Maulana Azad National Institute of Technology, Bhopal – 462003
Civil Engineering Department

M Tech in Geoinformatics and its applications
SCHEME OF STUDY (wef July 2021)

First Semester:

Course No.	Subject	Scheme of studies periods per week			Total Credits
		L	T	P	
MTH 514	Advanced Mathematics	3	-	-	3
GI 511	Basic Concepts of Mapping Cartography	3	-	-	3
GI 512	Basics of Remote Sensing Technology	3	-	-	3
GI 513	Geodesy and GNSS based Mapping	3	-	-	3
HUM 511	Communication Skills	2	-	-	2
	Elective-1 (A)	3	-	-	3
	Elective-2 (B)	3	-	-	3
GI 514	Lab-1	-	-	2	1
GI 515	Seminar-1	-	-	2	1
Total Hours: 24 Total Credits: 22		Total Semester Credits			22

Second Semester:

Course No.	Subject	Scheme of studies periods per week			Total Credits
		L	T	P	
GI 521	Basic Concepts of GIS	3	-	-	3
GI 522	Digital Processing of Remotely Sensed Data	3	-	-	3
GI 523	Basic Concepts Photogrammetry	3	-	-	3
	Elective-3 (A)	3	-	-	3
	Elective-4 (A)	3	-	-	3
	Elective-5 (C)	3	-	-	3
MTH 524	Research Methodology	1	1	-	2
GI 525	Lab-2	-	-	2	1
GI 526	Seminar-2	-	-	2	1
Total hours: 24 Total Credits: 44		Total Semester Credits			22

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Third Semester:

Course No.	Subject	Scheme of studies periods per week			Total Credits
		L	T	P	
GI 611	Dissertation Phase - I	-	-	32	16
Total hours: 32 Total Credits: 60		Total Semester Credits			16

Fourth Semester:

Course No.	Subject	Scheme of studies periods per week			Total Credits
		L	T	P	
GI 621	Dissertation Phase - II	-	-	40	20
Total hours: 40 Total Credits: 80		Total Semester Credits			20

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List of Program Electives A		List of Open Electives C	
GI 551	Basic concepts and Applications of Microwave Remote Sensing	ARP - 581	Introduction to Urban Planning
GI 552	Remote Sensing and GIS applications in Earth Sciences and Geotechnical Engg.	HUM – 581	Intellectual Property Rights for Engineers
GI 553	Remote sensing and GIS for applications in agriculture & forestry	HUM – 582	Applied Psychology: Human Centered Design and Engineering
GI 554	Air Borne Laser Terrain Mapping	CHE – 581	Analytical Techniques
GI 555	Hyper spectral Remote Sensing	CHE – 582	Green Technology & Processes
GI 556	Remote sensing and GIS for Hydrology and Water Resources	CSE – 581	Machine Learning
GI 557	Remote sensing and GIS applications in Environmental Engineering	CSE – 582	Advanced Data Structures and Algorithms
GI 558	Geo informatics in urban development and planning	PHY – 581	Nanotechnology and Nanoscience
GI 559	Remote sensing and GIS applications in Disaster Mitigation and Management	EE – 581	Electric Machines & Applications
GI 560	Change detection using remote sensing	EE – 582	Control and Instrumentation
GI 561	Digital Photogrammetry	ECE – 581	Introduction to Fuzzy Logic
GI 562	Advanced Soft Computing Techniques	ECE – 582	Neural Networks and its Applications
GI 563	Concepts of Database Systems	EC - 581	Energy Resource Technologies
GI 564	Geo informatics Applications in Engineering Projects and Utility Management	BSE – 581	Bioprocess Engineering
	List of Departmental Electives B	BSE – 582	Biophysics Tools and Techniques
EN 512	Air and Noise Pollution	MTH – 581	Advanced Operations Research
EN 560	Global Warming and Climate Change	MTH – 582	Computing Technologies
GE 511	Advanced Geotechnical Engineering	ME – 581	Value Engineering
GE 512	Advanced Foundation Engineering	ME – 582	Design Thinking
GE 513	Soil Dynamics	ME - 583	Mechatronics and NDT in Engineering
GE 558	Earthquake Engineering	MME – 581	Advanced Instrumentation Methods for Material Analysis
HY 513	Hydro Power Potential Assessment	MME – 582	Smart Materials and their Application
HY 558	Design and Analysis of Piping Systems	MBA-581	Engineering Startup Management
ST 514	Advanced Design of Structures		
ST 559	Soft Computing		
TR 512	Traffic Engineering and Management		
TR 513	Transport Planning		
TR 552	Transport System Analysis		
WR 511	Computational Techniques in Water Resources		
WR 513	Irrigation Management for Sustainable Development		

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-I**	**Year-2020-21**
Name of Course	BASIC CONCEPTS OF MAPPING AND CARTOGRAPHY		
Course Code	GI511		
Core / Elective / Other	Core		
Prerequisite:			
1.	There is no prerequisite for learning this course		
Course Outcomes:			
1.	Basic Understanding on the fundamental concepts related to Mapping and cartography.		
2.	Knowledge on the working principle of conventional and modern surveying instrumentation.		
3.	Learning on the methodology for the preparation of Map/Plan after collecting field survey data for various applications		
Description of Contents in brief:			
1.	Introduction to Cartography: Nature and scope, significance of mapping in a digital age. Categories & characteristics of maps, study of different types of maps, basics of map scales, component of map, conventional mapping verses digital mapping. Survey of India national series maps, interpretation of topographic maps, indexing and numbering of topographical maps.		
2.	Basic concepts of Mapping: Definition, principle, and terminology related to surveying. Classifications of surveying based on measurement approaches, applications, and other criteria. Basic concepts related to precision, accuracy, and errors applicable in Surveying measurements and map preparation.		
3.	Measurements in Surveying: Linear and angular measurements and their types such as horizontal and slope distances, bearing, azimuth, elevation, and depression angles. Basic understanding on the errors and their rectification in the linear and angular measurements of surveying data using different instruments. Base line corrections, traverse survey, and its error adjustments Tacheometry terminology, principle, and methods.		
4.	Instrumentation in Surveying: Brief introduction to conventional surveying instruments like chain, tape, compass, Vernier theodolite and plane table along with their working principle such as chain triangulation, traversing, intersection and resection solutions, local attractions in ground measurements. Understanding on the working principle, components and use of different surveying instruments such as digital theodolite, total station, auto level, digital level, laser level, Smart		

	Stations, 3D scanners etc.
5.	Leveling and contouring: Basic terminology used in leveling like level plane, level surface, datum, benchmark, GTS etc. concepts. Different types of leveling such as profile leveling reciprocal leveling etc. used for the engineering projects. Indirect leveling. Cross-section and contour mapping for various applications such as Highway, Railways, Route Surveying, Canal, Reservoir etc. Contour survey methods, contour characteristics, terminology, and applications. Computations for area and volume.
6.	Fundamentals of Cartographic Design: Colour, pattern, lettering, compilation, border information, aesthetics, Symbolization, dot, isopleth and choropleth mapping, map production, methods of map printing.
List of Text Books:	
1.	Surveying and Leveling-Part-I & II, T. P. Kanetkar and S. V. Kulkarni, Pune Vidhyarthi Griha Prakashan
2.	Plane Surveying, A. M. Chandra., New Age International Publishers, New Delhi
3.	Schaum's Outline of Introductory Surveying
List of Reference Books:	
1.	Engineering Surveying: Theory and Examination Problems for Students, W. Schofield. Butterworth-Heinemann
2.	Introduction to Surveying, Michael Minchin, Department of Training, Government of Western Australia
3.	Surveying Principles and Application, B.F. Kavanagh and S.J.G. Bird, Prentice Hall
URLs:	
1.	https://nptel.ac.in/courses/105/107/105107122/
2.	https://nptel.ac.in/courses/105/104/105104101/
3.	https://nptel.ac.in/courses/105/104/105104100/

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1 & 2	Introduction to Cartography: Nature and scope, significance of mapping in a digital age. Categories & characteristics of maps,
3	study of different types of maps,
4	basics of map scales, component of map,
5	conventional mapping verses digital mapping
6	Survey of India national series maps
7	interpretation of topographic maps, indexing and numbering of topographical maps
8& 9	Basic concepts of Mapping: Definition, principle, and terminology related to surveying
10	Classifications of surveying based on measurement approaches, applications, and other criteria.

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11&12	Basic concepts related to precision, accuracy, and errors applicable in Surveying measurements and map preparation.
13 & 14	Measurements in Surveying: Linear and angular measurements and their types such as horizontal and slope distances, bearing, azimuth, elevation, and depression angles.
15& 16	Basic understanding on the errors and their rectification in the linear and angular measurements of surveying data using different instruments.
17	Base line corrections
18 & 19	traverse survey, and its error adjustments
20&21	Tacheometry terminology, principle, and methods.
22 & 23	Instrumentation in Surveying: Brief introduction to conventional surveying instruments like chain, tape, compass,
24 & 25	Vernier theodolite and plane table along with their working principle such as chain triangulation, traversing, intersection and resection solutions, local attractions in ground measurements.
26 to 28	Understanding on the working principle, components and use of different surveying instruments such as digital theodolite, total station, auto level, digital level, laser level, Smart Stations, 3D scanners etc.
29 & 30	Leveling and contouring: Basic terminology used in leveling like level plane, level surface, datum, benchmark, GTS etc. concepts.
31&32	Different types of leveling such as profile leveling reciprocal leveling etc. used for the engineering projects.
33	Indirect leveling
34 & 35	Cross-section and contour mapping for various applications such as Highway, Railways, Route Surveying, Canal, Reservoir etc.
36 & 37	Contour survey methods, contour characteristics, terminology, and applications.
38 & 39	Computations for area and volume.
40	Fundamentals of Cartographic Design: Colour, pattern, lettering, compilation, border information, aesthetics,
41	Symbolization, dot, isopleth and choropleth mapping,
42	map production, methods of map printing.

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-I**	**Year-2020-21**
Name of Course	BASICS OF REMOTE SENSING TECHNOLOGY		
Course Code	GI 512		
Core / Elective / Other	Core		
Prerequisite:			
1.	No prerequisite, but basic understanding of computer use		
Course Outcomes:			
1.	Knowledge on the basic principle, techniques, and types of remote sensing technology.		
2.	Learning on the analysis of remotely sensed digital data using commercial and open source software and data resources.		
3.	Skill development for evolving methodology to use Remote Sensing techniques for various applications in engineering.		
Description of Contents in brief:			
1.	Remote Sensing Technology: Basic Concepts, principle & terminology, components, and classifications of Remote Sensing (RS). Physical basis of Remote Sensing with relevance to radiation laws, spectral windows and spectral signatures and their significance. Remote sensing satellite orbits, image acquisition process, repeativity & related terminology, platforms, and sensor systems. Passive and Active remote sensors and their characteristics with special relevance to currently available remote sensors at global level. Radiometric quantities used in the collection of spectral signatures.		
2.	Remotely Sensed Imagery Characteristics and Processing: Geometry, Radiometry, and other characteristics of remotely sensed data products. Geometric and Radiometric distortions in RS imagery and their rectification by using pre-processing techniques. Ground truth collection Georeferencing of satellite imagery and defining the coordinate system datum and map projection. Rubber sheet transformation, rectification, and registration.		
3.	Remote Sensing Analysis and Applications: Manual and computer aided image interpretation approaches and their comparative advantages and disadvantages. Characteristics of photographic images and visual photo/image-interpretation keys. Computer aided digital image analysis techniques: Density slicing, False color Composite (FCC), Vegetation Index map, digital image classification techniques and extraction of thematic information using manual and semi-		

	automatic digitization of image features. Extraction of topographic information from remotely sensed data and generation of digital terrain model from stereo pairs of images.
4.	Applications of remote sensing in terrain investigation and engineering projects and advantages over conventional mapping techniques. Commercial and open source data resources and software for remote sensing data analysis.
List of Text Books:	
1.	Remote Sensing and image interpretation, Lillesand T.M. and Kiefer R. W., Willey publications
2.	Physical Principles of Remote Sensing, W. G. Rees Cambridge University Press
3.	Introduction to remote sensing, J. B. Campbell, Guilford Press
List of Reference Books:	
1.	Introductory Digital Image Processing: A Remote Sensing Perspective, John R. Jensen, Pearson Press
2.	Remote sensing models & methods for image processing, Robert Shcowebgerdt, Academic Press
URLs:	
1.	https://nptel.ac.in/courses/105/107/105107121
2.	https://nptel.ac.in/courses/105/104/105104100/
3.	https://nptel.ac.in/courses/105/103/105103193/

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1 & 2	Remote Sensing Technology: Basic Concepts, principle & terminology, components
3	classifications of Remote Sensing (RS)
4	Physical basis of Remote Sensing with relevance to radiation laws
5	Spectral windows and spectral signatures and their significance
6	Remote sensing satellite orbits
7 & 8	image acquisition process, repeativity & related terminology
9	platforms, and sensor systems
10 to 13	Passive and Active remote sensors and their characteristics with special relevance to currently available remote sensors at global level
14	Radiometric quantities used in the collection of spectral signatures.
17 &18	Remotely Sensed Imagery Characteristics and Processing: Geometry, Radiometry, and other characteristics of remotely sensed data products.
19 to21	Geometric and Radiometric distortions in RS imagery and their rectification by using pre-processing techniques.
22	Ground truth collection
23 & 24	Georeferencing of satellite imagery and defining the coordinate system datum and map projection

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26	Rubber sheet transformation, rectification, and registration.
27	Remote Sensing Analysis and Applications: Manual and computer aided image interpretation approaches and their comparative advantages and disadvantages.
28	Characteristics of photographic images and visual photo/image-interpretation keys.
29	Computer aided digital image analysis techniques: Density slicing, False color Composite (FCC)
30	Vegetation Index map,
31 to 34	digital image classification techniques and extraction of thematic information using manual and semi-automatic digitization of image features.
36	Extraction of topographic information from remotely sensed data and generation of digital terrain model from stereo pairs of images.
37& 38	Applications of remote sensing in terrain investigation and engineering projectsand advantages over conventional mapping techniques.
39 to 42	Commercial and open source data resources and software for remote sensing data analysis.

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-I**	**Year-2020-21**
Name of Course	GEODESY AND GNSS BASED MAPPING		
Course Code	GI 513		
Core / Elective / Other	Core		
Prerequisite:			
1.	No prerequisite		
Course Outcomes:			
1.	Basic understanding on the principle and terminology related Geodesy and GNSS		
2.	Knowledge of different methods of GNSS/GPS based Surveying/Mapping		
3.	Skill for developing methodology on GNSS/GPS use for various applications		
Description of Contents in brief:			
1.	Geodesy: Definition, fundamental concepts and terminology, chronology of developments in Geodesy and its classifications.		
2.	Global Navigation Satellite System (GNSS): Introduction, principle, components of GNSS/GPS, Space segment, control segment and user segment. Different types of GNSS receivers, single and multi-frequency receivers, and their selection for specific applications.		
3.	GNSS Coordinate Systems: Basic concepts and terminology related to field astronomy for defining Terrestrial and Astronomical coordinates. Coordinate systems for locating heavenly bodies, geographic, geodetic, geocentric, cartesian, local and projected coordinates. Modelling the figures of earth, some important Ellipsoids, properties of Ellipsoids and Geoid and computations of geodetic positions.		
4.	Datum and Map Projection for GNSS data: International and local datums, time systems, satellite orbit determination, Map projection-necessity and classifications. Commonly used map projections and transformation of GPS coordinates from WGS-84 to Indian datum and vice versa.		
5.	GPS Surveying methods: Basic terminology and errors in GPS observations, data acquisition, Point Positioning, Differential Positioning, Static Positioning and Kinematic positioning. GPS data formats and processing. DGPS Survey, Real		

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	Time Kinematic (RTK) Survey and mobile mapping survey planning and data analysis and their comparative accuracy of measurements.
6.	Advantages of GPS surveys over the conventional methods of surveying. Various applications of GPS technology in the management and monitoring of natural resources, engineering projects, planning, disaster mitigation etc.
List of Text Books:	
1.	Global Positioning System: Principles and Applications, Sateesh Gopi, Tata McGraw Hill
2.	GPS for Land Surveyors, Jan Van Sickle, CRC Press, Taylor, and Francis group
3.	Introduction to GPS: The Global Positioning System, Ahmed El Rabbany, Artech House Boston/London.
List of Reference Books:	
1.	Understanding GPS: Principles and Applications, Kaplan, E.D., Artech House Boston/London.
2.	Global positioning system: Theory and Practice, Hofman-Wellenhof, B. et. al, Springer-Verlag Wien GmbH
3.	GPS Satellite Surveying, Alfred Leick, Lev Rapoport, Dmitry Tatarnikov, John Wiley & Sons, Inc
4.	GPS Theory, Algorithms and Applications- Guocheng Xu, Springer
URLs:	
1.	https://nptel.ac.in/courses/105/107/105107157
2.	https://nptel.ac.in/courses/105/104/105104100/
3.	https://nptel.ac.in/courses/105/107/105107121/

Lecture Plan (about 40-50 Lectures):

Lecture No.	**Topic**
1 & 2	Geodesy: Definition, fundamental concepts, and terminology
3 &4	Chronology of developments in Geodesy and its classifications.
5 & 6	Global Navigation Satellite System (GNSS): Introduction, principle
7 to 9	components of GNSS/GPS, Space segment, control segment and user segment.
10 & 11	Different types of GNSS receivers, single and multi-frequency receivers, and their selection for specific applications.
12to 14	GNSS Coordinate Systems: Basic concepts and terminology related to field astronomy for defining Terrestrial and Astronomical coordinates.
15 to 17	Coordinate systems for locating heavenly bodies, geographic, geodetic, geocentric, cartesian, local and projected coordinates.
18	Modelling the figures of earth,
19 & 20	some important Ellipsoids, properties of Ellipsoids and Geoid and computations of geodetic positions.
21 to 23	Datum and Map Projection for GNSS data: International and local datums

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24	time systems
25	satellite orbit determination
26& 27	Map projection-necessity and classifications
28 & 29	Commonly used map projections
30	transformation of GPS coordinates from WGS-84 to Indian datum and vice versa.
31 & 32	GPS Surveying methods: Basic terminology and errors in GPS observations
33	data acquisition, Point Positioning, Differential Positioning, Static Positioning and Kinematic positioning
34	GPS data formats and processing.
35 to 37	DGPS Survey, Real Time Kinematic (RTK) Survey and mobile mapping survey planning and data analysis and their comparative accuracy of measurements.
38	Advantages of GPS surveys over the conventional methods of surveying
39to41	Various applications of GPS technology in the management and monitoring of natural resources, engineering projects, planning, disaster mitigation etc.

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-I**	**Year-2020-21**
Name of Course	LAB- 1		
Course Code	GI 514		
Core / Elective / Other	Core		
Prerequisite:			
1.	Basic Concepts of Mapping and Cartography (GI102)		
2.	Basics of Remote SensingTechnology (GI103)		
3.	Geodesy and GNSS Based Mapping (GI104)		
Course Outcomes:			
1.	Practical knowledge on the use of conventional and modern surveying instrumentation for making map		
2.	Competence on field setting out work of engineering projects for surveying related inputs.		
3.	Developing skills for the creation of GIS based digital maps using modern survey techniques such as Remote Sensing & GPS		
Description of Contents in brief:			
1.	This is practical subject and students will have to perform field exercises designed from topics taught in the above-mentioned prerequisite subjects		
2.	The list of practical exercise is given under the section Lecture Plan and this may be revised time to time by the subject coordinator, depending on the requirements and addition of more advanced instruments in the department Survey Lab		
List of Text Books:			
1.	Same as given in the prerequisite subjects		
List of Reference Books:			
1.	Same as given in the prerequisite subjects		
URLs:			

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1.	Same as given in the prerequisite subjects

Lecture Plan (about 40-50 Lectures): *List of practical exercises is given below:*

Lecture No.	Topic
1	Study of conventional surveying instruments.
2	Drawing of conventional symbols of maps and study of Survey of India topographic and other available thematic maps.
3	Traverse Survey using Digital Theodolite and computation of coordinates using Gales Traverse Table.
4	Determination of the height of accessible and inaccessible object using indirect levelling methods.
5	Preparation of contour map of given area using Direct/Indirect methods of contouring.
6	3D Digital Map data collection using Auto level and hand held GPS instrument.
7	Topographic mapping using Total Station instrument.
8	Determination of GCP coordinates using hand held GPS instrument.
9	DGPS Survey for establishing the control point of geodetic accuracy
10	Remote Sensing satellite image reading and geo-referencing using commercial/open source software and data resources and GPS data.
11	Creation of color coded, FCC and vegetation index maps from the given multi spectral remote sensing data.
12	Creation of Digital Terrain Model (DTM) from different sources of Digital Elevation Model (DEM) of remotely sensed data and their accuracy comparison.
13	Land Use and Land Cover (LULC) map preparation from the satellite imagery using supervised classification approach.
14	Land Use and Land Cover (LULC) map preparation from the satellite imagery using unsupervised classification approach.

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-I**	**Year-2020-21**
Name of Course	SEMINAR 1		
Course Code	GI 515		
Core / Elective / Other	Core		
Prerequisite:			
1.	Not Required		
Course Outcomes:			
1.	Learning for the literature review of published academic and research contents from books and research papers.		
2.	Developing skills for the report writing in standard format.		
3.	Developing skills for the presentation of academic and research contents through power point presentation		
Description of Contents in brief:			
1.	Not applicable as this is Seminar subject		
List of Text Books:			
1.	Not applicable as this is Seminar subject		
List of Reference Books:			
1.	Not applicable as this is Seminar subject		
URLs:			
1.	Students can use online search facilities of institute library and Google, in addition to theory subject online resources		
Lecture Plan (about 40-50 Lectures): Not applicable as this is Seminar subject			

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	BASIC CONCEPTS OF GIS		
Course Code	GI 521		
Core / Elective / Other	Core		
Prerequisite:			
1.	There is no prerequisite for learning this course but working knowledge of computer use.		
Course Outcomes:			
1.	Basic knowledge on principle and components of GIS.		
2.	Knowledge on the development and management of GIS based database.		
3.	Learning on the methodology development to carry outGeospatial analysis for various applications.		
Description of Contents in brief:			
1.	Basics of Geographic Information System (GIS), Definition, Evolution, terminology & components. Data structure and formats, different types of Raster and Vector spatial data models and their comparative advantages and disadvantages, Linkage between spatial and non-spatial data. GIS data input devices like scanner, digitizer, Total Station, GPS, Remote sensing etc. Manual and semi-automatic line following and automatic digitization. Commonly used GIS database formats. Digital Elevation Models: Generation, Representation, and applications. Metadata; Conversion of existing data.		
2.	Data base design- editing and topology creation in GIS. Types of Digitizing Errors, Causes for Digitizing Errors; Topological Editing and Non-topological Editing; Other Editing Operations; Editing Using Topological Rules.		
3.	Geo-referencing of GIS layers, and defining the coordinate system, datum, map projection, and reprojection for GIS data. Spatial and attribute data visualization and query. Various type, Vector and Raster data analysis tools such as buffering, overlays, distance measurements, pattern analysis and other useful spatial analysis tools like Slope and Aspect, Geographic Visualization Data Classification, Map Comparison etc.		
4.	Geo Statistical Analysis Techniques: Introduction to Spatial Interpolation: Control Points, Global Method- Trend surface analysis, regression model, local methods- Thiessen polygons, density estimation, Inverse Distance weighted Interpolation, Kriging- Ordinary Kriging and Universal Kriging etc.		

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5.	Learning on the functionalities of popular commercial and open source GIS software and data resources. Introduction to customization in GIS, Object Oriented GIS, Web-GIS. Various applications of GIS.
List of Text Books:	
1.	Introduction to Geographic Information Systems, Kang-Tsung Chang, McGraw Hill, Indian edition
2.	Concepts and Techniques of Geographic Information Systems,Chor Pang Lo, Albert K.W. Yeung
3.	Principles of Geographic Information, P.A. Burrough, Oxford University Press
List of Reference Books:	
1.	Principles of Geographic Information Systems for land Resources Assessment-P.A. Burrough, Wiley.
2.	Fundamentals of Spatial Information Systems-Robert Laurini and Derek, Thompson Academic Press.
3.	Geographical Information Systems, Vo. I and II -Paul Longely, M.F. Goodchild, et.al, Wiley.
4.	Geographic Information Systems A Management Perspective - Stan Arnoff, WDL Publications.
URLs:	
1.	https://nptel.ac.in/courses/105/103/105103193/
2.	https://nptel.ac.in/courses/105/104/105104100/
3.	https://nptel.ac.in/courses/105/107/105107121/

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1	Basics of Geographic Information System (GIS), Definition, Evolution, terminology
2	Components of GIS
3	Data structure and formats
4 to 6	different types of Raster and Vector spatial data models and their comparative advantages and disadvantages
7	Linkage between spatial and non-spatial data
8	GIS data input devices like scanner, digitizer, Total Station, GPS, Remote sensing etc.
9	Manual and semi-automatic line following and automatic digitization.
10	Commonly used GIS database formats
11 & 12	Digital Elevation Models: Generation, Representation, and applications.
13	Metadata; Conversion of existing data
14& 15	Data base design- editing and topology creation in GIS.
16	Types of Digitizing Errors
17	Causes for Digitizing Errors;
18&19	Topological Editing and Non-topological Editing; Other Editing Operations;

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20	Editing Using Topological Rules
21&22	Geo-referencing of GIS layers, and defining the coordinate system, datum, map projection, and reprojection for GIS data.
23to 25	Spatial and attribute data visualization and query
26 to 28	Various type, Vector and Raster data analysis tools such as buffering, overlays, distance measurements, pattern analysis and other useful spatial analysis tools like Slope and Aspect,
29& 30	Geographic Visualization Data Classification, Map Comparison etc.
31	Geo Statistical Analysis Techniques: Introduction to Spatial Interpolation
32	Control Points, Global Method- Trend surface analysis,
33 & 34	regression model, local methods- Thiessen polygons, density estimation,
35 & 36	Inverse Distance weighted Interpolation, Kriging- Ordinary Kriging and Universal Kriging etc.
37 to 39	Learning on the functionalities of popular commercial and open source GIS software and data resources.
40 to 42	Introduction to customization in GIS, Object Oriented GIS, Web-GIS.
43 to 45	Various applications of GIS.

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	DIGITAL PROCESSING OF REMOTELY SENSED DATA		
Course Code	GI 522		
Core / Elective / Other	Core		
Prerequisite:			
1.	Basics of Remote Sensing Technology (GI103)		
Course Outcomes:			
1.	Basic understanding on principle, techniques, and tools for the digital processing of remote sensing data		
2.	Learning on conventional and advanced digital image enhancement and analysis methods for the pre-processing of remotely sensed digital data		
3.	Skill development for evolving methodology to use digital Remote Sensing images for different applications.		
Description of Contents in brief:			
1.	Basic terminology related to remotely sensed image storage and analysis. Image rectification and restoration: Geometric and radiometric correction, establishing, spatial transformation model using GCP's, intensity interpolation techniques (nearest neighbor, bilinear and cubic convolution). Image geo-referencing and registration.		
2.	Image Enhancements: Contrast manipulation: Grey Level threshold, level slicing and contrast stretching. Spatial feature manipulation: spatial filter, edge enhancement and Fourier analysis. Point, local and regional operation, scale-space transform, wavelet transform, Multi image manipulation: Multi-band rationing and differencing, principal components, vegetation indexes, color composition and Intensity Hue Saturation (IHS) images.		
3.	Extraction of image statistics: Image histogram, mean, standard deviation, variance, and covariance. Variance-Covariance and correlation matrices. Image display alternatives: mono and color, composites of MSS, Band Combination, and optimum index factor (OIF).		
4.	Pattern recognition, boundary detection and representation, textural and contextual analysis, Image Classification and thematic information extraction,		

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	General steps for land cover information extraction, classification levels and supervised and unsupervised classification techniques, selection of appropriate algorithms for classification: Parallelepiped, Minimum distance, Maximum likelihood, Isodata, fuzzy classification, classification accuracy assessment. Hybrid training, Non- parametric, and sub-pixel classification, Hyper–spectral image analysis.
5.	Learning on commercial and open source image processing software.
List of Text Books:	
1.	Remote Sensing and image interpretation, Lillesand T.M. and Kiefer R. W., Willey publications
2.	Introductory Digital Image Processing: A Remote Sensing Perspective, John R. Jensen, Pearson Press
3.	Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, Pearson
List of Reference Books:	
1.	Physical Principles of Remote Sensing,W.G.Rees Cambridge University Press
2.	Remote sensing models & methods for image processing,Robert Shcowebgerdt,Academic Press
3.	Remote Sensing Digital Image Analysis, John A. Richards, Springer
URLs:	
1.	https://nptel.ac.in/courses/105/103/105103176
2.	https://nptel.ac.in/courses/105/104/105104100/
3.	https://nptel.ac.in/courses/105/107/105107121/

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1& 2	Basic terminology related to remotely sensed image storage and analysis
3	Image rectification and restoration:
4 & 5	Geometric and radiometric correction,
6	establishing, spatial transformation model using GCP's
7 to 9	intensity interpolation techniques (nearest neighbor, bilinear and cubic convolution). Image geo-referencing and registration.
10	Image geo-referencing and registration.
11 & 12	Image Enhancements: Contrast manipulation: Grey Level threshold, level slicing and contrast stretching.
13 to 15	Spatial feature manipulation: spatial filter, edge enhancement
16	Fourier analysis. Point, local and regional operation, scale- space transform
17	wavelet transform
18	Multi image manipulation: Multi-band rationing and differencing
19	principle component analysis
20 & 21	vegetation indexes, colour composition and Intensity Hue Saturation

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	(IHS) images.
22 & 23	Extraction of image statistics: Image histogram, mean, standard deviation, variance and covariance.
24	Variance-Covariance and correlation matrices.
25 & 26	Image display alternatives: mono and color, composites of MSS, Band Combination, and optimum index factor (OIF)
27	Pattern recognition, boundary detection and representation
28& 29	textural and contextual analysis
30	Image Classification and thematic information extraction
31	General steps for land cover information extraction
32 to 34	classification levels and supervised and unsupervised classification techniques, selection of appropriate algorithms for classification: Parallelepiped, Minimum distance, Maximum likelihood
35	Isodata classification
36	fuzzy classification
37& 38	classification accuracy assessment.
39	Hybrid training, Non- parametric, and sub-pixel classification,
40	Hyper – spectral image analysis
41 to 45	Learning on commercial and open source image processing software

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	BASIC CONCEPTS OF PHOTOGRAMMETRY		
Course Code	GI 523		
Core / Elective / Other	Core		
Prerequisite:			
1.	No prerequisite		
Course Outcomes:			
1.	Learning on the basic concepts and classifications photogrammetry.		
2.	Understanding on the various type distortions and their rectification in the photogrammetry.		
3.	Skill development for the preparation of topographic and 3D maps using photogrammetry techniques.		
Description of Contents in brief:			
1.	Basic terminology and history of development: Definition, terminology, chronology of developments and classifications of photogrammetry.		
2.	Terrestrial photogrammetry: computations for ground distances, elevation & coordinates. Applications of terrestrial and close-range photogrammetry.		
3.	Aerial photogrammetry: classifications, geometry and scale of aerial photographs, and terminology used. Classification of aerial cameras, vertical, tilted, and oblique photo characteristics, and applications. Aerial photography flight planning, distortions and their rectification process and generation of ortho photos. Photo mosaic types and uses.		
4.	Stereo photogrammetry: Requirements for good stereoscopic view from stereo pairs of aerial photos and overlapping concept. Parallax equation and computation of ground heights from parallax measurements, parallax bar and its use.		

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5.	Viewing and measuring systems, image and object coordinates, creation of stereo model. Concepts of interior, relative, absolute orientation, object, image relation, linearization, effect of orientation elements, scaling and leveling, analytical procedures, map compilation using stereo plotters and computers. Elements of analytical photogrammetry, collinearity condition and different approaches for the solution to collinearity equation. Introduction to digital photogrammetry & Aero Triangulation.
List of Text Books:	
1.	Elements of Photogrammetry- Paul R.Wolf, McGraw-Hill
2.	Introduction to Modern Photogrammetry, Introduction to Modern Photogrammetry Edward M. Mikhail, James S. Bethel, J. Chris McGlone, Wiley publisher
3.	Remote Sensing and image interpretation- Lillesand T.M. and Kiefer R. W., Willey
4.	Elements of Photogrammetry with Application in GIS, Paul Wolf, Bon DeWitt, Benjamin Wilkinson, McGraw-Hill Education.
List of Reference Books:	
1.	Computational models in surveying and photogrammetry, B. D. F. Methley, Blackie publisher.
2.	Photogrammetry, Vol 1&II – Karl Kraus, Walter de Gruyter
3.	Geoinformation: Remote Sensing, Photogrammetry and Geographic Information Systems-Gottfried Konecny, CRCPress
4.	Manual Photogrammetry, McGlone, C., Edward, M. and Bethel, J, American Society for Photogrammetry & Remote Sensing.
URLs:	
1.	https://nptel.ac.in/courses/105/103/105103176
2.	https://nptel.ac.in/courses/105/104/105104100/
3.	https://nptel.ac.in/courses/105/107/105107121/

Lecture Plan (about 40-50 Lectures):

Lecture No.	**Topic**
1 & 2	Basic terminology and history of development: Definition, terminology, chronology of developments
3	classifications of photogrammetry.
4 to6	Terrestrial photogrammetry: computations for ground distances, elevation & coordinates.
7	Applications of terrestrial and close-range photogrammetry
8	Aerial photogrammetry: classifications, geometry
9 & 10	scale of aerial photographs, and terminology used.
11	Classification of aerial cameras
12& 13	vertical, tilted, and oblique photo characteristics, and applications.
14	Aerial photography flight planning

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15 to 17	distortions and their rectification process and generation of ortho photos
18	Photo mosaic types and uses.
19 to 21	Stereo photogrammetry: Requirements for good stereoscopic view from stereo pairs of aerial photos and overlapping concept
22to 24	Parallax equation and computation of ground heights from parallax measurements
25	parallax bar and its use.
26 to 28	Viewing and measuring systems, image and object coordinates, creation of stereo model.
29to31	Concepts of interior, relative, absolute orientation, object, image relation, linearization, effect of orientation elements,scaling and leveling
32 & 33	analytical procedures, map compilation using stereo plotters and computers.
34to36	Elements of analytical photogrammetry, collinearity condition and different approaches for the solution to collinearity equation
37 to 39	Introduction to digital photogrammetry
40 to 42	Introduction to Aero Triangulation.

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	LAB- 2		
Course Code	GI 525		
Core / Elective / Other	Core		
Prerequisite:			
1.	Basic Concepts of GIS (GI201)		
2.	DigitalProcessing ofRemotely Sensed Data (GI202)		
3.	Basic Concepts of Photogrammetry (GI203)		
Course Outcomes:			
1.	Practical knowledge on the use of photogrammetry techniques for map making.		
2.	Competence on the use of advanced techniques for the pre and post processing of Geospatial data collected in the field.		
3.	Developing skills for the use of integrated Remote Sensing, GPS and GIS techniques for the digital mapping and cartography.		
Description of Contents in brief:			
1.	This is practical subject and students will have to perform field exercises designed from topics taught in the above-mentioned prerequisite subjects		
2.	The list of practical exercise is given under the section Lecture Plan and this may be revised time to time by the subject coordinator, depending on the requirements and addition of more advanced instruments in the department Survey Lab		
List of Text Books:			
1.	Same as given in the prerequisite subjects		
List of Reference Books:			

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1.	Same as given in the prerequisite subjects
URLs:	
1.	Same as given in the prerequisite subjects
Lecture Plan (about 40-50 Lectures): *List of practical exercises is given below:*	
Lecture No.	**Topic**
1	Study and visual interpretation of Stereo pairs of Aerial Photographs and use of pocket stereoscope for 3D view.
2	3D mapping using stereo workstation and LPS software.
3	Enhancement of Remote Sensing satellite image using different image enhancement techniques.
4	DGPS survey data post processing using CORS data as base station.
5	DGPS survey using RTK method.
6	GIS data collection using Mobile Mapper instrument.
7	Extraction of low and high spatial frequency features from the multi spectral satellite images using standard methods.
8	Fusion of multi-sensor and multi-resolution remotely sensed imagery.
9	Accuracy assessment of Supervised/ Unsupervised image classification techniques.
10	Creation of GIS map using Survey of India toposheet/remote sensing imagery.
11	Learning on the GIS data overlay, editing, cleaning and Georeferencing operations using commercial and open source GIS software.
12	Creation of contour and slope aspect map in GIS using open source DEM and commercial/open source GIS software.
13	Graphic and attribute query operations using commercial/open source GIS software.
14	Spatial analysis using commercial/open source GIS software techniques.
15	Geo-statistical analysis using commercial/open source GIS software tools.

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	SEMINAR 2		
Course Code	GI 526		
Core / Elective / Other	Core		
Prerequisite:			
1.	Not Required		
Course Outcomes:			
1.	Learning for the literature review of published academic and research contents from books and research papers for tentative thesis topic selection		
2.	Developing skills for the report writing as per standard thesis text format.		
3.	Developing skills for the presentation of academic and research contents through power point presentation		
Description of Contents in brief:			
1.	Not applicable as this is Seminar subject		
List of Text Books:			
1.	Not applicable as this is Seminar subject		
List of Reference Books:			
1.	Not applicable as this is Seminar subject		
URLs:			
1.	Students can use online search facilities of institute library and Google, in addition to theory subject online resources		
Lecture Plan (about 40-50 Lectures): Not applicable as this is Seminar subject			

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-I**	**Year-2020-21**
Name of Course	Basic concepts and Applications of Microwave Remote Sensing		
Course Code	GI 551		
Core / Elective / Other	Elective		
Prerequisite:			
1.	Knowledge of Computer		
2.	Basic knowledge of land resources, Physics Principles		
Course Outcomes:			
1.	Basic concepts of Microwave Remote Sensing		
2.	Applications of Microwave Remote Sensing		
3.	Comparative advantages of Microwave Remote Sensing over optical Remote Sensing		
Description of Contents in brief:			
1.	Introduction, basic concepts, terminology, sensors in MWRS, Radar basics, radar interaction with earth surface and vegetation, surface scattering theory.		
2.	radar equation, fading concept, measurement and discrimination, physical mechanisms and empirical models for scattering and emission,		
3	geometry of radar images, radar return and image signature, resolution concepts, sar, speckle in radar imagery, concept of roughness, geometry of targets.		
4	resonance, dielectric constant, surface and volume scattering, signal penetration and enhancement.Polarimetry and SAR interferometry, scatterometer and its applications in agriculture, forestry, geology, hydrology,		
5	ice studies, land use mapping and ocean related studies, military, and surveillance applications		
6	search and rescue operations, ground and air target detection and tracking		
List of Text Books:			
1.	Microwave remote sensing vol-1,vol-2- Ulaby,F.T.,Moore,K.R. and Fung,Artech House Publishers.		
2.	Principles and applications of Imaging - Floyd. M. Handerson Anthony, J.Lewis,		

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	Wiley.
3.	Introduction to microwave remote sensing- Iain H.woodhouse,CRCPress
List of Reference Books:	
1.	Air and space borne radar systems-An introduction- Philippe Lacomme and Eric Normant, Elsevier.
2	Theory of microwave remote sensing Book by Leung Tsang CRS Press
3	Microwave Propagation and Remote Sensing: Atmospheric Influences with Models by P KARMAKAR CRC Press
URLs:	
1.	https://nptel.ac.in/courses/105/108/105108077/
2.	https://www.iirs.gov.in/EDUSAT
3.	https://radar.community.uaf.edu/
Lecture Plan (about 40-50 Lectures):	
Lecture No.	**Topic**
1-2	Introduction, basic concepts, terminology (2L)
3-5	sensors in MWRS (3L)
6-9	Radar basics, radar interaction with earth surface and vegetation, surface scattering theory.(4L)
10-15	radar equation, fading concept, measurement and discrimination, physical mechanisms and empirical models for scattering and emission, (6L)
16-18	geometry of radar images, radar return and image signature, (3L)
19-22	resolution concepts, sar, speckle in radar imagery, concept of roughness, geometry of targets, (4L)
23-25	resonance, dielectric constant, surface and volume scattering, (3L)
26-30	signal penetration and enhancement.Polarimetry and SAR interferometry, (5L)
31-36	scatterometer and its applications in agriculture, forestry, geology, hydrology,(6L)
37-42	ice studies, land use mapping and ocean related studies, military and surveillance applications (6L)
43-44	search and rescue operations, ground and air target detection and tracking (2L)

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-I**	**Year-2020-21**
Name of Course	REMOTE SENSING AND GIS APPLICATIONS IN EARTH SCIENCES AND GEOTECHNICAL ENGG.		
Course Code	GI 552		
Core / Elective / Other	Elective		
Prerequisite:			
1.	Computer knowledge		
2.	Basic knowledge of Rocks and Minerals,		
3.	Engineering properties of material		
Course Outcomes:			
1.	Identifying Various types of Rocks and Minerals using RS technique. Mapping various mineral resources with the help of GIS		
Description of Contents in brief:			
1.	Introduction – Rocks and Minerals, image characters of igneous, sedimentary, and metamorphic rocks, Lithological mapping using aerial and satellite data.		
2.	Structural Geology, - introduction, Mapping structural feature. Elemental composition and nature of the spectra of rocks and minerals,Optimal spectral windows Geomorphic Landforms		
3.	Drainage network and patterns,classification andimplications of drainage patterns, geomorphic mapping using, aerial and satellite data.		
4.	Landform analysis in natural resources and management case studies. Different types of Geophysical Surveys, Planning Geophysical surveys using satellite data. Integration of all relevant primary and secondary data using GIS in Surface and groundwater studies.		
5.	Engineering Geology, Mineral exploration and Petroleum exploration, Disaster Management studies like Droughts, Floods-Case studies.		
List of Text Books:			
1.	Remote Sensing principles and interpretation- Sebins, F. ,Waveland PrInc.		
2.	Engineering and General Geology- Parbin Singh, S K Kataria& Sons.		
3.	Image interpretation in Geology- Drury, S.A., Routledge.		

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4	Fundamentals of GIS- Michael N. Demers, Wiley.
List of Reference books	
1	Remote Sensing Geology by Gupta, Ravi P. ISBN 978-3-662-55876-8
2	Image interpretation in geologyS. A. Drury Tailor and Francishttps://www.tandfonline.com/doi/abs/10.1080/10106048709354098
3	Advances In Remote Sensing And Gis Analysis by ATKINSON, John Wiley
URLs:	
1.	https://www.nrsc.gov.in/EO_Geosciences
2.	https://www.iirs.gov.in/EDUSAT
3.	https://nptel.ac.in/courses/105/108/105108077/
Lecture Plan (about 40-50 Lectures):	
Lecture No.	**Topic**
1-2	Introduction – Rocks and Minerals
3-5	image characters of igneous, sedimentary and metamorphic rocks
6-8	Litho logical mapping using aerial and satellite data
9-11	Structural Geology, - introduction, Mapping structural feature
2-14	Elemental composition and nature of the spectra of rocks and minerals,Optimal spectral windows
15-17	Geomorphic Landforms
18-20	Drainage network and patterns
21-23	classification and implications of drainage patterns
24-26	geomorphic mapping using, aerial and satellite data
27-29	Landform analysis in natural resources and management case studies
30-33	Different types of Geophysical Surveys, Planning Geophysical surveys using satellite data
34-37	Integration of all relevant primary and secondary data using GIS in Surface and groundwater studies
38-41	Engineering Geology, Mineral exploration and Petroleum exploration
42-44	Disaster Management studies like Droughts, Floods-Case studies

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	REMOTE SENSING AND GIS APPLICATIONS IN AGRICULTURE & FORESTRY		
Course Code	GI 553		
Core / Elective / Other	Elective		
Prerequisite:			
1.	No prerequisite		
Course Outcomes:			
1.	Developing theoretical understanding in the area Agriculture & Forestry for the use of Geospatial techniques.		
2.	Skill development for the use of Remote Sensing & GIS techniques in Agriculture & Forestry.		
Description of Contents in brief:			
1.	Introduction: Spectral properties of crops, crop canopy, identification & inventory, Yield Modeling, crop production, forecasting through digital analysis, crop condition assessment and monitoring, land use and land cover analysis.Microwave RS for crop inventory & case studies.		
2.	Detection of pest & diseases, Flood mapping and Assessments of crop loss, Remote sensing capabilities & contribution for drought management, Land degradation due to water logging & Salinity, crop stresses reflectance properties of stressed plants and stress detection.		
3.	Introduction, Forest taxonomy, inventory of forestlands, forest types and density mapping using RS techniques. Forest stock mapping, factors for degradation of forest, delineation of degraded forest, Forest change detection and monitoring, Forest fire mapping & damage assessment, LiDAR remote sensing for Forest studies.		
4.	RS & GIS for drawing out action plans, water shed approach, precision farming and case studies.		
List of Text Books:			
1.	Applications of Remote Sensing in Agriculture, M. D. Steven & J. A. clark, Elsevier Science		
2.	Remote Sensing and image interpretation- Lillesand T.M. and Kiefer R. W., Willey		

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3.	Advances in Land Remote Sensing System, Modeling, Inversion and Application, Springer
List of Reference Books:	
1.	Remote Sensing in Soil Science, M.A. Mulders, Elsevier Science
2.	Advances in Land RS: System, modeling invention and applications,Shunlin Liang, Springer
3.	Wetland & Environmental application of GIS- John G. Lyon, Jack MCcarthy, CRC Press.
URLs:	
1.	https://nptel.ac.in/courses/105/102/105102015/
2.	https://nptel.ac.in/courses/105/104/105104100/
3.	https://nptel.ac.in/courses/105/107/105107121/

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1 to4	Introduction: Spectral properties of crops,
5 & 6	crop canopy, identification & inventory
7 to 9	Yield Modeling,
10 to 12	crop production, forecasting through digital analysis
13 to 15	crop condition assessment and monitoring, land use and land cover analysis
16to 18	Microwave RS for crop inventory & case studies
19 to 21	Detection of pest & diseases, Flood mapping and Assessments of crop loss
22 &23	Remote sensing capabilities & contribution for drought management
24& 25	Land degradation due to water logging & Salinity,
26& 27	crop stresses reflectance properties of stressed plants and stress detection.
28& 29	Introduction, Forest taxonomy, inventory of forestlands
30& 31	forest types and density mapping using RS techniques
32 & 33	Forest stock mapping, factors for degradation of forest, delineation of degraded forest
34 & 35	Forest change detection and monitoring, Forest fire mapping & damage assessment
36 & 37	LiDAR remote sensing for Forest studies
38 & 39	RS & GIS for drawing out action plans, water shed approach, precision farming
40to43	case studies

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	AIR BORNE LASER TERRAIN MAPPING		
Course Code	GI 554		
Core / Elective / Other	Elective		
Prerequisite:			
1.	No prerequisite		
Course Outcomes:			
1.	Understanding on the principle, components and working of Air Borne Laser technique.		
2.	Knowledge on the processing of different format data from Airborne Laser.		
3.	Skill development for the use of Airborne Laser technique for the terrain mapping and other applications.		
Description of Contents in brief:			
1.	LASER, LiDAR: Principles and properties, different LiDAR system, applications, advantages, & disadvantages. Space borne and airborne LiDAR missions, Typical parameters of a LiDAR system. Principle of Laser Altimetry, Components of the system: GPS, IMU LASER, LiDAR		
2.	Data formats, Terrain Mapping Laser Configuration – Ocean bathymetry Laser Configuration & Limitations of the system. GPS and IMU data processing – Strip Adjustment – Geometric Correction.		
3.	Data quality enhancement – Digital Surface Model&Elevation Model, Ground Point Filtering – Digital Hydrology, Disaster Mitigation and Management – 3D city models – Telecommunication Modeling – Urban planning – Coastal Zone Bathymetry Mapping.		
4.	Feature extraction, vectorization – Surface and land use classification. Orthophoto rectification using LiDAR – Integrated LiDAR and Digital Photogrammetry Techniques – Integration of LiDAR DEM with other hyper spectral data.		
List of Text Books:			
1.	Altimetry- Principles and Applications- Mathias Lemmens, CRCPress.		

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2.	Topographic Laser Ranging and Scanning: Principles and Processing, Jie Shan, Charles K. Toth, CRC Press
3.	Digital Terrain Modeling: Principles and Methodology- Zhilin Li Qing Zhu, Chris Christopher Gold, CRC Press.
List of Reference Books:	
1.	Airborne Laser Hydrography, William Philpot, Springer
2.	Laser Manual of Aerial Survey, Primary Data Acquisition- Roger Read and Ron Graham
URLs:	
1.	https://nptel.ac.in/courses/105/102/105102015/
2.	https://nptel.ac.in/courses/105/104/105104100/
3.	https://nptel.ac.in/courses/105/107/105107121/
Lecture Plan (about 40-50 Lectures):	

Lecture No.	**Topic**
1 & 2	LASER, LiDAR: Principles and properties,
3 to 5	different LiDAR system, applications, advantages, & disadvantages.
6 & 7	Space borne and airborne LiDAR missions
8	Typical parameters of a LiDAR system
9 & 10	Principle of Laser Altimetry
11 & 12	Components of the system: GPS, IMU LASER, LiDAR
13	Data formats
14 to 17	Terrain Mapping Laser Configuration – Ocean bathymetry Laser Configuration and Limitations of the system.
18to 21	GPS and IMU data processing – Strip Adjustment – Geometric Correction.
22& 23	Data quality enhancement
24& 25	Digital Surface Model & Elevation Model
26&27	Ground Point Filtering
28to 30	Digital Hydrology, Disaster Mitigation and Management
31 & 33	3D city models Telecommunication Modeling
34 & 35	Urban planning – Coastal Zone Bathymetry Mapping.
36 to 38	Feature extraction, vectorization – Surface and land use classification
39 to 41	Orthophoto rectification using LiDAR – Integrated LiDAR and Digital Photogrammetry Techniques
42 to 44	Integration of LiDAR DEM with other hyper spectral data.

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-I**	**Year-2020-21**
Name of Course	Hyper spectral Remote Sensing		
Course Code	GI 555		
Core / Elective / Other	Elective		
Prerequisite:			
1.	Knowledge of Remote Sensing		
2.	Knowledge of Image Processing Techniques		
Course Outcomes:			
1.	Basic principles of field spectroscopy and techniques for the collection and analysis of hyperspectral ground-truth data.		
2.	How data extraction techniques and hyper-spectral algorithms work.		
3.	Know the potential application areas for hyper-spectral analysis		
Description of Contents in brief:			
1.	History and Description of Hyper spectral Imaging, Electromagnetic Spectrum, Scientific Principles, Hyper-spactral Sensing Concept, Limitations of Hyper spectral Remote sensing		
2.	Working Principle, Hyper Spectral Radiometry, Imaging Spectrometers, Hyperspectral Remote Sensing and the Atmosphere, Absorption Features, Information Extraction from Hyperspectral Information		
3.	Extraction Approaches, Spectral Library: AVIRIS data, JPL data and USGS hyper spectral data classification		
4.	Application of Hyperion data in Agricultural, Environmental, Forestry, Geology, Mining, and coastal mapping.		
List of Text Books:			
1.	Hyperspectral Remote Sensing, Principles and Applications- Marcus Borengasser, William S.Hungate, CRC Press.		
2.	Introductory Digital Image Processing- Jensen, J.R.., Pearson.		

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3.	Remote Sensing and Image Interpretation- Lillesand, T.M. and Kiefer, R.W.,Willey.
List of Reference Books:	
1.	Hyperspectral Remote Sensing Fundamentals and PracticesBy Ruiliang Pu CRC Press
2.	Hyperspectral Remote Sensing by Michael T. Eismann SPIE PRESS BOOK
3.	Hyperspectral Imaging Remote Sensing: Physics, Sensors, and Algorithms 1st Editionby Dimitris G. Manolakis (Author), Ronald B. Lockwood (Author), Thomas W. Cooley (Author)
URLs:	
1.	https://nptel.ac.in/courses/105/108/105108077/
2.	https://www.iirs.gov.in/EDUSAT
3.	https://nptel.ac.in/courses/121/107/121107009/

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1-3	History and Description of Hyper spectral Imaging
4-6	Electromagnetic Specrtum, Scientific Principles
7-9	Hyperspactral Sensing Concept, Limitations of Hyper spectral Remote sensing
10-13	Working Principle, Hyper Spectral Radiometry
14-15	Imaging Spectrometers
16-21	Hyperspectral Remote Sensing and the Atmosphere
22-24	Absorption Features
25-28	Information Extraction from Hyperspectral Information Extraction Approaches
29-31	Spectral Library: AVIRIS data, JPL data and USGS Library
32-38	Hyper spectral data classification Methods
39-40	Application of Hyperion data in Agricultural
41-42	Application of Hyperion data in Forestry
43-44	Application of Hyperion data in Environmental
45-46	Application of Hyperion data in Geology
47-48	Application of Hyperion data in Mining and coastal mapping

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-I**	**Year-2020-21**
Name of Course	REMOTE SENSING AND GIS FOR HYDROLOGY AND WATER RESOURCES		
Course Code	GI556		
Core / Elective / Other	Elective		
Prerequisite:			
1.	Computer knowledge		
2.	Basic knowledge of Hydrology		
Course Outcomes:			
1.	Understanding the basic principle underlying the GIS/model-based management of water resources and environment		
Description of Contents in brief:			
1.	Hydrological cycle, components of hydrology cycle, Spectral Properties of Water, GIS Application In Surface Water Modeling & Case Studies. Watershed Parameters,		
2.	Stream Networks, Watersheds Morph Metric Analysis, Rainfall- Runoff Modeling, Mapping of Snow-Covered Area, Snow Melt Runoff, Flood Forecasting, Risk Mapping and Flood Damage Assessment		
3.	Soil Moisture Area Drought Forecasting and Damage Assessment, GIS Application in Aerial Assessment, Case Studies, Project Investigation, Implementation, Maintenance Stage- Location of Storage/ Diversion Works,		
4.	Urban Hydrology of Canal and Reservoir, Conjunctive Use of Surface and Ground Water, Water Harvesting Structures, Development of Information System for Natural Resource Management,		
5	Case Studies. Applications of Remote Sensing, GPS & GIS In Water Resources Projects.		
List of Text Books:			
1.	Satellite Remote Sensing for Hydrology and Water Management- Eric C. Barrett, Clare H.Power, Taylor & Francis Ltd		
2.	Hydrologic and Hydraulic Modeling Supportwith Geographic Information Systems- Dr. David Maidment, Dr. Dean Djokic, Esri Press.		

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3.	Hydrology: An Introduction Trimble Environmental Hydrology- WilfriedBrutsaert Andy D.WardandStanley W., CRCPress.
List of Reference Books	
1	GIS and Remote Sensing in Hydrology, Water Resources and Environment by YANGBO CHEN, KAORU TAKARA, IAN D. CLUCKIE and F.HILAIRE DE SMEDT © IAHS Press 2004
2	Remote sensing and GIS for hydrology and water resourcesY. Chen, C. Neale, Zhongbo Su, J. Zhou, Qiang Huang, Z. XuIAHSPublication : International Association of Hydrological Sciences
3	Remote Sensing Of The Environment: An Earth Resource Perspective by Jensen, Pearson , Pearson India
URLs:	
1.	https://www.nrsc.gov.in/sites/default/files/pdf/ebooks/Chap_6_Water_RS.pdf
2	https://nptel.ac.in/courses/105/101/105101002/
3	https://nptel.ac.in/courses/105/108/105108081/

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1-5	Hydrological cycle, components of hydrology cycle (5L)
6-8	Spectral Properties of Water, GIS Application In Surface Water Modeling & Case Studies. (3L)
9-11	Watershed Parameters, (3L)
12-13	Stream Networks, (2L)
14-15	Watersheds Morph Metric Analysis(2L)
16-18	Rainfall- Runoff Modeling, (3L)
19-21	Mapping of Snow Covered Area, (3L)
22-23	Snow Melt Runoff, (2L)
24-25	Flood Forecasting, (2L)
26-28	Risk Mapping and Flood Damage Assessment(3L)
29-31	Soil Moisture Area Drought Forecasting and Damage Assessment, GIS Application In Aerial Assessment, Case Studies(3L)
32-33	Project Investigation, Implementation, Maintenance Stage- Location Of Storage/ Diversion Works, (2L)
34-35	Urban Hydrology of Canal And Reservoir, (2L)
36-37	Conjunctive Use of Surface And Ground Water, (2L)
38-39	Water Harvesting Structures, (2L)
40-41	Development of Information System For Natural Resource Management, Case Studies. (2L)
42-45	Applications of Remote Sensing, GPS & GIS In Water Resources Projects. (3L)

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	REMOTE SENSING & GIS APPLICATIONS IN EVIRONMENTAL ENGINEERING		
Course Code	GI557		
Core / Elective / Other	Elective		
Prerequisite:			
1.	No prerequisite		
Course Outcomes:			
1.	Developing theoretical understanding in the area of Environmental Engineering for the use of Geospatial techniques.		
2.	Skill development for the use of Remote Sensing & GIS techniques in Environmental Engineering		
Description of Contents in brief:			
1.	Resource development in remote areas, impacts of anthropogenic activity- Solid Waste management- Carbon footprints and sinks, carbon trading, carbon credits and marketing using RS and GIS, Indian and international status.		
2.	Soil classification & mapping. Impact of agricultural and industrial activity on soil properties. soil salinity/alkalinity, erosion studies, Applications of Remote Sensing & GIS in assessing soil salinity, erosion productivity etc.		
3.	Creation and maintaining water supply network, sewerage network using GIS. Case studies.		
4.	Remote Sensing and GIS techniques to monitor, air and noise pollution due to industrial activity, modeling using GIS case Studies. Environmental Impact Assessment using Remote Sensing & GIS techniques.		
List of Text Books:			
1.	GIS, Environmental Modeling and Engineering- Allan Brimicombe, CRC Press		
2.	Remote Sensing Applications in Environmental Research, Srivastava, P.K., Mukherjee, S., Gupta, M., Islam, T. (Eds.), Springer		
3.	GIS for sustainable development- Michele Campagna, CRCPress		

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List of Reference Books:	
1.	Remote Sensing and GIS Technologies for Monitoring and Prediction of Disasters (Environmental Science and Engineering), Shailesh Nayak (Editor), SisiZlatanova (Editor), Springer
2.	Integrated Solid Waste Management, TechobanoglousGeorge, Hilary Theisen,Samuel Vigi, McGraw-Hill
3.	Remote Sensing and image interpretation- Lillesand T.M. and Kiefer R. W., Willey
URLs:	
1.	https://nptel.ac.in/courses/105/102/105102015/
2.	https://nptel.ac.in/courses/105/104/105104100/
3.	https://nptel.ac.in/courses/105/107/105107121/

Lecture Plan (about 40-50 Lectures):	
Lecture No.	**Topic**
1 & 2	Resource development in remote areas
3 to 5	impacts of anthropogenic activity
6 & 7	Solid Waste management
8& 9	Carbon footprints and sinks
10to 14	Carbon trading, carbon credits and marketing using RS and GIS,Indian and international status
15to 18	Soil classification & mapping
19 & 20	Impact of agricultural and industrial activity on soil properties.
21& 22	soil salinity/alkalinity,
23 & 24	erosion studies
25 to30	Applications of Remote Sensing & GIS in assessing soil salinity, erosion productivity etc.
31 to 33	Creation and maintaining water supply network, sewerage network using GIS. Case studies.
34to37	Remote Sensing and GIS techniques to monitor, air and noise pollution due to industrial activity
38 to 40	modeling using GIS case Studies
41 &45	Environmental Impact Assessment using Remote Sensing & GIS techniques.

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	GEOINFORMATICS IN URBAN DEVELOPMENT AND PLANNING		
Course Code	GI558		
Core / Elective / Other	Elective		
Prerequisite:			
1.	No prerequisite		
Course Outcomes:			
1.	Basic understanding on the areas and issues, where Geoinformatics techniques can be applied in Urban Development and Planning.		
2.	Skill development for the use of Remote Sensing & GIS techniques in Urban Development and Planning.		
Description of Contents in brief:			
1.	Remote sensing for the detection of urban features, introduction & basic terminology. Digital image processing techniques case studies for the segmentation of built-up areas.		
2.	Classification algorithms – Land use/ Land cover mapping – change detection – high resolution remote sensing case studies.		
3.	Regional, Master, and detailed development. Use of remote sensing and GIS in plan preparation. Urban information system – Web GIS – case studies.		
4.	Mapping transportation network –Alignment planning – Traffic and parking studies, Accident analysis case studies. Urban growth modeling, Expert systems in planning.		
List of Text Books:			
1.	Remote Sensing and Urban Analysis,Donnay J P, Taylor and Francis		
2.	Remote Sensing Applications for The Urban Environment by Xian G Z, Taylor and Francis		
3.	GIS for the Urban Environment- Juliana Maantay, John Ziegler, John Pickles		

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	Esri Press
List of Reference Books:	
1.	GIS Environmental Modeling and Engineering- Allan Brimicombe, CRC Press
2.	Spatial Analysis: Modeling in a GIS Environment- Paul Longley, Michael Batty, Wiley
3.	Applied Remote Sensing for Urban Planning, Governance and Sustainability Editors: Netzband, Maik, Stefanov, William L., Redman, Charles (Eds.), Springer
URLs:	
1.	https://swayam.gov.in/nd1_noc20_ce24
2.	https://www.geos.ed.ac.uk/~gisteac/gis_book_abridged/files/ch62.pdf
3.	https://www.classcentral.com/course/swayam-geo-spatial-analysis-in-urban-planning-17624

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1 to 4	Remote sensing for the detection of urban features, introduction & basic terminology.
5 to 7	Digital image processing techniques case studies for the segmentation of built-up areas.
8to 11	Classification algorithms – Land use/ Land cover mapping
14 & 15	change detection
16to18	high resolution remote sensing – case studies.
19to21	Regional, Master and detailed development
22 to 24	Use of remote sensing and GIS in plan preparation
25 to 27	Urban information system
28 to 30	Web GIS – case studies
31&32	Mapping transportation network
33 to35	Alignment planning – Traffic and parking studies
36to38	Accident analysis – case studies
39 to 41	Urban growth modeling
42to44	Expert systems in planning

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	REMOTE SENSING AND GIS APPLICATIONS IN DISASTER MITIGATION AND MANAGEMENT		
Course Code	GI559		
Core / Elective / Other	Elective		
Prerequisite:			
1.	Basics of Remote Sensing Technology (GI103)		
2.	Basic Concepts of GIS (GI201)		
Course Outcomes:			
1.	Basic understanding on the areas and issues, where Remote Sensing & GIS techniques can be applied in Disaster Mitigation and Management.		
2.	Skill development for the use of Remote Sensing & GIS techniques in Disaster Mitigation and Management.		
Description of Contents in brief:			
1.	Basic concepts and principles, Hydrological and geological disasters, characteristics crisis and consequences. Needs and approach towards prevention, principles and components of mitigation Disaster legislation and policy, Insurance, Cost effective analysis, Utilization of resources, Training, Education, Public awareness, Role of media.		
2.	Role of Geoinformatics in the Slope stability of Ghat roads, Structural safety of Dams, Bridges, Hospital, Industrial structures. Cyclone shelter projects and their implications and utility of Remote Sensing and GIS.		
3.	Reconstruction after disasters: Issues of practices, Remote Sensing, GIS and GPS role in Hazard evaluation, Zonation, Risk assessment, Damage		

	assessment, Land use planning and regulation for sustainable development. Vulnerability analysis of infrastructure and settlements. Pre-disaster and post disaster planning for relief operations, Potential of GIS applications in the development planning, Disaster management plan and Case studies.
List of Text Books:	
1.	Geometrics Solutions for Disaster Management- S Zlatanova, Andrea F. Jonathan, Springer.
2.	Remote Sensing and GIS Technologies for Monitoring and Prediction of Disasters, Nayak, Shailesh, Zlatanova, Sisi (Eds.), Springer
3.	Flood Hazards Mitigation Analysis Using Remote Sensing and GIS: Correspondence with Town Planning Scheme Dhruvesh P. Patel & Prashant K. Srivastava,Springer
List of Reference Books:	
1.	Mitigation of Natural Hazards & Disasters- C. EmdadHaque, Springer.
2.	Disaster Recovery Planning and Services- Gerard, Blokdijk, Emereo Publishing
3.	Large Scale Disasters: Prediction, Control and Mitigation-Mohamed Gad, Wiley.
URLs:	
1.	https://link.springer.com/article/10.1007/s11269-006-9116-1
2.	https://www.iirs.gov.in/EDUSAT-News
3.	https://nptel.ac.in/courses/105/102/105102015/

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1 & 2	Basic concepts and principles
3 to 7	Hydrological and geological disasterscharacteristics crisis and consequences.
8 to 12	Needs and approach towards prevention, principles and components of mitigation.
13& 14	Disaster legislation and policy, Insurance,
15 to 17	Cost effective analysis, Utilization of resources
18& 19	Training, Education, Public awareness, Role of media.
20 to 25	Role of Geoinformatics in the Slope stability of Ghat roads, Structural safety of Dams, Bridges, Hospital, Industrial structures,
26 to 28	Cyclone shelter projects and their implications and utility of Remote Sensing and GIS.
29& 30	Reconstruction after disasters: Issues of practices,
31 to 35	Remote Sensing, GIS and GPS role in Hazard evaluation, Zonation, Risk assessment, Damage assessment,
36to 38	Land use planning and regulation for sustainable development, Vulnerability analysis of infrastructure and settlements.
39& 40	Pre-disaster and post disaster planning for relief operations
41 to 46	Potential of GIS applications in the development planning, Disaster

	management plan and Case studies.

Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	CHANGE DETECTION USING REMOTE SENSING		
Course Code	GI 560		
Core / Elective / Other	Elective		
Prerequisite:			
1.	Basics of Remote Sensing Technology (GI103)		
Course Outcomes:			
1.	Basic understanding on the change detection techniques and their implementation methodology.		
2.	Skill development for the use of Remote Sensing in change detection.		
Description of Contents in brief:			
1.	Definition and importance of Change detection, Land use Land cover, Classification of Multi temporal data sets, LULC classification system, Stages of land use land cover classification, General Methods of change detection for land use land cover, Change Detection Based on Remote Sensing Information Model.		
2.	Algebraic methods of Change Detection, principle components, post classification comparison, Multivariate alteration detection (Canonical correlation analysis, Orthogonality properties, Scale invariance, iteratively re-weighted MAD, Correlation with the original observation, post processing), Decision thresholds and unsupervised classification of changes, Radiometric Normalization.		
3.	Image Fusion techniques of change detection, Change Vector analysis Technique, Change detection using remote sensing technology as a tool for		

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	Natural hazards planning and damage assessment.
4.	Urban change detection mapping and analysis, Landslides, causes of landslides, Factors affecting, Detection of landslides using remote sensing and GIS techniques.
List of Text Books:	
1.	Image analysis Classification and Change Detection in remote Sensing with algorithms for ENVI/ID Morton J Canty, CRC Press.
2.	Two-Dimensional Change Detection Methods: Remote Sensing Applications, İlsever, Murat, Unsalan, Cem, Springer
3.	Remote Sensing Change Detection, Ross S. Lunetta, CRC press
List of Reference Books:	
1.	Remote Sensing Change Detection: Environmental Monitoring Methods and Applications, Ross S. Lunetta, Christopher Elvidge, CRC press.
2.	Remote Sensing for Environmental Monitoring and Change Detection, Manfred Owe and Christopher Neale, IAHS Press
3.	Application of Remote Sensing in Shoreline Change Detection: Using Multi-Temporal Satellite Data, Shrimanta Ray, VDM Verlag Dr. Müller press
URLs:	
1.	https://www.tandfonline.com/doi/full/10.1080/01431160310001398?src=recsys
2.	https://www.omicsonline.org/open-access/land-use-change-detection-using-remote-sensing-technology-2157-7617-1000496-105716.html

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1	Definition and importance of Change detection
2&3	Land use Land cover, Classification of Multi temporal data sets,
4 to 7	LULC classification system, Stages of land use land cover classification
8&9	General Methods of change detection for land use land cover,
10 to 12	Change Detection Based on Remote Sensing Information Model.
13& 14	Algebraic methods of Change Detection
15 & 16	principle components
17 & 18	post classification comparison
19 to 24	Multivariate alteration detection (Canonical correlation analysis, Orthogonality properties, Scale invariance, iteratively re-weighted MAD, Correlation with the original observation, post processing)
25to 27	Decision thresholds and unsupervised classification of changes
28 & 29	Radiometric Normalization.
30 to 32	Image Fusion techniques of change detection
33 & 34	Change Vector analysis Technique
35 to 37	Change detection using remote sensing technology as a tool for Natural hazards planning and damage assessment.
38 & 39	Urban change detection mapping and analysis

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40 to 45	Landslides, causes of landslides, Factors affecting, Detection of landslides using remote sensing and GIS techniques.

Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	DIGITAL PHOTOGRAMMETRY		
Course Code	GI561		
Core / Elective / Other	Elective		
Prerequisite:			
1.	Basic Concepts of Photogrammetry(GI203)		
Course Outcomes:			
1.	Understanding the working principle and instrumentation of Digital Photogrammetry.		
2.	Skill development for the use of Digital Photogrammetry in mapping and cartography works.		
Description of Contents in brief:			
1.	Evolution of digital Photogrammetry, comparison of analog, analytical & digital systems, and advantages. Digital cameras- geometric problem of CCD image – types of CCD systems - use of CCD scanner in high resolution remote sensing satellites such as SPOT, MOMS, IRS, IKONOS and Quick Bird.		
2.	Image Generation - Data procuring concepts –Display modes - Image measurements.		
3.	Review of space resection & intersection - interior & exterior orientation - Automatic tie point generation - Automatic Block triangulation, feature collection and plotting annotation, editing, various formats of map data.		

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4.	DEM generation - accuracy of DEMs, Orthorectification - regular & irregular data collection methods - contour generation - satellite photogrammetry principles – missions - stereo image products - issues - stereo satellite missions.
List of Text Books:	
1.	Digital Photogrammetry: A Practical Course- Wilfried Linder, Springer
2.	Introduction to Modern Photogrammetry, Edward M. Mikhail, James S. Bethel, J. Chris McGlone, Wiley
3.	Digital Photogrammetry: Theory and Application, Linder, Wilfried, Springer
List of Reference Books:	
1.	Image Sensors and Signal Processing for Digital Still- Cameras, Junichi Nakamura, CRC Press.
2.	Digital Terrain Modeling: Principles and Methodology- Zhilin Li, Qing Zhu, Chris Gold, CRC Press.
3.	Fundamentals of Computational Photogrammetry- Ghosh, Sanjib K., Concept Publishing Co
URLs:	
1.	https://engineering.purdue.edu/online/courses/digital-photogrammetric-systems
2.	https://www.isprs.org/society/ecbi/ECBI-2018 TC5_Tucci_et_al_Final_Report.pdf
3.	https://nptel.ac.in/courses/105/107/105107121/

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1	Evolution of digital Photogrammetry
2 to 4	comparison of analog, analytical & digital systems and advantages.
5 to 10	Digital cameras- geometric problem of CCD image –types of CCD systems
11to 13	use of CCD scanner in high resolution remote sensing satellites such as SPOT, MOMS, IRS, IKONOS and Quick Bird.
14& 15	Image Generation
16 & 17	Data procuring concepts
18	Display modes
19 & 20	Image measurements.
21 to 24	Review of space resection & intersection - interior & exterior orientation
25&26	Automatic tie point generation
27 & 28	Automatic Block triangulation
29 & 30	feature collection and plotting annotation
31& 32	editing – various formats of map data.
33 & 34	DEM generation&accuracy of DEMs
35to 37	Orthorectification - regular & irregular data collection methods
38	contour generation
39&40	satellite photogrammetry principles
41&42	stereo image products - issues

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43&44	stereo satellite missions

Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	ADVANCED SOFT COMPUTING TECHNIQUES		
Course Code	GI562		
Core / Elective / Other	Elective		
Prerequisite:			
1.	Good knowledge of computer programming and numerical methods		
Course Outcomes:			
1.	Understanding the principle and working of Advanced Soft Computing Techniques.		
2.	Skill development for the use of Advanced Soft Computing Techniques for Geospatial data storage and analysis tasks.		
Description of Contents in brief:			
1.	Artificial Neural Systems – Perceptron – Representation – Linear separability – Learning – Training algorithm – The back-propagation network – The generalized delta rule – Practical considerations – BPN Geomatic applications.		
2.	Fuzzy Logic: Fuzzy sets and Fuzzy reasoning – Fuzzy matrices – Fuzzy membership functions– Operators Decomposition – Fuzzy automata and languages – Fuzzy control methods – Fuzzy decision-making Neuro – Fuzzy Modeling: Adaptive networks based Fuzzy interface systems.		
List of Text Books:			
1.	Soft Computing Techniques in Engineering Applications, Editors: Patnaik,		

	Srikanta, Zhong, Baojiang (Eds.), Springer
2.	Principles of Soft Computing, S.N.Sivanandam&S.N.Deepa, John Wiley & Sons
3.	Fuzzy Logic with Engineering Applications- Timothy J.Ross, Wiley.
List of Reference Books:	
1.	Fundamentals of Neural Networks: Architectures, Algorithms And Applications, Lqurene V. Fausett, Pearson.
2.	Neural Networks – Algorithms Applications & Programming Techniques - James Freeman A. and David Skapura M., Addison, Wesley.
3.	Artificial Neural Networks- Yegnanarayana B., PHI Learning Pvt. Ltd.
URLs:	
1.	https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html
2.	https://swayam.gov.in/nd1_noc20_cs17
3.	https://nptel.ac.in/courses/106/105/106105173/

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1 to 6	Artificial Neural Systems – Perceptron – Representation
7 to 9	Linear separability – Learning
10& 11	Training algorithm
12& 13	The back-propagation network
14 & 15	The generalized delta rule
16 to 18	Practical considerations – BPN Geomatic applications.
19 to 23	Fuzzy Logic: Fuzzy sets and Fuzzy reasoning
24 to 28	Fuzzy matrices – Fuzzy membership functions
29 & 30	Operators Decomposition
31 to 34	Fuzzy automata and languages
35 & 36	Fuzzy control methods
37	Fuzzy decision-making
38 to 40	Neuro – Fuzzy Modeling
41 to 45	Adaptive networks based Fuzzy interface systems

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	CONCEPTS OF DATABASE SYSTEMS		
Course Code	GI563		
Core / Elective / Other	Elective		
Prerequisite:			
1.	Good knowledge of computer programming and numerical methods		
Course Outcomes:			
1.	Learning on the fundamental concepts of database systems.		
2.	Skill development for the analysis of Geospatial database.		
Description of Contents in brief:			
1.	Relational Databases: Introduction to relational data models and SQL. Advanced SQL and Query languages.		
2.	Database design and ER model, relational database design.		
3.	Database storage and querying, Indexing and hashing Query processing and optimization.		
4.	Database Transaction management Transactions, concurrency control and recovery system.		
5.	Spatial and temporal data and mobility.		

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6.	Case studies on Oracle, IBM DB2 Universal database Microsoft SQL server and other popular systems
List of Text Books:	
1.	Concepts of Database Management System by Shefali Naik, Pearson
2.	Database system concepts- Silberschatz, Henry F. Korth, S. Sudarshan, C.J. McGraw-Hill
3.	Fundamentals of Database System, ElmasriRamez and NavatheShamkant, Pearson India.
List of Reference Books:	
1.	Database Systems A Practical Approach to Design Implementation and Management, Thomas Connolly, Pearson India
2.	DATABASE SYSTEMS: THE COMPLETE BOOK, Garcia-Molina, Pearson Education India
URLs:	
1.	https://www.google.com/aclk?sa=L&ai=DChcSEwilxaLuq-DpAhWT15YKHbxuAIMYABACGgJ0bA&sig=AOD64_1rrCr7Xs3aFwzTEcsX22A1xUllZA&q=&ved=2ahUKEwiak5nuq-DpAhUF4zgGHX-yBiYQ0Qx6BAgTEAE&adurl=
2.	https://nptel.ac.in/courses/106/106/106106093/
3.	https://nptel.ac.in/courses/106/105/106105175/

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1 to 6	Relational Databases: Introduction to relational data models and SQL.
7 to 12	Advanced SQL and Query languages.
13 to 16	Database design and ER model
17to19	relational database design
20 to 23	Database storage and querying,
24 to 28	Indexing and hashing Query processing and optimization.
29 to 33	Database Transaction management Transactions, concurrency control and recovery system.
34 to 37	Spatial and temporal data and mobility.
38 to 45	Case studies on Oracle, IBM DB2 Universal database Microsoft SQL server and other popular systems

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Name of Program	**M. Tech. Geoinformatics & its Applications**	**Semester-II**	**Year-2020-21**
Name of Course	GEOINFORMATICS APPLICATIONS IN ENGINEERING PROJECTS AND UTILITY MANAGEMENT		
Course Code	GI564		
Core / Elective / Other	Elective		
Prerequisite:			
1.	Basics of Remote Sensing Technology (GI103)		
2.	Basic Concepts of GIS (GI201)		
Course Outcomes:			
1.	Basic understanding on the areas and issues, where Geoinformatics techniques can be applied inEngineering Projects and Utility Management.		
2.	Understanding on the methodology for the use of Remote Sensing, GPS& GIS techniques inEngineering Projects and Utility Management.		
Description of Contents in brief:			
1.	Role of Geoinformatics in the infrastructure planning and management, advantages of Geoinformatics over conventional methods.		
2.	Remote Sensing, GIS and GPS applications in Forestry, Water, Electricity		

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	distribution system, Telecommunication infrastructure.Tower spotting, route optimization for meter reading.
3.	Vehicle Tracking: Automatic vehicle location (AVL), Components of AVL & Mobile mapping. Web GIS: Architecture of Web GIS, Map server, Web GIS applications, Structure health monitoring using Geoinformatics Techniques.
4.	Reservoir Sedimentation and Dam safety input using Geoinformatics Techniques.
List of Text Books:	
1.	GIS Tools for Water, Wastewater, and Stormwater Systems- UzairM.Shamsi ASCE Press
2.	Introduction to Geographic Information Systems for Public Health- Alan L, MD Melnick Aspen Publishers.
3.	GIS Environmental Modeling and Engineering- Allan Brimicombe. CRC Press.
List of Reference Books:	
1.	Remote Sensing of the Environment: An Earth Resource Perspective, Jensen, Pearson India
2.	Geographic Information Systems and Science Paul Longley, Michael F. Goodchild et al, Wiley.
URLs:	
1.	https://www.geos.ed.ac.uk/~gisteac/gis_book_abridged/files/ch57.pdf
2.	https://core.ac.uk/download/pdf/25574403.pdf
3.	http://www.nwmissouri.edu/library/theses/2009/VegaRamiro.pdf
4.	https://www.esri.com/library/brochures/pdfs/gis-sols-for-civil-engineering.pdf

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
1 to 3	Role of Geoinformatics in the infrastructure planning and management
4 & 5	advantages of Geoinformatics over conventional methods.
8 to 11	Remote Sensing, GIS and GPS applications in Forestry
14 to 16	Water
17& 18	Electricity distribution system
19& 20	Telecommunication infrastructure. Tower spotting
21	route optimization for meter reading
22 to 26	Vehicle Tracking: Automatic vehicle location (AVL), Components of AVL & Mobile mapping.
27 to 34	Web GIS: Architecture of Web GIS, Map server, Web GIS applications,
35& 36	Structure health monitoring using Geoinformatics Techniques.
37 to 42	Reservoir Sedimentation and Dam safety input using Geoinformatics Techniques.