M.Sc., GEOINFORMATICS

SYLLABUS

(Revised Syllabus w.e.f the academic year 2024-25 under the CBCS)

CENTRE FOR GEOINFORMATICS
The Gandhigram Rural Institute (Deemed to be University)
(Ministry of Education, Govt. of India)
Accredited by NAAC with 'A' Grade (3rd Cycle)
Gandhigram – 624 302
Dindigul District, Tamil Nadu

CENTRE FOR GEOINFORMATICS

The Gandhigram Rural Institute (Deemed to be University)

I. Programme Code : GISP

II. Programme : M.Sc. Geoinformatics

III. Programme Educational Objectives (PEO)

PEO1: to assess the spatial distribution of natural resources using tools of Geoinformatics.

PEO2: to succeed in getting employment in their field of interest / related areas of RS/ GIS/ GNSS.

PEO3: to grow in their professional career through higher education in the areas of GIS/ RS/ GNSS and software development.

PEO4: to cater to the needs of the industry in order to contribute for the development of the society

PEO5: to become a consultant

IV. Graduate Attributes for M.Sc., Geoinformatics (GA)

1. Computational Knowledge:

In the area of natural resource and disaster management, they can apply the tools/ techniques of Geoinformatics.

2. Geospatial problem Analysis:

For the problems related to natural resource and disaster management, they can identify, formulate, review and solve, by which they can provide a valid solutions using the tools/techniques of Geoinformatics.

3. Design /Development of Solutions:

For complex geospatial problems in the area of natural resource management, they can design and evaluate solutions. Similarly, they can evolve models that can meet specified needs with appropriate consideration for rural development in general and public health and safety, cultural, societal and environmental considerations in particular.

4. Conduct Investigations of Complex Geospatial Problems:

In case studies, internship and dissertation they experiment, analyse and interpret the data to provide valid alternate solutions. Thus adopts research-based knowledge and research methods.

5. Professional Ethics:

Understand and commit to professional ethics.

6. Life-long Learning:

As a Geoinformatics professional, as per the requirement and need, they have the

ability to learn independently for periodic updating.

7. Communication Efficacy:

They are capable to communicate effectively with the professional community and also with the society; as they are able to understand clear instructions, comprehend and write effective reports, design documentation and make effective presentations.

8. Societal and Environmental Concern:

Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional practice.

9. Individual and Team Work:

They can function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

10. Innovation and Entrepreneurship

They can use innovation to pursue an opportunity to create value and wealth for the betterment of the society in serve and an individual in particular.

V. Programme Outcomes (PO)

PO1: Become knowledgeable in the use of tools of Geoinformatics and apply them to the needs of the Employer / Institution / Enterprise / Society.

PO2: Gain hands on experience in Remote Sensing, Digital Image Processing (DIP), GIS, GPS and Programming / scripting languages

PO3: Analyze the problems associated with natural resource and disaster management

PO4: Develop tools / software in analyzing the issues in Natural Resource and Disaster Management

PO5: Acquire knowledge in designing a GIS to gain field experience in identifying and analyzing problems related to natural resources/ disasters at various levels.

VI. Programme Specific Outcome (PSO)

PSO1: Map the natural resources/ disaster using tools of Geoinformatics

PSO2: Inventory of rural resource using Geoinformatics to solve natural resource related issues at various levels.

PSO3: Apply the knowledge of Geoinformatics in the domain of identification and solving of natural resources/ disaster problems

PSO4: Design new tools/ tool bars and customize software to analyse natural resource/ disaster data using Programming/ scripting languages along with the use of open source data and software

PSO5: Selection and evaluation of tools and techniques of Geoinformatics and their suitability for natural resource/ disaster management.

Eligibility: A pass in UG degree in Sciences, Social Sciences, Engineering, Vocational and Technology discipline

VIII. Scheme of Examination of the Programme
M.Sc. Geoinformatics
(Revised Syllabus w.e.f the Academic year 2024 – 2025 under the CBCS)

Semester	Category	Course Code	Title of the Course	K	No. of Credits	Theory (hours)	Practical (hours)	Duration of ESE (Hours)	Evaluation Marks		Total Marks
									CFA	ESE	
I	Major Courses	24GISP0101	Introduction to Geoinformatics	2-4	4	4		3	40	60	100
		24GISP0102	Remote Sensing and Photogrammetry	2-4	4	4	-	3	40	60	100
		24GISP0103	Digital Image Processing	2-6	4	4	-	3	40	60	100
		24GISP0104	Programming Languages for Geoinformatics	2-6	4	4		3	40	60	100
		24GISP0105	Practical -I: Remote Sensing, Digital Image Processing and Photogrammetry	2-6	2		4	3	60	40	100
		24GISP0106	Practical - II: Programming Languages for Geoinformatics	2-6	2		4	3	60	40	100
	AUC	21GTPP0001	Gandhi in Everyday Life	2-3	2	2	-	-	50	-	50
				Total	**22**	**18**	**8**	**-**			
II	Major Courses	24GISP0207	Cartography	2-4	4	4		3	40	60	100
		24GISP0208	Geographical Information System	2-6	4	4		3	40	60	100
		24GISP0209	Spatial Data Science	3-4	4	4	-	3	40	60	100
		24GISP0210	Practical - III: Cartography & Geographical Information System	3-6	2		4	3	60	40	100
		24GISP0211	Practical -IV: Spatial Data Science	2-6	2		4	3	60	40	100
	MC	24GISP00MX	Modular Course	3-6	2	2			50	-	50
	GE		Elective - Generic	4-5	3	3		3	40	60	100
	VAC	24GISP2VAX	VAC		-	-	-	-	50	-	50
	AUC	24ENGP00C1	Communication / Soft Skills		2	2		-	50	-	50
	MC	24GTPP04M1	Human Value and Professional Ethics		2	2		-	50	-	50
				Total	**25**	**21**	**8**	**-**			
III	Major Courses	24GISP0312	Global Navigation Satellite System	2-6	3	3		3	40	60	100
		24GISP0313	Geoinformatics in Resource Management	2-6	4	4		3	40	60	100
		24GISP0314	Geoinformatics in Disaster Management	2-6	3	3		3	40	60	100
		24GISP0315	Practical -V: Geoinformatics in	2-6	2		4	3	60	40	100

			Resources and Disaster Management								
		24GISP0316	Practical -VI: Case Study in GIS / RS/ Web GIS	3-6	2		4	3	60	40	100
		24APRP0101	Research Methods and Statistics	4-6	4	4		3	40	60	100
	DCE	24GISP03DX	Elective – Discipline Centric	3-6	3	3	-	3	40	60	100
	VAC	**24**GISP3VAX	VAC	-	-	-	-	-	50	-	50
	EXW	24GISP03V1	Village Placement Programme	5-6	2		-	-	50	-	50
	MC	24GISP00MY	Modular Course	3-6	2	2	-		50	-	50
	Total				**25**	**19**	**8**	**-**			
IV	Major	24GISP0417	Dissertation *	5-6	6		**12**		75	125	200
		24GISP0418	Internship**	5-6	12		**24**		200	-	200
	Total				**18**	**-**	**36**				
Grant Total (I + II + III + IV)					**90**	**58**	**60**				

Major Course

Semester	Course Code	Title of the Course	No. of Credits
I	24GISP0101	Introduction to Geoinformatics	4
	24GISP0102	Remote Sensing and Photogrammetry	4
	24GISP0103	Digital Image Processing	4
	24GISP0104	Programming Languages for Geoinformatics	4
	24GISP0105	Practical -I: Remote Sensing, Digital Image Processing and Photogrammetry	2
	24GISP0106	Practical - II: Programming Languages for Geoinformatics	2
		Total	**20**
II	24GISP0207	Cartography	4
	24GISP0208	Geographical Information System	4
	24GISP0209	Spatial Data Science	4
	24GISP0210	Practical - III: Cartography & Geographical Information System	2
	24GISP0211	Practical -IV: Spatial Data Science	2
		Total	**16**
III	24GISP0312	Global Navigation Satellite System	3
	24GISP0313	Geoinformatics in Resource Management	4
	24GISP0314	Geoinformatics in Disaster Management	3
	24GISP0315	Practical -V: Geoinformatics in Resources and Disaster Management	2
	24GISP0316	Practical -VI: Case Study in GIS / RS/ Web GIS	2
	24APRP0101	Research Methods and Statistics	4
		Total	**18**
IV	24GISP0417	Dissertation *	6
	24GISP0418	Internship**	12
		Total	**18**
		Grant Total (I + II + III + IV)	**72**

Elective - Discipline Centric

Discipline Centric courses - 24GISP03DX	
24GISP03D1	Earth, Atmospheric, Ocean and Planetary Sciences
24GISP03D2	Geoinformatics for Watershed Management
24GISP03D3	Web Technology for Geoinformatics
24GISP03D4	Google Earth Engine for Remote Sensing Applications
24GISP03D5	Geoinformatics for Agriculture
24GISP03D6	Geoinformatics for Forestry
24GISP03D7	Geoinformatics for Water Resource Management
24GISP03D8	Geoinformatics for Urban Planning and Utility Management

Modular Course

Modular Course 24GISP00MX / MY	
24GISP00M1	Spatial Decision Support System
24GISP00M2	Open Source Software
24GISP00M3	LiDAR and its Applications
24GISP00M4	Drone Image Processing
24GISP00M5	Geoinformatics for Network Planning and Management

Value Added Courses

VAC 24GISP2VAX/ 24GISP3VAX	
24GISP2VA1	Advanced Surveying
24GISP2VA2	Planetary Remote Sensing
24GISP2VA3	Satellite Meteorology
24GISP2VA4	Land Use/ Land Cover Mapping using Google Earth Engine
24GISP2VA5	ArcGIS API for JavaScript
24GISP2VA6	Data Visualization with Tableau
24GISP2VA7	Spatial Databases and MySQL

Name of the Programme	**M.Sc. Geoinformatics**				
Year of Introduction	2002				
Year of Revision	2024				
Semester-wise Courses and Credit distribution	I	II	III	IV	**Total**
No. of Courses	7	9	9	2	**27**
No. of Credits	22	25	25	18	**90**

Semester	I	**Course Code**	**24GISP0101**
Course Title	**Introduction to Geoinformatics**		
No. of Credits	4	No. of contact hours per Week	4
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze)		
Course Objectives	The Course aims to • Understand Earth's origin, interior, and physiography. • Understand leveling methods, traversing, triangulation, trilateration. • Explore Remote sensing and GIS • Analyze geodata visualization and analysis • Explore applications in geosciences, forestry, soil studies, meteorology etc.,		

UNIT	**Contents**	**No. of Hours**
I	Earth – Origin, Interior, Age, size, shape and Physiography. Atmosphere: Origin and nature, Composition and layers of the atmosphere. Hydrosphere and lithosphere constituents – Biosphere Interactions – Human Impact on Earth Systems	10
II	Geodetic information - lat - long - time – altimetry. Basic principles of surveying – Classification and applications- Scales - Land Surveying - Various Levels, Leveling methods, Compass, Theodolite and Total Station and their uses, Tachometer, Trigonometric leveling, Traversing, Triangulation and Trilateration - Survey Data Processing - Surveying Standards and Accuracy	15
III	Meaning and Scope of Geoinformatics – Science and Technologies involved: Remote Sensing - Geographical Information System- Digital Image Processing - Photogrammetry - Geodesy- GNSS - Information & Communication Technologies	15
IV	Aerial and Satellite based survey techniques - Photogrammetry, RADAR, LiDAR – survey using GNSS & UAV.	10
V	Application of Geoinformatics: Rural Development, Civil Engineering, Disaster Management, Geosciences, Agriculture, Forestry, Soil, Land, Water, Meteorology, Military, Transport, Environmental studies, Banking, Health, Telecommunication, Electricity, Coastal, Oil & Gas Industries etc.,	10
References	Text Books 1. Chandra A.M., Geoinformatics, New Age International Publishers, New Delhi, 2016.	

	2. LO. C.P., and Albert K.W.Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall of India, New Delhi, 2006.
	Reference Books: 1. Peter A. Burrough et al., Principles of Geographical Information System (3rd Edition), Oxford University Press Inc., New York, 2015. 2. Ian Heywood, Sarah Cornelivs and Steve Carver, An Introduction to Geographical Information System (3rd Edition), Pearson Education Pvt .Ltd., New Delhi, 2017. 3. Arthur H. Robinson et al. Elements of Cartography (6th Edition), Wiley India Pvt .Ltd, New Delhi, 2016. 4. Misra, R.P. and Ramesh, A, Fundamentals of Cartography, Concept Publishing Company, New Delhi, 2002. 5. Lillesand, Kiefer and Chipman, Remote Sensing and Image Interpretation (6th Edition), Wiley India Pvt. Ltd, New Delhi, 2017.
	E-Resources: 1. https://courses.lumenlearning.com/geophysical/chapter/the-composition-and-structure-of-earth/ 2. https://www.britannica.com/topic/evolution-of-the-atmosphere-1703862 3. https://ncert.nic.in/textbook/pdf/kegy303.pdf 4. http://bbsbec.edu.in/wp-content/uploads/2020/01/com.pdf 5. http://www.gitta.info/Generalisati/en/image/Signs.pdf 6. https://www.icsm.gov.au/education/fundamentals-mapping/surveying-mapping/surveying-methods 7. https://www.researchgate.net/publication/291833102_GIS_Scope_and_Benefits 8. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/remote-sensing-technology 9. http://sdeuoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20Gonzalez%2C%20R.%20Woods-ilovepdf-compressed.pdf 10. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/photogrammetry
Course Outcomes	On completion of the course, students should be able to do,
	CO1 Understand the basic information about to earth, atmosphere and principles of acquiring earth related information. CO2 Understand the meaning, scope and science & technologies involved in Geoinformatics. CO3 Understand and analyze the basics principles of surveying using conventional and modern tools and technologies. CO4 Apply various methods of Geodata visualization for analysis. CO5 Apply tools of Geoinformatics in various applications.

Mapping of COs with PSOs :

CO	PSO				
	1	**2**	**3**	**4**	**5**
CO 1	2	2	2	1	1
CO 2	2	2	2	1	1
CO 3	3	3	3	1	1
CO 4	2	2	2	2	2
CO 5	3	3	3	3	3

Semester	I	**Course Code**	**24GISP0102**
Course Title	**Remote Sensing and Photogrammetry**		
No. of Credits	4	No. of contact hours per Week	4
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze)		
Course Objectives	The Course aims to • understand the basic concepts of remote sensing and photogrammetry • Understand the systems and techniques of data acquisition, LiDAR, Hyperspectral remote sensing and data products of different satellites.		

UNIT	Content	No. of Hours
I	History and development - Electro Magnetic Spectrum - Components and types of remote sensing – Energy interaction with atmosphere and Earth features - Resolutions (Spectral, Spatial, Temporal & Radiometric) - Platforms – Sensors - Scanning & Orbiting Mechanism of Satellites and Data Acquisition. - Optical Remote Sensing: Basic concepts - Optical sensors and scanners Image interpretation – Visual Interpretation elements	10
II	Aerial Photograph: Historical development – Classification - Geometry of vertical aerial photograph, Flight planning - scale of vertical aerial photograph, relief displacement. - Stereoscopic parallax - Aerial triangulation – Ortho photograph generation, Mosaic - Digital photogrammetry	10
III	Thermal Remote Sensing: Basic concepts - Thermal sensors & scanners - Thermal Inertia. Microwave Remote Sensing: Basic Principles, Radar Operation, Polarization, Spatial Resolution, Radar Image Geometry, Relief Displacement, Shadows and Speckle effect, Side Looking Radar System (SLAR) Operation, Synthetic Aperture Radar (SAR), Radar Interferometry, RADAR Environmental Considerations. Missions : RISAT,	10

	RADARSAT, Sentinel 1A&1B, NISAR, ALOS PALSAR – SRTM LiDAR – LiDAR system - components - operating principles–- LiDAR data characteristics – advantages.	
IV	Hyper spectral Remote Sensing: basic concepts Hyperspectral sensors, data formats and systems, AVIRIS, CASI, MODIS and Hyperion. Lunar Remote Sensing – Mars Mission.	8
V	Types of satellites – environmental, resource survey satellites, weather and communication satellites, GPS satellites and Shuttle Mission - Major satellite systems: Sensors and data products of IRS, LANDSAT, SPOT, ERS, IKONOS, Quik Bird, ORBVIEW, WORLD VIEW and others – UAV and low altitude payloads in different spectral regions.	10
References	**Text Books** 1. Lillesand, Kiefer & Chipman, Remote Sensing and Image Interpretation (6th Edition), Wiley India Pvt.Ltd, New Delhi, 2017. 2. Paul R. Wolf., Elements of Photogrammetry, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2014.	
	Reference Books 1. Basudeb Bhatta, Remote Sensing and GIS (2nd Edition), Oxford University Press, New Delhi, 2017. 2. John R.Jensen, Remote Sensing of the Environment: An Earth Resource Perspective (2nd Edition), Pearson India Education Services Pvt Ltd, Noida, 2018. 3. Ravi P. Gupta, Remote Sensing Geology (2nd Edition), Springer (India) Pvt. Ltd., 2014. 4. M. Anji Reddy, Text Book of Remote Sensing and Geographical Information Systems (4th Edition), BS Publications, Hyderabad, 2019. 5. Chandra A.M and Ghosh. S.K., Remote Sensing and Geographic Information System (2nd Edition), Narosa Publishing House Pvt. Ltd., New Delhi, 2017. 6. Mikhail et al., Introduction to Modern Photogrammetry, Wiley India Pvt. Ltd., New Delhi, 2013.	
	E-Resources 1. https://ncert.nic.in/textbook/pdf/kegy307.pdf 2. https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/resource/tutor/fundam/pdf/fundamentals_e.pdf 3. https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesremotesensing.pdf 4. https://www.electronicshub.org/different-types-sensors/ 5. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000017GE/P00178 8/M027029/ET/1517207018AERIALPHOTOGRAPHY(2.pdf 6. https://www.slideshare.net/virajain/lecture-1aerial-photogrammetry 7. /1002056/CK3.pdf/4e5b4e5a-d898-43b8-9e5c-ba7494aa58c8 8. http://www.geoinformatie.nl/courses/gima_rs/Day%203/GIMA%20ch4%20Microwave%20Remote%20Sensing.pdf 9. https://www.sciencedirect.com/topics/earth-and-planetary-	

	sciences/side-looking-radar
Course Outcomes	On completion of the course, students should be able to do, CO1 Understand the basic concepts of remote sensing. CO2 Understand aerial photography, types, planning and execution. CO3 Apply different photogrammetric techniques CO4 Understand the basics of LiDAR, RADAR, Microwave remote sensing and its principles. CO5 Understand various satellite and sensors

Mapping of Cos with PSOs :

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	3	1	1
CO 2	2	2	2	1	1
CO 3	3	3	3	1	1
CO 4	3	3	3	1	1
CO 5	2	2	2	1	1

Semester	I	Course Code	**24GISP0103**
Course Title	**Digital Image Processing**		
No. of Credits	4	No. of contact hours per Week	4
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate)		
Course Objectives	The Course aims to • apply the concept of digital image processing techniques • analyze the digital data • evaluate and create information on Earth using digital data		

UNIT	Content	No. of Hours
I	Digital Data: Basic Characteristics of digital image - data type and file format. Data acquisition and interpretation - Image display systems - Image sampling and quantization - Basic relationship between pixels - data merging - image transmission and compression.	8
II	Digital Image Processing: Introduction - stages in digital image processing - Preprocessing: geometric correction, atmospheric correction and radiometric correction	10
III	Image Enhancement: stretch, Single Band Enhancement (Image reduction & Magnification, Contrast Stretching, Filtering & Edge enhancement) - Multiband Enhancement (Band rationing, color composite generation, Principal Component Analysis, NDVI, NDWI & other indices).	9
IV	Image Classification: Unsupervised classification - Supervised classification technique - training sites - classification stage - minimum distance to mean classifier – parallelepiped classifier - maximum likelihood classifier - Hybrid Classification – Sub Pixel Classification - Fuzzy Classification - accuracy assessment- post classification smoothing change detection procedures	13

V	Hyperspectral Image Processing: Data cube, Hyperspectral Profiles, Data Redundancy, - Problems with Dimensionality, Principal Component, Minimum Noise Fraction (MNF) - Atmospheric Correction, Pixel Purity Index, Empirical line Calibration - Reflectance Transformation, Continuum Removal - Spectral feature Fitting, Spectral Angle mapper & SVM. Microwave Image Processing	8
References	**Text Books** 1. John R Jenson, "Introducing Digital Image Processing", Prantice Hall. New Jersy 1986. 2. Lillesand, Kiefer and Chipman, Remote Sensing and Image Interpretation (6th Edition), Wiley India Pvt.Ltd, New Delhi, 2017.	
	Reference Books 1. Jensen R. John, Remote Sensing of the Environment An Earth Resource Perspective, Pearson Education Pvt. Ltd., Delhi, 2006. 2. Gibson, Paul.J. and Clare H. Power, Introductory Remote Sensing: Digital Image Processing and Applications, Routledge, London, 2000. 3. Milman S. Andrew, Mathematical Principles of Remote Sensing making Inferences from Noisy Data, Ann Arbor Press, Noida, 1999. 4. J.Curran, Principles of Remote Sensing, English Language Book Society, Longman, 1985. 5. John A. Richards, Springer-Verlag, Remote Sensing Digital Image Analysis, 1999. 6. Digital Image Processing (3rd Edition) Rafael c.Gonzolez, Richard E.Woods Prentice Hall, 2007.	
	E-Resources 1. https://www.youtube.com/watch?v=hhddNZloKWs 2. https://www.youtube.com/watch?v=H0MQ287871o 3. https://www.iare.ac.in/sites/default/files/lecture_notes/DIP-LECTURE_NOTES.pdf 4. https://www.mtholyoke.edu/courses/tmillett/course/geog205/files/remote_sensing,pdf 5. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004021910156883ajay_misra_geo_Digital_Image_Processing.pdf 6. https://www.ques10.com/p/33595/what-is-image-processing-explainfundamental-steps/ 7. https://sisu.ut.ee/imageprocessing/book/6coursesonline.iasri.res.in/mod/page/view.php?id=2065 8. file:///C:/Users/admin/Downloads/HyperspectraRemoteSensingDataAPr acticalManual_20131.pdf 9. https://www.l3harrisgeospatial.com/Company/News/NewsDetail/ArtMID/11139/ArticleID/23460/The-Science-and-Art-of-Hyperspectral-Image-Analysis 10. 10.https://sisu.ut.ee/imageprocessing/book/6coursesonline.iasri.res.in/mod/page/view.php?id=2065	
Course Outcomes	On completion of the course, students should be able to do,	

	CO1	Understand digital data, format, acquisition and interpretation of various remotely sensed satellite images.
	CO2	Understand maps preprocessing and enhancement.
	CO3	Understand various image classification techniques
	CO4	Understand various DIP techniques used in Hyperspectral Images.
	CO5	Understand various outputs and other techniques.

Mapping of Cos with PSOs:

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	3	1	1
CO 2	2	2	2	1	1
CO 3	3	3	3	1	1
CO 4	2	2	2	1	1
CO 5	2	2	2	1	1

Semester	I	Course Code	**24GISP0104**
Course Title	**Programming Languages for Geoinformatics**		
No. of Credits	4	No. of contact hours per Week	4
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • Offer Object Oriented Programming concepts in python and basic knowledge on Machine Learning and Deep Learning.		

UNIT	Content	No. of Hours
I	Introduction OOPS Concept – Application of OOPS –Introduction - Variables - Expressions - Statements - Operators - Conditionals and Looping Statements - Functions.	10
II	Strings - Lists - Tuples - Dictionaries - Files and exceptions. Library : Geemap - Arcpy- Pandas - Geopandas - Geemap - RSGISLib - GDAL/OGR - Folium - ipyleaflet - Scikit - Matplotlib - NumPy - PyProj- PyTorch - Keras - TensorFlow - Theano–SciPy – LiDAR. Reading Satellite images.	10
III	Packages and Modules - Class and objects - Class and methods - Sets of objects - Inheritance - Linked lists - Stacks - Queues – Trees.	10
IV	Introduction to Machine Learning - Overview of Machine Learning - Types of Machine Learning - Machine Learning Workflow - Tools and Libraries - Practical Examples and Exercises - Ethical Considerations and Challenges in Machine Learning - GIS in Machine Learning.	9
V	Introduction to Deep Learning - Overview of Deep Learning - Neural Networks Fundamentals - Deep Learning Frameworks - Training Neural Networks - Convolutional Neural Networks (CNNs) - Recurrent Neural Networks (RNNs) - Practical Examples and Exercises- Evaluation and Tuning - Ethical Considerations in Deep	9

	Learning. Applications of GIS in Deep Learning.	
References	**Text Book** 1. Think Python: How to Think Like a Computer Scientist by Allen B. Downey 2. Introduction to Machine Learning with Python by Andreas C. Müller and Sarah Guido 3. Deep Learning by Ian Goodfellow, YoshuaBengio, and Aaron Courville	
	Reference Books 1. Machine learning algorithms using python programming, Gopal Sakarkar, Gaurav Patil And Prateek Dutta, Nova Publisher. 2. E.Balagurusamy, Introduction to Computing and Problem Solving Using Python, McGraw Hill Education (India) Pvt. Ltd., Chennai, 2016. 3. ReemaThareja, Problem Solving and Programming with Python, Oxford University Press, New Delhi, 2018. 4. Allen B.Downney, Think Python (2nd Edition), Shroff Publishers & Distributors Pvt. Ltd., New Delhi, 2019. 5. Michael Bowled, Machine Learning in Python, Wiley India Pvt.Ltd, New Delhi, 2015. 6. Guida Van Rossum et al., An Introduction to Python, Shroff Publishers & Distributors Pvt. Ltd., New Delhi, 2019	
	E-Resources: 1. ArcPy and ArcGIS, http://www2.arinigeo.com/wp-content/uploads/2016/05/ArcPy-and-ArcGIS-Geospatial-Analysis-with-Python-by-Silas-Toms.pdf 2. Programming ArcGIS 10.1 with Python Cookbook, http://pdf.th7.cn/down/files/1312/Programming%20ArcGIS%2010.1%20with%20Python%20Cookbook.pdf 3. Python, http://www.davekuhlman.org/python_book_01.pdf 4. Python Scripting for ArcGIS , http://darrylmcleod.com/wp-content/uploads/2016/06/Python-Scripting-for-ArcGIS.pdf	
Course Outcomes	On completion of the course, students should be able to do, CO1 Understand the basic concepts of object oriented programming CO2 Write simple programs using Python. CO3 Understand advanced concept of Python CO4 Understand Machine Learning Algorithms CO5 Understand Deep Learning Algorithms	

Mapping of Cos with PSOs:

CO/PO	PSO				
	1	**2**	**3**	**4**	**5**
CO 1	1	2	3	2	3
CO 2	2	2	3	2	3
CO 3	1	3	2	3	3
CO 4	1	2	3	3	3
CO 5	1	3	2	1	2

Semester	I	**Course Code**	**24GISP0105**
Course Title	**Practical –I: Remote Sensing, Digital Image Processing and Photogrammetry**		
No. of Credits	2	No. of contact hours per Week	4
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Core Course		
Scope of the Course	Basic Skill / Advanced Skill Skill Development Employability		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • Provide hands on experience on visual interpretation of different satellite images and digital image processing techniques.		

UNIT	**Content**	**No. of Hours**
I	1. Study of various visual Remote Sensing Equipments 2. Decoding of different aerial and satellite data 3. Interpretation of Black & White and Multi-color images 4. Interpretation of optical, thermal and microwave images 5. Generation of various thematic maps using image. 6. Preparing maps using Total Station & DGPS	12
II	7. Stereovision Test and Anatomy of pocket & Mirror Stereoscopes. 8. Interpretation of Aerial photographs 9. Decoding, Marking & Transfer of Principal Points, Base line drawing, Flight line marking, 3D Observation, Tracing details, Transfer the details to base map.	12
III	10. Reading and displaying satellite data from BIL, BSQ and BIP formats 11. Layer stacking and Band Combination 12. Georeferencing the base image, Image to Image, Map to Image 13. Extracting / Subset, Area of Interest (AOI) 14. Measuring distance and area. 15. Mosaic	12

IV	16. Preprocessing - Geometric correction of satellite image 17. Enhancement using different filtering techniques, Image Fusion 18. Principal Component Analysis (PCA) 19. Band ratio, NDWI, NDSI, RVI, TNDVI, PRI, NDVI etc. 20. Classification (Supervised, Unsupervised, SVM, etc) 21. Accuracy Assessment 22. Change detection 23. Terrain Analysis	12
V	24. Layout Preparation 25. Hyper spectral Image Analysis – (BBL, Band Combination, Destriping, Spectral Angle Mapping, End member extraction, Spectral Unmixing) 26. 3D visualization 27. SAR Image Processing	12
Course Outcomes	On completion of the course, students should be able to do,	
	CO1 Interpret aerial photographs, satellite images	
	CO2 Transfer of information from image to base map	
	CO3 Preprocessing and enhancement of satellite data.	
	CO4 Apply unsupervised and supervised classification techniques and apply &analyze the accuracy.	
	CO5 Apply various Image Processing technique.	

Mapping of Cos with PSOs:

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	3	1	1
CO 2	2	2	2	1	1
CO 3	2	2	2	2	2
CO 4	3	3	3	2	2
CO 5	3	3	3	3	3

Semester	I	**Course Code**	**24GISP0106**
Course Title	**Practical – II: Programming Languages for Geoinformatics**		
No. of Credits	2	No. of contact hours per Week	4
New Course / Revised Course	Revised	If revised, Percentage of Revision effected	**20%**
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-6: (Create)		
Course Objectives	The Course aims to • Import basic programming knowledge using Python for Geoinformatics. • Provide basic knowledge on GDAL to read GIS image files Python. • Provide basic knowledge on lpyleaflet in python.		

UNIT	Content	No. of Hours
I	**<u>Python Programming</u>** 1. Operators 2. Decision statements (if- else, switch) 3. Basic Loop operations 4. Strings 5. Math Functions and IO functions 6. Functions 7. Recursion Function 8. File Operations 9. Class and Objects 10. Constructor 11. Overloading (Functional and Operator) 12. Inheritance 13. Exception Handling 14. Modules 15. List 16. Tuple 17. Dictionaries 18. Stacks 19. Queues 20. Linked List	20

	21. Trees	
II	**GDAL Libraries** 1. File Reading Operations 2. Satellite Image Reading 3. Manipulation on Satellite Images	15
III	**Ipyleaflet Libraries** 1. Simple Map reading 2. Simple Map operations 3. Adding marks on a Map	15
Course Outcomes	On completion of the course, students should be able to do,	
	CO1 Develop programs using decision making, functions, Class, Inheritance, Data structures and in Python	
	CO2 Write Python programming for GDAL Libraries	
	CO3 Write Python programs for lpyLeaflet Libraries	

Mapping of Cos with PSOs:

CO/PO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	1	3	2	3	3
CO 2	2	3	2	1	3
CO 3	2	1	3	3	2

Semester	II	**Course Code**	**24GISP0207**
Course Title	**Cartography**		
No. of Credits	4	No. of contact hours per Week	4
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	50%
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4:(Analyze)		
Course Objectives	The Course aims to • help the students to know about the basic principles and importance of cartography, map projection, data visualization, map design and layout and various techniques of map production and reproduction.		

UNIT	Content	No. of Hours
I	**Basics:** Definition – nature, scope and its role – Types of map – Principles, Characteristics - Components of Digital Cartography - Benefits – disadvantages of digital cartography - Conventional mapping Vs Digital Mapping; Web cartography - Nano cartography. Trends, challenges, and opportunities in digital cartography.	10
II	**Map projection:** Basics and importance of Projections in digital mapping - Uses and types of projection - Conical – Azimuthal - Cylindrical – map scale	11
III	**Source & Data Collection:** Primary & Secondary Sources, types and methods of collecting geospatial data - Traditional and modern methods of field data collection - Open Data Portals (Exploring sources like Open Street Map, USGS Earth Explorer, and other open data repositories) - Data Quality and Standards - Metadata and Documentation - Sensor Networks and IoT - Data Collection Tools and Software.	10
IV	**Visualization of data**: Conventional signs and symbols - Typography and font selection, Color theory in cartography, Labeling and annotation guidelines – 2D visualization (Choropleth – Chorochromatic – Isopleth - Choroschematic) – 3D visualization (TIN, DEM, DSM, DTM, Hill Shading, Hatching, visibility analysis, slope, aspect) – 4D visualization (creation of movies, animation) – virtual reality map – Big Data Visualization - Designing maps for web and mobile platforms - Layout Design	12

V	**Data Management, Analysis & Future Trends** : Geospatial Databases **-** Data Integration and Interoperability - Spatial Analysis - Geospatial Data Standards - Geospatial Artificial Intelligence (GeoAI) Smart Cities and IoT (role of digital cartography in smart city initiatives) – various ways of sharing of geospatial data with users.	12
References	Text Books : 1. Arthur H. Robinson et al. Elements of Cartography (6th Edition), Wiley India Pvt. Ltd., New Delhi, 2016.	
	Reference Books: 1. LO, C.P. and Albert K.W.Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall of India, New Delhi, 2006. 2. Misra, R.P. and Ramesh, A., Fundamentals of Cartography, Concept Publishing Company, New Delhi, 2002. 3. Cartwright .W, Gartner G. ALehn (Eds.), Cartography and Art, Springer – Verlag Berlin Heidelberg, 2009.	
	E-Resources 1. Fundamentals of General Cartography, http://164.100.133.129:81/econtent/Uploads/Fundamentals_of_General_Cartography.pdf 2. Elements of Cartography by Arthur H. Robinson, http://rapidshare.com/files/685095396/Elements.of.Cartography.rar 3. Cartography – a tool for spatial analysis, https://www.pdfdrive.net/cartography-a-tool-for-spatial-analysis-d39693639.html 4. Map Projection, https://pubs.usgs.gov/pp/1395/report.pdf.	
Course Outcomes	On completion of the course, students should be able to do,	
	CO1	Explain the basic principles of cartography and interpretation of maps
	CO2	Choose appropriate projection for a map
	CO3	Select a method of data collection and visualization
	CO4	Construct a map with design and layout principles
	CO5	Apply the computers in digital map making on web

Mapping of Cos with PSOs:

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	1	1	2
CO 2	3	2	1	1	3
CO 3	3	2	1	1	2
CO 4	3	3	1	1	3
CO 5	3	2	1	1	2

Semester	II	**Course Code**	**24GISP0208**
Course Title	**Geographical Information System**		
No. of Credits	4	No. of contact hours per Week	4
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-2:(Understand) • K-3:(Apply) • K-4:(Analyze) • K-5:(Evaluate) • K-6:(Create)		
Course Objectives	The Course aims to • Provide knowledge on various methods of data input, types of errors and its correcting methods. • Gain knowledge on GIS analysis ,GIS data modeling, • Know about various forms of GIS output and their method of visualization		

UNIT	Content	No. of Hours
I	GIS: Definition–components–characteristics of Spatial Data–sources of GIS data – spatial data models/ structure-raster and vector–representation of spatial data in GIS: Layer based – tile Based – object oriented based.	7
II	Data Input methods: Keyboard – scanning – digitization: manual – semi-automatic–automatic,–electronic data transfer. Errors in Spatial data and attribute data– edge matching – rubber sheeting. Integration of spatial and non-spatial (attribute) data.	9
III	Basic tools of GIS: Measurement – Query – Proximity Analysis Spatial Analysis – I: Spatial interpolation: TIN – Thiessen Polygon–IDW – Kriging – Spline – trend surface- Spatial moving average–extrapolation. Surface Analysis: DEM–Slope – Aspect - Hill Shade – visibility analysis. Hydrological Analysis: Fill – flow direction – flow accumulation – flow length–basin/ watershed.	10
	MCE: Estimation of weights: ranking – rating – pair-wise comparison method.	

IV	Spatial Analysis – II: Reclassification – Overlay: Vector Overlay: Erase – Update – Union – Intersect; Raster Overlay: Point-in-polygon – Line-in-polygon – Polygon-on-Polygon: Arithmetic operators – map algebra. Building an integrated database: Weighted overlay– weighted Sum – fuzzy membership – fuzzy overlay Network modelling: Arc – Node–vertices–Analysis: travelling sales person problem – location-allocation modelling – route tracing – service area – closest facility – OD cost matrix.	12
V	Spatial Statistics: Ordinary Least Square, Geographical Weighted Regression – Correlation. Model building - Cartographic Output: Maps as output – cartograms: definition – types of cartograms - non-cartographic output: Tables and Charts – Linked display – spatial multimedia – delivery mechanism: Hardcopy output– softcopy output: monitors - slide shows – virtual reality – map as a decision tool. Customization of GIS software using ArcPY.	10
References	Text Books: 1. Ian Heywood, Sarah Cornelivs and Steve Carver, An Introduction to Geographical Information System (3rdEdition), Pearson Education Pvt. Ltd., New Delhi, 2017.	
	Reference Books: 1. Peter A. Burrough e tal., Principles of Geographical Information System (3rd Edition), Oxford University Press Inc., New York, 2015. 2. Kang-tsung Chang, Introduction to Geographic Information Systems (4thEdition), McGraw Hill Education (India)Pvt.Ltd.,NewDelhi,2013. 3. John R.Jensen and Ryan R. Jensen, Introductory Geographic Information Systems, Pearson Education Pvt. Ltd., New Delhi, 2018. 4. LO.C.P. ,and Albert K.W.Yeung, Concepts and Techniques of Geographic InformationSystems,Prentice-HallofIndia,NewDelhi,2006. 5. M. Anji Reddy, Text Book of Remote Sensing and Geographical Information Systems (4thEdition), BS Publications, Hyderabad, 2019.	
	E-Resources: 1. Michael J de Smith, Michael F Goodchild and Paul A Lougley, Geospatial Analysis(6thEdition),2020, https://spatialanalysisonline.com/HTML/index.html 2. Paul Bolstad, GIS Fundamentals: A First Text on Geographic Information Systems, 2016, https://www.pdfdrive.com/gis-fundamentals-a-first-text-on-geographic-information-systems-e188660361.html 3. Michael D.Kennedy, Michael F. Goodchild & Jack Danger mond, Introducing Geographic Information Systems with ArcGIS: A Workbook Approach to Learning GIS, 2013, https://www.pdfdrive.com/introducing-geographic- 4. information-systems-with-arcgis-a-workbook-approach-to-learning-gis-e156925406.html	

Course Outcomes	On completion of the course, students should be able to do,	
	CO1	Explain the basics of GIS
	CO2	Discuss the various methods of data input and editing.
	CO3	Apply the tools of GIS in Vector & Raster data.
	CO4	Identify and produce different GIS output
	CO5	Analyze, evaluate and create various GIS based models.

Mapping of Cos with PSOs:

CO	PSO				
	1	**2**	**3**	**4**	**5**
CO1	1	1	1	1	1
CO2	1	1	2	1	1
CO3	3	3	3	1	3
CO4	2	2	2	1	2
CO5	3	3	3	2	3

Semester	II	Course Code	**24GISP0209**
Course Title	**Spatial Data Science**		
No. of Credits	4	No. of contact hours per Week	4
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Core Course		
Scope of the Course	• Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze)		
Course Objectives	The Course aims to • provide the concept o Data Science, Basic Statistics, Spatial Data Base Management System and Spatial Data Science. • provide R programs for Data Science • provide point pattern analysis.		

UNIT	Content	No. of Hours
I	Software for Spatial Data Science: Basic R programming - R-Language – overview – Data types - Operators – Control structures – Looping statements – Functions – String.	8
II	Vectors – List – Matrix – Arrays – Data Frames - Data Interfaces - Chart and Graphs – Statistics Operations– Data Visualization – R Packages: sf, sp, rgdal, raster, tmap. Software: Geoda, GeoDaSpace, PySAL, CAST, GeoPandas, MapInfo Professional.	7
III	Introduction Data Science – Components – Process – Roles – Tools – Applications- Problems in Data Science- Spatial Data Science. Exploratory Data Analysis. Statistics for Data Science - Linear Regression - Multiple Regression - Normal Distribution - Binomial Distribution - Time Series Analysis - Decision Tree - Random Forest.	10
IV	Introduction to Spatial Data Science - Spatial Data analysis - Mapping - Statistical Mapping - Univariate - Bivariate- Multivariate exploratory data analysis - Spatial Autocorrelation - Global Autocorrelation - Visualizing Autocorrelation -LISA and Local Moran - Other autocorrelation - Multi-variate LISA - LISA for binary variable.	10
V	Spatial Point Patterns Methodology and Applications with R: Point pattern concept - Point Pattern Intensity - Point pattern vs Intensity - Point Pattern Distance - Point Pattern K function -	10

	Point Pattern Local K -DBScan-Smoothing Rates -Scan statistics - Dimension Reduction Methods - Clustering Methods-Classical - Advanced methods.	
References	Reference Books: 1. Spatial Point Patterns Methodology and Applications with R - Adrian Baddeley, Ege Rubak, Rolf Turner. CRC publications 2. Cluster Analysis, Brian S. Everitt . Sabine Landau Morven Leese . Daniel Stahl, 5th edition Wily publications. 3. Practical Data Scince with R, 2nd Edition, Nina Zumel and John Mount and Rachel Thomas, Manning Publications.	
	E-Resources: 1. Spatial Data Science: https://www.youtube.com/watch?v=JwHxJsesG2Y&list=PLzREt6r1NenmFyTw8v2JZpEE4PZGNi5Ht	
Course Outcomes	On completion of the course, students should be able to do,	
	CO1	Understand the Concept of Data Science and Statistics
	CO2	Understand database management system and Spatial Database Managements system.
	CO3	Understand Spatial Data Science.
	CO4	Understand R programming
	CO5	Understand Point Pattern methodology.

Mapping of Cos with PSOs :

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	1	2	3	2	3
CO 2	1	2	3	2	3
CO 3	1	2	3	2	3
CO 4	1	2	2	2	2
CO 5	2	3	1	2	3

Semester	II	**Course Code**	**24GISP0210**
Course Title	**Practical – III: Cartography & Geographical Information System**		
No. of Credits	2	No. of contact hours per Week	4
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	30 %
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • apply the tools of AutoCAD and ArcGIS in creating, analyzing and evaluating geospatial data, create a model and to design map and layout		

UNIT	Content	No. of Hours
I	Map Appreciation - Map interpretation – Conventional Signs and Symbols – data dictionary - mapping techniques.	10
II	Introduction to commercial and open-source GIS software. (AutoCAD, ArcGIS, QGIS etc). Georeferencing - projections – Database creation. Spatial and attribute data entry, editing and joining them. Working with tables and layer properties.	12
III	Methods of data analysis I: Measurement - Buffer – overlay– spatial interpolation – reclass – TIN – DEM. Methods of data analysis II: Network – surface – hydrology.	15
IV	Map algebra – MCE - Building models - Map Design and Layout. Spatial Statistical Tools – Central Feature, Mean Centre, Median Center, Standard Distance, Correlation, Ordinary Least Square – Geographical Weighted Regression, Spatial autocorrelation.	15
V	Creation of tool bar – introduction to ArcPY – generating python scripts from Model Builder – Programs for spatial analysis.	10

Course Outcomes	On completion of the course, students should be able to do,	
	CO1	Apply the tools of AutoCAD, ArcGIS, QGIS etc.
	CO2	Analyze the data in GIS with appropriate tools

	CO3	Create new models
	CO4	Write simple scripts in python
	CO5	Design and layout a map

Semester	II	Course Code	**24GISP0211**
Course Title	**Practical- IV Spatial Data Science**		
No. of Credits	2	No. of contact hours per Week	4
New Course/ Revised Course	Revised	If revised, Percentage of Revision effected	20%
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • to learn MYSQL, • to learn Spatial Data Science using R • to utilize them in GeoDa software.		

UNIT	Content	No. of Hours
I	**<u>MySQL</u>** 1. Introduction to MYSQL 2. Data Definition Language(DDL) commands 3. Data Manipulation Language (DML) 4. Sub Queries and Joins 5. Views 6. Procedures 7. Cursors 8. Triggers	12
II	**Spatial Data Science – LAB (Practical)** 9. R- Introduction 10. Filtering a data frame for specific entries 11. Selecting and renaming columns 12. Creating a simple features spatial object 13. Checking and adding/adjusting projection information 14. Dealing with missing data 15. Spatial join 16. Spatial aggregation 17. PDF file Manipulation - (Parsing, Merging, Creating)	12
III	**GeoDa Software** 18. Basic Mapping	12

	19. Rate Mapping 20. Exploratory Data Analysis 21. Local Spatial Autocorrelation 22. Global Spatial Autocorrelation 23. Density-Based Clustering Methods 24. Cluster Analysis 25. Spatial Clustering	
Course Outcomes	On completion of the course, students should be able to do,	
	CO1 Understand and Apply MySQL Database Concepts	
	CO2 Design and Implement Complex SQL Queries	
	CO3 Conduct Spatial Data Analysis Using R	
	CO4 Manipulate PDF Files Programmatically	
	CO5 Analyze Spatial Data Using GeoDa Software	

Semester	III	Course Code	**24GISP0312**
Course Title	**Global Navigation Satellite System**		
No. of Credits	3	No. of contact hours per Week	3
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4:(Analyze) • K-5:(Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • Understand the working principles of GNSS, • Provide knowledge on various GNSS systems • Analyze and correct the GNSS errors • Create database on geo co-ordinates using various GNSS techniques • Apply GNSS in various fields		

UNIT	Content	No. of Hours
I	GNSS: Definition - History of GNSS - advantages and limitations of GNSS - Segments of GNSS - Control segment - Space segment - User segment – Uses of GNSS.	9
II	GNSS: NAVSTAR GPS – GALILEO – GLONAAS- Beidou. Regional – IRNSS –- QZSS. Types of receivers - realization of channel – user community. GNSS Augmentation: WAAS – LAAS – EGNOS – MSAS – SNAS.	10
III	Errors: Ionospheric and atmospheric delays - satellite and receiver clock error - anti spoofing - selective availability - multi path - dilution of precision - Number and geometry of visible satellites - location of GNSS receiver - distance between base station and rover receiver - signal to noise ratio - occupation time at a point. Error correction methods	10
IV	GNSS surveying: Standalone & DGPS - Static method, Rapid static positioning method -Reoccupation method - Stop & go method - Kinematic positioning method - Relative advantages and disadvantages of these methods - Data transfer and analysis.	9
V	Applications: Surveying – navigation - aviation - vehicle tracking - military - Precision farming – Location based services.	10

References	Text Books: 1. Sathees Gopi et al., Advanced Surveying: Total Station, GPS, and Remote Sensing (2nd Edition), Pearson India Education Services Pvt. Ltd., Noida, 2019.	
	ReferenceBooks: 1. Hofmann – Wellenhof, Lichtenegger and Collins, GPS: Theory and Practice (5th Edition), SpringerWien, New York, 2015. 2. Alfred Et al., GPS Satellite Surveying (4th Edition), Wiley India Pvt. Ltd., New Delhi, 2018. 3. Michael Kennedy, 'The Global Positioning System and GIS: An Introduction', Taylor and Francis Inc. New York, 2002. 4. Satheesh Gopi, Global Positioning System Principles and Applications. Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.	
	E-Resources: 1. http://www.maps-gps-info.com/ed-resources.html 2. http://www.gisdevelopment.net/tutorials/tuman004.htm 3. http://www.colorado.edu/geography/gcraft/notes/gps/gps_f.html	
Course Outcomes	On completion of the course, students should be able to do,	
	CO1	Understand fundamental of GNSS.
	CO2	Understand different GNSS satellites and systems.
	CO3	Analyze the errors and various correction methods
	CO4	Create a database on geo coordinates
	CO5	Apply GNSS in various fields.

Mapping of Cos with PSOs:

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	2	2	2	1	1
CO 2	2	2	2	1	1
CO 3	3	3	3	1	1
CO 4	2	2	2	1	1
CO 5	3	3	3	1	1

Semester	III	Course Code	**24GISP0313**
Course Title	**Geoinformatics in Resource Management**		
No. of Credits	4	No. of contact hours per Week	4
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • Apply various tools of Geoinformatics in recourse management.		

UNIT	Content	No. of Hours
I	Soil – importance – problems - soil erosion estimation using RUSLE - Soil salinity mapping. Land Classification System – FAO- USDA - land capability assessment – Land use / Land cover classification. Land use planning: Rural and urban - Land Reclamation – Land Information System.	10
II	Introduction – Water Conservation - water quality monitoring - Ground water investigation - artificial recharge zone identification – surface water harvesting structure - flood prediction model - Climate Change Impact on Water Resources - Integrated Water Resource Management (IWRM).	9
III	Agriculture: Spectral properties of crops - crop canopy - identification & inventory - Yield modeling - crop production forecasting - crop condition assessment and monitoring - Microwave RS for crop inventory & case studies - Precision farming. Forestry: Forest taxonomy - inventory of forestlands - forest types and density mapping - factors for degradation of forest - Forest change detection and monitoring - Forest fire mapping & damage assessment -Wildlife Corridor Identification and Management.	10
IV	Infra structure demand analysis - Transportation planning – mapping transportation - network – classification - Transportation interaction models – intelligent transportation systems – optimum route – traffic and parking studies - accident	10

	analysis. Water utility - electrical utility - telecommunication – tower spotting – Sitting a new facility - customer loyalty studies - health information system - Solid and liquid waste management - Crime Analysis: mapping crime data - hot spot analysis.	
V	Environmental types and components – Pollution: Air – Water – Soil and Noise – Environmental Impact Assessment - Environmental Information System - Environmental and ecological concerns – resource development in remote areas - impacts of anthropogenic activities Oceanography: Major issues/problem – wetland classification - Thematic maps on coastal resources – site suitability analysis for aquaculture – Fishery – coral reef – Coastal Regulation zone – Coastal aquifer modeling– Integrated coastal Zone Management.	9
References	Text Books: 1. Fundamentals of Remote Sensing, George Joseph. Universities Press (India) Pvt Ltd, 3-5-819 Hyderguda, Hyderabad500 029. 2003. 433 pp.	
	Reference Books: 1. Nitish Dogra, Sangeet Srivastava, Climate Change and Disease Dynamics in India, The Energy and resources Institute (TERI), New Delhi, 2012. 2. Narayan Singh and Amit Kumar Thakur, Climate Change and Environmental Issues, The Energy and resources Institute (TERI), New Delhi, 2018. 3. Joshi PK and Singh TP., Geoinformatics for Climate Change Studies, The Energy and resources Institute (TERI), New Delhi, 2013. 4. Alan L., MD Melnick, Introduction to Geographic Information Systems for Public Health, Aspen Publishers, 1st Edition, 2002. 5. Amim Hammad, Hassan karimi, Telegeoinformatics: Location-based Computing and Services, CRC Press, 1st Edication, 2004 6. Allah Brimicomber, GIS Environmental Modeling and Engineering, Taylor and Francis, 2003 7. Van Dijk M.G.Bos, GIS and Remote Sensing Techniques in Land-And-Water-Management, Kluwer Academic Publishers, 2001. 8. Juliana Maantay, John Ziegler and John Pickles, GIS for the Urban Environment, ESRI Press, 2006. 9. Laura Lang, GIS for Health Organizations, ESRI Press, 2000. 10. Lisa Godin, GIS in Telecommunications Managements, ESRI Press, 1st Edition, 2001.	
	E-Resources: 1. https://www.pdfdrive.com/geostatistical-and-geospatial-approaches-for-the-characterization-of-natural-resources-in-the-environment-challenges-processes-and-strategies-d175603772.html 2. https://egyankosh.ac.in/bitstream/123456789/39604/3/MGY-001-E-B4.pdf 3. https://www.esds.co.in/blog/gis-applications-in-utility-sector/ 4. https://www.researchgate.net/publication/329963373_Application_of_GIS_in_Planning_of_Facilitate_Infrastructure 5. https://www.esri.com/content/dam/esrisites/sitecore-archive/Files/Pdfs/library/brochures/pdfs/transportation-infrastructure.pdf 6. https://www.pdfdrive.com/landscape-analysis-and-visualisation-spatial-	

	models-for-natural-resource-management-and-planning-lecture-notes-in-geoinformation-and-cartography-d184489152.html	
Course Outcomes	On completion of the course, students should be able to do,	
	CO1	Apply Geoinformatics in Land resource management
	CO2	Apply Geoinformatics in Water Resources Management
	CO3	Apply Geoinformatics in Agriculture and Forestry
	CO4	Apply Geoinformatics in Utility management
	CO5	Apply Geoinformatics in Environmental and Oceanography

Mapping of Cos with PSOs:

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	3	2	2
CO 2	3	3	3	2	2
CO 3	3	3	3	2	2
CO 4	3	3	3	2	2
CO 5	3	3	3	2	2

Semester	III	Course Code	**24GISP0314**
Course Title	**Geoinformatics in Disaster Management**		
No. of Credits	3	No. of contact hours per Week	3
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	70%
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • apply various tools of Geoinformatics in disaster management.		

UNIT	Content	No. of Hours
I	Nature, characteristics and types of Disasters – Causes and effects of Disaster – Disaster Profile of India – Disaster Management cycle.	9
II	Disaster Management; Earthquakes: Causes and effects – measurements - earthquake zones of the world and India – vulnerability and microzonation; Volcanoes: Causes and effects – volcanic zones of the world and in India - volcanic hazards; Landslides: Causes and effects – landslide prone zones in India – GIS case studies for earthquake, volcano and landslide.	10
III	Drought : Types – factors influencing drought – variable identification – vegetation index – land use / ground water level changes – soil erosion –delimiting drought prone areas – short term and long term effects; Desertification: Processes – over utilization of water and land resources – GIS based management strategies – GIS case studies for drought and desertification.	10
IV	Cyclone: Origin and types - effects on land and sea – damage assessment; Flooding: Topography, land use and flooding – Space-time integration – GIS based parameters and layers – flood prone area analysis and management – risk assessment – GIS case studies for cyclones and floods.	10

<table>
<tr><td>V</td><td colspan="2">Atmospheric Disasters: Ozone layer depletion – green house / global warming –acid rain – snow melt – sea level rise – related problems; Nuclear, Chemical /Industrial and Mining Disasters: Types – consequences – major disasters of the world and India; Marine Disasters: Oil spill and chemical pollution – coastal zone management strategies – GIS case studies.</td><td>9</td></tr>
<tr><td>References</td><td colspan="3">Text Books:
1. R. Subramanian, Disaster Management, Vikas Publishing House, 2005.</td></tr>
<tr><td></td><td colspan="3">Reference Books:
1. National Disaster Management Division (2004) Disaster Management in India - A Status Report, Ministry of Home Affairs, Government of India, New Delhi.
2. Matthews, J.A., (2002) Natural Hazards and Environmental Change, Bill McGuire, Ian Mason.
3. Skeil, A (2002) Environmental Modeling with GIS and Remote sensing, John Wiley and sons, New York.
4. Singh, R.B (Ed.) (1996) Disasters, Environment and Development, Oxford & IBH, New Delhi.
5. Barrett E.C., and L. F. Curtis, (1992) Introduction to Environmental Remote Sensing, Chapman and Hall, London.
6. UNDRO (1995) Guidelines for Hazard Evaluation Procedures, United Nations Disasters Relief Organization, Vienna.
7. Nagarajan, R., (2004) Landslide Disaster Assessment and Monitoring, Anmol Publications, New Delhi.</td></tr>
<tr><td></td><td colspan="3">E-Resources
1. Asian Development Bank, Disaster Management: A Disaster Manager's Handbook – Asian, Disaster Management: A Disaster Manager's Handbook – Asian
2. Bhandari, Disaster Education and Management: A Joyride for Students, Teachers and Disaster, https://www.pdfdrive.com/disaster-education-and-management-a-joyride-for-students-teachers-and-disaster-managers-e157698367.html</td></tr>
<tr><td>Course Outcomes</td><td colspan="3">On completion of the course, students should be able to do,</td></tr>
<tr><td></td><td>CO1</td><td colspan="2">Understand the concept of disaster</td></tr>
<tr><td></td><td>CO2</td><td colspan="2">Explain different types of disasters</td></tr>
<tr><td></td><td>CO3</td><td colspan="2">Apply the various ways to prevent and prepare for drought</td></tr>
<tr><td></td><td>CO4</td><td colspan="2">Understand the methods of emergency preparedness of Cyclones</td></tr>
<tr><td></td><td>CO5</td><td colspan="2">Understand the concept of Geoinformatics in Atmospheric disaster</td></tr>
</table>

Mapping of Cos with PSOs:

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	3	2	2
CO 2	3	3	3	2	2
CO 3	3	3	3	2	2
CO 4	3	3	3	2	2
CO 5	3	3	3	2	2

Semester	III	Course Code	**24GISP0315**
Course Title	**Practical – V: Geoinformatics in Resources and Disaster Management**		
No. of Credits	2	No. of contact hours per Week	4
New Course / Revised Course	Revised	If revised, Percentage of Revision effected	20%
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to 1. collect data for preparation various thematic maps 2. generate base maps for various fields of GIS 3. assess the land and water resource management, disaster management, network and drainage analysis, environment management etc using the thematic maps.		

UNIT	Content	No. of Hours
I	Preparation of various geo-system layers: Drainage –slope - aspect – land use/ land cover – ground water level – lineament - soil – geology – geomorphology - Digital Elevation Model (DEM) Creation and Analysis. Survey using total station and DGPS. Rainfall - AQI – water quality data.	12
II	Land resource management: Change detection in various land use/ land cover types and cross tabulation - soil erosion estimation - Village GIS - urban sprawl.	10
III	Water resource management: Watershed delineation - Morphometric Analysis: Areal – Linear – Relief aspects - locating site for ground water potential and artificial recharge zone – identification of suitable site for constructing water harvesting structures - water quality assessment. Infrastructural demand analysis - Renewable Energy Resource Mapping Agriculture: Spectral properties of crops - crop canopy - identification & inventory. Forestry: Forest types and density mapping - Forest change detection and monitoring.	15

	Marine : Coastal Mapping	
IV	Disaster management: flood – landslide – drought assessment.	15
V	Environmental management: Climate change – land surface temperature – sea level rise– air pollution monitoring.	12
Course Outcomes	On completion of the course, students should be able to do,	
	CO1	Prepare various thematic maps for various areas of applications.
	CO2	Use various thematic maps in specific applications.
	CO3	Apply the tools of GIS in various ways for different applications.
	CO4	Analyze the output generated and interpret it.
	CO5	Analyze infrastructural demands, map renewable resources, manage environmental impacts

Mapping of Cos with PSOs:

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	3	1	3
CO 2	3	3	3	1	3
CO 3	3	3	3	1	3
CO 4	3	3	3	1	3
CO5	3	3	3	1	3

Semester	III	Course Code	**24GISP0316**
Course Title	**Practical-VI: Case Study in GIS / Remote Sensing / WebGIS**		
No. of Credits	2	No. of contact hours per Week	4
New Course / Revised Course	-	If revised, Percentage of Revision effected	-
Category	• Project		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • Apply knowledge of Geoinformatics technologies in real world spatial problems and create/ develop models.		

UNIT	Content	No. of Hours
	▪ Identification of an issue in consultation with internal guide. ▪ Collecting of existing works/ resources/ literatures on the identified issues. ▪ Collecting primary and secondary information (remote sensing, GNSS, field visit etc). ▪ Analyzing the collected data/ information (Digital Image Processing, GIS, Geoinformatics software development etc). ▪ Identifying the solution. ▪ Suggesting management/ mitigation plan. ▪ Report writing.	60
Remarks	▪ The size of the case study may be between 50 and 70 pages, which is not inclusive of scripts and other appendices ▪ The case study should be submitted both in print form and digital form (pdf / crystal reports).	
Course Outcomes	On completion of the course, students should be able to do CO1. Apply the tools of GIS, DIP. Customization of software and WebGIS in solving spatial problems.	

Semester	IV	Course Code	**24GISP0417**
Course Title	**Dissertation**		
No. of Credits	6	No. of contact hours per Week	12
New Course / Revised Course	-	If revised, Percentage of Revision effected	-
Category	• Core Course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and life skills • Field Placement / Field Project • Internship		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • Implement the above learned technologies for solving spatial related issues in real world scenario		
	Content		No. of Hours
	▪ Identification of a problem in consultation with internal guide ▪ Executing the work as per the instructions of both internal and external guide while incorporating any of the following activities or combination of activities ▪ GIS implementation and application ▪ Remote Sensing and Digital Image Processing application ▪ GNSS application ▪ Photogrammetry application ▪ LiDAR application ▪ UAV application ▪ Designing of GIS ▪ Map server design ▪ Development of Spatial model ▪ Development Geoinformatics software or such other related topics, which will give focus to Geoinformatics implementation		180
Remarks	▪ The size of the dissertation may be between 50 and 70 pages, which is not inclusive of scripts and other appendices ▪ The dissertation should be submitted both in print form and digital form (pdf / crystal reports).		

Semester	IV	Course Code	**24GISP0418**
Course Title	**Internship**		
No. of Credits	12	No. of contact hours per Week	24
New Course / Revised Course	-	If revised, Percentage of Revision effected	-
Category	• Industrial Placement • Internship		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and life skills • Field Placement / Field Project • Internship		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • provide working experience in an organization, institution, companies etc.		
	Content		No. of Hours
	• Carry out on-site internship programme in any one of the government organizations, academic & research institutes, public & private industries etc. working/applying Geoinformatics technologies • It demands submission of fortnight reports on learning process and execution of desired objectives.		360
Remarks	• The internship is evaluated internally by the content the reports and viva voce		

Semester	III	Course Code	**24GISP03D1**
Course Title	**Earth, Atmospheric, Ocean and Planetary Sciences**		
No. of Credits	3	No. of contact hours per Week	3
New Course / Revised Course	-	If revised, Percentage of Revision effected	-
Category	• Major Elective		
Scope of the Course	• Basic Skill / Advanced Skill • Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-1: (Remember) • K-2: (Understand) • K-3: (Apply)		
Course Objectives	The Course aims to • Provide important concepts of basic geosciences		

UNIT	Content	No. of Hours
I	Mineralogy and petrology – structural geology and geotectonic –– sediment logy and stratigraphy – marine geology and pale oceanography: Sources and methods of information – geochemistry: Elements and Earth– Extraction – Geochemical Environments – Applied Geology	9
II	Physical Geography: geomorphology: Process - Landforms – climatology: Insolation – Distribution of Temperature – Distribution of Atmospheric Pressure – Windbelts – Humidity – Cloud formation and precipitation – water balance Bio-geography: Trans-Himalayas – Himalayan Zone – Indian Desert – Semi-Arid Zone – Western Ghats – Deccan Plateau – Gangetic Plains – North Eastern Region - Coastal Region – Andaman Nicobar Islands Geography of India: Location of India – Area – Physical features of India	9
III	Geophysics: gravity - magnetic methods – electrical and electromagnetic methods – seismic methods – Radioactive methods	10
IV	Meteorology: Climatology – physical meteorology – atmospheric electricity – cloud physics – dynamic meteorology – numerical weather prediction – general circulation and climate modelling – synoptic meteorology – aviation meteorology – satellite meteorology.	10
V	Ocean science: Physical oceanography – chemical oceanography – geological oceanography – biological oceanography.	10
References	Text Books: 1. Dr. Surendra Kumar & RPH Editorial Board , Joint CSIR-UGC (NET) Earth, Atmospheric, Ocean and Planetary Sciences Exam Guide (Part B & C), January 2021, Ramesh Publishing House, New Delhi.	

<table>
<tr><td></td><td>Reference Books:
1. Mahapatra. G.B., A Textbook of Geology, CBS publisher, 2019.
2. Huggett, Fundamentals of Geomorphology , Taylor and Francis, 2016
3. W.M. Telford, Exclusive with Professional Books (Hyd) Applied Geophysics South Asian Edition, 2010
4. Willis Isbister Milham, Meteorology, Andesite Press, 2015
5. Savindra Singh, Oceanography, Pravalika Publications, 2013</td></tr>
<tr><td></td><td>E-Resources:
1. Carl Willhelm Correns, Introduction to Crystallography and Petrology 2nd Edition, https://www.pdfdrive.com/introduction-to-mineralogy-crystallography-and-petrology-d169738500.html
2. Richard C. Selley, Robin Cocks and Ian Plimer, Encyclopedia of Geology, Five Volume Set, Volume 1-5 (Encyclopedia of Geology Series), https://www.pdfdrive.com/encyclopedia-of-geology-five-volume-set-volume-1-5-encyclopedia-of-geology-series-d184350405.html
3. Alan H. Strahler, Introducing Physical Geography, 6th edition, https://www.pdfdrive.com/introducing-physical-geography-6th-edition-d188301758.html
4. William Lowrie, Fundamentals of Geophysics, 2nd Edition, https://www.pdfdrive.com/fundamentals-of-geophysics-second-edition-e38471798.html
5. Geology, Mining, Climatology, Meteorology, Sediment logy, Earth Science, Oceanography, https://www.pdfdrive.com/geology-mining-climatology-meteorology-sediment-logy-earth-science-oceanography-e40744251.html
6. Robert H Stewart, Introduction to Physical Oceanography, https://www.pdfdrive.com/introduction-to-physical-oceanography-e33277726.html</td></tr>
<tr><td>Course Outcomes</td><td>On completion of the course, students should be able to do,
CO1 Explain the mineralogy, petrology.
CO2 Understand physical geography and geophysics
CO3 Explain the concept of meteorology
CO4 Explain the concept of oceanography.
CO5 Understand and analyze physical, chemical, geological, and biological oceanography</td></tr>
</table>

Mapping of Cos with PSOs :

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	2	2	2	1	1
CO 2	2	2	2	1	1
CO 3	2	2	2	1	1
CO 4	3	3	3	2	2
CO5	3	3	2	2	1

Semester	III	Course Code	**24GISP03D2**
Course Title	**Geoinformatics for Watershed Management**		
No. of Credits	3	No. of contact hours per Week	3
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	35 %
Category	• Major Elective		
Scope of the Course	• Basic Skill/ Advanced Skill • Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-2:(Understand) • K-3:(Apply) • K-4:(Analyze) • K-5:(Evaluate)		
Course Objectives	The Course aims to • Introduce watershed management and watershed characteristics • acquire knowledge on use of GIS and Remote Sensing in watershed management • acquire knowledge on watershed evaluation		

UNIT	Content	No. of Hours
I	Watershed–definition – Watershed delineation and codification – watershed approach – advantages – watershed as a unit of planning – causes and consequences for watershed deterioration – Watershed management – principles and components of watershed management – approaches to watershed development.	9
II	Characteristics of Watershed: Size – Shape - Physiographic – slope – climate – drainage – land use – vegetation – geology – soil – hydrology – hydrogeology – socio-economic - Concentration time – Isochrones. Watershed management planning – watershed restoration	9
III	Remote Sensing – data sources – land use / land cover – DEM - slope – aspect – flow accumulation – flow direction – stream network – modeling sediment yield. Collection of Ground Control Points (GCP) – Ground truth verification/training sites for Digital Image Processing	10
IV	GIS – data sources for watershed management & data structures-Watershed delineation – Manual – Automatic - resource mapping Morphometric analysis: Linear aspect – Areal aspect – Relief aspect. Identification of erosion prone zones.	10

V	Monitoring & Evaluation: Depth of water table –cropping pattern – area under biomass – various Land use/ land cover –water body. Purpose – types of evaluation – factors affecting evaluation – understanding community participation -– PRA methods of evaluation.	10
Course Outcomes	On completion of the course, students should be able to do,	
	CO1	Understand principles of watershed management comprehensively
	CO2	Understand hydrology and hydrogeology within watersheds.
	CO3	Identify remote sensing data sources for analysis.
	CO4	Analyze spatial data for effective decision-making.
	CO5	Identify factors affecting evaluation processes.

Mapping of Cos with PSOs:

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO1	2	3	2	2	2
CO2	2	3	2	1	2
CO3	2	3	2	1	2
CO4	2	3	2	2	2
CO5	2	3	2	2	2

Semester	III	Course Code	**24GISP03D3**
Course Title	**Web Technology for Geoinformatics**		
No. of Credits	3	No. of contact hours per Week	3
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	40%
Category	• Major Elective		
Scope of the Course (may be more than one)	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-6: (Create)		
Course Objectives (Maximum: 5)	The Course aims to • provides the basic knowledge about the Internet, Cloud computing & Web Technology for Geoinformatics		

UNIT	Content	No. of Hours
I	**Introduction to Web Technologies** - Basics of Web Technologies: Overview of Internet and Web, Evolution of Web Technologies, Web Standards and Protocols (HTTP, HTTPS). - HTML and CSS: HTML Structure and Elements, CSS Basics and Styling, Responsive Web Design. - Introduction to JavaScript: JavaScript Syntax and Basics, DOM Manipulation, Event Handling.	9
II	**Geospatial Data and Web Mapping -** Geospatial Data Formats: Vector and Raster Data, GeoJSON, KML, and other Geospatial Formats - Introduction to Web Mapping: Concepts of Web Mapping, Web Map Services (WMS), Web Feature Services (WFS). OpenLayers and Leaflet: Introduction to OpenLayers, Introduction to Leaflet, Basic Mapping Applications with OpenLayers and Leaflet.	9
III	**Geospatial Web Services-** Server-Side Technologies: Overview of Server-Side Scripting Languages (PHP, Python), Setting up a Web Server (Apache, Nginx), Geospatial Web Services- Introduction to OGC Standards: Setting up Geoserver, Publishing Geospatial Data - Web Map Applications: Building Interactive Maps, Layer Control and Styling, Data Visualization Techniques.	10
IV	**Advanced Web Development for Geoinformatics-** JavaScript Libraries and Frameworks: Using Libraries like D3.js for Data	10

	Visualization, Introduction to Front-End Frameworks (React, Angular, Vue.js) - Developing Geospatial Applications: Integrating APIs (Google Maps API, Mapbox), Real-time Data in Web Maps - Web GIS Development: Building Web GIS Applications, User Interactions and Functionalities, Case Studies of Web GIS Applications.	
V	**Cloud and Mobile Technologies in Geoinformatics**- Cloud Computing for Geoinformatics: Introduction to Cloud Platforms (AWS, Google Cloud), Storing and Managing Geospatial Data in the Cloud - Mobile Web Development: Basics of Mobile Web Design, Developing Mobile-Friendly Geospatial Applications - uture Trends in Web Technologies for Geoinformatics - Web 3.0 and its Impact on Geoinformatics, Emerging Technologies (AR/VR in Geospatial, IoT).	10
References	Text Books: 1. Laura Lemay et al., Mastering HTML, CSS & JavaScript Web Publishing, BPB Publications, New Delhi, 2019. 2. Mike McGrath, JavaScript: Create functions for the web (5th Edition), McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2016. 3. Programming Python, Edition 2 Mark Lutz, ORelilly publisher (Server Side Scripting 15th Chapter)	
	ReferenceBooks: 1. Jon Raasch et al., Java Script and jQuery for Data Analysis and Visualization, Wiley India Pvt. Ltd., New Delhi, 2015. 2. Dane Cameron, HTML5, JavaScript and jQuery, Wiley India Pvt. Ltd., New Delhi, 2015.	
	E-Resources: 1. https://nptel.ac.in/courses/106/105/106105084/ 2. https://developers.arcgis.com/javascript/latest/ 3. https://www.djangoproject.com/start/overview/ 4. https://flask.palletsprojects.com/en/2.0.x/#	
Course Outcomes	On completion of the course, students should be able to do,	
	CO1 Understand the basics of websites and HTML, CSS, and Javascript	
	CO2 Understand Geo Spatial Data and web mapping	
	CO3 Understand Geo spatial Web services	
	CO4 Understand advanced development in Geoinformatics	
	CO5 Understand Cloud and Mobile Technologies	

Mapping of Cos with PSOs:

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	2	3	3	2	3

CO 2	1	3	2	3	2
CO 3	2	3	3	2	1
CO 4	3	2	1	3	3
CO 5	2	1	3	2	3

Semester	III	Course Code	**24GISP03D4**
Course Title	**Google Earth Engine for Remote Sensing Applications**		
No. of Credits	3	No. of contact hours per Week	3
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Major Elective		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and lifeskills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • Explore the students to Google Earth Engine and its application in Remote sensing		

UNIT	Content	No. of Hours
I	Introduction to Google Earth Engine platform - advance JavaScript for Google Earth Engine - Download satellite data (Landsat and Sentinel) - Apply image processing in downloaded data - import and export spatial data (Vector and Raster) - analysis geospatial data cloud - Spectral indices - maximum composites on big data on cloud - image classification land cover mapping basics in earth engine.	10
II	Introduction to Google Earth Engine - Sign up for Google Earth Engine - Interface of Google Earth Engine: Code Editor & Explorer - Short Introduction to Spatial and satellite data - Types of spatial data: vector and raster data - Introduction to raster data (satellite images) Introduction to Landstat Program of NASA - Introduction to Sentinel Program of ESA - Using cloud platform for spectral indices & land cover analysis. Getting started with Javascript and geospatial analysis in Google Earth Engine - Overview of datasets in Earth Engine.	9
III	JavaScript: Introduction to JavaScript - Mapping and Reducing Collection landsat - Working with image collections and image visualization - Image visualization. Image Calculation and Map functions in Earth Engine - Introduction to image data: Landsat - Image Calculations - Create a composite and calculate NDVI -	9

	Maximum NDVI - image collection Landsat and NDVI - change default names for output image collection	
IV	• Importing and exporting data: image data and spatial data - Image mosaicking, clipping, reprojecting, and exporting as TIFF - Geospatial analysis in Google Earth Engine - Drought monitoring using remote sensing images - Cloud masking of Sentinel-2 images - Normalized Difference Water Index (NDWI) for flood monitoring - Flood mapping with Sentinel-2 and NDWI.	10
V	Global Forest Cover Change - Map of Life - Global Forest Watch - Tiger Habitat Monitoring - Malraia Risk Mapping - Collect Earth - Global Surface Water - Remote Sensing for Land cover mapping using Google Earth Engine - Land use land cover change detection analysis -	10
References	Text Books: 1. Spatial Analysis, GIS and Remote Sensing: Applications in the Health Sciences (2000), Donald P. Albert, Taylor & Francis, Year: 2000	
	Reference Books: 1. Programming Google App Engine with Java, Sanderson, Dan, O'Reilly Media, Year: 2015 2. Programming Google App Engine with Python: Build and Run Scalable Python Apps on Google's Infrastructure, Dan Sanderson O'Reilly Media, Year: 2015	
	E-Resources: 1. https://earthengine.google.com/	
Course Outcomes	On completion of the course, students should be able to do,	
	CO1 Understand the concept Earth Engine and Java Script	
	CO2 Learn about Unsupervised classification	
	CO3 Learn about Supervised classification	
	CO4 Understand Change Detection analysis	
	CO5 Apply Google Earth Engine in areas of application of remote sensing	

Mapping of Cos with PSOs:

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	2	3	3	2	3
CO 2	1	3	2	3	2
CO 3	2	3	3	2	2
CO 4	3	2	1	3	3
CO 5	2	1	3	2	3

Semester	III	Course Code	24GISP03D5
Course Title	**Geoinformatics for Agriculture**		
No. of Credits	3	No. of contact hours per Week	3
New Course / Revised Course	New Course	If revised, Percentage of Revision effected	-
Category	• Major Elective		
Scope of the Course (may be more than one)	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and lifeskills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • Introduce the technologies of Geoinformatics. • Create an outline on Crop inventory. • Teach the concept of Soil genesis.		

UNIT	Content	No. of Hours
I	Geoinformatics: Definition - Meaning –Concept of Geoinformatics - Contributing Technologies: Remote sensing – Digital Image Processing – GIS – GNSS.	8
II	Crop inventory and remote sensing: Introduction – leaf optical properties – identification of crops and crop inventorying – crop acreage estimation – vegetation indices – yield estimation.	10
III	Remote sensing for soil: Introduction – soil genesis and soil classification – soil taxonomy – soil reflectance properties – soil mapping using remote sensing – soil erosion estimation and sedimentation.	10
IV	Land Evaluation and management: Introduction – land use/ land cover classification – change dynamics – land capability assessments.	10
V	Damage assessment: Introduction – crop loss assessment by floods – flood hazard zone mapping – drought management – reflectance properties of stressed crops.	10

References	Text Books (with chapter number & page number, wherever needed): 1. Francis J. Pierce, David Clay, GIS Applications in Agriculture, CRC Press, 2007

	Reference Books: 1. Dr. Graciela Metternicht, Dr. Alfred Zinck, Remote Sensing of Soil Salinization: Impact on Land Management, CRC Press, 2008 2. Janis L. Boettinger, David W. Howell, Amanda C. Moore, Alfred E. Hartemink, Suzann Kienast-Brown, Digital Soil Mapping: Bridging Research, Environmental Application, and Operation, Springer Science & Business Media, 2010
	E-Resources (URLs of e-books / YouTube videos / online learning resources, etc.) 1. Remote Sensing Handbook: Volume 2 - Land Resources Monitoring, Modeling, and Mapping, https://www.pdfdrive.com/remote-sensing-handbook-volume-2-land-resources-monitoring-modeling-and-mapping-with-remote-sensing-e157908108.html 2. Satellite Remote Sensing and GIS Applications in Agricultural Meteorology, https://www.pdfdrive.com/satellite-remote-sensing-and-gis-applications-in-agricultural-meteorology-e40010463.html 3. GIS Applications in Agriculture, Volume Four: Conservation Planning , https://www.pdfdrive.com/gis-applications-in-agriculture-volume-four-conservation-planning-e26616670.html
Course Outcomes	On completion of the course, students should be able to do CO1. Discuss the technologies of Geoinformatics CO2. Explain the concept of crop inventory CO3. Apply remote sensing technology in soil CO4. Use Geoinformatics technologies in land evaluation and management CO5. Apply the concept in damage assessment

Mapping of Cos with PSOs:

CO/PO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	1	1	2
CO 2	3	2	1	1	3
CO 3	3	2	1	1	2
CO 4	3	3	1	1	3
CO 5	3	2	1	1	2

Semester	III	Course Code	24GISP03D6
Course Title	**Geoinformatics for Forestry**		
No. of Credits	3	No. of contact hours per Week	3
New Course / Revised Course	New Course	If revised, Percentage of Revision effected	-
Category	• Major Elective		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and lifeskills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • concept of Geoinformatics in forestry		

UNIT	Content	No. of Hours
I	Forest: introduction – distribution of forest – types in India. Forestry: introduction – concept – role of Geoinformatics	7
II	Interaction of EMR with vegetation – spectral characteristics of vegetation – temporal characteristics of vegetation – vegetation indices – forest cover mapping.	9
III	Forest types mapping - forest density mapping –forest cover change detection – mapping of stressed vegetation – association between rock and forest types.	10
IV	Microwave remote sensing in forest studies – biomass estimation – growing stock estimation – formulation forest work plan.	12
V	Biodiversity studies – wildlife habitat analysis - biological invasion and monitoring of invasive species – forest management information system	10

References

Text Books:

1. Peter A. Burrough et al., Principles of Geographical Information System (3rd Edition), Oxford University Press Inc., New York, 2015.
2. Ian Heywood, Sarah Cornelivs and Steve Carver, An Introduction to Geographical Information System (3rd Edition), Pearson Education Pvt .Ltd., New Delhi, 2017.
3. Lillesand, Kiefer & Chipman, Remote Sensing and Image Interpretation (6th Edition), Wiley India Pvt.Ltd, New Delhi, 2017.

	Reference Books: 1. David H. White, S. Mark Howden, Climate Change: Significance for Agriculture and Forestry,1994 2. Matti Maltamo, Erik Næsset, Jari Vauhkonen, Forestry Applications of Airborne Laser Scanning-Concepts and Case Studies, Springer, Dordrecht 2014, reprint edition, ISBN 978-94-017-8662-1
	E-Resources 1. https://www.electronicshub.org/different-types-sensors/ 2. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000017GE/P001788/M027029/ET/1517207018AERIALPHOTOGRAPHY(2.pdf 3. https://www.slideshare.net/virajain/lecture-1aerial-photogrammetry 4. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000017GE/P001788/M028382/ET/1521702258Divyani_Digi_Photogrammetry (2.pdf 5. 8.https://earth.esa.int/documents/973910/1002056/CK3.pdf/4e5b4e5a-d898-43b8-9e5c-ba7494aa58c8
Course Outcomes	On completion of the course, students should be able to do CO1. Explain the basics of forestry and role of Geoinformatics in it CO2. Discuss the concept of Remote sensing in forestry CO3. Apply the tools of Geoinformatics in forest mapping and assessment CO4. Explain the use of micro wave remote sensing in forest studies CO5. Analyze the use of Geoinformatics in different biodiversity studies.

Mapping of Cos with PSOs:

CO/PO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	2	3	1	3	2
CO 2	3	3	3	1	3
CO 3	2	2	1	2	2
CO 4	3	3	2	1	3
CO 5	3	2	1	3	2

Semester	III	Course Code	24GISP03D7
Course Title	**Geoinformatics for Water Resource Management**		
No. of Credits	3	No. of contact hours per Week	3
New Course / Revised Course	New Course	If revised, Percentage of Revision effected	-
Category	• Major Elective		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and lifeskills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to 1. provide basic knowledge on hydrology, remote sensing in ground water exploration 2. gives an idea about watershed 3. explain the areas of applications of Remote sensing and GIS in surface water, glaciology, meteorology and oceanography		

UNIT	Content	No. of Hours
I	Hydrology: Definition – its important – hydrological cycle – issues in water resource development – management and utilization. Spectral characteristics of water and relevance of remote sensing for hydrological investigation.	10
II	Remote Sensing in ground water exploration – factors affecting ground water occurrence. Types of aquifers – aquiclude – aquitard – aquifuge – location of aquifers. Drainage mapping – morphometric analysis. DEM in hydrological modeling.	10
III	Watershed: Definition – concept – role of Remote Sensing in conservation – planning – management. Mapping and monitoring of catchment and command areas – mapping of drought prone zones. Runoff estimation, groundwater flow – surface and ground water interaction – control and occurrence of ground water movement.	10
IV	Application of Remote sensing and GIS: Oceanographic studies: Definition – concept – importance of ocean – satellite and sensors for ocean studies – sea ice monitoring – estimation of wind velocity – direction – sea surface temperature – salinity – ocean colour – phytoplankton and seaweed mapping - potential fishing	12

	zones – suspended sediment – bathymetry mapping.	
V	Application of Remote sensing and GIS: Meteorology: Rainfall mapping – potential and actual evapo-transpiration – atmospheric water content – cloud mapping. Glaciology: monitoring snow melt – snow formation – snow melt runoff estimation. Surface Fresh water: river diversion studies – site suitability for surface water storage – hydro-electric power plant – storage yield.	10
References	**Text Books:** **1. J**ohn G. Lyon, GIS for Water Resource and Watershed Management, CRC Press, 2003	
	Reference Books: 1. John G. Lyon, Geographic Information Systems in Water Resources Engineering, CRC Press, 2009.	
	E-Resources: 1. Geographic Information Systems in Water Resources Engineering, https://www.pdfdrive.com/geographic-information-systems-in-water-resources-engineering-e190107317.html 2. Integrating GIS, Remote Sensing, and Mathematical Modelling for Surface Water Quality Management, https://www.pdfdrive.com/integrating-gis-remote-sensing-and-mathematical-modelling-for-surface-water-quality-management-in-irrigated-watersheds-unesco-ihe-phd-thesis-e165584308.html 3. GIS and Geocomputation for Water Resource Science and Engineering, https://www.pdfdrive.com/gis-and-geocomputation-for-water-resource-science-and-engineering-e158241847.html	
Course Outcomes	On completion of the course, students should be able to do CO1. Explain the basics of Hydrology CO2. Discuss the about remote sensing in ground water. CO3. Explain the concept of watershed, mapping and monitoring CO4. Apply GIS and Remote Sensing in oceanography CO5. Apply GIS and Remote Sensing in Meteorology, Glaciology, Surface Fresh Water	

Mapping of Cos with PSOs:

CO/PO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	2	1	2
CO 2	2	3	2	1	2
CO 3	1	1	3	2	3
CO 4	2	3	3	2	2
CO 5	2	2	1	3	3

Semester	III	Course Code	24GISP03D8
Course Title	**Geoinformatics for Urban Planning and Utility Management**		
No. of Credits	3	No. of contact hours per Week	3
New Course / Revised Course	New Course	If revised, Percentage of Revision effected	-
Category	• Major Elective		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and lifeskills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to 1. explore the use of Geoinformatics in urban planning, utility management, demography, urban governance, urban ecology 2. provide knowledge on wastewater business, hospital utility, electricity distribution and solid waste management.		

UNIT	Content	No. of Hours
I	Urban planning and mapping: urban – regional planning – LU/LC mapping. Geoinformatics data modeling for urban design – urban infra-structure – urban site selection – site suitability analysis for utilities and civic amenities. Urban sprawl – problems of urbanization	12
II	Mapping and Management of facilities: Geoinformatics applications in Automates Mapping (AM) – Facility Mapping (FM) – types of utility sectors – Geoinformatics for pipeline planning and alignment – electricity and power supply – water and sewage – telecom – radio coverage prediction – signal strength mapping.	9
III	Demography and Urban governance: Population distribution map by age – gender – education – occupation – socio-economic grouping – health criteria index – crime rates and types. Urban governance: mapping administrative boundaries – city base map generation – property enumeration and property GIS – tax revenue rationalization – metropolitan information management system.	10
IV	Urban ecology applications: Air quality indexing and mapping – monitoring atmospheric haze – smoke – toxic gas movement and prediction of vulnerable zones – noise pollution. Natural resources inventory and management – vegetation – soil – surface	12

	water and ground water conservation – site suitability for ground water recharging – rain water harvesting – urban heat budgeting.	
V	Wastewater Business: Integration of hydraulic/ hydrologic modeling. Generation of hospital utility database – generation of road network map – utility map for ambulance – blood bank and medical college. Electric distribution: data management – planning and analysis – workforce automation Solid waste management: landfills location selection – routing efficiency for solid waste collection.	10
References	**Text Books:** 1. Manish Kumar, R. B. Singh, Anju Singh, Ram Pravesh, Syed Irtiza Majid, Akash Tiwari, Geographic Information Systems in Urban Planning and Management, Springer, 2023.	
	Reference Books: 1. Sulochana Shekhar, Deepak Kumar, Geoinformatics for Sustainable Urban Development, CRC Press, 2024. 2. M.S. Nathawat and A.C. Pandey, Geoinformatics For Decentralized Planning And Governance, 2008	
	E-Resources: 1. Michael J de Smith, Michael F Goodchild and Paul A Lougley, Geospatial Analysis(6thEdition),2020, https://spatial analysis online.com / HTML/Index.html 2. Paul Bolstad, GIS Fundamentals: A First Text on Geographic Information Systems, 2016, https://www.pdfdrive.com/gis-fundamentals-a-first-text-on-geographic-information-systems-e188660361.html 3. Michael D. Kennedy, Michael F.Goodchild & Jack Dangermond, Introducing Geographic Information Systems with ArcGIS: A Workbook Approach	
Course Outcomes	On completion of the course, students should be able to do CO1. Explain urban planning and mapping CO2. Map and manage the urban facilities CO3. Explain demography and urban governance CO4. Apply Geoinformatics in Urban Ecology CO5. Apply Geoinformatics in wastewater management, electric distribution, and solid waste management.	

Mapping of Cos with PSOs:

CO/PO	PSO				
	1	**2**	**3**	**4**	**5**
CO 1	2	1	3	1	3
CO 2	2	2	2	3	2
CO 3	2	3	3	2	2
CO 4	3	3	2	2	1
CO 5	2	2	1	3	3

Semester		Course Code	**24GISP00M1**
Course Title	**Spatial Decision Support System**		
No. of Credits	2	No. of contact hours per Week	2
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Modular course		
Scope of the Course	• Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives (Maximum: 5)	The Course aims to • exposes the students to decision making and concepts of spatial decision support system		

UNIT	Content	No. of Hours
I	Introduction to Decision Making - Concept and Characteristics of Spatial Decision Support Systems (SDSS) – Architecture of SDSS - Spatial Decision Support System (SDSS) and GIS - technologies for developing SDSS	6
II	Decision variables - Concept – Deterministic, Random - Decision Alternatives and Constraints - Efficiency and Effectiveness of Decision Making	5
III	Concept of Estimating Weights – Ranking Methods – Rating Methods – Pairwise comparison methods – Trade-off analysis methods	6
IV	Concept and types of Multi-attribute Decision modelling – Multi objective Decision Modeling – Sensitivity Analysis - GIS and Spatial decision Making – Expert systems and Spatial Decision Making – MCDM and Spatial Decision Making – Comparison of GIS and Expert Systems.	6
V	Land Suitability Analysis – Educational institution site selection - Health Care Resources location – Water Resources Management – logistic management – urban planning.	7

<table>
<tr><td rowspan="3">References</td><td colspan="2">Text Books:
1. Ramanathan Sugumaran and John Degroote, Spatial Decision Support Systems- Principles and Practices, CRC Press, Taylor and Francis Group, USA, 2011.</td></tr>
<tr><td colspan="2">Reference Books:
1. Bonczek, R.H., C.W. Holsapple, and A.B. Whinston, 1981, Foundations of Decision Support Systems, Academic Press, New York.
2. House, W.C. (ed.), 1983. Decision Support Systems, Petrocelli, New York.
3. Jenson, J.R. 2000, Remote Sensing of the environment – An Earth Resource Perspective, Prentice Hall Inc.
4. Malczewski, J. 1999, GIS and Multicriteria Decision Analysis, John Willey and Sons, New York.
5. Raghu Ramakrishnan, 2002, Database Management Systems, Johannes Gehrke, McGraw- Hill.</td></tr>
<tr><td colspan="2">E-Resources:
1. Ramanathan Sugumaran and John Degroote Spatial Decision Support Systems: Principles and Practices, CRC press, http://www.gisresources.com/wp-content/uploads/2014/06/spatial-decision-support-system.pdf</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="2">On completion of the course, students should be able to do,</td></tr>
<tr><td>CO1</td><td>Understand the concept, architecture and frame work of SDSS and decision variables</td></tr>
<tr><td>CO2</td><td>Learn about various ranking, rating and comparison methods involved in decision modeling</td></tr>
<tr><td>CO3</td><td>Gain knowledge on types of decision modeling</td></tr>
<tr><td>CO4</td><td>Apply the SDSS in specified areas</td></tr>
<tr><td>CO5</td><td>Evaluate spatial criteria for optimal land use planning</td></tr>
</table>

Mapping of Cos with PSOs:

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	2	2	2	1	2
CO 2	1	2	2	1	2
CO 3	2	1	2	1	2
CO 4	1	1	2	1	2
CO5	2	3	3	2	3

Semester		Course Code	**24GISP00M2**
Course Title	**Open Source Software**		
No. of Credits	2	No. of contact hours per Week	2
New Course / Revised Course	Revised	If revised, Percentage of Revision effected	20
Category	• Modular course		
Scope of the Course	• Advanced Skill • Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • the open source software available for research and development.		

UNIT	**Content**	**No. of Hours**
I	Introduction to Open source: Importance – Advantages – Applications. Open source operating systems LINUX: Introduction – General Overview – Kernel Mode and user mode – Process – Advanced Concepts.	6
II	Open source Software: GIS: Openjump – GRASS – QGIS – Saga GIS Image Processing: ILWIS, SciLab. GIS Database: Post GIS. Compilers: Python, R. Scripting Language: Java Scripting. Mark-up languages: HTML - WebODM Compare QGIS – ArcGIS – SagaGIS - OpenJump.	6
III	Web Mapping with Open source tool kit - Introduction to Web mapping – Merits and demerits of web mapping - Different kinds of web mapping – Architecture of Web GIS- Web GIS applications Basic web-development language - Mapping Libraries and other utilities - Map Servers - Backend and Data base - Frontend libraries - Spatial Data Infrastructure (SDI) Platforms - Project on Web mapping: A Panchayat GIS will be created by different groups.	6

IV	Mobile GIS apps: Weather apps, Wind speed/direction, Pollution apps, Location/navigation apps, Data collection apps, Geo data collect, Geo area Map, Geo Camera - ArcGIS Earth - ArcGIS Collector - ArcGIS Workforce – Google Earth Engine. Mobile mapping -Fundamental of mobile mapping, application of GPS in resources surveys and mapping.	6
V	GIS Customization Programming: GIS Customization - Needs of Scripting Language – Advantage of Macro Scripting – Sample Case studies.	6
References	Text Books: 1. Markus Neteler, Helena Mitasova, Open Source GIS: A GRASS GIS Approach, Edition, Springer 2007.	
	Reference Books: 1. Neteler, M and H.Mitasova, Open Source GIS. A GRASS GIS Approach, Kluwer Academic Publishers, Boston, USA/London, UK, 2008. 2. Qgis: https://www.packtpub.com/application-development/mastering-qgis 3. Machtelt Garrels Introduction to Lmux beginner Guide 4. Pride Fu, Jiulus S : WebGIS: Principle & Application, ESRI Press, 2011	
	E-Resources: 1. Linux Operating System: http://nptel.ac.in/courses/106106144/ 2. Javascript: http://nptel.ac.in/courses/106105084/25 3. SciLab: http://nptel.ac.in/courses/113101002/5 4. R programming: http://nptel.ac.in/courses/102101056/9	
Course Outcomes	On completion of the course, students should be able to do,	
	CO1	Understand the concept and protocols in Open Source Software & describe about various open source operating system.
	CO2	Understand various Open Source Software.
	CO3	Understand and create WebGIS.
	CO4	Know about GIS related mobile apps.
	CO5	Understand Customisation of GIS

Mapping of Cos with PSOs:

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	2	3	2	3
CO 2	3	1	3	2	3
CO 3	1	3	2	3	2
CO 4	1	2	3	1	3
CO 5	3	3	1	2	3

Semester		Course Code	**24GISP00M3**
Course Title	**LiDAR and its Applications**		
No. of Credits	2	No. of contact hours per Week	2
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Modular course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability • Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • Explores the open source software available for research and development.		

UNIT	Content	No. of Hours
I	LASER & LiDAR Principles – Different LiDAR system – Applications – Advantages and Disadvantages – Space borne and airborne LiDAR missions – Typical parameters of a LiDAR system.	6
II	Principle of Laser Altimetry – Components of the system – GNSS, IMU, LASER, LiDAR data formats – Terrain Mapping Laser Configuration – Ocean bathymetry Laser Configuration - Limitations and Challenges of the system	6
III	GNSS and IMU data processing – Strip Adjustment – Geometric Correction – Data quality enhancement – Digital Surface Model – Filtering – Ground Point Filtering – Digital Elevation Model.	6
IV	Hydrology, Disaster Mitigation and Management – 3D city models – Telecommunication	6
V	Modeling – Urban planning – Coastal Zone Bathymetry Mapping – Feature extraction & Classification, vectorisation – Surface and land use classification. Orthophoto rectification using integrated LiDAR and digital photogrammetry techniques - Integration of LiDAR DEM with other hyper spectral data.	6
References	Text Books (with chapter number & page number, wherever needed): 1. Altimetry- Principles and Applications- Mathias Lemmens, CRC Press.	

<table>
<tr><td></td><td>Reference Books:
1) Digital Photogrammetry - Yves Egels and Michel Kasser, CRC Press.
2) Laser Manual of Aerial Survey, Primary Data Acquisition- Roger Read and Ron Graham
3) Digital Terrain Modeling: Principles and Methodology- Zhilin Li Qing Zhu, Christopher Gold, CRC Press.</td></tr>
<tr><td></td><td>E-Resources (URLs of e-books / YouTube videos / online learning resources, etc.)
1. Pinliang Dong & Qi Chen, LiDAR Remote Sensing and Applications, 2018, CRC Press, https://www.pdfdrive.com/lidar-remote-sensing-and-applications-d158479644.html
2. Light Detection and Ranging (LiDAR) Technology Evaluation, https://www.pdfdrive.com/light-detection-and-ranging-lidar-technology-evaluation-d26826416.html
3. LiDAR 101: An Introduction to LiDAR Technology, Data, and Applications, https://www.pdfdrive.com/lidar-101-an-introduction-to-lidar-technology-data-and-d17380303.html</td></tr>
<tr><td>Course Outcomes</td><td>On completion of the course, students should be able to do,
CO1 Understand the concept and protocols in Open Source Software
CO2 Describe about various open source operating system
CO3 Summarise functions of Geo apps
CO4 Understand the web mapping and web servers
CO5 Work on sample case studies using open source software</td></tr>
</table>

Mapping of Cos with PSOs:

CO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	2	2	2	1	1
CO 2	2	2	2	1	1
CO 3	2	2	2	1	1
CO 4	3	3	3	2	2
CO 5	3	3	3	2	2

Semester		Course Code	**24GISP00M4**
Course Title	**Drone Image Processing**		
No. of Credits	2	No. of contact hours per Week	2
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Modular course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-6: (Create)		
Course Objectives (Maximum: 5)	The Course aims to • Explain the concept of Drone image processing		

UNIT	Content	No. of Hours
I	UAV/Drone Image Processing for GIS data generation i.e Aerial Triangulation, Orthophoto, 3D Point Cloud, DSM, DTM, 3D Mesh Model and Contour. Comprehensive workflow to process UAV/drone images that will save time during image processing. The basic theory behind UAV/Drone image Processing and Hardware/Software Requirement.	6
II	UAV/Image preprocessing: Geotagging, Geotagging removal, Point Shape File Creation, Renaming images using ExifTOOL and QGIS. UAV/Drone Image Processing Platforms	6
III	Stereo Satellite Image Processing. Working with Ortho photo, Color correction, Seam line editing, 3D point Cloud classification, Conventional Ortho generation and Contour generation.	6
IV	Processing Oblique and Nadir Images for High Accurate 3D Model Generation. Volume Calculation and Earthworks for Civil or Mining Engineer. 360^{o} panorama generation for UAV/Drone Spherical Images	6
V	Processing RTK/PPK images and their image acquisition theory Export Aerial Triangulation Result as Stereo Setup for Stereo Compilation. Accuracy Assessment Method (Relative, Absolute and Survey Grade)	6

	for UAV/Drone data product.	
References	Text Books (with chapter number & page number, wherever needed): 1. Amy E. Frazier, Kunwar K. Singh, Fundamentals of Capturing and Processing Drone Imagery and Data, CRC Press, 2021, ISBN 9780367245726.	
	Reference Books: 1. John R. Jensen, Drone Aerial Photography and Videography: Data Collection and Image Interpretation, 2018. 2. Felipe Gonzalez Toro and Antonios Tsourdos, Mdpi AG, UAV-Based Remote Sensing: Volume 2, 2018	
	E-Resources (URLs of e-books / YouTube videos / online learning resources, etc.) 1. Felipe Gonzalez Toro & Antonios Tsourdos, UAV or Drones for Remote Sensing Applications, https://www.pdfdrive.com/uav-or-drones-for-remote-sensing-applications-e176213164.html 2. Henri Eisenbeiss, UAV Photogrammetry, https://www.pdfdrive.com/uav-photogrammetry-e33411397.html 3. Pablo Zaroo-Tejada, High resolution hyperspectral and thermal remote sensing from UAV, https://www.pdfdrive.com/high-resolution-hyperspectral-and-thermal-remote-sensing-from-uav-e14457225.html	
Course Outcomes	On completion of the course, students should be able to do,	
	CO1	Understand data generation using Drone
	CO2	Understand the pre processing steps and platforms for drone image processing
	CO3	Explain the concept of stereo satellite image processing.
	CO4	Apply the UAV in 3D model, civil engineering etc.
	CO5	Check and export the output.

Mapping of Cos with PSOs:

CO/PO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	2	3	3	3	2
CO 2	2	3	3	1	2
CO 3	3	2	3	1	2
CO 4	2	3	3	1	2
CO 5	2	3	3	2	2

Semester		Course Code	**24GISP00M5**
Course Title	**Geoinformatics for Network Planning and Management**		
No. of Credits	2	No. of contact hours per Week	2
New Course / Revised Course	New Course	If revised, Percentage of Revision effected	-
Category	• Modular course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-6: (Create)		
Course Objectives (Maximum: 5)	The Course aims to • Introduce network theory, applications of network theory • Explains network data models, graph theory • Apply the concept of Geoinformatics in network		

UNIT	Content	No. of Hours
I	Network: Definition – importance – applications of network theory.	6
II	Network Data models: nature and utility – basic representation of node and link tables – layer-based approach – object-oriented approach to network analysis	6
III	Graph Theory: basic graph definition – links and their structures – basic structural properties – measures and indices: detour – network intensity – Eta – Theta – Beta – Alpha – Gamma) – connectivity – total accessibility.	6
IV	Application of Geoinformatics: data representation – analysis and modeling: multi-dimensional GIS-T models. Applications: utility networks – electricity – water distribution – sewage line – telecom.	6
V	Application of Geoinformatics: Traveling sales person problem – facility location problems and spatial interaction models – OD cost matrix – Closest facility.	6
References	Text Books: 1. Jean-Paul Rodrigue, The Geography of Transport Systems (6th edition), 2024, Routledge, New York	

	Reference Books: 1. Peter Haggett and Richard J Chorley, Network Analysis in Geography, Hodder & Stoughton Educational;1974 2. Kang-tsung Chang, Introduction to Geographic Information Systems (4thEdition), McGraw Hill Education (India) Pvt.Ltd., NewDelhi,2013. 3. Selected Essays, Spatial Analysis and Geocomputation, Springer, 2006	
	E-Resources: 1. David A Hensheir et al, Handbook of Transport Geography and Spatial Systems, Volume 5, Pearson, 2008, https://www.pdfdrive.com/handbook-of-transport-geography-and-spatial-systems-volume-5-e165969497.html 2. Jean Paul Rodrigeetal, the Geography of Transport System, Routledge, 2006, https://geonas.at.ua/_ld/0/34_The_Geography_o.pdf	
Course Outcomes	On completion of the course, students should be able to do	
	CO1	Explain the basics of network data
	CO2	Discuss the network data models
	CO3	Explain the concept of Network Theory
	CO4	Apply Geoinformatics in Transportation
	CO5	Understand role of Geoinformatics in Management.

Mapping of Cos with PSOs:

CO/PO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	2	2	3	1
CO 2	2	2	3	1	1
CO 3	1	3	3	1	3
CO 4	3	1	1	2	3
CO 5	1	1	3	1	3

Semester	II	**Course Code**	24GISP2VA1
Course Title	**Advanced Surveying**		
No. of Credits	2	No. of contact hours per Week	2
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Value added course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-2:(Understand) • K-3:(Apply) • K-4:(Analyze)		
Course Objectives	The Course aims to • Introduces the advance tool of surveying viz., total station, DGPS, UAV		

UNIT	Content	No. of Hours
I	Introduction to Total Station: Overview of Surveying and Total Station - Measurement Principles and Techniques - Types and Features of Total Stations - Operating Total Station Equipment - Data Acquisition and Processing - Applications of Total Station in Surveying	6
II	Introduction to Differential GPS (DGPS): Principle and Function. Duel and Single Frequency DGPS, RTK and Static Surveys in DGPS, Use of DGPS in Topographical Survey. Comparison of total station with DGPS in Topographical Surveying	6
III	Introduction to Unmanned Aerial Systems (UAS), UAV (Unmanned Aerial Vehicle): Principle and Functions, Drone survey.	6
IV	Total station Survey and data processing. Area selection, setup of instrument at base station and collecting points using reflector.	6
V	DGPS setting of Instruments at base and rover. DGPS Survey and Data Processing. Generation of digital elevation model (DEM)	6

References

Text Books:

1. Sathees Gopi et al., Advanced Surveying: Total Station, GPS, and Remote Sensing (2nd Edition), Pearson India Education Services Pvt. Ltd., Noida, 2019.

Reference Books:

1. Hofmann – Wellenhof, Lichtenegger and Collins, GPS: Theory and Practice (5th Edition), Springer Wien, New York, 2015.
2. Alfred Et al., GPS Satellite Surveying (4th Edition), Wiley India Pvt. Ltd., New Delhi, 2018.

<table>
<tr><td></td><td colspan="2">3. Michael Kennedy, 'The Global Positioning System and GIS: An Introduction', Taylor and Francis Inc. New York, 2002.
4. Satheesh Gopi, Global Positioning System Principles and Applications. Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.</td></tr>
<tr><td></td><td colspan="2">E-Resources:
1. http://www.maps-gps-info.com/ed-resources.html
2. http://www.gisdevelopment.net/tutorials/tuman004.htm
3. http://www.colorado.edu/geography/gcraft/notes/gps/gps_f.html</td></tr>
<tr><td>Course Outcomes</td><td colspan="2">On completion of the course, students should be able to do,</td></tr>
<tr><td></td><td>CO1</td><td>Understand the concept about total station</td></tr>
<tr><td></td><td>CO2</td><td>Understand the concept of DGPS and its working principle.</td></tr>
<tr><td></td><td>CO3</td><td>Understand the technology of UAV</td></tr>
<tr><td></td><td>CO4</td><td>Process the data derived from total station.</td></tr>
<tr><td></td><td>CO5</td><td>Process DGPS surveying and its data.</td></tr>
</table>

Mapping of Cos with PSOs:

CO/PO	PSO				
	1	**2**	**3**	**4**	**5**
CO 1	1	3	2	2	1
CO 2	1	1	2	3	2
CO 3	2	2	2	2	3
CO 4	3	3	3	3	2
CO 5	2	3	2	3	3

Semester	II	**Course Code**	24GISP2VA2
Course Title	**Planetary Remote Sensing**		
No. of Credits	2	No. of contact hours per Week	2
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Value added course		
Scope of the Course	• Basic Skill / Advanced Skill • Skill Development • Employability		
Cognitive Levels addressed by the Course	• K-2:(Understand) • K-3:(Apply) • K-4:(Analyze)		
Course Objectives	The Course aims to • Introduce the technology of remote sensing in planetary science.		

UNIT	Content	No. of Hours
I	Origin of the Universe: Theories: Big Bang and Steady State - Evolution of the cosmos and cosmic background radiation. Solar System Overview: Planetary composition and characteristics - Study of satellites, asteroids, meteorites, and comets. Internal Differentiation of Planets: Processes leading to planetary differentiation - Geological implications for planetary evolution	6
II	Terrestrial Planets: Geology and geophysics of terrestrial planets: earth, mars, venus and mercury; physical properties, composition, mineralogy and petrology of the planets and the Moon	6
III	Planetary Atmosphere: Exo and Endogenic processes associated with origin and internal evolution of planets – planetary volcanism, craters, elemental composition; mineralogy and petrology; thermal, seismic and magnetic properties	6
IV	Remote Sensing for Planetary Geology: Approaches to Remote Sensing analysis of the planetary surfaces; applications derived from interaction of electromagnetic radiation (X-ray, gamma-ray, visible, near-IR, mid-IR, radar).	6
V	Planetary Exploration Missions: Past, present and future missions - Analyses and Interpretation of data gathered through various missions: identification of morphological features	6
References	Text Books: 1. Bo Wu, Kaichang Di, Jürgen Oberst, Irina Karachevtseva, Planetary Remote Sensing and Mapping, CRC Press, 2018	

	Reference Books: 1. Shuanggen Jin , Planetary Geodesy and Remote Sensing, CRC Press, 2015. 2. Remote Sensing Application for Planetary Surfaces, Kumar Deepak (2014) Lambert Publication. 3. Fundamental Planetary Science: Physics, Chemistry and Habitability, Jack J. Lissauer, Imke de Pater (2013) Cambridge University Press 4. Physical principles of Remote Sensing, Rees, W.G. (2013) 3rd Edn, Cambridge University Press 5. Radar Remote Sensing of Planetary Surfaces, Bruce A Campbell (2011) Cambridge University Press	
	E-Resources: 1. Introduction to Planetary Geomorphology, https://www.pdfdrive.com/introduction-to-planetary-geomorphology-e166013877.html **2.** Planetary Remote Sensing and Mapping,https://www.pdfdrive.com/planetary-remote-sensing-and-mapping-e190135569.html	
Course Outcomes	On completion of the course, students should be able to do,	
	CO1	Understand the basic information about to universe and solar system.
	CO2	Understand the concept of terrestrial planets
	CO3	Understand the planetary atmosphere
	CO4	Apply remote sensing for planetary geology
	CO5	Apply remote sensing in planetary exploration missions.

Mapping of Cos with PSOs:

CO/PO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	2	3	2	1
CO 2	2	3	3	3	2
CO 3	1	2	3	2	3
CO 4	2	1	3	3	2
CO 5	3	1	2	3	3

Semester	II	Course Code	24GISP2VA3
Course Title	**Satellite Meteorology**		
No. of Credits	3	No. of contact hours per Week	3
New Course / Revised Course	Revised Course	If revised, Percentage of Revision effected	20%
Category	• Value added course		
Scope of the Course	• Basic Skill / Advanced Skill		
Cognitive Levels addressed by the Course	• K-1: (Remember) • K-2: (Understand) • K-3: (Apply)		
Course Objectives	The Course aims to • introduce the technologies of remote sensing in meteorology		

UNIT	Content	No. of Hours
I	Fundamental concepts – Conventional Direct Measurements – Indirect Methods and Remote Sensing	6
II	Orbit Types, Altitudes, and View Angles: Overview of satellite orbits: geostationary vs. polar - Implications of view angles on satellite observations. Key Weather Satellites: Overview of INSAT, KALPANA, TRMM, GPM, and others - Comparison of American and European meteorological missions - Availability and utilization of data and derived datasets.	6
III	Data Records and Applications – Active and Passive Sensor Data – Microwave Sensors and Applications – Altitude. Wind. Temperature and Wave Measurements and Sensors – AWS Global Network in Measurements.	6
IV	Meteorological Applications – Oceanographic Applications – Weather Forecasting – Aviation Meteorology – Agriculture and Irrigation Management – Meteorology in Transportation Industry – Business and Trade Application	6
V	Management and Monitoring : Satellite Meteorology in Welfare Management – Cyclone Warning Systems – World Precipitation and Warming – Sea level Monitoring – Ice and Snow – Flood and Storm Surge Warning Systems – Storms – Wild Fires and Volcanic Ash.	6

References

Text Books:

1. R R Kelkar, Satellite Meteorology, 2nd Edition, BS Publications, 2017
2. Introduction to Satellite Remote Sensing Atmosphere, Ocean, Land and Cryosphere Applications, William Emery Adriano Camp, 2017.
3. Fundamentals of Satellite Remote Sensing: An environmental

<table>
<tr><td></td><td colspan="2">Approach, (Second Edition) Emilio Chuvieco, 2017.</td></tr>
<tr><td></td><td colspan="2">Reference Book:
1. Text book on Satellite Meteorology, https://metnet.imd.gov.in/imdetp/lecture_notes/course10/LN_10_55_Lecture%20on%20Satellite%20Meteorology.pdf.
2. A Short Course in Cloud Physics, M.K. Yau, R R Rogers, 1996.
3. Remote Sensing and Image Interpretation, T M Lillesand, 2016</td></tr>
<tr><td></td><td colspan="2">E.Resources:
1) Remote Sensing Applications with Meteorological Satellites, https://cimss.ssec.wisc.edu/rss/brienza/source/AppMetSat12.pdf
2) Satellite Meteorology, http://iprc.soest.hawaii.edu/users/yqwang/EOLSS_satellite.pdf.</td></tr>
<tr><td>Course Outcomes</td><td colspan="2">On completion of the course, students should be able to do,</td></tr>
<tr><td></td><td>CO1</td><td>Understand the basic concept of satellite meteorology</td></tr>
<tr><td></td><td>CO2</td><td>Understand different types of weather satellites and sensors</td></tr>
<tr><td></td><td>CO3</td><td>Understand data records and applications.</td></tr>
<tr><td></td><td>CO4</td><td>Apply satellite data in different fields</td></tr>
<tr><td></td><td>CO5</td><td>Apply the technology in management and monitoring.</td></tr>
</table>

Mapping of Cos with PSOs:

CO/PO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	2	3	2	3	3
CO 2	3	2	1	2	2
CO 3	3	1	2	3	1
CO 4	2	2	2	2	3
CO 5	1	2	2	3	2

Semester	II	Course Code	24GISP2VA4
Course Title	**Land Use/ Land Cover Mapping using Google Earth Engine**		
No. of Credits	2	No. of contact hours per Week	2
New Course / Revised Course	Revised	If revised, Percentage of Revision effected	20%
Category	• Value added course		
Scope of the Course	• Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives	The Course aims to • exposes the students to know about Earth engine and its applications.		

UNIT	Content	No. of Hours
I	Introduction to Earth Engine - Explore Earth Engine - Sign Up with Earth engine. GEE code Editor – Basic operations – Scripting with JavaScript – Data Management in GEE	6
II	Unsupervised Classification – Clustering algorithms – Evaluation of classification results. Supervised Classification with Landsat - - Training data Collection – Classification algorithms (e.g CART, Random forest, SVM) - Processing Landsat Data - Classification with Landsat - Confusion Matrix	6
III	Supervised classification with Sentinel - Processing Sentinel Data - Classification with sentinel - Confusion matrix Supervised Classification with MODIS - Processing MODIS Data - Classification with MODIS - Confusion Matrix	6
IV	Time Series Analysis - Change Detection Analysis - Water Change Analysis - Forest Change Analysis – Handling multi – temporal datasets	6
V	Global Land Cover Products - Globe Cover - NLCD Land Cover.- Case Study.	6

References	Text Books: 1. Google Earth Engine Applications, Lalit Kumar and Onisimo Mutanga, MDPI publications	
	Reference Books: 1. Programming Google App Engine with Java, Sanderson, Dan, O'Reilly Media, Year: 2015 2. Programming Google App Engine with Python: Build and Run Scalable Python Apps on Google's Infrastructure, Dan Sanderson O'Reilly Media, Year: 2015	
	E-Resources: 1. https://earthengine.google.com/	
Course Outcomes	On completion of the course, students should be able to do,	
	CO1	Understand the concept Earth Engine and Java Script
	CO2	Learn about Unsupervised classification
	CO3	Learn about Supervised classification
	CO4	Understand Change Detection analysis
	CO5	Understand Global Land Cover and Analysis case study.

Mapping of Cos with PSOs:

CO/PO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	1	3	2	1	2
CO 2	2	2	3	2	3
CO 3	2	2	1	3	1
CO 4	2	1	3	1	3
CO 5	3	3	2	3	2

Semester	III	Course Code	24GISP2VA5
Course Title	**ArcGIS API for JavaScript**		
No. of Credits	2	No. of contact hours per Week	2
New Course / Revised Course	New Course	If revised, Percentage of Revision effected **(Minimum 20%)**	-
Category	• Value added course		
Scope of the Course (may be more than one)	• Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives (Maximum: 5)	The Course aims to • exposes the students to know about ArcGIS API for JavaScript its applications.		

UNIT	Content	No. of Hours
I	**Introduction to JavaScript and ArcGIS:** Overview of JavaScript: Basics of JavaScript: Variables, Data Types, Operators, and Control Structures, Functions, Objects, and Events in JavaScript, Introduction to Document Object Model (DOM)-Introduction to ArcGIS: Overview of GIS and ArcGIS Platform, Introduction to ArcGIS Online and ArcGIS Enterprise, Understanding ArcGIS REST API.	6
II	**Getting Started with JavaScript API for ArcGIS:** Setting Up the Development Environment: Installing and configuring the development environment, Introduction to ArcGIS API for JavaScript SDK, Basic HTML and CSS for building web applications - Creating Your First Map: Loading the ArcGIS API for JavaScript, Adding a basic map to a web page, Working with MapView and SceneView.	6
III	**Working with Layers and Data:** Layers and Feature Layers: Adding and managing different types of layers (TileLayer, FeatureLayer, etc.), Querying and displaying spatial data - Data Visualization: Creating and using renderers to visualize data, Applying symbology and labeling, Using pop-ups to display	6

	feature information.	
IV	**Advanced Map Interactions:** User Interactions: Handling user events (click, hover, etc.), Using widgets (Search, BasemapGallery, LayerList, etc.), Implementing custom widgets - Geospatial Analysis: Performing spatial analysis tasks (buffer, intersect, etc.), Using Geometry Engine and Geoprocessor.	6
V	**Building and Deploying Applications**: Developing Applications: Building responsive web applications with ArcGIS API for JavaScript, Integrating with other web services and APIs, Managing application state and performance optimization - Deploying Applications: Best practices for deploying ArcGIS web applications, Hosting and publishing applications, Security considerations and user authentication.	6
References	Text Books: 1. Learning ArcGIS API for JavaScript by Eric Pimpler	
	Reference Books: 1. Getting to Know Web GIS by Pinde Fu	
	E-Resources: 1. ArcGIS API for JavaScript documentation and tutorials 2. Esri Community and ArcGIS Blog 3. Various online courses and tutorials available on platforms like Coursera, Udemy, and Esri's training site.	
Course Outcomes	On completion of the course, students should be able to do CO1. Understand the concept ArcGIS API for JavaScript CO2. Learn about IDE CO3. Learn about Layer and Data CO4. Understand Map Interaction CO5. Understand Building and Deployment of application.	

Mapping of Cos with PSOs:

CO/PO	PSO				
	1	**2**	**3**	**4**	**5**
CO 1	1	2	2	3	1
CO 2	2	1	3	3	2
CO 3	2	3	2	1	3
CO 4	1	1	2	2	2
CO 5	3	2	2	3	1

Semester	II	Course Code	24GISP2VA6
Course Title	**Data Visualization with Tableau**		
No. of Credits	2	No. of contact hours per Week	2
New Course / Revised Course	New Course	If revised, Percentage of Revision effected **(Minimum 20%)**	-
Category	• Value added course		
Scope of the Course (may be more than one)	• Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives (Maximum: 5)	The Course aims to • exposes the students to know about Data Visualization with Tableau		

UNIT	Content	No. of Hours
I	**Introduction and Basics of Tableau**: Overview of data visualization: Importance and principles, Key concepts: accuracy, clarity, efficiency, aesthetics, Introduction to Tableau: Overview and installation - Tableau Interface and Basics: Getting familiar with the Tableau workspace, Connecting to different data sources (Excel, CSV, databases), Understanding Tableau's data types and structure. Basic Visualization Techniques: Creating bar charts, line charts, and pie charts, Using filters, sets, and groups, Formatting and customizing visualizations.	6
II	**Advanced Visualization and Dashboards**: Advanced Visualization Techniques: Scatter plots, histograms, and heat maps, Dual-axis and combination charts, Using calculated fields and table calculations - Creating Interactive Dashboards, Building interactive dashboards, Adding interactivity with actions (filters, highlights), Best practices for dashboard design - Storytelling with Data: Creating and formatting stories in Tableau, Linking multiple visualizations into a cohesive narrative, Practical	6

	examples of storytelling with data.	
III	**Spatial Data Visualization:** Spatial Data Visualization: Importing and visualizing spatial data, Creating maps and geographic visualizations, Layering and customizing maps - Advanced Mapping Techniques: Spatial joins and calculations, Visualizing geospatial distributions and densities, Case studies in spatial data visualization.	6
IV	**Data Preparation and Integration:** Data Preparation and Cleaning: Techniques for data preparation and cleaning in Tableau, Handling missing data and data inconsistencies, Using Tableau Prep for complex data transformations- Integration with Other Tools: Integrating Tableau with R and Python for advanced analytics, Using external data sources and APIs, Practical examples and case studies.	6
V	**Optimization and Applications:** Performance Optimization: Best practices for optimizing Tableau performance, Reducing load times and improving efficiency, Tips for handling large datasets - Case Studies and Applications: Real-world applications of Tableau in geoinformatics, Student presentations on data visualization projects, Discussion and feedback on project work.	6
References	Text Books: 1. Tableau Your Data: Fast and Easy Visual Analysis with Tableau Software by Daniel G. Murray	
	Reference Books: 1. Learning Tableau 2020: Create effective data visualizations, build interactive visual analytics, and transform your organization by Joshua N. Milligan	
	E-Resources: 1. Tableau Public (https://public.tableau.com) 2. Tableau Learning Resources (https://www.tableau.com/learn/training)	
Course Outcomes	On completion of the course, students should be able to do 2. Understand the Basics of Tableau 3. Learn about Visualization and Dashboards 4. Learn about Spatial Data Visualization 5. Understand Data Preparation and Integration 6. Understand Optimization and Applications.	

Mapping of Cos with PSOs:

CO/PO	PSO				
	1	**2**	**3**	**4**	**5**
CO 1	3	2	2	2	1
CO 2	2	2	2	2	3
CO 3	3	2	3	1	1
CO 4	1	3	3	3	3
CO 5	2	1	1	1	1

Semester	I	Course Code	24GISP2VA7
Course Title	**Spatial Databases and MySQL**		
No. of Credits	2	No. of contact hours per Week	2
New Course / Revised Course	New Course	If revised, Percentage of Revision effected	-
Category	• Value added course		
Scope of the Course (may be more than one)	• Value-Added Courses imparting transferable and life skills		
Cognitive Levels addressed by the Course	• K-2: (Understand) • K-3: (Apply) • K-4: (Analyze) • K-5: (Evaluate) • K-6: (Create)		
Course Objectives (Maximum: 5)	The Course aims to • exposes the students to know about Data Visualization with Tableau		

UNIT	Content	No. of Hours
I	**Introduction to Spatial Databases:** Overview of Spatial Databases: Definition and importance of spatial databases, Differences between spatial and non-spatial databases, Key concepts: spatial data, spatial queries, and spatial indexing-Spatial Data Models:Vector and raster data models, Geometry types: points, lines, and polygons, Spatial reference systems and projections.	6
II	**Fundamentals of MySQL:** Introduction to MySQL: Overview of MySQL database management system, MySQL architecture and components, Installation and configuration of MySQL - Basic SQL: SQL syntax and commands, Data definition language (DDL) and data manipulation language (DML), Creating and managing databases, tables, and indexes, Querying data using SELECT, INSERT, UPDATE, and DELETE statements.	6
III	**Working with Spatial Data in MySQL:** Spatial Extensions in MySQL: Introduction to MySQL spatial extensions, Installing and enabling spatial extensions, Spatial data types in MySQL	6

	(geometry, point, line, polygon) - Handling Spatial Data: Creating and managing spatial tables, Inserting and updating spatial data, Importing and exporting spatial data, Spatial functions and operations in MySQL.	
IV	**Spatial Queries and Indexing:** Spatial Queries: Constructing spatial queries in MySQL, Using spatial functions: ST_Distance, ST_Contains, ST_Within, etc., Performing spatial joins and relationships - Spatial Indexing: Importance of spatial indexing, Creating and managing spatial indexes, Optimizing spatial queries using indexes.	6
V	**Applications and Advanced Topics**: Practical Applications: Case studies and real-world applications of spatial databases, Integrating MySQL with GIS software (e.g., QGIS, ArcGIS), Developing spatial data applications using MySQL and web technologies - Advanced Topics: Advanced spatial functions and analysis, Handling large spatial datasets, Introduction to PostGIS as an alternative spatial database	6
References	Text Books: 1. Beginning Spatial with SQL Server 2008 by Alastair Aitchison (for concepts applicable to MySQL)	
	Reference Books: 1. MySQL Cookbook by Paul DuBois	
	E-Resources: 1. MySQL documentation and spatial extensions guide 2. Tutorials and courses on spatial databases and MySQL available on platforms like Coursera, Udemy, and YouTube 3. GIS and spatial databases communities and forums for additional support and resources	
Course Outcomes	On completion of the course, students should be able to do CO1. Understand the Spatial Database CO2. Learn about Fundamentals of MySQL CO3. Learn about Spatial Data in MySQL CO4. Understand Spatial Queries and Indexing CO5. Understand Applications and Advanced Topics.	

Mapping of Cos with PSOs:

CO/PO	PSO				
	1	**2**	**3**	**4**	**5**
CO 1	1	2	3	2	1
CO 2	3	1	1	3	2
CO 3	2	2	2	3	1
CO 4	1	2	2	2	3
CO 5	2	3	3	3	3