ACADEMIC YEAR 2016-2018

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

COURSE STRUCTURE AND SYLLABUS

M.Tech (ENVIRONMENTAL GEOMATICS)

(6+1 PATTERN)

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

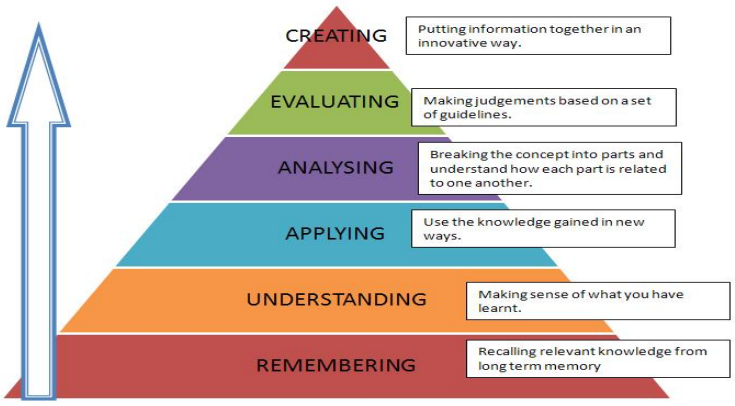
Vision:

- 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:



Program Educational Objectives (PEOs)

The program educational objectives are

PEO 1: To provide students with fundamental knowledge and skills in the Geomatics discipline especially for Environmental protection and Management.

PEO 2: 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.

PEO 3: 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.

PEO 4: To acquire the ability to start entrepreneurship in the geospatial industry.

PEO 5: To get involved with state, national, and international organizations, to place the students in their mission projects and industry employability.

Program Outcomes (POs) are as follows

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.

M. TECH. -ENVIRONMENTAL GEOMATICS
COURSE STRUCTURE

I YEAR

I SEMESTER

Semester		Course Title	Int. marks	Ext. marks	L	P	C
1	**EGM-CC- I**	Ecology and Natural Resources	25	75	4	--	4
2	**EGM-CC- II**	Surveying and Photogrammetry	25	75	4	--	4
3	**EGM-CC- III**	Remote Sensing & Image Interpretation	25	75	4	--	4
4	**EGM-CE- I A** **EGM-CE- I B**	1. Digital Image Processing 2. Geographical Information System and Land Information System (GIS & LIS)	25	75	4	--	4
5	**EGM-CE- II A** **EGM-CE- II B**	1. DBMS and Programming Language 2. Experimental Statistics	25	75	4	--	4
6	**EGM-OE- I A** **EGM-OE- I B**	1. Space Geodetic Techniques & GNSS 2. Elements of Photogrammetry	25	75	4	--	4
7	**EGM-LAB- I**	Thematic Mapping and Digital Image Processing Lab	25	75	--	4	2
8	**Seminar I**		50	--	--	4	2
Total C (6 Theory + 1 Lab+ seminar)							**28**

M.TECH. -ENVIRONMENTAL GEOMATICS

COURSE STRUCTURE

I YEAR

II SEMESTER

Semester		Course Title	Int. marks	Ext. marks	L	P	C
1	**EGM-CC- I**	Geographical Information System	25	75	4	--	4
2	**EGM-CC- II**	Environmental Impact Assessment (EIA)	25	75	4	--	4
3	**EGM-CC- III**	Geomatics for Natural Resource Management	25	75	4	--	4
4	**EGM-CE- I A** **EGM-CE- I B**	**1.** Spatial Data Analysis & Modeling **2.** Microwave and Hyper spectral remote sensing	25	75	4	--	4
5	**EGM-CE- II A** **EGM-CE- II B**	1. Ecosystem based Disaster and risk reduction 2. Remote Sensing for Vegetation	25	75	4	--	4
6	**EGM-OE- I A** **EGM-OE- I B**	1. Satellites and Sensors 2. Global Environmental Issues 3. Land use Planning and Management 4. Environmental Modeling & Planning for Smart cities	25	75	4	--	4
7	**EGM- LAB- II**	GIS and GNSS lab	25	75	--	4	2
8	**Seminar II**		50	--	--	4	2
Total C (6 Theory + 1 Lab+ seminar)						--	**28**

M. TECH. -ENVIRONMENTAL GEOMATICS
COURSE STRUCTURE

II Year

III SEMESTER

	I Semester	Int. marks	Ext. marks	L	P	C
1	Comprehensive Viva-Voce	--	100	--	--	4
2	Project work Review I	50	--	--	24	12
	Total Credits			--	24	16

IV SEMESTER

	II Semester	Int. marks	Ext. marks	L	P	C
1	Project work Review II	50	--	--	8	4
2	Project Evaluation (Viva-Voce)	--	150	--	16	12
	Total Credits			--	24	16

Course Title	ECOLOGY AND NATURAL RESOURCES		
Course code	EGM-101	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	Core Course I		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C111.1:** Classify the role of ecosystem, its functions and importance. **C111.2:** Discuss and relate the population dynamics, resources exploitation and conservation. **C111.3:** Design and develop soil conservation methods, integrating with water resource management . **C111.4:** visualize resources depletion, future projections and consequence of impact of Land use & land cover. **C111.5:** give reason for resource conservation. Also will evaluate and relate consumerism and carbon credits.		

UNIT I -ECOSYSTEMS:

Definition, Concept of ecosystem; Biotic, abiotic and ecological systems. structure, functions and classification of ecosystems. Ecological pyramids.

Ecological energetics: Flow of energy through food chains and food webs; Laws of thermodynamics; entropy, ecological efficiency; bioconcentration and biomagnifications Biogeochemical cycles or Nutrient Cycles: sedimentary cycles; Causes and consequences of disruption of nutrient cycles with reference to Greenhouse gases and SO_x. Hydrological cycle.

UNIT II -POPULATION ECOLOGY, BIODIVERSITY AND ITS CONSERVATION:

Concept of a species and definition of a population. Biological and group attributes of populations. Density, natality, mortality, migrations and growth of populations. Natural regulation of populations. Human population explosion and its consequences. Food, fodder, fibre, fuel, timber and medicines. Forests and the ecological implication of depletion of forests, conservation of biodiversity.

UNIT III -SOIL AND WATER RESOURCES:

Soil formation and soil erosion; conservation of soil and nutrients. Water resources: Distribution, exploitation, depletion of water resources; conservation of water; water use efficiency; water poverty index

UNIT IV -NATURAL RESOURCES:

Classification of natural resources, biotic resources; Renewable and non-renewable resources: mutable and immutable resources; Different types of resources and their natural sources. Demographic quotient; rate of consumption and depletion. Value system, equitable resource use.

Distribution and exploitation; environmental implications of mining; strategies for conservation of mineral resources, land evaluation and suitability, land use/land cover mapping, LU/LC for Environmental Planning.

Renewable and non-renewable resources energy; Alternate and additional sources of energy; depletion of

energy resources; Conservation of energy resource; Energy use efficiency. Solar radiation and its technological ways of harvesting; Solar collectors, photovoltaic, solar ponds; Hydroelectric power, Tidal, Ocean Thermal Energy Conversion, Wind, Geothermal Energy, Nuclear energy-fission and fusion, Hydrogen & Fuel cells.

UNIT V-SUSTAINABLE DEVELOPMENT:

Current concepts of conservation, sustainable development, homeostatic, ecological footprint, carbon foot print and consumerism.

Books Recommended

1. Fundamentals of Ecology by EP odum, WB Saurders & Co., 5th edition.
2. Environment and Natural Resources conservation by Trivedi R.K, 2002.
1. Remote sensing in Geology to Seigal, John wiely 1999.

Course Title	**SURVEYING AND PHOTOGRAMMETRY**		
Course code	**EGM-102**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Core Course II**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C112.1:** Discuss photogrammetric surveys related to hydrographic, mining and cadastral surveys. **C112.2:** Demonstrate various surveying and mapping technologies connected with elevation, contour survey, trigonometric leveling. **C112.3:** Focus on Modern surveying trends using GPS, ETS and digital cartography. **C112.4:** Tabulate various types of aerial cameras in relief displacement and flight planning **C112.5:** Evaluate parallax equations and height determinations.		

UNIT I: INTRODUCTION TO SURVEYING AND CARTOGRAPHY:

Datum and Reference System, horizontal data and Vertical data: Topographical surveys, Photogrammetric surveys, Engineering surveys:- Hydrographic surveys, Mine surveys, Cadastral surveys.

UNIT II: SURVEYING AND MAPPING:

Conventional mapping versus Digital mapping, list of mapping organizations, Classification of maps. Control Survey: Horizontal, vertical and both, Contour survey and Depiction of heights. Introduction to Elevation Determination, Systematic Errors in Differential Leveling, Random Errors In Differential Leveling, Error Propagation in Trigonometric Leveling.

UNIT III: MODERN TRENDS IN SURVEYING AND MAPPING:

Global Positioning System for ground control and extension, Total station system for detail surveying, Digital Photogrammetric Survey, Remote Sensing, Digital Cartography, Geographical Information System.

UNIT IV: BASICS OF PHOTOGRAMMETRY:

History of Photogrammetry, Definition and terminology, Geometry and Types of photographs, Photographic scale, relief displacement, photographic overlaps, Types of aerial cameras, Ground control, Photo mosaics. Flight planning – Crab and drift – Computations for flight planning, Specification for Aerial Photography.

UNIT V: PHOTOGRAMMETRY AND CONSIDERATIONS:

Stereo photogrammetry introduction, Parallax equations and height determination, Overview on applications of Photogrammetry.

Textbooks:

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.

References:

1. Manual of Photogrammetry – American society of Photogrammetry & R.S by Albert.D, 1952.

Course Title	**REMOTE SENSING & IMAGE INTERPRETATION**		
Course code	**EGM-103**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Core Course III**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C113.1:** Identify the interaction of electromagnetic spectrum with atmospheric interactions on earth surface materials. **C113.2:** Interpret remote sensing systems, sensors and their capabilities with varied resolutions. **C113.3:** Extract different features from the satellite imageries and analyze various data products **C113.4:** Discriminate factors affecting microwave measurements using various space and air borne radar systems **C113.5:** Integrate application of multi spectral images in analysis of LULC and agricultural/Forest applications.		

UNIT I REMOTE SENSING – BASIC PRINCIPLES:

Introduction, Electromagnetic Remote Sensing Process, Physics of Radiant Energy: Nature of Electromagnetic Radiation, Electromagnetic Spectrum. Energy Source and its Characteristics, Atmospheric Interactions with Electromagnetic Radiation: Atmospheric Properties, Absorption Ozone, Atmospheric Effects on Spectral Response Patterns. Energy Interactions with Earth's Surface Materials: Spectral Reflectance Curves. Cossine Law.

UNIT II REMOTE SENSING SYSTEM AND SENSOR PARAMETERS:

Introduction, Satellite System Parameters: Instrumental Parameters, Viewing Parameters. Sensor Parameters, Spatial Resolution, Spectral Resolution, Radio metric resolution. Imaging Sensor Systems: Multispectral imaging sensor systems, 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 :

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

UNIT IV MICROWAVE AND HYPERSPECTRAL REMOTE SENSING:

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

UNIT V REMOTE SENSING SYSTEM APPLICATIONS:

Advantages and Disadvantages of Remote Sensing, Applications of - Multi spectral imaging, Microwave imaging and Hyper spectral imaging, Visual image analysis for land use/land cover mapping, geological and soil mapping, agriculture applications, forestry applications and water resources applications.

Text books:

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	**EGM-104**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Core Elective - I**		
UNIT I: DIGITAL COMPUTERS AND IMAGE PROCESSING:	**At the end of the course, The student will be able to** **C114.1:** Illustrate satellite data acquisitions, image display subsystems and file formats **C114.2:**Correlate sensor calibration and image enhancement techniques **C114.3:** Compare various image filtering techniques and arithmetic operations. **C114.4**: Prioritize various techniques of image classification techniques for accuracy assessment. **C114.5:** Give reasons for integration of GIS in image classification and software's related to image classification.		

UNIT I: DIGITAL COMPUTERS AND IMAGE PROCESSING:

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

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

Cosmetic Operations- Missing Scan Lines, De –stripping Methods, Geometric Corrections and Registration. Coordinate Transformations, Atmospheric Correction Methods, Illuminations and View Angle Effects, Sensor Calibration and Terrain Effects and radiometric correction methods.
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:

Introduction, Arithmetic Operations- Image Addition, Subtraction, Multiplication and Division.
Empirically Based Image Transforms- Perpendicular Vegetation Index, Tasselled Cap Transformations, NDVI. PRINCIPAL COMPONENT ANALYSIS: Standard PCA, Noise Adjusted PCA, Decorrelation Stretch, Hue -Saturation and Intensity Transform, Fourier Transform
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:

Introduction**,** Geometrical Basis of Classification, Unsupervised classification, Supervised Classification Training Samples, Statistical Parameters and Classifiers, Other Approaches to Image Classification, Feature Selection, Contextual Information
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:

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

Text books:

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.
2. Paul. M. Mather & Magaly Koch - Computer Processing of RS Images- An Introduction, Wiley Blackwell publication, 4th edition, 2011.

Course Title	**GEOGRAPHICAL INFORMATION SYSTEM AND LAND INFORMATION SYSTEM (GIS & LIS)**		
Course code	**EGM-104**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Core Elective I**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C114.1:** Illustrate Fundamental operations of GIS in Mapping, Data structure, and analysis of spatial and attribute data. **C114.2:** categorize the various data input methods. **C114.3:** examine various GIS functionalities. **C114.4:** understand , differentiate types of maps and their purpose. **C114.5:** validate the role of GIS for various applications.		

UNIT I: INTRODUCTON TO FUNDAMENTALS OF GIS:

Introduction, Definitions of GIS and related terminology, The Evaluation of GIS, Components of GIS, Geospatial data, Spatial data infrastructure.

Map language: Introduction, Map as a model, Spatial elements and terminology, Classification of maps, Map scale, Spatial referencing system, Computers in map production, Trends in computer construction, General software's in map production and Open source GIS.

Fundamentals of GIS: A brief history of GIS, GIS architecture, Components of a GIS, GIS workflow, Theoretical models of GIS: Functional elements, Fundamental operations, Theoretical framework, GIS categories, Levels of measurement.

UNIT II: DATA INPUT METHODS, EDITING AND QUALITY:

Introduction, The data stream, Data input methods: Keyboard entry, Manual digitizing, Scanning and automatic digitizing; GPS for GIS data capture

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; Modeling errors, Point data error models, Line and area data error models, Models for dot and pixel counting; Error evaluation by graphical methods.

UNIT III OVERLAY ANALYSIS:

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: LAND CADASTRAL INFORMATION:

Definition, Practices in India, Units in vougue; Elements of cadastral survey – graphical and textual records; National Land Records Modernization programme – Vectorization of Village Cadastral Maps, Record of Rights (RoRs), Use of Total Station, GNSS, Orthophoto, hybrid techniques; Coordinate systems – Field practices; Preparing Land Parcel Map (LPM), village map, district level database; QA / QC procedures.

UNIT V INTEGRATED MODELING USING GIS:

Hydrological Modeling - water quality modeling, watershed management and modeling,

saltwater intrusion models. Land-surface-subsurface Process Modeling - pipeline alignment studies, solid and hazardous waste disposal site selection, zoning atlas for industrial siting, environmental information system development. Ecosystem modeling, risk and hazard modeling.

Textbooks:

1. Manual of Geospatial Science and Technology Edited By John. D. Bossler, Taylor And Francis, London
2. Geographical Information Systems by Demers
3. Geo-informatics for Environmental Management by M. Anji Reddy, BS Publications, 2nd edition, 2004.

Course Title	**DBMS AND PROGRAMMING LANGUAGE**		
Course code	**EGM-105**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Core Elective I I A**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C115.1:** explain and relate data base, database structures, and concepts C115.2: distinguish database types, advancements and data security **C115.3:** elaborate various data compression and data storage techniques. **C115.4:** adapt to the programming skills and evolve few application oriented tools. **C115.5:** analyze and develop object oriented programs.		

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 fundamantals in C#, Control statements.

Language fundamantals 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.

Reference Books:

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	**EXPERIMENTAL STATISTICS**		
Course code	**EGM-105**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Core Elective I I B**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C115.1:** Categories and analyze the different types of frequencies. **C115.2:** Examine the various types of data sets& its usage **C115.3:** Estimate the random errors and confidence interval. **C115.4:** Integration of correlation & regression methods **C115.5:** Measure the statistical testing methods and analysis techniques		

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 0gives, Relative cumulative-frequency distribution and percentage 0gives, frequency curves and smoothed 0gives,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:

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	**SPACE GEODETIC TECHNIQUES & GNSS**		
Course code	**EGM-106**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Open Elective I A**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C116.1:** Inspect the problems of geodesy, ellipsoid revolution and satellite geodesy **C116.2:** Discuss on global navigation system, its advantages and limitation **C116.3:** Simplify GPS codes, receivers, pseudo ranging system **C116.4:** Test various models of DGPS and their accuracies **C116.5:** Plan geodetic control surveys for defense, vehicle tracking and navigation		

UNIT I: INTRODUCTION

Definition of Geodesy- problems of Geodesy- Ellipsoid of Revolution- coordinate system of Rotational Ellipsoid and spatial Ellipsoid- computations on the Ellipsoid- Gravity- Satellite Geodesy, reference surface, Geoid models- Indian datum- World Geodetic System.

UNIT II: GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS):

Global Positioning System (GPS), Description of the System and their orbits, GPS measurement strategies; Advantages and limitations of GPS, reference frames and other space geodetic techniques (satellite & lunar laser ranging, VLBI, Doppler orbitography, GLONASS, GALILEO).

UNIT III: GPS SIGNAL STRUCTURE:

Carriers, GPS codes: C/A, P, navigational message, GPS receiver: Types and Structure of receivers, Principles of GPS position fixing: Pseudo ranging**.** Determination of GPS satellite coordinates, Types of ephemerides, Data Pre-processing, GPS data formats.

UNIT IV: DIFFERENTIAL GPS:

Principles of DGPS, Real Time Kinematics, Various modes and applications of DGPS, Enhancement of Accuracy.

UNIT V: APPLICATIONS:

Geodetic control surveys, Cadastral surveys, Photogrammetry, Remote sensing, Engineering and monitoring. Military applications, Geographical Information System, Vehicle tracking and car navigation, LBS and special applications.

Reference Books:

1. Linear Algebra, Geodesy and GPS, Gilbert strang Kai Borre, Wellesley- Cambridge press, 1997.
2. Satellite Geodesy by Gunter Seeber, 1st eition, Walter de gruzter Gmbtl & co.KG, 10785 Berlin, 1993.
3. Essentials of GPS by N.K. Agrawal, spatial network Pvt.Ltd. Hyderabad, 2004.
4. Geo-informatics for Environmental Management by M. Anji Reddy, BS Publications, 2nd edition, 2004.

Course Title	**ELEMENTS OF PHOTOGRAMMETRY**		
Course code	**EGM-106**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Open Elective I B**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C116.1:** Discuss photogrammetric system and its various properties **C116.2:** Demonstrate various surveying and mapping technologies and discuss about the parallax equation and its functionality. **C116.3:** Examine the image measurement and its characteristics **C116.4:** Tabulate various types of orientation techniques and tie points **C116.5:** Estimate the 3 D visualization and examine the DEM and interpolation techniques		

UNIT I: INTRODUCTION TO DPW SYSTEMS:

Definition of Digital Photogrammetry & Its Development, Digital Photogrammetry Vis-À-Vis Analogue Photogrammetry, Advantages of Digital Photogrammetry,
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: STEREO PHOTOGRAMMETRY

Stereoscopic depth perception – different types of stereoscopes vertical exaggeration – base lining and orientation – principle of floating mark, Photographic co-ordinate systems, Measurement and refinement of image co-ordinates – Methods of parallax measurement, derivation of parallax equations, Elevations by parallax differences, Measurement of parallax differences, computing flying height and airbase, Interior orientation, Empirical and numerical relative orientation, absolute orientation, model deformation. Derivation of the collinearity and coplanarity equations and their applications.

UNIT III: IMAGE MEASUREMENTS & THEIR REFINEMENT:

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. 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 IV: ORIENTATION PROCEDURES IN DIGITAL PHOTOGRAMMETRY:

Inner orientation(IO),Transformation & Its Suitability, Exterior Orientation (EO),Auto Tie Point Generation, Digital Image Matching Process: Area Based, Feature and Relation Based, Collinearity 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 V: 3D VISUALIZATION & STEREO-COMPILATION:

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

Text Books:

1.Elements of Photogrammetry- Paul r. wolf, 2nd edition, 1983.

2.Elements of Photogrammetry with application in GIS (3rd edition)- Paul Wolf & Bon Dewitt,
3.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.
3.

Course Title	**THEMATIC MAPPING AND DIGITAL IMAGE PROCESSING LAB**		
Course code	**EGM-107**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Laboratory I**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C117.1:** Isolate the various thematic layers using SoI toposheets and satellite images **C117.2:** Establish the error free satellite images for classification **C117.3:** Determine the image processing techniques and implementation in preparation of various maps. **C117.4:** Estimate the LULC classification and distinguish the supervised and unsupervised classification using digital image processing techniques. **C117.5:** Evaluate the different features in the satellite image and its classification categories.		

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

M. Tech EGM- II SEMESTER

Course Title	**GEOGRAPHICAL INFORMATION SYSTEMS**		
Course code	**EGM-201**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Core Course I**		
UNIT I: FUNDAMENTALS OF GIS:	**At the end of the course, The student will be able to** **C121.1:** Illustrate Fundamental operations of GIS in Mapping, Data structure, and analysis of spatial and attribute data. **C121.2:** Correlate directionality and spatial arrangement of liner, theissen polygons, in measuring distances. **C121.3:** Discriminate surface mapping and digital elevation models, choropleth maps, and overlay analysis. **C121.4:** Theorize role of GIS in environmental and cartographic modeling. **C121.5:** 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:

Map – scale, projection and symbolism. GIS - Introduction, definition and terminology, categories, components, fundamental operations, functional elements. 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:

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. Classification – Principles, Neighborhood functions, Polygonal neighborhoods, Buffers. Spatial Arrangement - Point patterns, Theissen Polygons, Area patterns, Linear patterns, Directionality of Linear and Areal objects, Connectivity of Linear objects, Routing and allocation.

UNIT III: STATISTICAL SURFACES AND OVERLAY ANALYSIS:

Surface mapping, sampling the statistical surface, Digital Elevation Model (DEM). Interpolation- linear and non-linear, uses and problems. 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:

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 V: INTEGRATED MODELING USING GIS:

Hydrological Modeling - water quality modeling, watershed management and modeling, saltwater intrusion models. Land-surface-subsurface Process Modeling - pipeline alignment studies, solid and hazardous waste disposal site selection, zoning atlas for industrial siting, environmental information system development. Ecosystem modeling, risk and hazard modeling.

Text Books:

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	**ENVIRONMENTAL IMPACT ASSESSMENT (EIA)**		
Course code	**EGM-202**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Core Course II**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C122.1:** Direct, Indirect, cumulative and induced environmental impacts at Regional, sectoral and project level. **C122.2:** Data products, thematic maps, collateral data in planning and management of baseline data acquisition. **C122.3:** Screening of environmental clearance, for category B&B2 industries and feasibility studies. **C122.4:** Predicting impact of Air, Water, Noise, Socio economic status on environment. **C122.5:** Environmental management plans on emission controls and green belt development and hazardous wastes		

UNIT I: CONCEPTUAL FACTS OF EIA:

Introduction, Definition and Scope of EIA, Objectives in EIA, Basic EIA Principles, 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:

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.

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:

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.

Background Information, Interaction-Matrix Methodologies: simple matrices, stepped matrices, development of a simple matrix, other types of matrices, summary observations on 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):

a) 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.

b) 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.

c) 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.

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

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

UNIT V: ENVIRONMENTAL MANAGEMENT PLAN (EMP):

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, 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.

Text Books:

1. Textbook of Environmental Science & Technology by M.Anji Reddy, BS Publications, 2010
2. Technological guidance manuals of EIA. MoEF.
3. Environmental Impact Assessment by Harry W. Canter, McGraw Hill, 1996, 2nd edition.
4. Man and Environment D.H.Carson 1976 Interactions Part I and III.
5. Environmental Impact Assessment, 2003, Y.Anjaneyulu, B.S Publications
6. Erickson, P.A.1979 Environmental Impact Assessment Principles and applications
7. Basic Concepts in Remote Sensing & Arial Photogrammetry Lillesand & Keifer Printice Hall Intl., 1994.
8. Renewable Energy: environment and development, Maheswar Dayal, Konark Publishers, 1989.

Course Title	**GEOMATICS FOR NATURAL RESOURCE MANAGEMENT**		
Course code	**EGM-203**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Core Course III**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C123.1:** Identifying the various land resources and its applications **C123.2:** Formulate spectral information in estimation of vegetative indexes, precision agriculture, and crop and forest management. **C123.3:** Illustrate role of remote sensing and GIS in Geological mapping, and identification of spectral signature on mining. **C123.4:** Assess crop type classification and estimates, watershed impact on soil erosion and water quality modeling. **C123.5:** Analyze spectral response on upland and wetland vegetation ecosystem, urban and municipal solid waste studies.		

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, GRICULTURE 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 man made hazards – Vulnerability assessment and Mapping on Disasters- Spatial Information for natural Hazard and risk assessment -Land slides- volcanoes- floods and famines- earth quakes- Drought hazard and risk assessment-Human Induced disasters- industrial disasters- dams- constructional and others.

Books:

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	**SPATIAL DATA ANALYSIS & MODELING**		
Course code	**EGM-204**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Core Elective I A**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C124.1:** classify various GIS data analytical techniques. **C124.2:** demonstrate generation of DEM and analysis. **C124.3:** elaborate spatial segmentation techniques and applications**.** **C124.4:** consider applications of network analysis. **C124.5:** visualize various GIS models.		

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.

Text Books:

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

Course Title	**MICROWAVE AND HYPER SPECTRAL REMOTE SENSING**		
Course code	**EGM-204**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Core Elective I B**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C124.1:** Illustrate components of Radar System and factors affecting Microwave measurements. **C124.2:** Interpret characteristics of Side looking Airborne Radar on relief, soil, vegetation and urban response. **C124.3:** Infer Passive Microwave radiometers on various ocean bound satellites **C124.4:** Categorize Hyperspectral and Microwave images and their spectral reflectance curves. **C124.5:** Choose Hyperspectral images for environmental management.		

UNIT I: INTRODUCTION TO MICROWAVE REMOTE SENSING:

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

UNIT II: SLAR, CHARACTERISTICS AND INTERPRETATION OF SLAR IMAGERY:

Definition, Radar working principle, range resolution, azimuth resolution, swath width resolution and SAR systems.

Slant range scale distortion, ground range geometry, image displacement due to relief, layover, fore shorting, shadow and speckle.

Geometric characteristics, Electrical characteristics, Effects of polarization, Soil response, Vegetation response, urban area response.

UNIT III: MICROWAVE SENSORS AND SATELLITES:

passive microwave radiometers SEASAT, SIR, ALMAZ, ERS, ENVISAT, JERS, ALOS, RADARSAT and Applications of microwave remote sensing.

UNIT IV: HYPER SPECTRAL REMOTE SENSING:

Hyper spectral imaging, imaging spectrometers, principles of spectroscopy, hyper spectral vs multi spectral imaging. spectral reflectance's, spectral libraries, absorption process, analysis of spectral curve.

UNIT V: SATELLITES AND APPLICATIONS:

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

TEXT BOOKS:

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

Course Title	**ECOSYSTEM BASED DISASTER RISK REDUCTION**		
Course code	**EGM-205**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Core Course II A**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C125.1:** Relate definitions, levels of disaster risks and phenomena. **C125.2:** List Disaster trends at Global and regional levels, differentiate natural and manmade disasters. **C125.3:** Compare disaster risk vulnerabilities, hazard mapping prevention and mitigation of disasters. **C125.4:** Assess impact of climate change, Biodiversity loss on desertification and disasters. **C125.5:** Evaluate Disaster Management Policy, organizational frame work in preparation of disaster management plans.		

UNIT I: UNDERSTANDING ECOSYSTEM AND DISASTER PHENOMENA

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),Parameters of Disaster Risk, Levels of disaster as per national guideline.

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

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, 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

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); Contingency planning for damage mitigation of different hazards; Relevance of indigenous knowledge, appropriate technology and local resources in disaster risk mitigation; Community based disaster risk reduction mechanism; Counter disaster resources and their roles.

UNIT IV: ENVIRONMENT AND DISASTERS

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

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.

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

Text books

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	**REMOTE SENSING FOR VEGETATION**		
Course code	**EGM-205**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Core Elective II B**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C125.1:** Relate role of remote sensing in concepts of plant physiology. **C125.2:** Focus on Characteristics of Electromagnetic Sources, radiation, Energy, spectrum on vegetation. **C125.3:** Appraise radiative and back scatter phenomenon of soil, water, plant canopy in microwave regions. **C125.4:** Devise spectral and vegetative indices for microwave and LiDAR technologies. **C125.5:** Integrate applications for detection and diagnosis of plant stress and crop management.		

UNIT I: INTRODUCTION

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

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

UNIT III : RADIATIVE PROPERTIES OF VEGETATION, SOILS AND WATER

Optical region: Leaf radiative properties, radiative properties of soil and water, radiative properties canopies.

Thermal region: Emissivity of canopy components, and canopies. 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

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

UNIT V : INTEGRATED APPLICATIONS

Detection and diagnosis of plant stress. Precision agriculture and crop management ,

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**.

Course Title	**SATELLITE AND SENSORS**		
Course code	**EGM-206**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Open Elective A**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C126.1:** categorize EMR and its characteristics. Also will link satellite / sensor parameters to EMR. **C126.2:** acclaim Indian Space program and capabilities. **C126.3:** distinguish various space platforms and mission programs. **C126.4:** explain satellite programs and future developments. **C126.5:** interpret suitable sensors and satellites and their limitations.		

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.

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 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	**GLOBAL ENVIRONMENTAL ISSUES**		
Course code	**EGM-206**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Open Elective B**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C126.1:** classify various environmental issues, protocols etc. **C126.2:** discuss significant global environmental movements. **C126.3:** visualize consequences of climate change **C126.4:** speculate the global energy demands and ascertain contemporary issues. **C126.5:** ascertain nuclear power issues and myths.		

UNIT I: INTRODUCTION

Human environmental Interactions- Global Environmental Agreements & Movements - Stockholm and Beyond – Evolution of International Environmental Laws- making international , national environmental agreements.

UNIT II ENVIRONMENTAL MOVEMENTS:

Global and national movements of Significance impact: RAMSAR Convention- Green Belt movement- Green Peace – Chipko movement- Narmada Bachao Andolan – Silent valley- Doon valley and related issues / case studies

UNIT III CLIMATE CHANGE

Sea level Change – primary and secondary impacts- Adapting to Sea level changes. Global Warming- Fossil fuels- Green house gases- Global and national scenario. National Action Plan on Climate Change. (NAPCC). Climate Change and Biodiversity loss.

UNIT IV ENERGY CRISIS & LAND DEGRADATION :

Energy requirements- Developed- Developing- Under Developed nations. Cases studies of International and National importance.

Land pollution • Desertification - Soil — Soil conservation • Soil erosion • Soil contamination • Soil salination. Mining- reclamation of mined area. Desertification-case studies.

UNIT V NUCLEAR ISSUES & CONTEMPORARY ISSUES

Nuclear issues —Nuclear power • Nuclear weapons • Nuclear and radiation accidents • Nuclear safety • High-level radioactive waste management.

Green Buildings- Genetic pollution- Genetically modified food controversies. Intensive farming Monoculture. Health and Diseases- Epidemics and Famines.

Books Recommended

1. Global environmental issues: a climatological approach by David D. Kemp, Taylor and Francis.

Course Title	**LAND USE PLANNING AND MANAGEMENT**		
Course code	**EGM-206**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Open Elective C**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C126.1:** Identify methods and tools for Land use, built environment, and zoning criterion. **C126.2:** Classify relevance of Geomatics in evaluating Land suitability, capability in decision making system. **C126.3:** Discuss sustainability of Land management, Net farm profitability, and Principles of ecology for planners. **C126.4:** Assess concepts of sustainable planning towards smart cities. **C126.5:** 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:

Land use System : Environmental inputs and impacts, economic inputs and outputs. Role of Geomatics in Land Evaluation and Suitability for land use planning. Land Capability classification and preference of land use. Decision Support System for land use planning.

UNIT III : ECOLOGICAL PRINCIPLES FOR PLANNERS

overview of ecology and the environment. Important ecological issues in land use for environmental planners. **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 :

Concept of Sustainability in planning practice. 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

Fundamentals of GIS and statistics. GIS-based land use and urban growth models, basins (stream and

runoff water quality model); Visualization and impact assessment models for alternative land use.
Books Recommended 1.

Course Title	**ENVIRONMENTAL MODELING AND PLANNING FOR SMART CITIES**		
Course code	**EGM-206**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Open Elective D**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C127.1:** Identify various environmental models and justifications for model building. **C127.2:** Classify relevance of Geomatics in evaluating watersheds, water quality and others. **C127.3:** Discuss principles of air pollution dispersion models. **C127.4:** devise sustainable planning towards smart cities. **C127.5:** recommend sustainability of land management, waste management.		

UNIT I MODELING CONCEPTS:

Basic concepts & classification of models; Principles of Environmental modeling and GIS models; Casual and statistical models-Characteristics- Steps in model development - Importance of model building;

UNIT II WATER QUALITY MODELING:

Philosophy of mathematical models of watershed hydrology, Conceptual and mathematical modeling processes; Classification of watershed models; watershed modeling ---terminology, components and methodology; Lake Water Quality Models; Ground Water Quality Modeling.

UNIT III AIR QUALITY MODELING:

Introduction of air quality meteorology and modeling; Air dispersion modeling- Gaussian and non-Gaussian dispersion model, Puff dispersion model; Applications of Air Quality Modeling; Tools of Air Quality Modeling-- Dispersion Modeling- Receptor Modeling- Air Pollution Chemical Transport Modeling;

UNIT IV Smart Cities 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; 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:

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;

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

Reference books:

1. Environmental modeling with GIS by Michael F. Good Child, Bradley O.Parks, Louis T. Steyaert.
2. Geo-informatics for Environmental management by Dr. M. Anji Reddy, B Publications

3. Open courseware -Civil and Environmental Engineering (Internet), MIT,USA.
4. Ground water hydrology MIT - Open courseware prof. Harvey.
5. AERMOD Air modeling software (Internet).

Course Title	**GIS AND GNSS LAB**		
Course code	**EGM-207**	No. of credits	04
Centre/ Department	Centre for Environment , IST, JNTUH		
Program	M. Tech : Environmental Geomatics		
Course type	**Laboratory**		
Course Outcome (COs)	**At the end of the course, The student will be able to** **C127.1:** Describe scale, projection, and coordinate systems and explain importance of each in GIS **C127.2:** Creating Vector data and attribute linking, Map composition and output generation **C127.3:** Gives better maps for easy estimation of environmental parameter changes and its consequences. **C127.4:** Estimation of change detection and its factors. **C127.5:** Evaluation of crop suitability, solid waste dumping site selection and lake restoration capacity.		

Electronic Total station (ETS):

Survey using total station, Recording data and Plotting.

GNSS:

- Alignment survey by handheld GPS
- Processing of GPS survey data with GIS software

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 Arc GIS software.