ACADEMIC YEAR 2019-2020 & 2020-2021

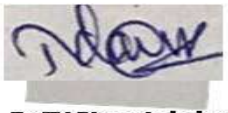
CENTRE FOR ENVIRONMENT
INSTITUTE OF SCIENCE & TECHNOLOGY (Autonomous)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD

COURSE STRUCTURE AND SYLLABUS

M.Tech (ENVIRONMENTAL GEOMATICS)
(Full Time PG Program)


Dr.V.Hima Bindu

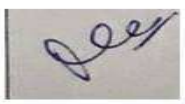

Dr.M.Anji Reddy


Dr.T.Vijaya Lakshmi


Dr.Debraj Bhattacharya


Mr.Sunil Kulakarni


Dr.K.Kiran


Mr.ASRKV. Murali Mohan


Mr.Ramesh

CENTRE FOR ENVIRONMENT
INSTITUTE OF SCIENCE & TECHNOLOGY
JAWAHARLALA NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
KUKATPALLY: HYDERABAD – 500 085.

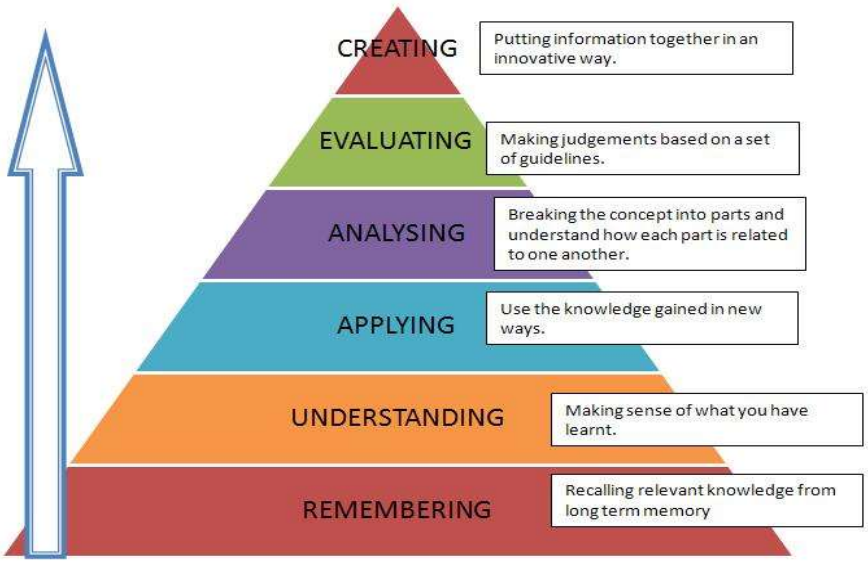
Vision:

- To disseminate advance knowledge by providing effective instruction and innovative research in environmental science and technology by promoting inter-disciplinary studies and research.
- To respond and to find technological solutions for pollution monitoring, abatement and control through innovation in environmental chemistry, environmental biotechnology and Environmental Geomatics.
- To maintain and develop liaison/collaboration with reputed universities, R&D organizations, industries and consultancy firms in India and abroad.

Mission:

- Producing highly motivated, technically competent, morally strong graduates with deep roots in our culture and with ability to respond to global challenges, thereby delighting all stakeholders namely parents, employers and humanity at large.
- To excel as a centre of Higher Education and Research in the field of Environmental Science & Technology.

Blooms Taxonomy:



ACADEMIC YEAR 2019-2020& 2020-2021
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
CENTRE FOR ENVIRONMENT
INSTITUTE OF SCIENCE & TECHNOLOGY (Autonomous)

PROGRAM STRUCTURE AND SYLLABUS
M.Tech (ENVIRONMENTAL GEOMATICS)

PROGRAMME EDUCATION OBJECTIVES:

To provide the engineering graduates and science post graduates with technical expertise in Environmental Geomatics which will enable them to have a career and professional accomplishment by allowing them to work in multidisciplinary/interdisciplinary areas in the public or private sector.

The program educational objectives of the **M. Tech (Environmental Geomatics)** are:

- To provide students with fundamental knowledge and skills in the Geomatics discipline especially for Environmental protection and Management.
- To generate trained manpower in the applied areas of Environmental Geomatics, and prepare students for a profession in geospatial science and technology in concurrence with the policies of Government of India.
- To demonstrate knowledge and skills product interpretation, analysis, integration with GIS and GNSS and management of geospatial database for land parcels surveying, environmental planning and in EIA studies as per the norms of Ministry of Environment, Forest and Climate change.
- To acquire the ability to start entrepreneurship in the geospatial industry.
- To get involved with state, national, and international organizations, to place the students in their mission projects and industry employability.

PROGRAM OUTCOMES:

PO1: Ability to independently carry out research/investigation and development work to solve practical problems.

PO2: Ability to write and present a substantial technical report/document.

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO4: To Train and make the student ready with appropriate skills and technologies with special reference to Geomatics industry and sustainable environment development.

OUTCOMESOF THE PROGRAMME:

By the time of their graduation, the students are expected to be able to:

1. An ability to independently carry out research/investigation and development work to solve practical problems.
2. An ability to write and present a substantial technical report/document.
3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
4. Understand the environmental, social and economic framework in which environmental management decisions are made understand the life cycle perspective, systems approach and environmental technologies for converting process, products and service related industrial environmental problems into opportunities to improve performance
5. Anticipate, recognize, evaluate, and control environmental issues in a variety of sectors and industries and liaison with federal, state, and local agencies and officials on issues pertaining to environmental protection
6. Recognize, evaluate, and control factors in the workplace and the environment that cause health and environmental hazards and utilize quantitative knowledge and skills and modern tools and technologies using Remote sensing, GIS & GPS to assess, analyze, plan, and implement environmental management systems
7. Engage in critical thinking and contribute to research in solving contemporary environmental problems with professional and ethical responsibility.
8. Pursue lifelong learning as a means of enhancing the knowledge and skills in environmental modeling.
9. Identify, formulate, analyze, and develop management systems and formulate solutions that are technically sound, economically feasible, and socially acceptable.
10. Communicate proficiently in writing and speaking for promoting and coordinating public consultations on environmental matters and for negotiating environmental service agreements and managing associated costs and revenues
11. Collaborate with environmental engineers, planners, technicians, and other specialists, and experts in to address environmental problems.
12. Find professional level employment or pursue higher studies and pursue research for contributing to the betterment of humanity and in shaping a sustainable society.

ACADEMIC YEAR 2019-2020 & 2020-2021

CENTRE FOR ENVIRONMENT
INSTITUTE OF SCIENCE & TECHNOLOGY (AUTONOMOUS)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. TECH. -ENVIRONMENTAL GEOMATICS
PROGRAM STRUCTRURE

M.Tech I Year I Semester

Course Number	Subject	Scheme of Studies Per Week			Credits	Int Marks	Ext Marks
		L	T	P			
1EGM01	**Program Core I** Surveying & Photogrammetric Engineering	3	0	0	3	30	70
1EGM02	**Program Core II** Remote Sensing	3	0	0	3	30	70
1EGMPE01	**Program Elective I** A) Digital Image Processing B) GNSS and UAV Technologies C) DBMS and Programming Language	3	0	0	3	30	70
1EGMPE02	**Program Elective II** A) Geomatics for Climate Change& Sustainable Development B) Smart Cities and GIS C) Advanced Photogrammetry	3	0	0	3	30	70
1A01	Research Methodology & Intellectual Property Rights	2	0	0	2	30	70
1A02	**Audit Course I** 1. English for Research Paper Writing 2. Disaster Management 3. Sanskrit for Technical Knowledge 4. Value Education 5. Constitution of India 6. Pedagogy Studies 7. Stress Management by Yoga 8. Personality Development through Life Enlightenment Skills.	2	0	0	0	0	0
1EGM03	Image Processing & Feature Extraction Lab	0	0	4	2	30	70
1EGM04	GNSS and UAV Lab	0	0	4	2	30	70
Total Credits		**16**	**0**	**08**	**18**	**210**	**490**

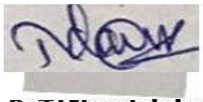
M.Tech I Year - II Semester

Course Number	Subject	Scheme of Studies Per Week			Credits	Int Marks	Ext Marks
		L	T	P			
2EGM05	**Program Core III** Geographical Information System	3	0	0	3	30	70
2EGM06	**Program Core IV** Spatial Data Analysis & Modeling	3	0	0	3	30	70
2EGMPE03	**Program Elective III** A) Microwave Remote Sensing B) Geo Statistics C) Applied Geomatics	3	0	0	3	30	70
2EGMPE04	**Program Elective IV** A) Environmental Impact Assessment B) Geo Visualization & Web Mapping C) Satellites and Sensors	3	0	0	3	30	70
2A03	**Audit Course II** 1. English for Research Paper Writing 2. Disaster Management 3. Sanskrit for Technical Knowledge 4. Value Education 5. Constitution of India 6. Pedagogy Studies 7. Stress Management by Yoga **8.** Personality Development through Life Enlightenment Skills.	2	0	0	0	0	0
2EGM07	GIS Lab	0	0	4	2	30	70
2EGM08	Applied Geomatics Lab	0	0	4	2	30	70
2A04	Mini Project with Seminar	2	0	0	2	30	70
	Total Credits	**16**	**0**	**08**	**18**	**210**	**490**

***Students are encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break.**


Dr.V.Hima Bindu


Dr.M.Anji Reddy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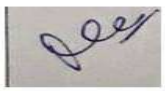
Mr.ASRKV. Murali Mohan


Mr.Ramesh

M.Tech II Year - III Semester

Course No.	Subject	Scheme of Studies Periods Per Week			Credits	Int Marks	Ext Marks
		L	T	P			
3EGMPE05	**Program Elective- V** A) Cadastral Land use Planning & Management B) Programming with Open Source GIS C) Geomatics for Disaster Risk Reduction & Management	3	0	0	03	30	70
3EGMOE	**Open Elective- I** A) Geomatics for Natural Resource Management B) Remote sensing for Vegetation C) Operations Research D) Cost Management of Engineering Projects	3	0	0	03	30	70
	Dissertation - I						
	a) Project review-I				0	0	0
3A05	b) Project review-II	0	0	20	10	100	0
Total Credits		**06**	**0**	**20**	**16**	**160**	**140**

M.Tech II Year – IV Semester

	Subject	Scheme of Studies Per Week			Credits	Int Marks	Ext Marks
		L	T	P			
	Dissertation Phase –II (Project Review-III 30 Marks + Project Evaluation 70 Marks = 100 Marks						
4A06	a. Project review-III	0	0	32	16	30	0
4A07	b. Project Evaluation (Viva-Voce)				0	0	70
Total Credits		**0**	**0**	**32**	**16**	**30**	**70**

TOTAL CREDITS = 68

L: Lecture Periods T: Tutorial periods L: Practical Periods


Dr.V.Hima Bindu


Dr.M.Anji Reddy


Dr.T.Vijaya Lakshmi


Dr.Debraj Bhattacharya


Mr.Sunil Kulakarni


Dr.K.Kiran


Mr.ASRKV. Murali Mohan


Mr.Ramesh

M. TECH. -ENVIRONMENTAL GEOMATICS
PROGRAM SYLLUBUS

I YEAR - I SEMESTER

Course Title	**SURVEYING, PHOTOGRAMMETRIC ENGINEERING**		
Course code	1EGM 01	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Core**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:** Discuss photogrammetric surveys related to hydrographic, mining and cadastral surveys. **CO2:** Demonstrate various surveying and mapping technologies connected with elevation, contour survey, trigonometric leveling. **CO3:** Focus on Modern surveying trends using GPS, ETS and digital cartography. **CO4:** Tabulate various types of aerial cameras in flight planning **CO5:** Evaluate parallax equations and height determinations.		
UNIT I: INTRODUCTION TO SURVEYING AND CARTOGRAPHY			
i. Datum and Reference System, horizontal datum and Vertical data ii. Topographical surveys, Photogrammetric surveys iii. Engineering surveys:- Hydrographic surveys, Mine surveys, Cadastral surveys			
UNIT II: SURVEYING AND MAPPING:			
i. Conventional mapping versus Digital mapping, list of mapping organizations, Classification of maps. ii. Control Survey: Horizontal, vertical and both, Contour survey and Depiction of heights. iii. Introduction to Elevation Determination, Systematic Errors in Differential Levelling iv. Random Errors In Differential Levelling, Error Propagation in Trigonometric Levelling v. Conversion of ellipsoidal heights to MSL.			
UNIT III: MODERN TRENDS IN SURVEYING AND MAPPING:			
i. Global Positioning System for ground control and extension, ii. Total station system for detail surveying, iii. Digital Photogrammetric Survey, iv. Remote Sensing, Digital Cartography v. Geographical Information System.			
UNIT IV: BASICS OF PHOTOGRAMMETRY:			
i. History of Photogrammetry, Definition and terminology, ii. Geometry and Types of photographs, Photographic scale, relief displacement, photographic overlaps, iii. Types of aerial cameras, Ground control, Photo mosaics.			

iv. Flight planning – Crab and drift – Computations for flight planning, v. Specification for Aerial Photography.
UNIT V: PHOTOGRAMMETRY AND CONSIDERATIONS:
i. Stereo photogrammetry introduction, ii. Parallax equations and height determination iii. Workflows in photogrammetry: Block adjustment, orthorectification. iv. Overview on applications of Photogrammetry
Books Recommended 1. Geo-informatics for Environmental Management by M. Anji Reddy, BS Publications, 2nd edition, 2004. 2. Text book of Photogrammetry by P.R. Wolf, 2nd edition. 3. Surveying and Mapping, Volume I and II by David Clarke, 1996. 4. Manual of Photogrammetry – American society of Photogrammetry & R.S by Albert.D, 1952

Course Title	REMOTE SENSING		
Course code	1 EGM 02	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Core**		
Course outcomes (COs)	**At the end of the course, The student will be able to** **CO1:**Appreciate the interaction of electromagnetic spectrum with atmospheric interactions on earth surface materials. **CO2:**Interpret remote sensing systems, sensors and their capabilities with varied resolutions. **CO3:**Extract different features from the satellite imageries and analyze various data products **CO4:**Discriminate factors affecting microwave measurements using various space and air borne radar systems **CO5:**Integrate application of multi spectral images in analysis of LULC and agricultural/Forest applications.		

UNIT I: BASIC PRINCIPLES

i. Introduction, Electromagnetic Remote Sensing Process, Physics of Radiant Energy:
ii. Nature of Electromagnetic Radiation, Electromagnetic Spectrum. Energy Source and its Characteristics,
iii. Atmospheric Interactions with Electromagnetic Radiation: Atmospheric Properties,
iv. Absorption Ozone, Atmospheric Effects on Spectral Response Patterns.

Energy Interactions with Earth's Surface Materials: Spectral Reflectance Curves. Cosine Law

UNIT II: REMOTE SENSING SYSTEM AND SENSOR PARAMETERS

i. Introduction, Satellite System Parameters: Instrumental Parameters, Viewing Parameters. Sensor Parameters, Spatial Resolution, Spectral Resolution, Radio metric resolution.
ii. Imaging Sensor Systems: Multispectral &imaging sensor systems,
iii. Thermal sensing systems, microwave image systems.

Latest Trends in Remote Sensing Platforms and sensors: Examples of different satellites and sensors

UNIT III: VISUAL IMAGE INTERPRETATION AND FEATURE EXTRACTION

i. Introduction, Types of Pictorial Data Products, Image interpretation strategy: Levels of Interpretation Keys.
ii. Process of Image Interpretation, Interpretation of Aerial Photo, General procedure for photo interpretation, Three-dimensional interpretation Method.
iii. Basic elements of Image Interpretation, Application of Aerial Photo Interpretation.
iv. Interpretation of Satellite Imagery, Key Elements of Visual Image Interpretation, Concept of Converging Evidence

UNIT IV: MICROWAVE AND HYPERSPECTRAL REMOTE SENSING:

i. Introduction, The Radar Principle, Factors affecting Microwave measurements: Surface roughness, Radars catering mechanism.
ii. Radar Wave binds, Side looking Airborne radar (SLAR) systems, Synthetic Aperture Radar (SAR).
iii. Spectroscopy, Hyper spectral vs. Multi spectral imaging, Spectral reflectance's, Spectra

Libraries – absorption process.
UNIT V: REMOTE SENSING SYSTEM APPLICATIONS
i. Advantages and Disadvantages of Remote Sensing, Applications of - Multi spectral and hyper spectral imaging. ii. Microwave imaging and Hyper spectral imaging, Visual image analysis for land use/land cover mapping, iii. Geological and soil mapping, agriculture applications, forestry applications and water resources applications
Books Recommended 1. M.Anji Reddy, Text book of Remote sensing and GIS by, BSP Publications, Hyderabad, 2001. 2. Lillesand, T.M. and Kiefer R.W. Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, New York, 1987. 3. Remote Sensing: Principles and Interpretation by Floyd F. Sabins, 1997. 4. Remote Sensing of the Environment: An Earth Resource Perspective by John R. Jensen, 2009.

Course Title	DIGITAL IMAGE PROCESSING		
Course code	1 EGMPE01	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course outcomes (COs)	**At the end of the course, The student will be able to** **CO1:** Illustrate satellite data acquisitions, image display subsystems and file formats **CO2:**Correlate sensor calibration and image enhancement techniques **CO3:** Compare various image filtering techniques and arithmetic operations. **CO4**: Prioritize various techniques of image classification techniques for accuracy assessment. **CO5:** Give reasons for integration of GIS in image classification and software's related to image classification.		

UNIT I : DIGITAL COMPUTERS AND IMAGE PROCESSING

i. Introduction: Information Systems – Encoding and decoding, modulation.
ii. Satellite data – acquisition, storage and retrieval – generation of data products digital data formats.
iii. Computer basics: Hardware and Software, Networks, Image Display Subsystem, Color Display System, Hard copy.
iv. Data Formats for Digital Satellite Imagery, Image file Formatsub-system and Data Compression

UNIT II :PROCESSING OF REMOTE SENSING DATA AND IMAGE ENHANCEMENT TECHNIQUES

i. Cosmetic Operations- Missing Scan Lines, De –striping Methods, Geometric Corrections and Registration.
ii. Coordinate Transformations, Atmospheric Correction Methods, Illuminations and View Angle Effects,
iii. Sensor Calibration and Terrain Effects and radiometric correction methods.
iv. Introduction to image enhancement, Human Visual Systems, Contrast Enhancement- Linear Contrast Stretch, Histogram Equalization, Guassian Stretch, Pseudo Color Enhancement- Density Slicing, Pseudo Color Transform.

UNIT III: IMAGE TRANSFORMS AND IMAGE FILTERING TECHNIQUES

i. Introduction, Arithmetic Operations- Image Addition, Subtraction, Multiplication and Division.
ii. Empirically Based Image Transforms- Perpendicular Vegetation Index, Tasselled Cap Transformations, NDVI.
iii. PRINCIPAL COMPONENT ANALYSIS: Standard PCA, Noise Adjusted PCA, De-correlation Stretch, Hue -Saturation and Intensity Transform, Fourier Transform
iv. Introduction to image filtering, Low Pass Filters- Moving Average Filters, Median Filters, Adaptive Filters, High Pass Filters- Image Subtraction Method, Derivative Based Method, Frequency Domain Filters, Filtering for Edge Enhancement

UNIT IV: IMAGE CLASSIFICATION AND ACCURACY ASSESSMENT

i. Introduction, Geometrical Basis of Classification,
ii. Unsupervised classification, Supervised Classification, Training Samples, Statistical Parameters and Classifiers, Other Approaches to Image Classification, Feature Selection, Contextual Information
iii. Image classification accuracy assessment, Performance analysis, Various Band Data for Land use, Land Cover Classification System with Case Studies.

UNIT V: IMAGE CLASSIFICATION AND GIS INTEGRATION

i. Image Classification and GIS,
ii. Integration and Linkage. Software:
- ERDAS,
- EASI /PACE,
- Geomatica and ENVI.

Books Recommended

1. M. Anji Reddy, Y. Harishanker - Digital Image Processing, B.S. Publications, Hyderabad, 2nd edition.
2. John, R. Jensen, Introductory Digital Image Processing – Prentice Hall, New Jersey, 1986.
3. Robert, A. Schowengergt. Techniques for image processing and classification in Remote Sensing, 1983.
4. Hord, R.M. Digital Image Processing, Academic Press Pub. 1982.
5. Paul. M. Mather & Magaly Koch - Computer Processing of RS Images- An Introduction, Wiley Blackwell publication, 4th edition, 2011

Course Title	**GNSS AND UAV TECHNOLOGIES**		
Course code	1 EGMPE01	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:**To learn flight take off and landing, UAV fundamentals. **CO2:** Types of drones and its controllers. **CO3:** Payloads, Interpretation and analysis. **CO4**: Flight conditions and approaches. **CO5:** UAV data downloading and processing.		

UNIT I : REGULATIONS OF DGCA, CIVIL AVIATION REQUIREMENTS & BASIC PRICIPLES OF FLIGHT

Classification of UAV, Basic air Regulations, Salient Points, Do's and Don'ts:
Fundamentals of Flight, Aerodynamics, Take-off Flight and Landing, Manoeuvre, turns and circuit pattern;
Drone Equipment maintenance: Maintenance of drone, flight control box, ground station, maintenance of ground equipment, batteries and payloads, Scheduled servicing, Repair of equipment, Fault detection and rectification;
Introduction of Sensors: Types of sensors, Applications and operations

UNIT II :FIXED WING OPERATIONS AND AERODYNAMICS & MULTI-MOTOR INTRODUCTION

Types of fixed wing drones,make,parts and terminology; Operations and maneuver of fixed wing drones; Applications and operations; Advantages /Disadvantages over multi-rotor drones;
Basic drone terminology, Types of drones, Material used and size of drones, Motors and propellers, Electronic speed controller (ESC), flight controllers, Operation and applications of drones. Advantages/disadvantages over multi rotor drones;

UNIT III: EMERGENCY IDENTIFICATION AND HANDLING; PAYLOAD, INSTALLATION AND UTILIZATION; IMAGE AND VIDEO INTERPRETATION

Types of payloads, Parts of payloads, Installations, Features of payloads, Utilization;
Principles of observations, Interpretation of image/video, Analysis.
In flight emergencies, Loss of link, Fly-aways (straying), Loss of power, Control surface failure;

UNIT IV:FLIGHT SIMULATOR TRAINING

Pre-flight checks and start-up, Preparation cum coordination for flight, Take-off and flight stage, Approach and landing, After flight checks.

UNIT V:UAV DATA PROCESSING

Understanding geo-spatial data, Introduction to Ground Control, Practical on data processing.

Books Recommended

Course Title	**DBMS AND PROGRAMMING LANGUAGE**		
Course code	1 EGMPE01	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:**Elaborate the database languages, applications and data base users. **CO2:**Summarize therelational database, SQL and intermediate SQL and its types. **CO3:**Formulate the database design And storage practices**.** **CO4:**Visualize the .Net platform and applications, C#, VB.NET software's. **CO5:**Discuss about the object oriented programming concepts.		

UNIT I: INTRODUCTION:

General:-Database System Applications- Purpose of Database System, View of Data, Database Languages, Relational Database, Database design, Data storage and querying, Transaction management, Database Architecture, Data mining and information retrieval, Database Users- Data-Administrators and History of Database systems.

UNIT II: RELATIONAL DATABASES:

Structure of Relational Databases, Database Schema, keys, Schema diagrams, Relational query languages and relational operations.

SQL: SQL data definition, Basic Structure of SQL queries, Set Operations, Aggregate Functions, Null Values, Nested Sub queries, Modification of the Database.

Intermediate SQL: Join expressions, views, transactions, integrity constraints, SQL data types and schemas and authorization.

UNIT III: DATABASE DESIGN and DATABASE STORAGE:

Overview of the design process, the entity- relationship model, ER- diagrams, features of good relational design, database design process.

Storage & File Structure: Overview of Physical Storage Media- Magnetic Disks- Flash Storage RAID, tertiary storage, File Organization- Organization of records in Files- Data-Dictionary storage, database buffer.

Indexing & Hashing: Basic Concepts- Ordered Indices- B^+ -Tree Index Files- B^+ -Tree extensions- Static Hashing- Dynamic Hashing, bitmap indices and index definition in SQL.

UNIT IV: INTRODUCTION TO DOT NET PLATFORM AND LANGUAGE FEATURES:

Understanding the .Net platform and its layers, components of .Net platform and its functions, structure of a .Net application.

Language fundamentals in C#, Control statements.

Language fundamentals in VB.NET, Features and Control statements.

UNIT V: OBJECT ORIENTED PROGRAMMING CONCEPTS:

Concepts of procedural programming, object oriented programming, classes, encapsulation, inheritance, polymorphism, understanding Csharp and VB.NET as object oriented programming languages.

Books Recommended:

1. Database System Concepts by Silberschatz- McGraw Hill Editon.
2. Database Management Systems by Gerald V Post- Tata Mc-Graw Hill edition.
3. Database Management Systems by Ramakrishnan- Tata Mc-Graw Hill edition.
4. .NET tutorial for Beginners by Microsoft professionals.

Course Title	**GEOMATICS FOR CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT**		
Course code	1 EGMPE 02	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**ProgramElective**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:** Categorise the role of aerosols and radiative effects of aerosols on global climate change. **CO2:** Elaborate changes in global climate and evaluate climate change policies **CO3:**Debate the impact of ecosystem, water resources developmental planning and their adaption on climate change. **CO4:**Infer GHG management, inorganic carbon sequestration on mitigation of climate change. **CO5:**Recommend climate modelling and early warning systems using GST towards Sustainable development in view of SDG's		

UNIT I: INTRODUCTION TO CLIMATE CHANGE

i. Introduction to atmospheres: vertical structure and residence time.
ii. overview of aerosols, radiative effects of aerosols: direct and indirect; scattering and absorbing behaviour of aerosols
iii. Energy budget - and greenhouse effect
iv. Global climate change- Evidences and Observations of climate change; Ice and climate change; Isotope evidence

UNIT II: CLIMATE CHANGE GOVERNANCE, INTERNATIONAL POLICY AND LEGAL FRAMEWORK

i. Global Climate Change Governance
ii. Climate change finance sources: Challenges and opportunities to accessing and managing climate finance
iii. Evaluate climate change policies:
- UNFCCC and other entities
- Kyoto protocol, Paris agreement
- Climate negotiations

iv. National scenario: NAPCC, India's commitments (INDCs) and National Communication (NATCOM) initiative Policies and regulation: Important agencies and organizations

UNIT III: CLIMATE CHANGE IMPACTS AND ADAPTATION

i. Climate Change Adaptation: Importance of adaptation- Adaptation options.
ii. Linkages between climate change adaptation and development planning
iii. approaches to climate change impacts and adaptation practices for:
- ecosystems,
- land use,
- water resources and
- human health

iv. Green Engineering

UNIT IV: CLIMATE CHANGE MITIGATION

i. Mitigation options :
   - technological and economic mitigation strategies:

ii. Biological and Inorganic Carbon Sequestration
iii. GHG Management
iv. energy system transformation and renewable energy technologies
v. carbon trading and carbon offsetting.
vi. Key sectors for low carbon development.
vii. The basic concepts of life cycle assessment (LCA) and Life cycle cost assessment (LCCA), common tools for performing LCA and LCCA.

UNIT V: CLIMATE CHANGE EARLY WARNING SYSTEM & SUSTAINABLE DEVELOPMENT

i. Climate Modelling: global and regional climate models, its applications and importance. climate change projections.
ii. Climate Prediction and Early Warning System: Tools and Technologies
iii. Preparedness to Climate Change: Geospatial Approach
iv. Human Behaviour and Climate Change
v. Overview on SDG 2030:
vi. Sustainability: Need and concept, understanding sustainability and threats, Different types of tools for assessing sustainability in engineering.

References • Business and Climate – UNFCCC • GHG protocol – A Corporate Accounting and Reporting Standard • Kyoto Protocol – UNFCCC • Low carbon inclusive growth – GoI • Making Paris Work (Accepted Manuscript) • Fundamentals of Climate change • IPCC – Climate change Action, Trends and Implications for Business • India-Biennial report to UNFCC – 2015 • Global Warming – Six Indias • IPCC technical guidelines for assessing Climate change impacts and adaptation

TED talks • Can clouds buy us more time to solve climate change https://www.ted.com/talks/kate_marvel_can_clouds_buy_us_more_time_to_solve_climate_change • A critical look at Geoengineering against climate change - https://www.ted.com/talks/david_keith_s_surprising_ideas_on_climate_change • Let's prepare for our new climate(Adaptation) - https://www.ted.com/playlists/78/climate_change_oh_it_s_real

Documentaries • Before the flood (2016) • An inconvenient truth (2006) • National Geographic: Six Degrees Could Change the World (2007) • An Inconvenient Sequel: Truth to Power (2017)

1. Handbook of climate change mitigation & Adaptation - Chen.Y
2. National acts for climate change – MoEF

Course Title	**SMART CITIES AND GIS**		
Course code	1 EGMPE 02	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:**Identifying the fundamentals of GIS, structure and usage. **CO2:**Examine the Data editing, analysis and output practices in GIS. **CO3:**Establish the data modelling in environmental problem solving and data relationship. **CO4:**Summarize the need of smart cities and role of Govt. and stake holders. **CO5:**Examine the smart cities spatial planning with case studies.		

UNIT I: FUNDAMENTALS OF GIS:

i. Introduction, Roots of GIS, Overview of Information System, The Four Ms, Contribution Disciplines, GIS Definitions and Terminology, GIS Queries, GIS Architecture, Theoretical Models of GIS. Theoretical Framework for GIS, GIS Categories, Levels/Scales of Measurement.

ii. GIS data Types, Spatial data models, Comparison of Raster and Vector models, and Topology.

iii. **GIS dataInput and Storage**: Introduction, The data stream, Data input methods: Keyboard entry, Manual digitizing, Scanning and automatic digitizing; GPS for GIS data capture; Storage of GIS database.

UNIT II: GIS DATA- EDITING, QUALITY, ANALYSIS AND OUTPUT:

i. Data editing, Detecting and correcting errors, Data reduction and generalization, Edge matching and Rubber sheeting. Components of data quality, Accuracy, Precision and resolution, Consistency, Completeness, Sources of error in GIS;

ii. Data Analysis- Format and Data medium conversion, spatial measurement methods, Reclassification, buffering techniques and overlay analysis; GIS output- Maps as output and graphical outputs. RS & GIS applications for environmental management: Forestry, Agriculture, water resources, urban & Geological studies

UNIT III: DATA MODELING

i. The state of GIS for Environmental Problem Solving, A Perspective on the State of Environmental Simulation Modeling, GIS and Environmental Modeling,

The Role of Software Venders in Integrating GIS and Environmental Modeling, Cartographic Modeling, Scope of GIS and relationship to environmental modeling, data models and data quality

UNIT IV: SMART CITIES I

i. Benchmarks; Smart city scheme; Infrastructure pillars—Social, Physical, Institutional and Economic; Instruments; Demand; Citizen participation; Role of Government; conditions precedent for smart city development; Financial architecture; Industrial promotion;

ii. Smart city reference frame wok and Implementation framework; smart mobility; smart environment; smart living; role of GIS and smart services.

UNIT V: SMART CITIES II

i. smart city model; principles and spatial planning; Instrumentation; Transportation ; water distribution; sewage treatment; Waste management; Smart communication; Quality assurance; Resilience-- the use of IT; Energy efficiency; Optimisation techniques; Zero emissions; sustainability;

ii. **Case studies**: Singapore; India; Songdo; Lavasa; and Vienna.

Books Recommended

1. Atmospheric Chemistry and Physics: From Air Pollution to Climate Change, 2ndEdition, John H. Seinfeld and Spyros N. Pandis, 2006, ISBN 978-0-471-72018-8
2. Fundamentals of Atmospheric Modeling, 2nd Edition, Mark Z. Jacobson, 2005, ISBN 978-0-521-54865-6
3. Air Quality Modeling, Vol. I-III. Paolo Zannetti, EnviroComp/A&WMA.
4. Atmospheric Chemistry and Physics of Air Pollution. Seinfeld, John H., John Wiley and Sons, Inc., New York, 1986.

Introduction to Boundary Layer Meteorology. Stull, Roland B., Kluwer Academic Publishers,

Course Title	ADVANCED PHOTOGRAMMETRY		
Course code	1 EGMPE 02	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:** Summarize digital photogrammetry Vis-à-vis Analogue photogrammetry, and various camera systems and principles of image scanning methods. **CO2:** Distinguish image measurement, scales, and digitizing methods. **CO3:** Justify procedures in image transformations, image matching techniques, and use of GPS in adjustments. **CO4:** Theorize principles of visualization in DEM, DTM & DSM. **CO5:** Prove role of LiDAR in range measurements and accuracies.		

UNIT I: INTRODUCTION TO DPW SYSTEMS

i. Definition of Digital Photogrammetry & Its Development, Digital Photogrammetry Vis-À-Vis Analogue Photogrammetry, Advantages of Digital Photogrammetry,

ii. Hardware & Software Components of DPWS, Various Inputs for Digital Photogrammetry: Scanned Photo, Digital Camera Data, Remote Sensing Data, Lidar Data, Video Camera Data, Basic Consideration of Photogrammetric Scanners: Principle of Image Scanning, Configuration of Scanners, Method of Scanning, File Format and Size.

UNIT II: IMAGE MEASUREMENTS & THEIR REFINEMENT

i. Introduction to Coordinate Systems and Image Measurements, Simple Scales for Photographic Measurements, Measuring Photo Coordinates with Simple Scales, Trilaterative Method of Photo Coordinate Measurement, Measurement of Photo Coordinates with Tablet Digitizers, Mono Comparator Measurement of Photo Coordinates.

ii. Refinement of Measured Image Coordinates: Distortions of Photographic Films and Paper, Shrinkage Correction, Lens Distortions Corrections, Atmospheric Refraction Correction, Earth Curvature Correction, Reduction of Coordinates to an Origin at the Principal Point.

UNIT III: ORIENTATION PROCEDURES IN DIGITAL PHOTOGRAMMETRY

i. Inner orientation (IO), Transformation& Its Suitability, Exterior Orientation (EO), Auto Tie Point Generation, Digital Image Matching Process: Area Based, Feature and Relation Based, Co linearity Conditions, Block Triangulation Method and Adjustment, Simultaneous Solution for unknowns in a Block, Space Resection Method, Space Forward Intersection. Use Of GPS And IMU in Digital Photogrammetry

UNIT IV: 3D VISUALIZATION & STEREO-COMPILATION

i. Principle and Method of 3d Visualization: Anaglyph, Polarized and Hybrid Techniques, Feature Extraction, Feature Coding, Data Model and Feature Class.

ii. Definition DEM, DTM, DSM, Various Inputs to DEM/DTM, DTM Specification And Accuracy, Application of DTM, Various Interpolation Techniques: Grid, TIN, Break Lines, Mass Points, Digital Ortho-Photo Generation and its uses.

UNIT V: AIR BORNE LASER TERRAIN MAPPING (LiDAR):

i. Introduction to Laser, Principle of LiDAR, System Components, Range Measurements, LiDAR Error Sources, LiDAR Accuracy, Applications & Advantages.

Books Recommended

1. Elements of Photogrammetry- Paul r. wolf, 2nd edition, 1983.
2. Elements of Photogrammetry with application in GIS (3rd edition)- Paul Wolf&Bon Dewitt, Benjamin Wilkinson, McGraw-Hill companies, incorporated, 2013, 4th edition.

Reference: -

1. Manual of Photogrammetry – American society of Photogrammetry & R.S by Albert.D, 1952.
2. Digital Photogrammetry – A practical course by Wilfried Linder, 3rd edition, Springer, 2009.
3. Digital Photogrammetry by – Y. Egels & Michel Kasser, Taylor & Francis group, 2002.
4. Geographic information systems an introduction by – Tor Bernhardsen, 3rd edition, John Wiley & Sons, Newyork, 2009.

Course Title	**IMAGE PROCESSING AND FEATURE EXTRACTION LAB**		
Course code	1 EGM 03	No. of credits	02
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**LABORATORY**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:** Isolate the various thematic layers using SoI toposheets and satellite images **CO2:**Will be exposed to various pre & post processing of satellite images. **CO3:** Determine the image processing techniques and implementation in preparation of various maps. **CO4:**Establish the error free satellite images for classification **CO5**: Evaluate the different features in the satellite image and its classification categories for preparation of LU/LC maps		

THEMATIC MAPPING:

- Study of Toposheet
- Base map preparation
- Road network
- Drainage
- Watershed
- Slope
- Land use/land cover
- Geomorphology

DIGITAL IMAGE PROCESSING on ERDAS, Arc GIS and ENVI:

- Loading of digital data and extraction of study area
- Geometric Correction
- Image rectification
- Filtering Techniques
- Image classification - Supervised and Unsupervised Classification
- Map Composition and Output Generation

Course Title	**GNSS AND UAV LAB**		
Course code	1 EGM 04	No. of credits	02
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**LABORATORY**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:** Illustrate the importance of GNSS technology. **CO2:** Plan and perform the survey using GPS and DGPS. **CO3:** Establish the survey information using GNSS technology and preparation of maps. **CO4:**Categorize and assembling of drone instrument **CO5:** establish the survey information using drone technology.		

GNSS:

- Alignment survey by handheld GPS,
- Arrangement of rover and Base stations, Survey Estimation using RTK & PPK modes, Field surveying/ studies using DGPS and Recording data and plotting.
- Processing of GPS&DGPS survey data with GIS software
- Electronic Total Station (ETS): Survey using Total Station, Recording data and plotting

UAV:

1. Assembling of drone; De-assembling
2. Integration of sub-sections/ modules; Integration of engine/propulsion system
3. Pre flight checks; Preparation cum coordination for flight; Take-off and flight stage; Approach and landing; After flight checks.
4. Fault detectionand rectification
5. Maintenance and documentation

Course Title	**RESEARCH METHODOLOGY & IPR**		
Course code	1A01	No. of credits	02
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**RM & IPR**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:**Understand research problemformulation. **CO2:** Analyze research relatedinformation, Follow researchethics **CO3:**Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, andcreativity. **CO4**: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering inparticular. **CO5:**Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and socialbenefits.		

UNIT I :

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II :

Effective literature studies approach, analysis Plagiarism, Research ethics,
Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT III:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT IV:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V:

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Books Recommended

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineeringstudents'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: AnIntroduction"
3. Ranjit Kumar, 2 nd Edition, "Research Methodology: A Step by Step Guide

forbeginners"

4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.
5. Mayall , "Industrial Design", McGraw Hill,1992.
6. Niebel , "Product Design", McGraw Hill,1974.
7. Asimov, "Introduction to Design", Prentice Hall,1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age",2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand,2008

Course Title	ENGLISH FOR RESEARCH PAPER WRITING		
Course code		No. of credits	00
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Audit Course I**		
Course outcomes (COs)	**At the end of the course, The student will be able to** **CO1:**Understand that how to improve writing skills and level of readability **CO2:**Learn about what to write in each section, **CO3:**Understand the skills needed when writing a Title Ensure the good quality of paper at very first-timesubmission **CO4**: establishing the skills needed for the result/ report framing. **CO5:**Visualize the research article quality.		

UNIT I :

Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II :

Clarifying Who DidWhat, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT III:

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT IV:

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V:

useful phrases, how to ensure paper is as good as it could possibly be the first- timesubmission

Books Recommended

1. Goldbort R (2006) Writing for Science, Yale University Press (available on GoogleBooks)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge UniversityPress
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

M. TECH. -ENVIRONMENTAL GEOMATICS
COURSE STRUCTRURE
I YEAR
II SEMESTER

Course Title	**GEOGRAPHICAL INFORMATION SYSTEMS**		
Course code	2EGM 05	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Core**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:** Illustrate Fundamental operations of GIS in Mapping, Data structure, and analysis of spatial and attribute data. **CO2:** Correlate directionality and spatial arrangement of liner, Theisen polygons, in measuring distances. **CO3:**Discriminate surface mapping and digital elevation models, choropleth maps, and overlay analysis. **CO4:**Theorize role of GIS in environmental and cartographic modeling. **CO5:**Compare integrated hydrological and water quality mapping with respect to watersheds. Compare impact of industrial sites on environment and ecological modeling.		

UNIT I: FUNDAMENTALS OF GIS:

i. Map – scale, projection and symbolism. GIS - Introduction, definition and terminology, categories, components, fundamental operations, functional elements.
ii. Data structures, data models, GIS data, acquisition, input, storage, output generation. Data preprocessing, database management, integrated analysis of spatial and attribute data.

UNIT II: GIS SPATIAL ANALYSIS, MEASUREMENT AND SPATIAL ARRANGEMENT:

i. Introduction, defining spatial objects - point, line and area objects based on their attributes, higher level point, line and area objects. Measuring length of linear objects, measuring polygons, measuring shape, measuring distance.
ii. Classification – Principles, Neighborhood functions, Polygonal neighborhoods, Buffers. Spatial Arrangement -Point patterns, Theisen Polygons, Area patterns, Linear patterns, Directionality of Linear and Areal objects, Connectivity of Linear objects, Routing and allocation.

UNIT III: STATISTICAL SURFACES AND OVERLAYANALYSIS:

i. Surface mapping, sampling the statistical surface, Digital Elevation Model (DEM). Interpolation- linear and non-linear, uses and problems.
ii. Terrain reclassification – steepness of slope, aspect, shape or form. Discrete surfaces - dot distribution maps, choropleth maps. Cartographic overlay, point-in-polygon and line-in-polygon operations, Polygon overlay, Automating point-in-polygon and line-in-polygon

procedures in Raster, Automating Polygon overlay in Raster, Automating vector overlay, types of overlay.

UNIT IV: DATA MODELING:

i. The state of GIS for Environmental Problem Solving, A Perspective on the State of Environmental Simulation Modeling, GIS and Environmental Modeling

ii. The Role of Software Venders in Integrating GIS and Environmental Modeling, Cartographic Modeling, Scope of GIS and relationship to environmental modeling, data models and data quality.

UNIT V: INTEGRATED MODELING USING GIS:

i. Hydrological Modelling - water quality modelling, watershed management and modelling, saltwater intrusion models.

ii. Land-surface-subsurface Process Modelling- pipeline alignment studies, solid and hazardous waste disposal site selection,

iii. Zoning atlas for industrial siting, environmental information system development. Ecosystem modelling, risk and hazard modelling.

Books Recommended

1. M.Anji Reddy, Text book of Remote sensing and GIS by, BSP Publications, Hyderabad, fourth edition..
2. Fundamentals of Geographic Information Systems by Michael N DeMers. Published By john Wiley & Sons Inc., 3rd edition, 2008.
3. Environmental Modeling with GIS, Michael F. Autor Goodchild, Bradley O. Parks, Louis T. Stewart, publisher- Oxford university press, 1993.
4. Geographic Information Systems: A Management Perspective by Stan Arnoff, WDL publications, 1989.

Course Title	**SPATIAL DATA ANALYSIS & MODELLING**		
Course code	2EGM 06	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Core**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:** Illustrate Fundamental operations of GIS in Mapping, Data structure, and analysis of spatial and attribute data. **CO2:** Correlate directionality and spatial arrangement of liner, theissen polygons, in measuring distances. **CO3:**Discriminate surface mapping and digital elevation models, choropleth maps, and overlay analysis. **CO4:**Theorize role of GIS in environmental and cartographic modeling. **CO5:**Compare integrated hydrological and water quality mapping with respect to watersheds. Compare impact of industrial sites on environment and ecological modeling.		

UNIT I: VECTOR DATA ANALYSIS AND RASTER DATA ANALYSIS:

Buffering, Overlay, Distance Measurement, Pattern Analysis, Map Manipulation.
Data Analysis Environment, Local Operations, Neighborhood Operations, Zonal Operations, Physical Distance Measure Operations, Other Raster Data Operations, Comparison of Vector- and Raster-Based Data Analysis

UNIT II: TERRAIN MAPPING AND ANALYSIS, VIEWSHEDS AND WATERSHEDS

Data for Terrain Mapping and Analysis, terrain Mapping, slope and Aspect, Surface, Curvature, Raster Versus TIN.
View shed Analysis, Parameters of View shed Analysis, Application of View shed Analysis, Watershed Analysis, Factors Influencing Watershed Analysis, Applications of Watershed Analysis

UNIT III: SPATIAL INTERPOLATION, GEOCODING AND DYNAMIC SEGMENTATION:

Elements of Spatial Interpolation, Global Methods, Local Methods, Kriging, Comparison of Spatial Interpolation.
Geocoding, Application of Geocoding, Dynamic Segmentation, Application of Dynamic Segmentation.

UNIT IV: PATH ANALYSIS AND NETWORK APPLICATIONS:

Path Analysis, Application of path Analysis, Network, Putting Together a Network, Network Application.

UNIT V: GIS MODELS AND MODELING:

Basic Elements of GIS Modeling, Binary Models, Index Models, Regression, Models, Process Models.

Books Recommended

1. Fundamentals of GIS by MICHAEL N DEMERS. Published By john Wiley & Sons Inc.
2. Environmental Modelling with GIS, Michael F. Goodchild, Bradley O. Parks, Louis T. Steyaert
3. Introduction to Geographic Information Systems by Kang-Tsung Chang (TATA McGRAW-HILL EDITION).
4. Ormsby T.E. Napoleon,R.Burke,C.groessl,L.Feaster 2004.Getting to know Arc GIS Desktop,ESRI Press

2. Burke R.T.Tilton,A.Arana 2003 Getting to Know ArcObjects.ESRI Press

Course Title	MICROWAVE REMOTE SENSING		
Course code	2EGM PE 03	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:** Illustrate components of Radar System and factors affecting Microwave measurements. **CO2:** Interpret characteristics of Side looking Airborne Radar on relief, soil, vegetation and urban response. **CO3:** Infer Passive Microwave radiometers on various ocean bound satellites **CO4:** Categorize Hyperspectral and Microwave images and their spectral reflectance curves. **CO5:** Choose Hyperspectral images for environmental management.		

UNIT I: INTRODUCTION TO MICROWAVE REMOTE SENSING

i. Definition, Radiometric Quantities, Radar System Components, Source of Radiation, Radar Wave Bands, RADAR Equation
ii. Factors Affecting Microwave Measurement, Beam Polarization and Look Angle.

UNIT II: SLAR, CHARACTERISTICS AND INTERPRETATION OF SLAR IMAGERY

i. Definition, Radar working principle, range resolution, azimuth resolution, swath width resolution and SAR systems.
ii. Slant range scale distortion, ground range geometry, image displacement due to relief, layover, fore shorting, shadow and speckle.
iii. Geometric characteristics, Electrical characteristics, Effects of polarization, Soil response, Vegetation response, urban area response.

UNIT III: MICROWAVE SENSORS AND SATELLITES

i. Passive microwave radiometers SEASAT, SIR, ALMAZ, ERS, ENVISAT, JERS, ALOS, RADARSAT
ii. Applications of microwave remote sensing

UNIT IV: HYPER SPECTRAL REMOTE SENSING

i. Hyper spectral imaging, imaging spectrometers, principles of spectroscopy
ii. Hyper spectral vs multi spectral imaging.
iii. Spectral reflectance, spectral libraries, absorption process, analysis of spectral curve.

UNIT V: SATELLITES AND APPLICATIONS

i. Hyper spectral satellite systems viz., AVIRIS, HYMAP, HYPERION
ii. Applications of Hyper Spectral Remote Sensing in the field of Environmental management.

Books Recommended

i. Textbook of Remote Sensing and Geographical Information Systems M.Anji Reddy, BS Publication, 3rd edition, 2008.
ii. Remote sensing and Image interpretation by Thomas Lilliesand and Ralphw. Keifer Published by John Wiley &Sons.6th edition, 2007.
iii. Remote sensing-Principles and interpretation by Floyd F Sabins.Jr. Published by Freeman & Co., New York, 3rd edition, 2003.

Course Title	GEOSTATISTICS		
Course code	2EGM PE 03	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course outcomes (COs)	**CO1:**Examine the statistics applications and frequency. **CO2:**Establish the measurement and its analysis process in standard deviation etc. **CO3:**Estimate the probability studies and error sources. **CO4:**Examine the correlations and regressions **CO5:**Organize the test significance and statistical process control		

UNIT I: INTRODUCTION AND FREQUENCY DISTRIBUTION:

Types of proof, Generality of Applications of statistics, Examples of statistical problems
Raw data, Arrays, Frequency Distributions, Class interval and Class limits, Class boundaries, Size, width of a class interval, class mark, general rules for forming frequency distributions,
Histograms and frequency polygons, relative frequency distributions, cumulative frequency distributions and Ogives, Relative cumulative-frequency distribution and percentage Ogives, frequency curves and smoothed Ogives, types of frequency curves

UNIT II: MEASUREMENTS AND THEIR ANALYSIS:

Introduction, Sample Versus Population, Range and Median, Graphical Representation of Data, Numerical Methods of Describing Data, Measures of Central Tendency, Standard deviation and other measures of Dispersion.

UNIT III: RANDOM ERROR THEORY AND CONFIDENCE INTERVAL:

Introduction, Theory of Probability, Properties of the Normal Distribution Function, Probability of the Standard Error, Uses of Percent Errors, Moments, Skewness and Kurtosis
Introduction, Distributions used in Sampling Theory, Confidence Interval for the Mean, Sampling, its uses, some sampling distributions, Analysis of Variance

UNIT IV: CORRELATION AND REGRESSION:

Curve fitting and the method of Least squares, Correlation theory, Multiple and partial correlations, Linear regression, Multiple regression, R^2, regression modeling.

UNIT V: STATISTICAL TESTING AND STATISTICAL ANALYSIS:

Tests of significance, Chi-square and F-test, Non parametric tests, t-tests.
Analysis of Time series, Statistical Process control and Process capability

Books Recommended

1. Theory and Problems of STATISTICS by Murray R. Spiegel and Larry J. Stephens
2. Basics Statistics by B.L.Agarwal
3. Introduction to statistical Analysis by Wilfred J. Dixon and Frank J. Massey JR

Course Title	APPLIED GEOMATICS		
Course code	2EGM PE 03	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course outcomes (COs)	**At the end of the course, The student will be able to** **CO1**Validate Air and space borne sensors with respect to spectral and radiometric resolutions. Appraise satellite navigation systems, outer space explorations, Chadrayan and Mangalyan. **CO2:**Formulate spectral information in estimation of vegetative indexes, precision agriculture, and crop and forest management. **CO3:**Illustrate role of remote sensing and GIS in Geological mapping, and identification of spectral signature on mining. **CO4:**Assess crop type classification and estimates, watershed impact on soil erosion and water quality modeling. **CO5:**Analyze spectral response on upland and wetland vegetation ecosystem, urban and municipal solid waste studies.		

UNIT I: SENSORS AND SATELLITES

SENSORS AND PLATFORMS

i. Introduction, satellite system parameters- instrumental and Viewing, Sensors- Active and passive, classification, sensor parameters- spatial, spectral and radiometric resolutions
ii. Platforms- Airborne and Space borne, constraints of satellite geometry, effects of the local environment, common orbits and details of elevation angle and ground area, types of Scanners

SATELLITE PROGRAM'S

i. INSAT series, IRS series, RADAR imaging satellites, other satellites, GAGAN & IRNSS satellite navigation system
ii. Extra terrestrial exploration- chandrayaan-1 and 2 & Mangalayaan, International cooperation of ISRO, future projects of ISRO

UNIT II: SPECTRAL INFORMATION FOR SENSING VEGETATION & APPLICATIONS

SPECTRAL INFORMATION FOR SENSING VEGETATION

i. Estimation of Vegetation Cove: Spectral Indices -Vegetation indices and vegetation descriptors.
ii. Microwave vegetation indices- estimation of vegetation using Lidar.

INTEGRATED APPLICATIONS

i. Detection and diagnosis of plant stress.
ii. Precision agriculture and crop management
iii. Ecosystems and Forestry Management.

UNIT III: SOIL SCIENCES

i. Role of Remote sensing and GIS in geological studies and case studies. Evaluation of Geological Mapping
ii. Introduction to Prospection Techniques, History of Remote Sensing in Geological Exploration. Image Lineaments and structural origin, Prospecting, Applications of thermal and Radar remote sensing in structural geology.
iii. Spectral response of Minerals, Rocks, Alterites, case studies

UNIT IV: WATER RESOURCES, AGRICULTURE AND FORESTRY

i. The hydrological cycle, Hillslope hydrology, The drainage basin, Channel networks, Automatic derivation of catchment characteristics, The global cycle.Ground water exploration and targeting. Introduction, Characteristics, Watershed and people, Watershed characteristics, watershed management and Integrated approach for sustainable planning. Water quality modeling. Watershed Management in India, Case studies.
ii. Soil and altitude, Soil and aspect, Soil and slopes, Soil landscapes, Soil erosion modeling.
iii. Crop type classification, area estimates, and spectral response of different crops. Crop diseases and Assessment, Crop and Water management and monitoring. Advances in Crop monitoring.

UNIT V: RESPONSE OF ECOLOGICAL FACTORS AND IMPACT STUDIES, MODELLING

i. Spectral response of vegetation and mapping, Ecosystem Analysis, Environmental impact analysis and monitoring, Ecosystem modeling,
ii. Wetland mapping.
iii. Urban growth studies
iv. Municipal solid waste studies
v. Land use land cover change detection studies
vi. Spatial Models of Ecological Systems and Process

Books Recommended

1. M.Anji Reddy, Text book of Remote sensing and GIS by, BSP Publications, Hyderabad, 2001.
2. Principles of Remote sensing, An introductory Text book by the international institute fo Geo-Information sciences and Earth Observation (ITC).
3. Satellite Technology: Principles and Applications, 2nd Edition, Anil K. Maini, Varsha Agrawal, ISBN: 978-1-119-95727-0694 pages, June 2011.

Course Title	ENVIRONMENTAL IMPACT ASSESSMENT (EIA)		
Course code	2 EGM PE 04	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:**Direct, Indirect, cumulative and induced environmental impacts at Regional, sectoral and project level. **CO2:**Data products, thematic maps, collateral data in planning and management of baseline data acquisition. **CO3:**Screening of environmental clearance, for category B&B2 industries and feasibility studies. **CO4:**Predicting impact of Air, Water, Noise, Socio economic status on environment. **CO5:**Environmental management plans on emission controls and green belt development and hazardous wastes.		

UNIT I: CONCEPTUAL FACTS OF EIA

i. Introduction, Definition and Scope of EIA, Objectives in EIA, Basic EIA Principles, and Classification of EIA: Strategic EIA (SEIA), Regional EIA, Sectoral EIA, Project Level EIA and Life Cycle Assessment, Project Cycle, Grouping of Environmental Impacts: Direct Impacts, Indirect Impacts, Cumulative Impacts and Induced Impacts. Significance of Impacts: Criteria/Methodology to Determine the Significance of the Identified Impacts.

UNIT II: BASELINE DATA ACQUISITION, PLANNING AND MANAGEMENT OF IMPACT STUDIES

i. Environmental Inventory, Data Products and Sources: thematic data, topographical data, collateral data and field data. Environmental Baseline Monitoring (EBM), Preliminary Study to determine impact significance, Environmental Monitoring network Design, Monitoring Stations, Air quality data acquisition, Water Quality data acquisition, soil data, socioeconomic data and biological data acquisition. Impact on Environmental Components: Significance of Impacts, Criteria to determine the significance of the identified Impacts.

ii. Conceptual Approach for Environmental Impact Studies, Proposal Development, Interdisciplinary Team Formations, Team Leader Selection and Duties, General Study Management, Fiscal Control.

UNIT III: OPERATIONAL ASPECTS OF EIA AND METHODS FOR IMPACT IDENTIFICATION

i. Screening: Application for Prior Screening for Environmental Clearance, Screening Criteria Category A Projects, Category B Projects, Criteria for Classification of Category B1 and B2 Projects, Consistency with other Requirements and Siting Guidelines. Scoping: Identification of Appropriate Valued Environmental Components (VEC), Identification of Impacts Information in Form 1, Structure of a Pre-feasibility Report. Public consultation: Appraisal Decision Making, Post-clearance Monitoring Protocol.

ii. Background Information, Interaction-Matrix Methodologies: simple matrices, stepped matrices, development of a simple matrix, other types of matrices, summary observations or

matrices, Network Methodologies: Checklist methodologies, simple checklists, descriptive Checklists, summary observations on simple and descriptive Checklists.

UNIT IV: PREDICTION OF IMPACTS (AIR-WATER- NOISE- BIOLOGICAL AND SOCIO-ECONOMIC)

i. **Air Environment:** Basic information on air quality, Sources of Pollutants, effects of pollutions, Conceptual approach for addressing air environment impacts, Air quality standards, Impact Prediction, Impact significance.

ii. **Water Environment:** Basic Information on surface-Water Quantity and Quality, Conceptual Approach for Addressing Surface-Water-Environment Impacts, Identification of Surface-Water Quantity or Quality Impacts, Procurement of Relevant Surface-Water Quantity-Quality Standards, Impact Predictions, Assessment of Impact Significance.

iii. **Noise Environment:** Basic Information on Noise Key Federal Legislation and Guidelines, Conceptual Approach for Addressing Noise-Environment Impacts, Identification of Noise Impacts, Procurement of Relevant Noise Standards and/or Guidelines, Impact Prediction, Assessment of Impact Significance.

iv. **Biological Environment:** Basic Information on Biological Systems, Conceptual Approach for Addressing Biological Impacts, Identification of Biological Impacts, Description of Existing Biological Environment Conditions.

v. **Socio-Economic Environment:** Procurement of Relevant Legislation and Regulations, Impact Prediction, Assessment of Impact Significance.

UNIT V: ENVIRONMENTAL MANAGEMENT PLAN (EMP)

i. Case Study, identification of Impacts, EMP for Air Environment: Dust Control Plan, Procedural Changes, Diesel Generator Set Emission Control Measures, Vehicle Emission Controls and Alternatives, Greenbelt Development. EMP for Noise Environment,

ii. EMP for Water Environment: Water Source Development, Minimizing Water Consumption, Domestic and Commercial Usage, Horticulture, Storm Water Management. EMP for land Environment: Construction Debris, hazardous Waste, Waste from temporary Labour settlements.

Books Recommended

i. Textbook of Environmental Science & Technology by M.Anji Reddy, BS Publications, 2010

ii. Technological guidance manuals of EIA. MoEF.

iii. Environmental Impact Assessment by Harry W. Canter, McGraw Hill, 1996, 2nd edition.

iv. Man and Environment D.H.Carson 1976 Interactions Part I and III.

v. Environmental Impact Assessment, 2003, Y.Anjaneyulu, B.S Publications

vi. Erickson, P.A.1979 Environmental Impact Assessment Principles and applications

vii. Basic Concepts in Remote Sensing & Arial Photogrammetry Lillesand & Keifer Printice Hall Intl., 1994.

viii. Renewable Energy: environment and development, Maheswar Dayal, Konark Publishers, 1989

Course Title	**GEO VISUALIZATION & WEB MAPPING**		
Course code	2 EGM PE 04	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course Program outcomes (COs)	**At the end of the course, the student will be able to** **CO1:**Understanding Spatial and Non Spatial Databaes, Architecture and Quires **CO2:**Projections, Datums, Concepts of Geo-Visualization **CO3:**Basics of web-designing software, Cartography, and spatio temporal databases. **CO4:**Vector layers, Java Script, Classification of Web Hardware **CO5:**Conceptualization of Web Mapping and 2D 3D mapping advantage, with cloud source.		

UNIT I:

Role of GIS in understanding visual communication., Spatial Databases, Attribute Databases, SQL Databases, Schema and Architecture of Databases, Understanding Spatial Quires.

UNIT II:

Transformation and Projection of Databases, Maps Design, Layout, linking nonspatial databases to maps. Concepts and Basics of Cartography. Projections, Datums, and Geoid. Geo-visualization, Spatial Query, and User Interaction, Geo-visualization and Interactive Transformation, Basic concepts of cartography and Geo-Visualization. Visualization and spatiotemporal phenomenon.

UNIT III:

Basics of Web Programming, System Architecture for Web Programming,Basics of Java Script in Web Programming, Spatial Data for Web Mapping, symbolize and sharing of geographic data on the Web, Classification of spatial web hardware and software architecture.

UNIT IV:

Basics of ArcGIS Online AGOL Basics,Web GIS layers, Maps, and Apps and Hosted Feature Layers.Common Web Mapping Software (Proprietary and Open Source), Considerations for Choosing Software, Basics of Data Publishing.

UNIT V:

Understanding collaborative and static web maps,Cloud sourcing, Integrating Web maps with cloud, Nature of 2D and 3D mapping procedures, Mobile mapping on Android platform, 3D modeling of satellite data.

Books Recommended

Kraak, M.-J. & Ormeling, F.J., Cartography: Visualization of Spatial Data. Third edition. Abingdon, Oxon & New York, 2013, NY: Routledge. ISBN 9781317903116.

Mastering HTML, CSS & Javascript Web Publishing Paperback – 15 Jul 2016, by Laura Lemay (Author), Rafe Colburn (Author), Jennifer Kyrnin (Author).

Thematic Cartography and Geovisualization: International Edition Paperback– Import, 8 May 2009. by Terry A. Slocum (Author), Robert B McMaster (Author), Fritz C

Kessler (Author), Hugh H Howard (Author).

Thematic Cartography and Geovisualization, 3rd Edition 3rd Edition, by Terry A. Slocum (Author), Robert B. McMaster (Author), Fritz C. Kessler (Author), Hugh H. Howard (Author)

Exploring Geovisualization (International Cartographic Association) HAR/CDR Editionby J. Dykes (Author), A.M. MacEachren (Author), M.-J. Kraak (Author).

Thematic Cartography and Geovisualization, 3rd Edition 3rd Edition, by Terry A. Slocum (Author), Robert B. McMaster (Author), Fritz C. Kessler (Author), Hugh H. Howard (Author).

Course Title	**SATELLITE AND SENSORS**		
Course code	2 EGM PE 04	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course Program outcomes (COs)	**At the end of the course, the student will be able to** **CO1:**Demonstrate the satellite orbits, sensor and its characteristics. **CO2:**Examine the types of satellites and history. Indian satellite missions. **CO3:**Estimate the satellite system parameters, platforms and sensor systems. **CO4:**Elaborate the INSAT, IRS and RADAR, GAGAn systems. **CO5:**Discuss the usage / applications of various satellites and sensors.		

UNIT I:INTRODUCTION :

An Overview of Remote Sensing from Space, Introduction to Electromagnetic Radiation, Basic Characteristics of Satellite Remote Sensing Systems - Satellite orbits- sensor attributes and observational characteristics, observational categories and corresponding Sensor.
Ocean Remote Sensing Systems-- Visible – Near Infrared Ocean Color- Thermal Infrared, Passive Microwave Radiometers, Scatterometers, Altimeters, Synthetic Aperture Radar

UNIT II:SATELLITE ORBITS AND MISSIONS :

Satellite orbits, classification of satellites, Types of satellites, satellite system infrastructure, History of Satellites, Satellite launch vehicle fleet, Indian Satellite missions namely-PSLV-C28, GSAT-16, PSLV-C27/IRNSS-1D, Mars Orbiter Mission and LVM3-X (CARE).

UNIT III:SENSORS AND PLATFORMS :

Introduction, satellite system parameters- instrumental and Viewing, Sensors- Active and passive, classification, sensor parameters- spatial, spectral and radiometric resolutions, Platforms- Airborne and Space borne, constraints of satellite geometry, effects of the local environment, common orbits and details of elevation angle and ground area, types of Scanners

UNIT IV:SATELLITE PROGRAM'S:

INSAT series, IRS series, RADAR imaging satellites, other satellites, GAGAN & IRNSS satellite navigation system, Extra terrestrial exploration- chandrayaan-1 and 2 & Mangalayaan, International cooperation of ISRO, future projects of ISRO.

UNIT V: APPLICATIONS :

Telecommunication, Resource management, Military, Academic, Telemedicine, Biodiversity Information System, Cartography, Navigation, Ocean / Marine studies and other applications.

Text books:

1. M.Anji Reddy, Text book of Remote sensing and GIS by, BSP Publications, Hyderabad, 2001.
2. Principles of Remote sensing, An introductory Text book by the international institute for Geo-Information sciences and Earth Observation (ITC).
3. Satellite Technology: Principles and Applications, 2nd Edition, Anil K. Maini, Varsha Agrawal, ISBN: 978-1-119-95727-0694 pages, June 2011.

Course Title	GIS LAB		
Course code	2 EGM 07	No. of credits	02
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**LABORATORY**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:** Planning survey using total station and hand held GPS. **CO2:** Describe scale, projection, and coordinate systems and explain importance of each in GIS **CO3:** Creating Vector data and attribute linking **CO4**: Establish theMap composition and output generation **CO5:** Evaluate the spectral signatures of individual bodies.		

GIS : Arc GIS Software-

- Scanning of maps using software
- Creating GIS data using Arc Catalog
- On Screen Digitization using Arc Map
- Addition of Attribute data to a feature class
- GPS linkage and data entry
- Data editing, manipulation and analysis using ARC GIS software
- Map Composition and Output Generation using ArcGIS software.

Dealing with open source GIS : QGIS

Course Title	APPLIED GEOMATICS LAB		
Course code	2 EGM 08	No. of credits	02
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**LABORATORY**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:**Describe scale, projection, and coordinate systems and explain importance of each in GIS **CO2:**Creating Vector data and attribute linking, Map composition and output generation **CO3:**Gives better maps for easy estimation of environmental parameter changes and its consequences. **CO4:**Estimation of change detection and its factors. **CO5:**Evaluation of crop suitability, solid waste dumping site selection and lake restoration capacity.		

Exercise using Geomatica, ERDAS, ArcGIS, iGIS software and using different satellite datasets viz. High, Medium, Low… for

i. Watershed development
ii. Forest information& change
iii. Agricultural information
iv. Preparation of Village Information System
v. Irrigation system
vi. Urban Expansion studies
vii. Land use Land cover assessment studies

Site suitability studies for

i. Crop
ii. Solid waste
iii. Water harvesting
iv. Lake restoration

Course Title	MINI PROJECT WITH SEMINAR		
Course code	2A04	No. of credits	02
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	Mini Project with Seminar		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1**: Students will get an opportunity to work in actual industrial environment if they opt for internship. **CO2:** In case of mini project, they will solve a live problem using software/analytical/computational tools. **CO3:** Study different techniques used to analyze complex systems **CO4:** Students will learn to write technical reports. **CO5:** Students will develop skills to present and defend their work in front of technically qualified audience.		

The mini project will be based on the work done during the industrial training/internshipof two months provided during semester break.

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done

1. Along with the report on identification of topic for the workand
2. The methodology adopted involving scientific research, collection and analysis ofdata,
3. Determining solutions highlighting individuals'contribution.

Continuous assessment of Mini Project at Mid Semester and End Semester will be monitored by the departmental committee.

Course Title	ENGLISH FOR RESEARCH PAPER WRITING		
Course code		No. of credits	00
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Audit Course II**		
Course outcomes (COs)	**At the end of the course, The student will be able to** **CO1:**Understand that how to improve writing skills and level of readability **CO2:**Learn about what to write in each section, **CO3:**Understand the skills needed when writing a Title Ensure the good quality of paper at very first-timesubmission **CO4**: establishing the skills needed for the result/ report framing. **CO5:**Visualize the research article quality.		

UNIT I :

Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II :

Clarifying Who DidWhat, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT III:

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT IV:

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V:

useful phrases, how to ensure paper is as good as it could possibly be the first- timesubmission

Books Recommended

4. Goldbort R (2006) Writing for Science, Yale University Press (available on GoogleBooks)
5. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge UniversityPress
6. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
2. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

M. TECH. -ENVIRONMENTAL GEOMATICS
COURSE STRUCTRURE
II YEAR /
III SEMESTER

Course Title	**CADASTRAL, LAND USE PLANNING AND MANAGEMENT**		
Course code	3 EGM PE 05	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course Program outcomes (COs)	**At the end of the course, the student will be able to** **CO1:** Identify methods and tools for Land use, built environment, and zoning criterion. **CO2:** Classify relevance of Geomatics in evaluating Land suitability, capability in decision making system. **CO3:** Discuss sustainability of Land management, Net farm profitability, and Principles of ecology for planners. **CO4:** Assess concepts of sustainable planning towards smart cities. **CO5:** Compose Urban growth models in assessing alternative land use for environmental modeling.		
UNIT I: INTRODUCTION TO LAND USE AND LAND COVER TYPES AND DISTRIBUTION			
Study of the methods and tools for managing land use and the built environment. Comprehensive Plan, Zoning Criteria and guidelines, regional, and state-level plans and socio-economic issues.			
UNIT II: GEOMATICS FOR LAND USE PLANNING			
i. Land use System: Environmental inputs and impacts, economic inputs and outputs. Role of Geomatics in Land Evaluation and Suitability for land use planning. ii. Land Capability classification and preference of land use. iii. Decision Support System for land use planning			
UNIT III: ECOLOGICAL PRINCIPLES FOR PLANNERS			
i. Overview of ecology and the environment. Important ecological issues in land use for environmental planners. ii. Sustainable land management: Crop Yield, Nutrient Balance, Maintenance of Soil Cover, Soil Quality/Quantity; Water Quality/Quantity; Net Farm Profitability; Conservation Practices			
UNIT IV: SUSTAINABLE URBAN PLANNING & SMART CITIES			
i. Concept of Sustainability in planning practice. ii. Objectives of (i) urban sustainability initiatives ;(ii) Transportation, solid waste reduction;(iii) Climate change initiatives; and (iv) smart cities policies.			

UNIT V: LAND USE AND ENVIRONMENTAL MODELLING
i. Fundamentals of GIS and statistics. ii. GIS-based land use and urban growth models, basins (stream and runoff water quality model) iii. Visualization and impact assessment models for alternative land use
Books Recommended

Course Title	PROGRAMMING WITH OPEN SOURCE GIS		
Course code	3 EGM PE 05	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:**Classify GUI application, debugging and console applications **CO2:**Distinguish Console raster/vector level operations. **CO3:**Assessment of various maps building and GUI applications. **CO4:**Discuss fundamentals of Web GIS, WFS, WMTS. **CO5:**Evaluating the use of Geo server and open layers i9n creative response applications.		

UNIT I:

i. Principles of Object-Oriented Programming - C# - example programmes - console application - GUI application - debugging – deployment

UNIT II:

i. Console level Raster operations: Introducing GDAL - OSSIM, format translations, geometric corrections to imagery, reproject the raster, geo-tagging the imagery, georeferencing an image, clip images, altering the radiometric quantization, pyramid building, Kernel-based image processing (Data to be used: Resourcesat / Cartosat / MODIS / DigitalGlobe / Sentinel imagery)

ii. Console level Vector operations: Introducing OGR, Merging the features of multiple vector files, create KML files, burning vector data onto raster (Data to be used: Open Source Maps)

UNIT III:

i. Building map applications - using MAPWINGIS: create a map, adding tool bar for standard map operations, create GUI, load GIS data into application programmatically

ii. Building applications: To load vector data, create basic symbology, change the feature symbology, add labels, create ESRI Shapefile and add a feature

iii. GUI application for handling raster data: Load a DEM file with custom colour-table, getting the metadata such as cell size, corner coordinates, read and display the cursor coordinates, read the map projection

UNIT IV:

i. Web GIS - Web GIS Fundamentals, Over view and Types of OGC Web Services, Web Map Service (WMS), Web Feature Service (WFS), Web Coverage Service (WCS), Web Processing Service (WPS), Web Map Tile Service (WMTS)

UNIT V:
i. **Geo Server –**Open Source Geo Spatial Tool, Install Geo Server, Loading the data into Geo Server, OGC protocols, Sample data access using Geo Server. **ii.** **Open Layers -** Introduction to Open Layers, Java Script Library for Open Layers, Creating Sample Maps using Open Layers, Sample Open Layers Map creation using data of Geo Server, Applying Custom Styles, Working with Layers, Creating Responsive Applications with Interaction and Controls**,** Controlling the Map, Open Layers for Mobile, 3D rendering with Cesium.
Books Recommended

Course Title	**GEOMATICS FOR DISASTER RISK REDUCTION & MANAGEMENT**		
Course code	3 EGM PE 05	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Program Elective**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:**Relate definitions, levels of disaster risks and phenomena. **CO2:**List Disaster trends at Global and regional levels, differentiate natural and manmade disasters **CO3:**Compare disaster risk vulnerabilities, hazard mapping prevention and mitigation of disasters. **CO4:**Assess impact of climate change, Biodiversity loss on desertification and disasters. **CO5:**Evaluate Disaster Management Policy, organizational frame work in preparation of disaster management plans.		

UNIT I: UNDERSTANDING ECOSYSTEM AND DISASTER PHENOMENA

i. Concept and definitions and functions of different terms of disaster and Ecosystem, approaches to understand disaster phenomena (natural science, applied science, progressive and holistic approaches)
ii. Parameters of Disaster Risk, Levels of disaster as per national guideline.

UNIT II: OVERVIEW, CLASSIFICATION, CHARACTERISTICS, PROBLEM AREAS OF DISASTERS

i. Disaster trends (Global, national and regional), Selected models for understanding the causes of disaster and disaster risk mitigation, Classification of hazards (natural and manmade), Response time, frequency, forewarning, exposure time of different hazards.
ii. General characteristics and problem areas of different natural and man-made hazards (e.g. flood, erosion, earthquake, landslide, lightning, tropical cyclone, drought, civil unrest etc.), Common approaches to study natural and manmade hazards; vulnerability and disasters.

UNIT III: DISASTER RISK MITIGATION

i. Disaster risk assessment (Hazard-Vulnerability-Capacity analysis), Hazard mapping and forecasting; Principles and aspects of Disaster prevention, Disaster mitigation, Preparedness for damage mitigation and coping with disasters; Capacity building for disaster/damage mitigation (structural and non-structural measures);
ii. Contingency planning for damage mitigation of different hazards; Relevance of indigenous knowledge, appropriate technology and local resources in disaster risk mitigation
iii. Community based disaster risk reduction mechanism; Counter disaster resources and their roles.

UNIT IV: ENVIRONMENT AND DISASTERS

i. Environment, ecosystem and disasters. Climate change – issues and concerns. Biodiversity loss and DRR; Global water crisis and DRR

ii. Desertification, soil erosion and DRR; ecosystems for urban risk reduction; Industrial hazards and safety measures; Post disaster impact on environment; Impact of developmental projects on disaster risk; Aspects of environmental management for disaster risk reduction; Environmental Impact Assessment (EIA).

UNIT V: PLANNING FOR DISASTER MANAGEMENT

i. Concept of spatial planning for DRR; Community-hazard profile in India; Different phases of Disaster Management (DM cycle; Relief mechanism (needs assessment, relief administration and distribution, management of relief centres, external support etc.); Disaster Management Act (2005); Disaster Management Policy (2009); organizational framework for disaster management in India.

ii. **Case studies**: Hazard mapping of vulnerable areas, Vulnerability assessment (physical, social, organizational, economical, technological), Risk mitigation planning for vulnerable areas.

Books Recommended

1. Alexander, D. Natural Disasters, ULC press Ltd, London, 1993.
2. Carter, W. N. Disaster Management: A Disaster Management Handbook, Asian Development Bank, Bangkok, 1991.
3. Disaster Management in India, Ministry of Home Affairs, Government of India, New Delhi, 2011.
4. National Policy on Disaster Management, NDMA, New Delhi, 2009.
5. Disaster Management Act. (2005), Ministry of Home Affairs, Government of India, New Delhi, 2005.
6. Parasuraman, S & Unnikrishnan, P. V. (ed.), India Disasters Repot Towards a policy initiative. Oxford, 2000

Course Title	**GEOMATICS FOR NATURAL RESOURCE MANAGEMENT**		
Course code	3 EGM OE	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Management		
Course type	**Open Elective**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:**Illustrate the Lu/Lc map preparation for various activities **CO2: To learn geological mapping & exploration, use of different sensors for mapping** **CO3:**Inventing the water resources, crops and forest cover **CO4**: Preparation of spatial models for various environmental features **CO5:**geomatics applications on disaster studies in the environment.		

UNIT I: LAND RESOURCES AND MUNICIPAL & URBAN GIS

Appropriate methodology, Rapid land use assessment, Rapid land use information system. Land evaluation and suitability studies by Remote sensing and Techniques of land use / land cover map preparation. Land use / land cover mapping and planning. Dynamic urban land use, Semi dynamic land use.

GST for Urban Environmental Monitoring. GST for Municipal Administration. Geomatics in Solid and Hazardous waste disposal site selection, Environmental Information System Development for municipalities: Case studies GST for Traffic and Transportation planning assessment

UNIT II: GEOSCIENCES

Role of Remote sensing and GIS in geological studies and case studies. Evaluation of Geological Mapping, Introduction to Prospection Techniques, History of Remote Sensing in Geological Exploration. Image Lineaments and structural origin, Prospecting, Applications of thermal and Radar remote sensing in structural geology. Spectral response of Minerals, Rocks, Alterites, case studies

UNIT III: WATER RESOURCES, AGRICULTURE AND FORESTRY

The hydrological cycle, Hillslope hydrology, The drainage basin, Channel networks, Automatic derivation of catchment characteristics, The global cycle. Ground water exploration and targeting. Introduction, Characteristics, Watershed and people, Watershed characteristics, watershed management and Integrated approach for sustainable planning. Water quality modeling. Watershed Management in India, Case studies.

Soil and altitude, Soil and aspect, Soil and slopes, Soil landscapes, Soil erosion modeling.

Crop type classification, area estimates, and spectral response of different crops. Crop diseases

and Assessment, Crop and Water management and monitoring. Advances in Crop monitoring.

Survey and mapping of forest cover, Forest change detection, Forest damage assessment and Forests monitoring, Land evaluation for forestry.

UNIT IV: ECOSYSTEM MODELING

Spectral response of vegetation and mapping, Ecosystem Analysis, Environmental impact analysis and monitoring, Ecosystem modeling, Wetland mapping. Spatial Models of Ecological Systems and Process.

UNIT V: DISASTER MANAGEMENT

Introduction and Overview- Natural and manmade hazards – Vulnerability assessment and Mapping on Disasters- Spatial Information for natural Hazard and risk assessment -Landslides- volcanoes- floods and famines- earth quakes- Drought hazard and risk assessment-Human Induced disasters- industrial disasters- dams- constructional and others.

Books Recommended

1. Good child : Environmental Modeling With GIS
2. Manual of Geospatial Science and Technology Edited By John. D. Bossler, Taylor And Francis, London
3. Lillesand, T.M. and Kiefer R.W. Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, New York, 1987.
4. Geographical Information Systems by David Martin
5. RS in Geology by Siegal
6. RS in Forest Resources by John. A. Howard, Chapman and Hall.

Course Title	**REMOTE SENSING FOR VEGETATION**		
Course code	3 EGM OE	No. of credits	03
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Open Elective**		
Course outcomes (COs)	**At the end of the course, the student will be able to** **CO1:**Relate role of remote sensing in concepts of plant physiology. **CO2:**Focus on Characteristics of Electromagnetic Sources, radiation, Energy, spectrum on vegetation. **CO3:**Appraise radiative and back scatter phenomenon of soil, water, plant canopy in microwave regions **CO4:**Devise spectral and vegetative indices for microwave and LiDAR technologies. **CO5:**Integrate applications for detection and diagnosis of plant stress and crop management.		

UNIT I: INTRODUCTION

i. Introduction,History, introduction and and interpretation of Remote sensing, Concepts of Plant Physiology and Remote Sensing. Data availability

UNIT II: BASICS OF RADIATION PHYSICS FOR REMOTE SENSING OF VEGETATION

i. Introduction, Radiation characteristics, Electromagnetic Radiation, Electromagnetic Spectrum, Electromagnetic Energy, Sources and terminology.
ii. Energy Interactions with matter and surfaces. The radiation Environment. LAI.

UNIT III: RADIATIVE PROPERTIES OF VEGETATION, SOILS AND WATER

i. Optical region: Leaf radiative properties, radiative properties of soil and water, radiative properties canopies.
ii. Thermal region: Emissivity of canopy components, and canopies.
iii. Microwave region: Microwave emissivity, back scatter, and advantages. Plant and Canopy Function: water relations, evaporations and water loss.

UNIT IV: SPECTRAL INFORMATION FOR SENSING VEGETATION

iii. Estimation of Vegetation Cove: Spectral Indices -Vegetation indices and vegetation descriptors.
iv. Microwave vegetation indices- estimation of vegetation using Lidar.

UNIT V: INTEGRATED APPLICATIONS

iv. Detection and diagnosis of plant stress.
v. Precision agriculture and crop management
vi. Ecosystems and Forestry Management.

Books Recommended

1. Lillesand, T.M. and Kiefer R.W. Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, New York, 1987.
2. Principles of *Geographic Information Systems* by John *Jensen* and Ryan
3. Remote Sensing: Principles and Applications - Kindle edition by Floyd F. *Sabins*.

M. TECH. -ENVIRONMENTAL GEOMATICS
COURSE STRUCTRURE
II YEAR /
III &IV SEMESTER

Course Title	**DISSERTATION - I & II**		
Course code		No. of credits	
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Dissertation Phase I & II**		

Objectives: At the end of this course, students will be able to

1. Ability to synthesize knowledge and skills previously gained and a pplied to an in-depth study and execution of new technical problem.
2. Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
3. Ability to present the findings of their technical solution in a writte n report.
4. Presenting the work i n International/ National conference or repute d journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

1. Relevance to social needs of society
2. Relevance to value addition to existing facilities in the institute
3. Relevance to industry need
4. Problems of national importance
5. Research and development in various domain

The student should complete t he following:

1. Literature survey Problem Definition
2. Motivation for study and Objectives
3. Preliminary design / feasibility / modular approaches
4. Implementation and Verification
5. Report and presentation

The dissertation stage II is ba sed on a report prepared by the students on dissertation allotted to them.

It may be based on:

1. Experimental verification / Proof of concept.
2. Design, fabrication, testing of Communication System.

The viva-voce examination will be based on the above report and work

Guidelines for Dissertation Phase – I and II

As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.

The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P co-coordinator.

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include Springer/Science Direct. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.

Phase – Ievaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the phase-I work.

During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/inn ovations should be

published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Phase – IIdeliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, A record of continuous progress.

Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work

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