MG26601
Course title	Project (Part - I)
Pre-requisite(s)	Completion of all Labs of 1st and 2nd semester
Co-requisite	
Credits	L: 0 T: 0 P: 0 C: 6
Class schedule per week	-
Class	M.Sc
Semester / Level	03/06
Branch	Geoinformatics
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	Carry out independent research project addressing real life Geospatial problems with sound scientific framework
2.	Prepare spatial maps from satellite data and other sources utilising various Geoinformatics techniques and produce research report with acceptable quality and ethics, and communicate results to stakeholders.

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Collect and summarise relevant existing literatures related to the problem in hand.
CO2	Identify Research Gaps, Develop appropriate research questions and Objectives in relation to their domain of research.
CO3	Design Research Methodology and Create coherent geospatial database and other relevant data for each objective.
CO4	Apply Geoinformatics tools and techniques to evaluate the appropriateness of results in relation to objectives and research questions.
CO5	Integrate and synthesis all results and write a scientifically sound academic report with appropriate referencing and communicate research findings to stakeholders.

COURSE INFORMATION SHEET

Course code	MG26603
Course title	AERIAL & SATELLITE BASED PHOTOGRAMMETRY AND GEO-AI MODELLING
Pre-requisite(s)	Basic concept of PRS and GIS
Co-requisite	Knowledge of programming
Credits	L: T: P: C: 3 1 0 4
Class schedule per week	4
Class	M.Sc
Semester / Level	03/06
Branch	Geoinformatics
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	Learn fundamental aspects of Aerial Photogrammetry (analogue and digital based approaches in photogrammetry)
2.	Understand the recent developments and role of satellites in terrain modelling and mapping.
3.	Develop concepts in integrating AI in Geospatial platform

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Understand the historic developments in the field of Photogrammetry and Make planimetric measurements (both manually and digitally)
CO2	Handle Stereoscopes, anaglyph glasses and digital workstations for Photogrammetric purposes.
CO3	Discuss flight planning requirements, Advantages and limitations
CO4	Understand concept of GeoAI
CO5	Understand and make use of different Gen AI techniques in Geospatial platform.

Syllabus

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	FUNDAMENTALS, FLIGHT PLANNING & IMAGE GEOMETRY	Introduction & Planning: Flight planning fundamentals, Scale, End Lap & Side Lap, Ground coverage, Flying height., Visual Interpretation: Elements of visual photo interpretation, Mapping terrain elements (land use/cover, drainage)., Geometric Characteristics: Projection types, Tilt, Swing, Scale variations, Image displacement due to relief and lens distortion., Photographs Types: Vertical vs. Tilted photographs.	6
2	PHOTOGRAMMETRIC MEASUREMENTS & TRIANGULATION	Parallax & Relief: Parallax equations, Stereoscopic depth perception, Overlaps, Floating marks, Parallax bar measurements, Contouring from stereometric heights., Analytical Formulations: Coordinate systems, Air base components, Interior and Exterior orientation, Coordinate transformation., Derivations & Triangulation: Numerical derivations for height based on relief displacement, Epi-polar geometry, Aero-triangulation (Semi-analytical, Analytical, and Bundle adjustment with GNSS).	8
3	DIGITAL PHOTOGRAMMETRY, UAVS & TERRAIN MODELING	Digital Processing: Analogue-to-Digital conversion, Image matching, Feature extraction (points, lines, regions), Ground Control Points (GCPs), Ortho-rectification & Ortho-photographs., Terrain Modeling: Digital Terrain Model (DTM) derivation from satellite images, Quality checks.	7
4	GEOSTATISTICS AND FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE (AI)	Kriging (Ordinary/Universal), Thiessen Polygons, IDW, Regression, Kriging and Spatial Autocorrelation; Introduction to AI, History and evolution of AI in Geoinformatics, Key concepts and terminology, AI Techniques and Algorithms: Random Forest, Support Vector Machines (SVM), and K-Means clustering;	8
5	INTEGRATING AI IN GEOSPATIAL MODELLING	Data Structures: Handling Raster (imagery, grids) and Vector (points, lines, polygons) data in an AI pipeline, Geospatial Data Preparation for AI: Tiling/chipping large satellite imagery into ML-ready formats (e.g., 256 X 256pixels);	6

Learning Resources	
Text Books	***Reference Books***
Wolf, P.R. (2000). Elements of Photogrammetry with Applications in MG26S, McGraw Hill Ins, Singapore.	Panday, S. N. (1987). Principles and Application of Photogeology, Parentice Hall Inc.
Rampal, K.K. (2004). Textbook of Photogrammetry, John-Wiley & Sons.	Ray, R. (2012). An Introduction to photogrammetry, MITRAM publications, Kolkata.ISBN:978-93-80036-41-0.
Moffit, F.M. (1980). Photogrammetry, International Text Book Co.	Handbook of Geospatial Artificial Intelligence * Editors: Song Gao, Yingjie Hu, and Wenwen Li, CRC Press (Published late December 2023)
McGlone J.C. (editor) (2013). Manual of Photogrammetry. 6th edition. American Society for Photogrammetry and Remote Sensing.	Kluwer Fotheringham A S, O'Kelly M E. (1998).Spatial Interaction Models: Formulations and Applications.
Drury, S.A. (2004). "Image Interpretation in Geology, Publisher: - Chapman and Hall, London, UK.	Burt James E., Barber Gerald M., Rigby David L. (2009). Elementary statistics for Geographers.3rd ed., New York: Guilford Press.

Gaps in the Syllabus (to meet Industry/Profession requirements)	
Pos met through Gaps in the Syllabus	
Topics beyond syllabus/Advanced topics/Design	Modern UAV Dynamics & Edge Computing, Cloud-Native Geospatial Processing
Pos met through Topics beyond syllabus/Advanced topics/Design	

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***				
	Continuous Internal Assessment	50%				
	Semester End Examination	50%				
	Continuous Internal Assessment	***% Distribution***				
	Best 2 Quiz marks out of 3 Quizzes of 15 marks each.	30%				
	Assignment(s)	10%				
	Seminar before a Committee	10%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Assig	Q1+Q2+Assig	Q2+Assig	Q2+Q3+Assig	Q3+Assig
	Semester End Examination	End Sem	End Sem	End Sem	End Sem	End Sem

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	1	2	2	-
CO2	2	-	2	3	-
CO3	2	-	2	3	-
CO4	2	-	2	3	
CO5	1	1	2	3	2

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning (SL) such as use of NPTEL materials and internets
CD7	Simulation

Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**
CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3, CD5
CO3	CD1, CD2, CD3
CO4	CD1, CD2, CD3, CD5, CD6

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION SHEET

Course code	MG26602
Course title	AERIAL & SATELLITE BASED PHOTOGRAMMETRY AND GEO-AI MODELLING LABORATORY
Pre-requisite(s)	Basic concept of PRS and GIS
Co-requisite	Knowledge of programming
Credits	**L: 0 T: 0 P: 4 C: 2**
Class schedule per week	4
Class	M.Sc
Semester / Level	03/06
Branch	Geoinformatics
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	To master stereoscopic vision and digital photogrammetry principles for extracting precise 3D terrain metrics, heights
2.	To apply graph theory (Dijkstra's) and advanced geostatistical interpolation methods (IDW, Kriging) to model network routing and predict continuous spatial surfaces.
3.	To integrate AI workflows and Machine Learning models for advanced spatial downscaling

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Interpret Aerial photos with stereoscopic vision for delineating various landforms and landcover features.
CO2	Use photogrammetric techniques and tools under Digital Environment so as to create digital surface models, and extract point, line and polygon features and their position, height, area and volume.
CO3	Understand and make use of different Gen AI techniques in Geospatial platform.

Syllabus

Lab No.	Integrated Syllabus Concepts & Objectives
Lab 1	Introduction to stereoscopic vision and 3D depth perception mechanics.
Lab 2	Advanced 3D viewing using mirror optics and calculating relief displacement, absolute distance, and feature heights
Lab 3	Delineating landforms and landcover using grayscale and colour signatures for enhanced landcover feature extraction.
Lab 4	Calculating differential parallax to generate basic manual contour profiles
Lab 5	Setting up a digital stereoscopic workspace and mathematical alignment of digital imagery using camera calibration and Ground Control Points (GCPs)
Lab 6	Extracting 3D coordinates, point positions, heights, areas, and volumes
Lab 7	AI Fundamentals: Data cleaning and handling missing data
Lab 8	Extraction of route networks by running Dijkstra's Algorithm
Lab 9	Geostatistics: IDW, and Thiessen Polygons
Lab 10	Geostatistics: Running Kriging (Ordinary/Universal)
Lab 11	AI based Spatial downscaling using Lab 9/11 outputs.
Lab 12	Decision Models & Bias: AHP (Analytical Hierarchy Process)
Lab 13	Deploying ML models for Urban Planning/Disaster Management

Learning Resources
Reference Books
1. Kluwer Fotheringham A S, O'Kelly M E. (1998). Spatial Interaction Models: Formulations and Applications.
2. Paul Longley, Michael Goodchild, David Maguire and David Rhind (2005). Geographical Information Systems. Principles, Techniques, Applications and Management. John Wiley & Sons.
3. Burt James E., Barber Gerald M., Rigby David L. (2009). Elementary statistics for Geographers.3rd ed., New York: Guilford Press.

Gaps in the Syllabus (to meet Industry/Profession requirements)	
Pos met through Gaps in the Syllabus	
Topics beyond syllabus/Advanced topics/Design	
Pos met through Topics beyond syllabus/Advanced topics/Design	

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***		
	Continuous Internal Assessment	60%		
	Semester End Examination	40%		
	Continuous Internal Assessment	***% Distribution***		
	2 Quizzes	20 % (2 × 10%)		
	Day to Day Performance & Lab File	30%		
	Viva	20%		
	Final Exam	30%		
	Assessment Components	***CO1***	***CO2***	***CO3***
	Continuous Internal Assessment	Q1+Lab file	Q1+Lab file	Q1+Lab file
	Semester End Examination	Final exam+viva	Final exam+viva	Final exam+viva

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	-	2	1	-
CO2	2	1	1	2	-
CO3	2	1	3	3	1

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning (SL) such as use of NPTEL materials and internets
CD7	Simulation
Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**
CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3, CD5
CO3	CD1, CD2, CD3
CO4	CD1, CD2, CD3, CD5, CD6

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

Elective: II
COURSE INFORMATION SHEET

Course code	MG26605
Course title	GEOINFORMATICS FOR NATURAL RESOURCE MANAGEMENT
Pre-requisite(s)	
Co-requisite	Knowledge of RS & MG26S\
Credits	L: 3 T: 1 P: 0 C: 3
Class schedule per week	4
Class	M.Sc
Semester / Level	03/06
Branch	Geoinformatics
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	Introduce students about ecological, economic and social dimension of natural resource and importance of its sustainable management.
2.	Make them understand various policies, ethics and geo-spatial techniques involved in natural resources management.

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Explain concepts related to different types of natural resources
CO2	Understand the policies and ethics regarding conservation practices
CO3	Make use of the scientific method of sustainable resources management
CO4	Apply Geospatial Techniques for better management of natural resources
CO5	Understand use of Renewable Energy Sources

Syllabus

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	INTRODUCTION	Fundamentals of Natural resources, Classification of Natural resources: Abiotic and biotic resources, Ecological, social and economic dimension of resource management, Sustainable utilization of the natural resources	7
2	NATURAL RESOURCES PLANNING & MANAGEMENT	Approaches in Resource Management**:** Ecological approach; economic approach; ethnological approach; Geoinformatics approach, Ecological principles, policies, and ethics regarding conservation practices, The Scientific Method and Adaptive Management, Management of Common International Resources	7
3	LAND AND WETLAND MANAGEMENT	Land use: Classification, planning and desertification, Wetland: A brief Introduction, Classification of Wetland, Over-utilization of surface and ground water, drought, conflicts over water, dams-benefits and problems. Water ecology and management, Impact of climate change on land and wetland, Fish and other marine resources: Production, status, dependence on fish resource, unsustainable harvesting, issues and challenges for resource supply, Solid waste Management, Waste water management.	7
4	FOREST MANAGEMENT AND WILDLIFE CONSERVATION	Forest: Present status, distribution and its contribution as natural resource, Over-exploitation: deforestation and its societal impact, Forest products. Developing and developed world strategies for forestry, Environmental Impact Assessment.	7
5	MANAGEMENT OF OIL & MINERAL RESOURCES	Petroleum Product and minerals: A brief introduction, Renewable Energy Sources, Use and exploitation, Environmental effects of extracting and using mineral resources, Case studies.	7

Learning Resources	
Text Books	***Reference Books***
1) Michael J. Conroy, James T. Peterson,(2013).Decision Making in Natural Resource Management: A Structured, Adaptive Approach. John Wiley & Sons. 2) Moulton, M.P. and J. Sanderson(1999). Wildlife issues in a changing world. Lewis Publishers, Boca Raton, Florida, 500 pp. 3) Francois Ramade (1984). Ecology of Natural Resources. John Wiley & Sons Ltd.	1) P. K. Joshi(2009).Geoinformatics for Natural Resource Management .Nova Science Publishers 2) Mann, K.H. (2000). Coastal Ecology & Management, Ecology of Coastal Waters with Implications for Management (2nd Edition).Chap. 2-5, pp.18-78 & Chap. 16, pp.280-303. 3) Harikesh N. Mishra(2014). Managing Natural Resources- Focus on Land and Water. PHI Lerning Publication. 4) 4.Vitousek, P.M.(1994). Global Change and Natural Resource Management, Beyond global warming: Ecology and global change. Ecology 75, 1861-1876.

Gaps in the Syllabus (to meet Industry/Profession requirements)	
Pos met through Gaps in the Syllabus	
Topics beyond syllabus/Advanced topics/Design	
Pos met through Topics beyond syllabus/Advanced topics/Design	

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***				
	Continuous Internal Assessment	50%				
	Semester End Examination	50%				
	Continuous Internal Assessment	***% Distribution***				
	Best 2 Quiz marks out of 3 Quizzes of 15 marks each.	30%				
	Assignment(s)	10%				
	Seminar before a Committee	10%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Assig	Q1+Q2+Assig	Q2+Assig	Q2+Q3+Assig	Q3+Assig
	Semester End Examination	End Sem	End Sem	End Sem	End Sem	End Sem

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	-	3	2	-
CO2	2	1	1	1	-
CO3	2	-	3	3	-
CO4	2	1	3	2	1

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning (SL) such as use of NPTEL materials and internets
CD7	Simulation
Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**
CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3
CO3	CD1, CD2, CD3
CO4	CD1, CD2, CD3, CD5, CD6

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION SHEET

Course code	MG26604
Course title	GEOINFORMATICS FOR NATURAL RESOURCE MANAGEMENT LABORATORY
Pre-requisite(s)	Knowledge of natural disasters
Co-requisite	Knowledge of RS & GIS\
Credits	L: T: P: C: 0 0 4 2
Class schedule per week	4
Class	M.Sc
Semester / Level	03/06
Branch	Geoinformatics
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	To apply satellite image interpretation, classification, indices, LST extraction, and haze removal techniques
2.	To perform feature extraction and site suitability analysis for forests, water bodies, fishing zones, solar/wind energy, forest fire, and urban waste management

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Visually and Digitally differentiate various agriculture and forestry features from satellite data.
CO2	Use various remote sensing and GIS tools for extracting land cover, land capability, degradation, waterlogging, and model acreage, lifezones and fire risk.
CO3	Execute spatial models related to landscape metrics, biodiversity, wild life habitat suitability, and environmental problems.

List of Laboratories

Sl.No.	Name of the Laboratories
Lab 1	Image Interpretation of Standard FCC on screen and on photograph
Lab 2	Classification of Satellite Images- Revision
Lab 3	Use of INDICES
Lab 4	Extraction of Land Surface Temperature from satellite data
Lab 5	Site Suitability for Forest Fire Zones
Lab 6	Extraction of Water Bodies
Lab 7	Extraction of Forested area
Lab 8	Site suitable for Fishing Zones
Lab 9	Site Suitability for Solid waste and Waste water for an upcoming urbanization
Lab 10	Identification of forest cover types in a satellite image
Lab11	Creation of Solar atlas for a given area
Lab 12	Removal of Haze from industrial townships in satellite imagery
Lab13	Site suitability analysis of wind mills

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***		
	Continuous Internal Assessment	60%		
	Semester End Examination	40%		
	Continuous Internal Assessment	***% Distribution***		
	2 Quizzes	20 % (2 × 10%)		
	Day to Day Performance & Lab File	30%		
	Viva	20%		
	Final Exam	30%		
	Assessment Components	***CO1***	***CO2***	***CO3***
	Continuous Internal Assessment	Q1+Lab file	Q1+Lab file	Q1+Lab file
	Semester End Examination	Final exam+viva	Final exam+viva	Final exam+viva

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	-	2	3	-
CO2	2	1	2	3	-
CO3	1	1	2	3	1

Course Delivery Methods	
CD1	Lecture by use of Boards/LCD Projectors
CD2	Tutorials/Assignments
CD3	Seminars
CD4	Mini Projects/Projects
CD5	Laboratory Experiments/Teaching Aids
CD6	Industrial/Guest Lectures
CD7	Industrial Visits/In-plant Training
CD8	Self- learning such as use of NPTEL Materials and Internets
CD9	Simulation

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION SHEET

Course code	MG26607
Course title	GEOINFORMATICS IN DISASTER MANAGEMENT ELECTIVE II
Pre-requisite(s)	Knowledge of natural disasters
Co-requisite	Knowledge of RS & GIS
Credits	L: T: P: C: 3 1 0 3
Class schedule per week	3
Class	M.Sc
Semester / Level	03/06
Branch	Geoinformatics
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	Impart basic concepts of disaster, its causes and its historial background
2.	Enhance student's knowledge about disaster management planning
3.	Make the students learn Geoinformatics approaches to deal with disaster risk reduction and management.

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Explain various types of disasters and responsible factors.
CO2	Interpret and discriminatedifferent stages of disaster management planning and utility of geoinformaticstools in every stage.
CO3	Understand administrative structure of disaster management in India.
CO4	Understand ethical values and humanitarian values.
CO5	Apply integrated geospatial techniques in disaster management and disaster risk reduction.

Syllabus

Module No.	***Module name***	***Detailed Contents***	***No. of Lecture***
1	INTRODUCTION	Fundamental concepts of hazards and disasters, their types, and characterization, Zonation of hazards, natural and human induced disasters, Disaster and National losses, historical perspective of disasters in India.	7
2	DISASTER MANAGEMENT	Fundamental concept of Disaster Management, Government, NGOs and peoples participation disaster management, Existing organizational structure for managing disasters in India, Geoinformatics in disaster mitigation.	7
3	GEOLOGICAL HAZARDS	Landslide, Earthquake, Mining hazards (Land subsidence, Mine flooding etc.), Volcanic hazards, Groundwater hazards, Glacial hazards, Geoinformatics in Geological Hazards.	7
4	HYDRO METEOROLOGICAL AND ENVIRONMENTAL HAZARDS	Flash floods, River floods, Dam burst, Cloud burst, Cyclones, Coastal hazards and Drought, Forest hazards (Deforestation, Degradation and Forest fire), Land & soil degradation, Desertification, Pollution (Water, air and soil), Geoinformatics in Hydro Meteorological and Environmental Hazards	7
5	CASE STUDIES	Earthquakes in India, Floods in Indo Gangetic plains, Landslides in Himalayan region, Drought in Indian plateau regions	7

Learning Resources	
Text Books	***Reference Books***
1) Roy, P.S. (2000). Natural Disaster and their mitigation. Published by Indian Institute of Remote Sensing (IIRS). 2) Skidmore A. (2002) Environmental Modeling with GIS & Remote Sensing, Taylor & Francis.	1. Anji Reddy, M. (2004). Geoinformatics for environmental Management. B. S. Publication. 2. Parag Diwan(2010). A MANUAL ON DISASTER MANAGEMENT. Pentagon Press ISBN: 10: 8182744385 / 13: 978-8182744387 3. Joshi, P. K.(2009). Geoinformatics for Natural Resource Management Nova Science Publishers

Gaps in the Syllabus (to meet Industry/Profession requirements)	
Pos met through Gaps in the Syllabus	
Topics beyond syllabus/Advanced topics/Design	
Pos met through Topics beyond syllabus/Advanced topics/Design	

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***				
	Continuous Internal Assessment	50%				
	Semester End Examination	50%				
	Continuous Internal Assessment	***% Distribution***				
	Best 2 Quiz marks out of 3 Quizzes of 15 marks each.	30%				
	Assignment(s)	10%				
	Seminar before a Committee	10%				
	Assessment Components	***CO1***	***CO2***	***CO3***	***CO4***	***CO5***
	Continuous Internal Assessment	Q1+Assig	Q1+Q2+Assig	Q2+Assig	Q2+Q3+Assig	Q3+Assig
	Semester End Examination	End Sem	End Sem	End Sem	End Sem	End Sem

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	1	3	2	
CO2	2	1	3	2	
CO3	2	2	3	2	1
CO4	1	1	1	1	3
CO5	3	2	3	3	2

Course Delivery Methods	
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning (SL) such as use of NPTEL materials and internets
CD7	Simulation

Mapping Between Course Outcomes and Course Delivery Method	
Course Outcomes	**Course Delivery Method**
CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3
CO3	CD1, CD2, CD3
CO4	CD1, CD2, CD3, CD5, CD6

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION SHEET

Course code	MG26606
Course title	GEOINFORMATICS IN DISASTER MANAGEMENT ELECTIVE – II Laboratory
Pre-requisite(s)	Knowledge of natural disasters
Co-requisite	Knowledge of RS & MG26S\
Credits	L: T: P: C: 0 0 4 2
Class schedule per week	4
Class	M.Sc
Semester / Level	03/06
Branch	Geoinformatics
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	To develop skills in satellite data downloading, display, field spectra collection, and reflectance comparison.
2.	To analyze spectral, thermal, and microwave satellite data for land surface feature discrimination and extraction

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Explain various types of disasters and responsible factors.
CO2	Interpret and discriminate different stages of disaster management planning and utility of geoinformatics stools in every stage.
CO3	Understand administrative structure of disaster management in India, the ethical values and humanitarian values.

List of Laboratories

Sl.No.	Name of the Laboratories
Lab 1	Overview of "Bhuvan" Geoportal of ISRO for disaster services
Lab 2	Estimation of flood inundated area using pre and post flood satellite image and its comparison with dataset provided by "Bhuvan"
Lab 3	Identification of coal-mine fire with the help of LST derived from satellite image
Lab 4	Identification of disaster prone areas in a satellite image w.r.t.Earthquake
Lab 5,6	Identification of regions prone to meteorological drought by downloading and analyzing rainfall data and generating drought indices
Lab 7	Identification of disaster prone areas in a satellite image w.r.t. Forest fires and its comparison with dataset provided by "Bhuvan"
Lab 8	Mapping of areas prone to road accidents
Lab 9	Performing water quality analysis for different parameters to test its suitability for drinking purposes
Lab 10,11	Performing air quality analysis by calculating AQI using CPCB dataset
Lab 12	Analysing lightning disaster by using satellite data and meteorological data
Lab 13	Prepare list of Do's and Dont's for at least three natural disaster and prepare the administrative hierarchy of disaster management of home district

Course Outcome (Co) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment	***Assessment Tool***	***% Contribution during CO Assessment***		
	Continuous Internal Assessment	60%		
	Semester End Examination	40%		
	Continuous Internal Assessment	***% Distribution***		
	2 Quizzes	20 % (2 × 10%)		
	Day to Day Performance & Lab File	30%		
	Viva	20%		
	Final Exam	30%		
	Assessment Components	***CO1***	***CO2***	***CO3***
	Continuous Internal Assessment	Q1+Lab file	Q1+Lab file	Q1+Lab file
	Semester End Examination	Final exam+viva	Final exam+viva	Final exam+viva

Indirect Assessment	Student Feedback on Course Outcome

Mapping Between Course Outcomes and Program Outcomes					
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	1	3	2	-
CO2	2	1	3	2	-
CO3	2	2	3	2	1
Course Delivery Methods					
CD1	Lecture by use of Boards/LCD Projectors				
CD2	Tutorials/Assignments				
CD3	Seminars				
CD4	Mini Projects/Projects				
CD5	Laboratory Experiments/Teaching Aids				
CD6	Industrial/Guest Lectures				
CD7	Industrial Visits/In-plant Training				
CD8	Self- learning such as use of NPTEL Materials and Internets				
CD9	Simulation				

Course Designers		
Experts from Industry	***Experts from Higher Technical Institutions***	***Internal Experts***

COURSE INFORMATION SHEETS

Course code	MG26609
Course title	Project (Part - II)
Pre-requisite(s)	Completion of all Labs of 1st and 2nd semester
Co-requisite	
Credits	L: T: P: C: 0 0 0 20
Class schedule per week	-
Class	M.Sc
Semester / Level	04/06
Branch	Geoinformatics
Name of Teacher	

Course Objectives *This course aims to:*	
Sl No.	Objectives
1.	Carry out independent research project addressing real life Geospatial problems with sound scientific framework
2.	Prepare spatial maps from satellite data and other sources utilising various Geoinformatics techniques and produce research reports with acceptable quality and ethics and communicate results to stakeholders.

Course Outcomes (COs) *Upon successful completion of the course, students will be able to*	
CO	Course Outcomes
CO1	Collect and summaries relevant existing literature related to the problem in hand.
CO2	Identify Research Gaps, Develop appropriate research questions and Objectives in relation to their domain of research.
CO3	Design Research Methodology and Create coherent geospatial databases and other relevant data for each objective.
CO4	Apply Geoinformatics tools and techniques to evaluate the appropriateness of results in relation to objectives and research questions.
CO5	Integrate and synthesis all results and write a scientifically sound academic report with appropriate referencing and communicate research findings of stakeholders.