JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

INSTITUTE OF SCIENCE AND TECHNOLOGY

COURSE STRUCTURE & SYLLABUS

M.Tech REMOTE SENSING Programme

(Applicable for batches admitted from 2019-2020)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

I SEMESTER

S.No	Course No	Category	Course Name	P.Os	L	T	P	C	Marks
1		Core 1	Remote Sensing		3	0	--	3	100
2		Core 2	Geographical Information Systems		3	0	--	3	100
3		Elective I	a) Photogrammetry		3	0	--	3	100
			b) Earth Systems						
			c) Water Resources Management						
4		Elective II	a) Object Oriented programming		3	0	--	3	100
			b) Principles of GeoDatabase						
			c) Geo-Statistical Methods						
5			Research Methodology and IPR		2	0	0	2	100
6		Laboratory 1	Remote Sensing Laboratory		-	--	4	2	100
7		Laboratory 2	Geographical Information Systems Laboratory		-	--	4	2	100
8		Audit Course –1	Audit Course –1		2	0	0	0	100
							Total Credits | Marks	**18**	**800**

II SEMESTER

S.No	Course No	Category	Course Name	P.Os	L	T	P	C	Marks
1		Core 3	RS & GIS Applications in Earth Sciences		3	0	--	3	100
2		Core 4	Satellite Image Processing		3	0	--	3	100
3		Elective III	a) Global Navigational Satellite System		3	0	--	3	100
			b) Geospatial Data Processing and Modeling						
			c) Climate Systems						
4		Elective IV	a) Advanced Remote Sensing		3	0	--	3	100
			b) Web & Mobile GIS						
			c) Geo-Spatial applications for Coastal Zone Management						
5		Laboratory 3	Satellite Image Processing Laboratory		-	--	4	2	100
6		Laboratory 4	GeoSpatial Simulation Laboratory		-	--	4	2	100
7		Core	Mini Project With Seminar		0	0	4	2	100
8		Audit Course –2	Audit Course –2		2	0	0	0	100
							Total Credits | Marks	**18**	**800**

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III SEMESTER **

S.No	Course No	Category	Course Name	P.Os	L	T	P	C	Marks
1		Elective-V	a) MOOCS		3	0	--	3	100
			b) Soft Computing Techniques						
			c) Environmental Impact Assessment and Management using RS & GIS						
			d) Urban & Regional Planning using Geospatial technologies						
2		Open Elective	a) MOOCS		3	0	--	3	100
			b) Fundamentals of Remote Sensing & GIS						
			c) Application of Remote Sensing in Environmental Management						
			d) Internet of Things						
			e) Business Analytics						
			f) Industrial Safety						
			g) Operations Research						
			h) Cost Management of Engineering Projects						
			i) Composite Materials						
			j) Waste to Energy						
3	Dissertation	Core	Dissertation Phase-I / Industrial Project (To be continued and Evaluated next Semester)*		--	--	20	10	
Total Credits | Marks								**16**	**200**

*** Evaluated and displayed in 4th Semester marks list**
**** Students Going for Industrial Project / Thesis will complete these courses through MOOCS**

IV SEMESTER

S No.	Course No	Category	Course Name	P.Os	L	T	P	C	Marks
1	Dissertation	Core	Dissertation Phase II (Continued from III semester)		0	0	32	16	100
Total Credits | Marks								**16**	**200**

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I Semester	REMOTE SENSING	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- Introduce the physical principles of Remote Sensing and Photogrammetry as a tool for mapping
- To familiarize data products, their properties and methods of preparing thematic information.
- Enhance their knowledge about optical, thermal and microwaves based Remote Sensing concepts.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Analyze the energy interactions in the atmosphere and earth surface features
CO2	Identify the earth surface features from satellite images
CO3	Select the type of remote sensing technique / data for required purpose
CO4	Acquire knowledge about concepts of remote sensing, sensors and their characteristics
CO5	Acquire knowledge in basic concepts of photogrammetry and mapping method

COURSESYLLABUS

Unit1 : PHYSICS OF REMOTE SENSING

Sources of Energy, Active and Passive Radiation, Electromagnetic Radiation - Reflectance, Transmission, Absorption, Thermal Emissions, Interaction with Atmosphere, Atmospheric windows, Interaction with Earth's surface features, Spectral reflectance of Earth's surface features, Multi concept of Remote Sensing.

Unit2 : SATELLITES PLATFORMS

Types of Platforms, Active and Passive Systems, Imaging and Non-Imaging Systems, Resolutions in Remote Sensing - Spatial, Spectral, Radiometric and Temporal, Satellite orbits, Scanning mechanism, Ground truth data collection Instruments.

Unit3 : EARTH OBSERVATION SATELLITES

LANDSAT, SPOT, IRS, MODIS, IKONOS, Cartosat, Oceansat, SeaSat, RADARSAT, RISAT, ASTER, SRTM, NOAA, Geoeye, Kompsat, Worldview II & III and Other recent satellites and their application potential;

Image Interpretation Techniques: Visual image interpretation techniques and applications of LU/LC, Geology and water resources.

Unit4 : TYPES OF REMOTE SENSING

Thermal Remote Sensing: Introduction, Thermal sensors and characteristics, emissivity, thermal inertia, Interpretation of thermal images; Microwave remote sensing: Introduction, Definitions, Wavelengths, Types of Sensors and platforms, SLAR, Geometry of radar Images; Hyperspectral Remote Sensing: Introduction, Spectral cube, Hyperspectral image analysis.

Unit5 : PHOTOGRAMMETRY

Introduction- Types of photographs, Geometry of vertical photographs, Scale of a vertical photograph over flat terrain, over variable terrain – average photo scale, methods of determining scale of vertical photographs, Flying height of a vertical photograph, Stereoscopic viewing of Vertical photographs – depth perception; overlap, side lap; flight planning; vertical exaggeration - factors involved.

Textbooks:

1. George Joseph. “Fundamentals of remote sensing”. Universities Press, 2005.
2. James B. Campbell , Randolph H. Wynne, ”Introduction to Remote Sensing” - The Guilford press, 5th edition, 2011.
3. Floyd F Sabins Jr,. "Remote Sensing: Principles and Interpretation”, W.H.Freeman & Co., New York, 3rd edition, 1997
4. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman “Remote sensing and image interpretation” John Wiley & Sons, New York, 2015..
5. Paul R. Wolf, Elements of Photogrammetry, McGraw-Hill Science, 2001, ISBN 0070713464, 9780070713468

References:

1. John A. Richards, and Xiuping Jia. “Remote Sensing Digital Image Analysis: An Introduction” (2006).
2. John R. Jensen “Remote Sensing of the Environment: An Earth Resource Perspective” Pearson Education India; 2ed (2013)
3. Fawwaz T. Ulaby, Richard K. Moore, and Adrian K. Fung. "Microwave remote sensing active and passive." Vol. 1,2 and 3, Addison – Wesley Publication Company, (2015)
4. Manual of Remote Sensing: American Society of Remote Sensing and Photogrammetry, Virginia, USA

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I Semester	GEOGRAPHICAL INFORMATION SYSTEMS	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

• Introduce the students to the basic concepts of GIS and making the students familiar with the spatial data and spatial analysis techniques
• To familiarize data models and data structures in GIS and to introduce various Raster and Vector Analysis capabilities.
• To expose the concept of quality and design of cartographic outputs in open GIS environment.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Analyze the basic components of GIS
CO2	Classify the maps, coordinate systems and projections
CO3	Process spatial and attribute data and prepare thematic maps
CO4	Perform Spatial Querying & Analysis
CO5	Conceptualization of GIS project

Unit1 : FUNDAMENTALS

Geographical Information System - Definition, – History and Developments, Map – analysis with paper based maps - limitations, Advantages of digital maps, Mapping concepts - Grid Systems for Mapping, Map Abstraction, Thematic maps, Projections and Coordinate systems, Spatial Elements, Spatial Measurement Level, Spatial Location and Reference, Spatial Patterns, Geographic Data Collection.

Unit2 : GIS MODELS

Data Models – Representation of geographical space, concept of Tessellation, Spatial and Non-spatial data, Data Collection and Input, Vector data models, Raster Data Models, Data compression techniques, Data Conversion between Raster and Vector, Metadata, file formats for Raster and Vector

Unit3 : GIS DATABASE

Database Management – Data storage, Files, Database Structures models - Hierarchical Data Structures, Network Systems, Relational Database Management Systems, OODBMS, Standard Data Formats, Compression Techniques.

Unit4 : GIS ANALYSIS

Spatial Analysis - Proximity Analysis - buffering, Thiessen polygon, Overlay Analysis-overlay operations, Network Analysis- optimal routing, Digital Elevation Models, Attribute data Analysis-concept of SQL queries.Map composition, Preparation of qualitative and quantitative maps, levels of maps, map elements and map scales.

Unit5 : GIS PROJECT PLANNING

GIS Project Planning and Implementation – Understanding the Requirements, Phases of Planning, Specifications, Procedure for analysis projects and design projects.

Textbooks:

1. Michael N Demers, "Fundamental of GIS", John Wiley & Sons Inc, 4ed, 2008
2. Kang Tsung Chang., "Introduction to Geographic Information Systems", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2008.
3. Burrough, P.A., "Principles of GIS for Land Resource Assessment", Oxford Publications, 2005.
4. C.P.Lo& Albert K. W.Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice Hall India Pvt.Ltd, 2002

References:

1. Jeffrey Star and John Estates,"Geographic Information System- An Introductory", Pretence Hall Inc.
2. Marble, D.F and Calkins, "Basic Readings in Geographic Information System",H.W – Spad Systems Ltd.
3. A.M.Chandra & S.K. Ghosh "Remote Sensing and GIS". Narosa Publishing House, New Delhi. 2000.

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I Semester	PHOTOGRAMMETRY	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- Learn fundamental aspects of Aerial Photogrammetry, Satellite/Aerial Photo interpretation and its applications in various thematic domains.
- Evaluate metrics from Aerial Photograph for Heights and Angles.
- Learn analogue and digital based approaches in photogrammetry.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Classify the photogrammetry methods and their applications
CO2	Determine the scale, ground coordinates and the aerial extent of aerial photographs
CO3	Demonstrate interior and exterior orientation on two overlapping aerial photographs
CO4	Measure parallax and compute elevations from parallax measurements
CO5	Prepare mosaics, orthophotos and photomaps for mapping in a range of applications

COURSESYLLABUS

UNIT 1 : FUNDAMENTALS

Aerial Photography Systems: Historical development – Classification, Application – Analogue and Digital Cameras – Geometry of Vertical Photographs – Scale – Coordinate Transformations, Flying Height of a vertical photograph, Stereoscopic viewing of Vertical photographs – Depth Perception; Overlap, Side Lap; Relief Displacement – Tilted and Oblique Photographs.

UNIT 2 : PARALLAX & HEIGHT

Photographic “Flight-Line” Axes for Parallax Measurement – Monoscopic methods Parallax measurement – Principle of the Floating Mark – Stereoscopic methods of Parallax Measurement – Parallax equation – Elevations by parallax Differences – Approximate Equation for elevations from Parallax Differences – Measurement of Parallax Differences- Parallax Correction Graph – Computing Flying Height and Air Base – Mapping with Stereoscope and Parallax Bar; Y parallax Error Evaluation. Determination of Horizonal ground length, Directions and Angles from photo coordinates.

UNIT 3 : MOSAIC & ORTHOPHOTO

Photo Elements and Mosaics – Types of mosaics, Materials for preparing Mosaics, Mosaic construction – Photomaps – Advantages and Disadvantages of Photomaps and mosaics – Uses of Photomaps and Mosaics.

Orthophotos: Orthophotos Plane & Curved objects – OrthoMosaics – Reproduction.

UNIT 4 : ELEMENTS OF AERIAL PHOTO

Elements of Aerial Photo Pattern – Rock Types, Landforms, Surface Drainage Patterns, Erosion Features, Photographic Gray Tones, Vegetative Details, Cultural Details, Boundary Characteristics, Micro details of the terrain.

UNIT 5 : FLIGHT PLANNING &DIGITAL PHOTOGRAMMETRY

Photogrammetric flight planning - Concepts of Interior, Relative, Absolute Orientation-

Direct Georeferencing-Object, Image relation - Effect of orientation elements - Elements and principles of Aero triangulation.

Digital Photogrammetry: Automatic DTM acquisition from stereo pairs or image blocks, Colour balancing, Digital image enhancement, Feature extraction

Textbooks:

1. Paul R.Wolf, "Elements of Photogrammetry", McGraw-Hill Science, 2001,
2. Karl Kraus, "Photogrammetry - Fundamentals and Standard processes", Dümmler, 2000
3. Edward M. Mikhail, James S. Bethel, J. Chris McGlone; "Introduction to Modern Photogrammetry", John Wiley & Sons Inc, 2001.
4. Wilfried Linder., "Digital Photogrammetry Theory and Applications", Springer 2003

References:

1. Moffitt, Francis H. & Mikhail, Edward M., "Photogrammetry", Harper and Row Publishers, 1980.
2. Sanjib K Ghosh., "Fundamentals of Computational Photogrammetry", Concept Publishing Company, 2005
3. McCurdy, P., L. Woodward, Jl Davidson, R. Wilson, and R. Ask. "Manual of photogrammetry",American Society of Photogrammetry, 1944

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I Semester	EARTH SYSTEMS	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- Impart knowledge about the various geological structures and Geomorphic Landforms
- Exposed to various Remote Sensing Applications to Earth Sciences
- Understand in detail about the Atmosphere and Oceanography

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Understand mapping lithological and structural features
CO2	Understand mapping concepts involved in Fluvial structures
CO3	Understand thematic concepts of Glacial/Aeolian landforms
CO4	Analyse the structure and behaviour of Atmosphere
CO5	Get exposed to various earth sciences applications

UNIT 1 :SCOPE

Earth Surface Forms and Processes – geomorphology; atmospheric components and systems; Oceans dynamics and Circulation Patterns, Fundamental concepts in geomorphology; Endogenetic processes: Volcanism and Tectonism; Exogenetic processes: weathering, Mass wasting and Erosion; Geomorphic Agents.

UNIT 2 : FLUVIAL & SHORE ZONE

Fluvial processes and landforms: valleys and valley forming processes - associated features; Alluvium – Active and Relict alluvium; Floodplain morphology; Types of streams – Genetic classification of streams; Alluvial fans and deltas

Shore Zone processes and landforms: shore line, shore zone and coast; Wind waves, tides,littoral currents, storm surges and tsunamis; Erosional and depositional landforms.

UNIT 3 : GLACIAL & AEOLIAN

Glacial processes and landforms: Ice and Glaciers; Types of Glaciers; Glacial Motion; Regimen of Glaciers – Nourishment and Wastage of Glaciers; Active, Passive and Dead Glaciers; Erosional And Depositional Landforms.

Aeolian processes and landforms: dominance of wind processes in arid and semi-arid regions; erosional and depositional landforms

UNIT 4 : ATMOSPHERE

Composition and Vertical Structure; Insolation and Heat Budget; Atmosphere Pressure and winds: variations of air pressure and weather – diurnal and seasonal; Wind: Factors affecting wind direction and speed, wind observation and measurement; wind shift, General circulation of the atmosphere; Atmospheric humidity, clouds and precipitation and monsoons; Air masses, fronts, weather disturbances – storms, tornadoes and their impact on life and property.

UNIT 5 : THE WORLD OCEANS

Physical properties of Sea Water – salinity, density, temperature, pressure, colour; Ocean dynamics: Waves – Wind Waves, Tsunamis; Tides – Diurnal Semi-Diurnal; Currents – Longshore Currents; Ocean currents – Cold and Warm Currents and Ocean Circulation Patterns; Sea level changes – Episodic, Seasonal and Long-terms changes and their impacts; Predicted sealevel rise: causes and consequences

Textbooks:

1. A L. Bloom, "Geomorphology",Waveland Pr.Inc. 2004
2. W.D. Thornbury, "Principles of Geomorphology"Wiley Eastern, 1984
3. Richard Huggett, "Fundamentals of Geomorphology"Routledge, 2ed, 2007
4. Howard J. Critchfield, "General climatology", Prentice-Hall of India private Limited, New Delhi, 1987
5. Reddy, M.P.M., "Descriptive Physical Oceanography", Oxford & IBH Publishing Co. 2001
6. Bengtsson et al., "Earth's Cryosphere and Sea Level Change", Springer, 2011

References:

1. Tikka, R.N., "Physical Geography", Kedar Nath Ram Nath &Co, Meerut, 2006
2. Beaches and Coasts, C.A.M. King, Edward Arnold, 1961
3. Oceanography – A Brief Introduction, Siddhartha, K., Kisalaya Publications, 2004

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I Semester	WATER RESOURCES MANAGEMENT	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- To learn how to assess surface and ground water resources.
- To learn how to develop suitable plans for water resource development and management
- To learn the optimization techniques in water resources planning and management.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Explain Hydrological cycle and its different parameters
CO2	Analyze the Rainfall-runoff relationship with flood forecasting
CO3	Describe various terms related to “Groundwater”
CO4	Explain the rainwater harvesting techniques and water models
CO5	Describe important characteristics of "Watershed".

UNIT 1 : FUNDAMENTALS OF HYDROLOGY

Hydrological cycle – estimation of various components of hydrological cycle – clouds – rainfall – runoff – evaporation – transpiration – evapotranspiration – interception – depression storage – spectral properties of water – case studies.

UNIT 2 : DRAINAGE BASIN ASSESSMENT

Watershed divide – Stream networks – Delineation and codification of watersheds – basin morphometric analysis – linear, aerial, relief aspects – Rainfall-runoff modeling – urban hydrology –flood forecasting, risk mapping, damage assessment - soil moisture area – drought forecasting and damage assessment – mitigation - Mapping of snow covered area – snow melt runoff - CASE STUDIES.

UNIT 3 : GROUNDWATER

Groundwater prospects – Surface Water Indicators – Vegetation, Geology, Soil – Aquifer Parameters – Well Hydraulics – Estimation of Groundwater Potential – Hydrologic Budgeting – Mathematical Models – Groundwater Modeling – Sea Water Intrusion – Modeling. CASE STUDIES.

UNIT 4 : WATER MANAGEMENT

Surface water - Study of Rainfall, Estimation of Run-off at Micro Catchments, Stream Gauging; Rainwater Harvesting; Catchment, Harvesting, Harvesting Structures, Groundwater - Exploration of Canal Command Areas, Potential Areas; Integrated Water Resources Management, Conjunctive Use.

Water Resource Models: SWAT, HEC-RAS, HEC HMS and others models

UNIT 5 : WATERSHED MANAGEMENT :

Watershed characteristics - size, shape physiography, slope, climate, drainage, land-use, vegetation, geology, soils, hydrology, hydrogeology, socio-economics. Linear aspects of channel systems - Aerial aspects of drainage basins.
Issues in watershed management - land degradation, agricultural productivity, reservoirs sedimentation, depletion of bioresources, floods and droughts. Principles and approaches - principles of watershed management, different approaches in watershed management;

Artificial recharge of groundwater – water harvesting structures – erosivity and erodability - Universal Soil Loss Equation – sediment yield – modeling of reservoir siltation – prioritization of watershed – RS & GIS based case studies.

Textbooks:

1. Ven Te Chow, "Hand book of Applied Hydrology ", 2010
2. H.M. Raghunath, "Groundwater", 2015
3. R.K. Linsely & J.B. Franzini "Water Resources Engineering"
4. Soil Erosion and Conservation by R. P. C. Morgan (2005), Longman Publishing Group.
5. Warren Viessman, Jr, and Lewis, G.L, Introduction to Hydrology, Prentice Hall India Pvt., Ltd., New Delhi, 2008

References:

1. McCuen, R.H., "Hydrologic Analysis and Design", Prentice Hall Inc. N York, 2005.
2. Patra, K.C, "Hydrology and Water Resources Engineering", Narosa Publications, 2008
3. Lynn E. Johnson, "Geographic Information Systems in Water Resources Engineering", CRC Press, 2008.
4. Lawrence K. Wang, Chih Ted Yang, "Modern Water Resources Engineering", Handbook of Environmental Engineering 15, Humana Press, 2014.
5. Peter P. Mollinga,"Integrated Water Resources Management (Water in South Asia)", Sage Publications Pvt. Ltd, 2006.

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I Semester	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- To understand the concept of object oriented programming
- To familiarize software reuse, different Object-Oriented methods and systems
- To apply Java and other programming languages for solving problems

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Understand the basics of any Object-Oriented Language
CO2	Write small programs with basic controls and objects
CO3	Write some complicated programs using Packages and Interfaces
CO4	Program Multi-threaded programs with exceptions
CO5	Design GUIs using AWT packages of Java

UNIT 1 : Introduction

Paradigms of Programming Languages – Basic concepts of Object Oriented Programming – Differences between Procedure Oriented Programming and Object Oriented Programming - Objects and Classes – Data abstraction and Encapsulation, Inheritance, Polymorphism, Dynamic binding, Message communication – Benefits of OOP – Application of OOPs in Natural Resource Applications. Introduction to Java: Importance of Java to internet, byte code, Java buzzwords, data types, variables, declaring variables, dynamic initialization, scope and life time of variables, type conversion and casting, compiling and running of simple Java program.

UNIT 2 : Arrays, Control Structures , Classes and Objects

Arrays, Operators, Control statements, Concepts of Classes and Objects, CLASS fundamentals, declaringObjects, Assigning Object Reference Variables, Introducing Methods, Constructors, Usage of STATIC with Data and Methods, Usage of FINAL with Data, Access Control, THIS-keyword, Garbage collection, Overloading Methods and Constructors, Parameter Passing - Call by Value, Recursion, Exploring the STRING class.

UNIT 3 : Inheritance, Packages and Interfaces

Inheritance - Basic concepts, Member Access Rules, Usage of SUPER keyword, Forms of Inheritance, Method Overriding, Abstract Classes, Dynamic Method Dispatch, Using FINAL with Inheritance, The Object Class. Defining, Creating and Accessing a Package, Importing Packages, Differences Between Classes and Interfaces, Defining an Interface, Implementing Interface, Applying Interfaces, Variables in Interface and Extending Interfaces.

UNIT 4 : Exception Handling and Multithreading

Concepts of Exception handling, Types of Exceptions, Usage of TRY, CATCH, THROW, THROWS and FINALLY Keywords, Built-in Exceptions, Creating own Exception Sub Classes, Concepts of Multithreading, Differences between Process and Thread, Thread Life Cycle, Creating Multiple Threads using THREAD Class, Runnable Interface, Synchronization, Thread Priorities, Inter Thread Communication.

I/O Streams: File –Streams, Advantages, The Stream Classes, Byte Streams, Character Streams.

UNIT 5 : Event Handling and AWT Controls

Applets - Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.

Abstract window tool kit - Events, Event Sources, Event Classes, Event Listeners, Delegation Event Model, Handling Mouse and Keyboard Events, Adapter classes. AWT components: Concepts of Components, Container, Panel, Window, Frame, Canvas, Font Class, Color Class and Graphics. Buttons, Labels, Text fields, Text area, Check boxes, Check box groups, Lists, Choice, Scrollbars, Menus, Layout Managers.

Textbooks:

. Herbert Schildt, “The Complete Reference Java - J2SE”, TMH Publishing Company Ltd, New Delhi, 7th Edition.

. Cay Horstmann, “Big Java”, John Wiley and Sons, 2nd Edition.

. H.M.Deitel, P.J.Deitel, “Java: How to program”, Prentice Hall of India private limited, Fifth edition, 2003

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I Semester	PRINCIPLES OF GEODATABASE	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- Understand the fundamental concepts of DBMS and Relational DBMS
- To gain knowledge regarding Spatial Data structure and formats
- Study Geospatial database and its applications

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Understand the components of DBMS and file management methods
CO2	Apply the concepts of SQL and its use to manage the databases
CO3	Understand the data models and data structures used for spatial data
CO4	Perform Geospatial Topology analysis
CO5	Design a geodatabase for various Remote Sensing & GIS applications

UNIT 1 : DBMS

Introduction to DBMS – Brief history – types of DBMS – data models – ER model: concepts design. GIS data model: Conceptualizing the real world in GIS

UNIT 2 : RDBMS& SOL

Relational Data Base Management Systems: Concepts – Constrains – Relational Data baseDesign – Relational Models Extended with ADT. SQL – simple – complex –spatial join.

UNIT 3 : SPATIAL OBJECTS

Representation of Spatial Objects: Geographic space modeling – Representation Modes – Representing the Geometry of a Collection of objects – Spatial data formats and Exchangeformats – Spatial Abstract data Types. – Object oriented GIS.

UNIT 4 : GEODATABASE

Geodatabase: – Topology – Defining the Relationship class – Geometric Networks – Geocoding services – Building geodatabases with CASE tools.

UNIT 5 : SPATIAL DATABASE

Methods of Knowledge discovery in Spatial database, Methods of Clustering, Exploring Spatial association, Mining in Image & Raster database, Big Data methods for RS & GIS Applications, National Spatial Database Infrastructure, Open Geospatial Consortium

Textbooks:

1. Korth and Silberschatz “Database System Concepts” - McGraw Hill – 2002.
2. Philippe Rigaux, Michel Scholl, and Agnès Voisard. “Spatial databases: with application to GIS.”Morgan Kaufmann Publishers, 2002.
3. MacDonald “Buliding Geodata Base” ESRI publication, USA, 2002.

References:

1. Arctur, David, and Michael Zeiler. "Designing Geodatabases: Case studies in GIS data modeling". ESRI, Inc., 2004.
2. Thomas Ott, Frank Swiaczny "Time-Integrative Geographic Information systems", Springer (2000)
3. Albert K.W. Yeung, G. Brent Hall "Spatial Database Systems_ Design, Implementation and Project Management", Springer, 2007.
4. Markus Schneider "Spatial Data Types for Database Systems_ Finite Resolution Geometry for Geographic Information Systems- Springer-Verlag Berlin Heidelber, 1997.

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I Semester	GEO-STATISTICAL METHODS	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- understand the Statistical measures of the sample datasets
- understand the concepts of Geo-Statistical methods and its applications in Engineering
- study the effect of estimation theory, testing of hypothesis, correlation and regression, randomized design, and multivariate analysis.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Study basics of statistical methods
CO2	Understand concept of probability distribution, correlation methods
CO3	Conduct hypothesis testing
CO4	Study GIS data with complex geospatial methods
CO5	Solve the geospatial problems using R

UNIT 1 : STATISTICAL METHODS

Introduction to Statistical Methods - Terminology, Measures of Central Tendency- Mean, Mode, Median, Quartiles, Measures of Dispersion- Range, Variance, Standard Deviation, Skewness & Kurtosis

UNIT 2 : CORRELATION AND REGRESSION

Binomial, Poisson and Normal distributions - Definitions, Principle of Least Squares, Fitting of straight line and parabola - Correlation - Karl Pearson's Coefficient of Correlation and Spearmann's rank correlation - Linear regression.

UNIT 3 : TESTING OF HYPOTHESIS

Tests based on Normal, t, χ^2 and F distributions for testing of Means, Variance and Proportions – Analysis of r × c tables – Goodness of fit.

UNIT 4 : INTERPOLATION

Interpolation & Extrapolation methods, IDW, Geostatistical Interpolation methods – Kriging and other methods of kriging, Semi-variance, Variogram

UNIT 5 : R APPLICATIONS FOR GEOSTATISTICAL METHODS

Introduction to R, Descriptive/Inferential statistics with R, Simple linear regression with R, spatial statistics analysis using R methods.

Textbooks:

1. Gupta,S.C.,andKapoor,V.K.,"FundamentalsofMathematicalStatistics",SultanChandan dsons, Reprint 20032. Gupta, S.C., and Kapoor, V.K.,
2. Fundamentals of Applied statistics, Sultan Chand and sons, 2003.
3. Veerarajan.T., "ProbabilityStatistics andRandom processes", TMH, 2004

References:

1. R Project for Statistical Computing [weblink] www.r-project.com
2. Jeffrey M. Yarus, and Richard L. Chambers,"Stochastic modeling and geostatistics_ principles, methods, and case studies" -American Association of Petroleum Geologists, 1994.
3. Wackernagel. Hans. "Multivariate geostatistics : An Introduction with Applications", Springer-Verlag Berlin Heidelberg, 3ed, 2003.
4. D.D. Sarma "Geostatistics with Applications in Earth Sciences" Springer,2ed, 2009.

I Semester	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		2	0	0	2

UNIT I- RESEARCH PROBLEM AND SCOPE FOR SOLUTION

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- FORMAT

Effective literature studies approaches, 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- PROCESS AND DEVELOPMENT

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

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

UNIT V- NEW DEVELOPMENTS IN IPR

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.

TEXT BOOKS

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”

REFERENCES

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

I Semester	REMOTE SENSING LABORATORY	L	T	P	C
		--	--	4	2

COURSEOBJECTIVE

This course aims to make the students:

- Get accustomed to the various Maps, Scales & Satellite Images
- Interpret various features on the Imageries and Toposheets
- Understand the various Remote Sensing Data Types

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Analyze temporal, spectral and spatial differences of satellite data using image processing software
CO2	Perform image pre-processing and post-processing techniques on a given satellite data
CO3	Classify given satellite data for thematic mapping process
CO4	Identify various geographical features on Toposheets & Satellite Images
CO5	Understand various elements of Visual Interpretations and their identities.

LIST OF EXPERIMENTS

Topographic Map Analysis

1. Maps – types of maps; maps scales; topographic maps – numbering system of topographic maps of India and adjacent countries series.
2. Contours; Topographic profiles – simple, superimposed and projected profiles.
3. River Profiles.
4. Drainage morphometry.
5. Identification of surface features from topographic maps

Remote Sensing Data Analysis

1. Understanding Remote Sensing Data - Elements of Visual Interpretation.
2. Land use and land cover
3. Geological and structural features
4. Drainage pattern and surface water bodies
5. Hydro-geomorphology for ground water potential zones
6. Urban growth and transportation network
7. Forests and crops mapping

References:

1. Fundamentals of Cartography, Rameshwar Prasad Misra, A. Ramesh, Concept Publishing Company, 1989
2. http://www.surveyofindia.gov.in

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

I Semester	GEOGRAPHICAL INFORMATION SYSTEMS LABORATORY	L	T	P	C
		--	--	4	2

COURSEOBJECTIVE

This course aims to make the students:

- Experience the power of GIS
- Understand the various aspects and applications of GIS
- Differentiate between a Raster & a Vector

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Delineate various geographical features using ArcGIS & QGIS softwares
CO2	Understand the various Projection Systems & Coordinate Systems
CO3	Generate 3D outputs and profiles
CO4	Differentiate various Analysis – 3D, Buffer, Network, Spatial etc…
CO5	Understand all the overlay analysis techniques

LIST OF EXPERIMENTS

1. Importing maps and layers from various sources
2. Georeferencing and Projection
3. Digitization - Point, Line, Polygon and Surface Data
4. Editing Map Elements
5. Attribute Data Entry and Manipulation
6. Cleaning, Building and Transformation
7. Map Generation with Patterns and Legends
8. Generation of TIN and DEM
9. Vector Analysis-Buffering, Overlay and Network analysis
10. Raster Analysis-Measurement-Arithmetic overlaying, Logical overlaying

(Above experiments has to be carried out using both ArcGIS & QGIS)

References:

1. ArcGIS User Manual by ESRI
2. QGIS User Guide Release 2.18, April 2019

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KAKINADA – 533 003, Andhra Pradesh, India

I Semester	AUDIT COURSE 1: MANUSCRIPT WRITING AND EDITING	L	T	P	C
		2	0	0	0

UNIT I: INTRODUCTION

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

UNIT II: COMPONENTS

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT III: REVIEW OF LITERATURE

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. 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

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: SUBMISSION

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

TEXT BOOKS:

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

I Semester	AUDIT COURSE 1: DISASTER MANAGEMENT	L	T	P	C
		2	0	0	0

UNIT I- INTRODUCTION

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT II- REPERCUSSIONS OF DISASTERS AND HAZARDS:

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III- DISASTER PRONE AREAS IN INDIA

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

UNIT IV- DISASTER PREPAREDNESS AND MANAGEMENT

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT V- RISK ASSESSMENT

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. Disaster Mitigation- Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

TEXT BOOKS

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.

REFERENCES

1. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

2 . Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep
Publication Pvt. Ltd., New Delhi.

I Semester	AUDIT COURSE 1: BIOSAFETY	L	T	P	C
		2	0	0	0

UNIT I INTRODUCTION

Introduction to biotechnology entrepreneurship: strategies in biotechnology led ventures, biotechnology driven business opportunities, major hurdles and barriers in biotechnology driven ventures and their solutions,

UNIT II COST BUDGET AND INVEST

Understanding company Law and commercial knowhow for biotechnological ventures, costing and capital budgeting in biotechnological ventures. Investing in biotechnology driven business, concept of biotechnology incubation center for knowledge-based industry.

UNIT III INTELLECTUAL ISSUES

Biotechnology and Intellectual issues: Introduction to Biotechnology in agriculture, medicine and industry, Biotechnology and its development in developing countries, patent eligibility issues in life science innovations: case study, checks and balances in biotechnology related patents, the importance of entrepreneurship in biotechnology, Intellectual property issues in agriculture, industrial and Pharmaceutical Biotechnology.

UNIT IV BIOHAZARD IDENTIFICATION

Biohazard identification: microbial flora of human and microbial virulence factors, indigenous and pathogenic agents of research animals, laboratory, growth chamber and green house microbial safety,

UNIT V EPIDEMIOLOGY

Epidemiology of laboratory associated infections, biohazard assessment, risk assessment of biological hazards, biohazard control, administrative control, special considerations for Biosafety.

TEXT BOOKS:

1. Craig Shimasaki, Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies, Academic Press, 2014
2. James F. Jordan, Innovation, Commercialization, and Start-Ups in Life Sciences, CRC Press; 1 edition 2014
3. Frank S. David, The Pharmagellan Guide to Biotech Forecasting and Valuation, Pharmagellan; 1st edition, 2017
4. Harikesh Bahadur Singh, Intellectual Property Issues in Biotechnology, CABI 1st edition, 2016
5. Kshitij Kumar Singh, Biotechnology and Intellectual Property Rights: Legal and Social Implications, Springer Nature; 2015 edition
6. Matthew Rimmer, Intellectual Property & Biotechnology: Biological Inventions, Edward Elgar, 2008
7. Goel and Parashar, IPR, Biosafety and Bioethics, Pearson Education India; First edition 2013 Diane O. Fleming (Editor), Debra L. Hunt, Biological Safety: Principles And Practices, ASM Press, 4th Edition

I Semester	AUDIT COURSE 1: VALUE EDUCATION	L	T	P	C
		2	0	0	0

UNIT I- INTRODUCTION

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

UNIT II- VALUES

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature,Discipline

UNIT III- PERONALITY DEVELOPMENT

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT IV- COMPETENCE

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence,Humility, Role of Women.

UNIT V- IMPLEMENTATIONS

All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

TEXT BOOKS

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

I Semester	AUDIT COURSE 1: CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

UNIT I- INTRODUCTION

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working**).** Philosophy of the Indian Constitution: Preamble Salient Features

UNIT II- CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES:

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies Directive Principles of State Policy, Fundamental Duties.

UNIT III- ORGANS OF GOVERNANCE:

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT IV- LOCAL ADMINISTRATION:

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT V- ELECTION COMMISSION:

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

TEXT BOOKS

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.

REFERENCES:

1. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

I Semester	AUDIT COURSE 1: PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

UNIT I- INTRODUCTION AND METHODOLOGY:
Aims and rationale, Policy background, Conceptual framework and terminology. Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

UNIT II- THEMATIC OVERVIEW
Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT III- EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES.
Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV- PROFESSIONAL DEVELOPMENT:
Alignment with classroom practices and follow-up support.Peer support Support from the head teacher and the community. Curriculum and assessment. Barriers to learning: limited resources and large class sizes

UNIT V- RESEARCH GAPS AND FUTURE DIRECTIONS
Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment. Dissemination and research impact

TEXT BOOKS

1 Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education
research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

REFERENCES:
1. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education.
Oxford and Boston: Blackwell.
2. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
3. www.pratham.org/images/resource%20working%20paper%202.pdf.

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KAKINADA – 533 003, Andhra Pradesh, India

I Semester	AUDIT COURSE 1: STRESS MANAGEMENT BY YOGA	L	T	P	C
		2	0	0	0

UNIT I- INTRODUCTIONS
Definitions of Eight parts of yog. (Ashtanga)

UNIT II- PARTS
Yam and Niyam.

UNIT III- DO`S AND DON'T'S IN LIFE.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT IV- BREATHING EXERCISES
Asan and Pranayam

UNIT V- TYPES
i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects-Types of pranayam

TEXT BOOKS
1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur

REFERENCES:
1. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

I Semester	AUDIT COURSE 1: ROAD MAP FOR PATENT CREATION	L	T	P	C
		2	0	0	0

UNIT I INTRODUCTION
Introduction to patent – Defination and concepts

UNIT II- ANALYTICS
Patent analytics- Introduction, How to a read patent?

UNIT III RESEARCH GAP AND PLANNING
Use of patent data for research gap analysis Identification of potential patent - various tools Research planning and patent -ling activity

UNIT IV TYPES AND MAINTENANCE
Types of patent and patent timelines Maintenance of laboratory notebook and patenting activity

UNIT V INTERACTIONS
Interaction with patent attorney at various stages of patenting and related timelines to be followed

TEXT BOOKS:
1. Petherbridge, L. (2007). Road map to revolution-patent-based open science. *Me. L. Rev.*, *59*, 339.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

II Semester	RS & GIS APPLICATIONS IN EARTH SCIENCES	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

• Know about the various geological structures and Geomorphic Landforms
• exposed to various Remote Sensing Applications to earth Sciences
• Study various Case studies of applications related Earth Sciences

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Visualize landforms, and locate / identify geographic and geologic features.
CO2	Explain the various components of Forests using various Remote Sensing Data
CO3	Explain the Soil and Agriculture relationship using RS & GIS
CO4	Understand the importance of Watershed and its application in the real world
CO5	Integrate between RS, GIS & Disasters and provide steps for mitigations

COURSESYLLABUS

Unit1 : GEOLOGY & GEOMORPHOLOGY

Principles of Remote Sensing Data Interpretation in Geology, Remote Sensing Image Interpretation for Lithological Mapping, Structural Feature Identification & Analysis; Thermal Remote Sensing for Geological applications, Earthquake Studies and Volcano monitoring; Microwave Remote Sensing for Geological applications
Surface indicators for Mineral Exploration, Spectroscopy of Minerals, Multi-spectral and Hyperspectral Remote Sensing for Mineral Exploration; Types of Hydrocarbon Resources, mode of occurrence and surface indicators; Fundamental concepts in geomorphology; Endogenetic and Exogenetic processes: weathering, masswasting and erosion; geomorphic agents. Geomorphic Landforms, Geomorphic mapping using aerial photographs and satellite data – CASE STUDIES.

Unit2 : FORESTRY

Geographical distribution, types, extent and status of vegetation of the World, Asia-Pacific and India, spectral properties of vegetation, factors affecting spectral reflectance; Hyperspectral remote sensing for species/community delineation, Microwave remote sensing in forestry, LiDAR remote sensing for tree height determination, Biophysical spectral response-based forest canopy density (FCD) mapping and biomass assessment. Forest degradation assessment and monitoring, Kyoto protocol, NATCOM, REDD, REDD+, Clean Development Mechanism (CDM) – CASE STUDIES.

Unit3 : AGRICULTURE & SOILS

Concept of soil, physico-chemical properties; spectral characteristics of soils. Soil forming factors and pedogenic processes; Remote Sensing in agriculture: overview and importance; Need for Agri-informatics; Spectral characteristics of crops and Spectral Vegetation Indices; Crop discrimination and acreage estimation; Plant signatures and vitality indicators, chlorophyll fluorescence. Hyperspectral Sensors, optimum narrow bands, red edge & their indices for crop stress assessment. Microwave RS - parameters, signatures and discrimination, microwave for crop growth monitoring and assessment, crop parameters (Roughness, plant water content and biomass) retrieval from microwave – CASE STUDIES.

Unit4 : WATERSHED MANAGEMENT

Principles of watershed management, different approaches in watershed management; Watershed characteristics - size, shape physiography, slope, climate, drainage, land use, vegetation, geology, soils, hydrology, hydrogeology, socio-economics. Linear aspects of channel systems - Aerial aspects of drainage basins. Land degradation, agricultural productivity, reservoirs sedimentation, depletion of bioresources. Principles and approaches. RS & GIS based – CASE STUDIES.

Unit5 : DISASTER MANAGEMENT

Introduction to Disasters, use of GIS in risk assessment, mitigation, preparedness, response and recovery phases in disaster management, types of disasters –Disaster Management overview on Natural and Technological disasters, Applications like Landslides, Droughts, Floods, Cyclones, Forest fires – CASE STUDIES.

Textbooks:

1. W.D. Thornbury, “Principles of Geomorphology” Wiley Eastern, 1984.
2. Brady, N.C., and Weil, R.R “The Nature and Properties of Soils”,12ed, Prentice Hall, Inc., 1999.
3. M.D. Steven, J.A. Clark, “Applications of remote sensing in agriculture”, Publisher – Butterworth, London, 1990
4. Champion, H.G. and Seth, S.K. “A Revised Survey of the Forest Types of India”. Manager of Publications, Govt. of India, New Delhi. 1968.
5. John R. Jensen, “Remote Sensing of the Environment: An Earth Resource Perspective”, 2ed., Prentice Hall. 2007
6. Gupta, R.P., “Remote Sensing Geology”, Springer Verlag, Berling. 2003.

References:

1. Schwartz, F.W. and Zhang, H., “Fundamentals of Ground Water”, John Wiley & Sons, Inc. USA.2003.
2. Todd, D.K. and Mays, L.W. “Ground Water Hydrology”. John Wiley & Sons, Inc. USA. 2005.
3. Arthur Holmes, “Physical Geology”, Elsevier Science Publishers. Ltd. 1-259.1985,
4. Ryerson, R.A., Rencz. A. N., “Manual of Remote Sensing: Remote sensing for the earth sciences, Volume 3”, American Society for Photogrammetry and Remote Sensing. 1999.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

II Semester	SATELLITE IMAGE PROCESSING	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- Understand procedure of satellite data acquisition and analysis
- To process the Satellite dataset for Remote Sensing Applications
- To extract information from a Satellite Image for Thematic maps

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Process the remotely sensed data with satellite image processing techniques
CO2	Statistically evaluate the image variables
CO3	Classify the processed remote sensing data
CO4	Evaluate the accuracy of the image classification
CO5	Apply the advanced image processing methods for deriving the useful information

Unit1 : FUNDAMENTALS

Satellite systems and data – acquisition - storage - orbits – Data formats –Data products - Image display systems - future missions - Elements of visual perception – Image sampling and quantization - Resolutions - Pixel characteristics - Image formation, missing scan lines

Unit2 : PREPROCESSING

Preprocessing - Geometric correction and registration, Atmospheric corrections, Radiometric correction - Noise models.

Histogram and its significance- Entropy and its significance - Univariate & multivariable Image statistics

Unit3 : ENHANCEMENT

Point, local and regional operation - Linear and non-linear Contrast enhancement techniques, density slicing, pseudo-colour images, spatial enhancement techniques (convolution filtering), spectral enhancement techniques, PCA, Wavelet transform, Multi-image fusion.

Unit4 : INFORMATION EXTRACTION

Classification - Feature extraction, Training set - Statistical computation, understanding feature space & scatter plots, signature purity & separability – Supervised, Unsupervised and Hybrid classification techniques, Sources of Classification Error, confusion matrix &Kappa coefficient error analysis, Analysis of Multi-Temporal series and change detection

Unit5 : ANALYSIS

Pattern recognition, boundary detection and representation, textural and contextual Analysis; Spectral indices - Vegetation indices, water related indices, indices related to cloud properties

Textbooks:

1. John R Jensen, “Introductory Digital Image Processing”, Prentice Hall, New Jersey,2004
2. John A.Richards, Springer-Verlag, “Remote Sensing Digital Image Analysis” 1999.
3. Florence Tupin, Jordi Inglada and Jean-Marie Nicolas, Remote Sensing Imagery, ISTE and Wiley, 2014

References:

1. Robert G Reeves, Manual of Remote Sensing Vol. I & II, American Society of Photogrammetry, Falls Church, USA, 1983.
2. Rafael C.Gonzalez, “Digital Image Processing” Prentice Hall, (2nd Edition), 2002.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

II Semester	GLOBAL NAVIGATIONAL SATELLITE SYSTEM	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- Introduce the concept of geodesy and augmentation systems
- Introduce satellite based positioning system using Pseudo-range Positioning methods
- Studyvarious Reference surfaces (Datum), Coordinate transformation models.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Identify GNSS components and their functions
CO2	Interpret the navigational message and signals received by the GNSS
CO3	Identify error sources in GNSS observations, and apply the corrections for accurate positioning
CO4	Select GNSS survey method
CO5	Map the geospatial features

UNIT 1 : GEODESY

Definition – Fundamental goals of Geodesy – Basic concepts – Historical perspective – Development applications in Satellite Geodesy – Geoid and Ellipsoid - satellite orbital motion – Keplerian motion – Kepler's Law- Coordinate systems in Geodesy - Indian Geodetic System and Everest Spheroid, WGS 84, Geodetic coordinate systems, Time systems.

UNIT 2 : GNSS

Space Segment – Satellite Configuration, Orbit determination and Orbit representation, Anti spoofing and Selective availability.Control Segment –Master, Monitor & Ground Control Stations, Task of control segmentUser Segment –GNSS receiver, Components of Receiver, Types of Receiver; History of GNSS: GPS system - Services and Segments, GLONASS system- Services and Segments, Galileo System- Services and Segments, Regional Navigation Satellite Systems (RNSS), Augmentation Systems, GAGAN, IRNSS systems

UNIT 3 : SATELLITE SIGNAL & OBSERVABLES

Structure of Signal, Navigation message, Pseudo range measurements, Atmospheric effects, Antenna phase center offset and variation, Multipath, system accuracy characteristics, Data formats, Error budget

UNIT 4 : DATA PROCESSING

Point Positioning, Different Positioning & Relative Positioning, Ambiguity Resolution, Adjustment Filtering & Smoothing, Network Adjustment,Dilution of Precision & Accuracy Measures

UNIT 5 : Surveying with GNSS

Planning a GPS survey,Prerequisites, Modes of Survey, Surveying procedure - Transformation of GPS results - Coordinate transformations, Datum transformations

Textbooks:

1. Hofmann-Wellenhof, Lichtennegger and Wasle., "GNSS: Global Navigation Satellite Systems", Springer-VerlagWein, New York, 2008
2. Seeber G. "Satellite Geodesy", Walter De Gruyter, Berlin, 1998.
3. Shuanggen Jin, EstelCardellachadnFeiqinXie., GNSS Remote Sensing: Theory, Methods and Applications, Springer, London, 2014
4. Guocheng Xu GPS Theory, Algorithms and Applications, Springer – Verlag, Berlin, 2003.

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II Semester	GEOSPATIAL DATA PROCESSING AND MODELING	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

• Study various Spatial Analysis techniques and Applications
• Execute various spatial techniques and models to quantify and solve real-life spatial patterns and problems
• Studyand design spatial techniques and models over R Programming

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Conduct advanced spatial analyses using GIS tools
CO2	Study GIS data with complex geospatial models
CO3	Solve the geospatial problems using programming tools
CO4	Develop models in GIS using appropriate GIS software
CO5	Analyse GIS data and generate applications

UNIT 1 : SPATIAL INTERPOLATION

Local and Global methods of Interpolation; Interpolation using Trend surfaces, Regression, ANOVA method, Nearest Neighbor method, IDW methods; Geostatistical Methods – Variogram models, Variogram for spatial analysis, Kriging methods – Ordinary, Block, Probabilistic kriging, Comparison between Interpolation methods.

UNIT 2 : DTM APPLICATIONS

Slope and aspect;site selection studies, Viewshed analysis– Line of Sight, preparation, Factors influencing Viewshed preparation, Applications; Watershed analysis – Flow direction, Flow accumulation, Watershed delineation and applications; Working with Open Source DEM's

UNIT 3 : GEOSPATIAL ROUTE ANALYSIS

Geocoding – Reference Database, Address matching, Offset Plotting; Applications of Geocoding, Dynamic Segmentation – Routes, Events; Applications: Geocoding and Dynamic Segmentation;

Least-Cost Path Analysis – Source Raster, Cost Raster, Cost Distance Measures, Options for Least-Cost Path, Applications

UNIT 4 : GIS MODELS AND MODELLING

Basic Elements of GIS Modelling, Classification, Modelling Process, Binary Models – Vector & Raster based Method and Applications, Index Models – Weighted Linear Combination method & Applications, Regression Models – Multiple Linear Regression models, Process Models – Revised USLE, Critical Rainfall Model; Classification; Model builder tools

UNIT 5 : PROGRAMMING TOOLS

Python& R Programming – Introduction, Data Types, Variables, Functions and Code style, Operators and Statements, Class and Objects, GIS Data Models, Python& R Scripting, Point, Polyline and Polygon, Python Language Control Structure; Automating Geospatial Tools with Python & R, Data accessing and editing, Data Manipulation and Complex Objects, Implementing Spatial Relationship Calculations

Textbooks:

1. Kang-Tsung Chang, "Introduction to Georaphic Information Systems", McGraw-Hill Education, 9th ed, 2019.
2. Burrough, P. A and Racael A. McDonnell, "Principles of Geographical Information Systems", Oxford University Publications, 1998.
3. C.P.Lo., Albert K and W.Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice Hall India Pvt.Ltd, New Delhi, 2002.
4. Chaowei Yang, "Introduction to GIS Programming and Fundementals with Python and Arc GIS", CRC Press, T&F Group, 2016

References:

1. Zandbergen, Paul A. Python scripting for ArcGIS. Esri press, 2015.
2. ArcGIS 10.3 User Manuals, ESRI, 2018.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

II Semester	CLIMATE SYSTEMS	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

• Understand about climatic system of earth and its changes over time.
• The impact of climatic parameters on climate change
• Disseminate information about various global initiatives, environmental impact assessment methods and modelling using remote sensing and GIS.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Understand and explain the differences between weather and climate, local to global climatic variations.
CO2	Quantify relationship between ecosystem, rainfall, and temperature, etc.,
CO3	identify/map different types of surface waterbodies, glaciers, and drought impact from satellite imageries.
CO4	Describe global policies and EIA methods, and link them with local, regional and national developmental initiatives and generate report.
CO5	Map/model the impact of global warming on these systems using RS & GIS.

UNIT 1

Climate and the atmosphere – Origin, nature, composition and vertical division of the atmosphere. Climate Change: Causes and impacts,Monsoons: Concepts of the origin of monsoon - Indian monsoons

UNIT 2

Meteorological parameters and their measurements - Geographical, seasonal and vertical distribution of temperature, pressure, wind and precipitation. Solar and terrestrial radiation: Distribution in clear, cloudy and average conditions. Mean heat balance.Weather disturbances: Air mass and Front, Cyclone and anti-cyclone.Thunderstorm and tornado.

UNIT 3

Climate models, methods, types, GCM, RCMs, climate databases. Concepts and definition of climate change and climate variability, causes, IPCC climate change scenarios. Modeling of climate change scenarios and scaling issues using RS & GIS. Dynamic and Statistical downscaling of climate model data. NetCDF formats for climate change, retrieval and analysis using R and python

UNIT 4

Weather analysis and Forecasting. Climate and agricultural factors in crop production WOFOST/PSN/CROPWAT approaches, Eddy-covariance measurements & simulation of energy, water, CO_2 exchange

UNIT 5

Impact of climate change on agriculture (productivity, water cycle, crop diversification, drought, desertification), earth observation signal for climate change, climate change mitigation and adaptation strategies

Textbooks:

1. Critchfield, Howard J., "General Climatology", 3ed, Prentice-Hall, Inc., 1974.
2. Frederick K. Lutgens_ Edward J. Tarbuck "The Atmosphere_ An introduction to Meteorology", Pearson, 2016.
3. Neelin J. David, "Climate Change and Climate Modeling", Cambridge University Press, 2011.

References:

1. Gordon Bonan, "Climate Change and Terrestrial Ecosystem Modeling" 1ed, Cambridge University Press, 2019.
2. John B. Drake, "Climate Modeling for Scientists and Engineers", Society for Industrial and Applied Mathematics (SIAM), 2014.
3. Barry R.G., Hall-McKim E.A. "Essentials of the Earth's Climate System", Cambridge University Press, 2014.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

II Semester	ADVANCED REMOTE SENSING	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

• To impart the knowledge of Microwave Remote sensing and its applications
• understand principles, processes and applications of thermal and hyper spectral remote sensing for earth resources
• Study the fundamentals of LiDAR and UAV systems

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Understand the principles of thermal and microwave remote sensing
CO2	Relate backscattering signals from different surfaces to physical processes, and understand active and passive microwave systems.
CO3	Make use of thermal and hyperspectral data for real world applications (analyzing Urban Heat Island problem, estimation of surface composition, forest species identification etc.).
CO4	Classify and analyze Hyperspectral data
CO5	Identify the working mechanism and applications of UAV systems

UNIT 1 : MICROWAVE REMOTE SENSING

Introduction, wavelengths, Radar equation, classification of Sensors, SLAR, Resolution concept- Range resolution and azimuthal resolution, SAR, Speckle noise and reduction, Radar return and Image signature- System parameters and Target parameters, Advanced Processing Techniques such as InSAR, differential InSAR or Polarimetric InSAR.

UNIT 2 : THERMAL REMOTE SENSING

Thermal radiation principles, Interpretation of Thermal Images, Determination of Emissivity, Application of LST in analyzing Urban Heat Island effect, Coalfire extent, Energy balance, etc.

UNIT 3 : HYPERSPECTRAL REMOTE SENSING

Principles, Spectral Cube, Airborne and Spaceborne sensors. Data correction – Atmospheric, Radiometric and Geometric, Data Visualization, Animation, Multiple Colour Composites, Observing Signatures of Various Features and Comparing with Spectral Libraries, Dimensionality reduction – Linear methods and Non-Linear methods.

UNIT 4 : LiDAR

Principles of LiDAR remote sensing, LIDAR working principle, Types of LIDAR, LIDAR system components, Data Processing, Applications – Interior, Exterior of Monuments and Structures, 3D Visualization and Analysis, Generation of Archives towards Planning and Development.

UNIT 5 : UAV: Unmanned Aerial Vehicle

Definition and Terminology, Advantages and Limitations of UAV's in Remote Sensing, UAV types, UAV – Data Acquisition, Image Processing, Ortho-Rectification, Data Modeling DEM/DTM; Applications.

Textbooks:

1. Floyd M. Henderson et.al. "Imaging Radar -Manual of Remote Sensing -Vol 2" 3ed , Wiley. 1998
2. Ulaby, F.T., Moore, R.K., and Fung, A.K., Microwave Remote Sensing – Active and Passive – Wesley Publishing,1986.
3. Dale A. Quattrochi et.al. "Thermal Remote Sensing in Land Surface Processing", CRC Press. 2004
4. Michael T, Eismann., "Hyperspectral Remote Sensing", SPIE press, USA, 2012
5. Felipe Gonzalez Toro, Antonios Tsourdos, "UAV - Based Remote Sensing - Volume 2". Sensors-MPDI, 2018.

References:

1. Peter M. Atkinson, Nicholas J. Tate, "Advances in Remote Sensing and GIS Analysis".
2. Chein-I Chang, "Hyperspectral Imaging: Techniques for Spectral Detection and Classification", Springer; 2003.
3. Chritian Matzler., "Thermal Microwave Radiation: Applications for Remote Sensing", The Institution of Engineering and Technology, 2006.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

II Semester	WEB & MOBILE GIS	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- Learn advanced GIS concepts
- Understand Network models, protocols and architectures.
- Learn techniques of Web GIS and Mobile applications.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Publish geospatial data in web environment
CO2	Analyse the geospatial layers in web environment
CO3	Establish Server-Client configuration for GIS environment
CO4	Develop applications in web and mobile platforms
CO5	Prepare and publish geospatial data in mobile applications

UNIT 1 : DISTRIBUTED GIS

Introduction, Distributed GIS – Basic components, Applications of distributed GIS.

UNIT 2 : NETWORKING

Network Models- OSI reference model, TCP/IP Model, Network environments protocols, Network Architectures- LAN- Ethernet, Token Ring , Wireless LAN, WAN- Circuit Switched and Packet switched

UNIT 3 : CLIENT/SERVER COMPUTING

Client, server, glue, client-server system partition, 2-tier, 3-tier & n-tier architectures, DCOM Architecture and Interface, CORBA Architecture.

UNIT 4 : WEB GIS,

History of Web GIS, components of web GIS, web GIS v/s Internet GIS - Web Mapping - Static map publishing, clickable maps, architecture of static web publishing, Static Web mapping architecture, Interactive web mapping, Geographic Markup Language - principles and characteristics, commercial web mapping programs.

UNIT 5 : MOBILE GIS

Location based services, Case studies on Mobile Solutions; Mobile App Development Approaches, HTML5 Geolocation; Creating a Mobile App, jQuery Mobile - Components, Event Handling, Mobile Configuration Third-party APIs; Google Maps API; ArcGIS API;

Textbooks:

1. Harwani, “Developing Web Applications in PHP and AJAX”, McGrawHill
2. Tereshenkov, A., “Web GIS Application in Local Government”, VDM Verlag, 2009.
3. Zhong-ren peng , Ming- Hsiang Tsou “Internet GIS – Distributed Geographic Information Services For Internet And Wireless Networks” ,
4. Pinde Fu and Jiulin Sun, “Web GIS: Principles and Applications, ESRI Press, 2011

References:

1. Beginning Map Server: Open Source GIS Development (Expert's Voice in Open Source)”, Apress; 1st edition (2005),

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

II Semester	GEO-SPATIAL APPLICATIONS FOR COASTAL ZONE MANAGEMENT	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

• To maximize the benefits provided by the coastal zone
• To minimize conflicts and harmful effects of activities upon each other, resources and the environment
• To evaluation of measures against pollution, erosion and degradation of coastal areas

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Manage the demands of the coastal zone as the interface between land and sea
CO2	Explain the Coastal Ecosystem and the role of RS & GIS to study
CO3	Understand the coastal disasters and their mitigations
CO4	Understand the Anthropogenic Disasters effecting the coasts
CO5	Explain various CZM techniques to solve various Coastal problems

UNIT 1

Coastal and littoral zones – Definitions and scope of study, Shore zone processes – waves, tides and currents Coastal landforms;River deltas: types of deltas and their morphological variations; Human activities and their impact on the delta-fringe coasts

UNIT 2

Coastal wetlands – Mangrove swamps, marshes, lagoons, tidal channels/creeks and their significance in coastal stability and economic importance - Continental margins – forms and processes; territorial waters and Exclusive Economic Zone; Sea level changes – factors involved; effects of sea level oscillations on coastal zones; Sea-level rise and coastal vulnerability; Role of Geoinformatics in assessment of coastalvulnerability to sea-level rise

UNIT 3

Coastal Hazards: Storm surges and Tsunamis, Origin, propagation and run-up of tsunamis; Tsunami impact – role of coastal topography and vegetation; Global warming and Sea-level rise - impact on coastal zones; coastal vulnerability Assessment; Coastal hazard preparedness – coastal protection, education and awareness of coastalcommunities; Role of Geoinformatics in assessment of coastal vulnerability to tsunamis

UNIT 4

Human activity and coastal environment – deforestation, agriculture/aquaculture, pollution and coastal structures, and their effect on coastal zones; Coastal vegetation; shelter belts; coastal aquifers; freshwater-seawater interface Morphology of Indian coasts

UNIT 5

Coastal Zone Management – concepts, models and information systems; Coastal Regulations Zones (CRZ) and Coastal Management Zones (CMZ):Indian contextApplication of remote sensing in coastal zone studies; Role of Geographic Information Systems in coastal zone studies

Textbooks:

1. Coleman, J.M., "Deltas", Continuing education Publication Co.Inc. 1976
2. Davis, A.R. (Jr.), "Coastal Sedimentary Environments", Springer-Verlag, 1985.
3. Beaches and Coasts, King, C.A.M., Edward Arnold, 1972
4. Introduction to Marine Geology and Geomorphology, King, C.A.M., Edward Arnold, 1974
5. Applications in Coastal Zone Research Management, Martin, K.St. (ed), U.N. Institute for Training and Research, 1993.
6. Integrated Ocean and Coastal Management, Sain, B.C., and Knecht, R.W.,UNESCO Publication, 1998.
7. Subtle Issues in Coastal Management, Sudarshan et al., (ed), IIRS, Dehra Dun, 2000.
8. Tsunamis – case studies and recent developments, Satake, K. (ed), Springer, 2005

References:

1. Geomorphology, Bloom, A.L., Prentice-Hall, 1978
2. www.vedas.sac.gov.in.
3.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

II Semester	SATELLITE IMAGE PROCESSING LABORATORY	L	T	P	C
		--	--	4	2

COURSEOBJECTIVE

This course aims to make the students:

- Have hands on experience on different steps of satellite image processing using various software.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Analyze temporal, spectral and spatial differences of satellite data using image processing software
CO2	Perform image pre-processing and post-processing techniques on a given satellite data
CO3	Classify given satellite data for thematic mapping process

LIST OF EXPERIMENTS

1. Satellite Data downloading from different sources (Bhuvan, USGS EarthExplorer, Alaska Satellite Facility, etc.); Reading and Displaying satellite data.
2. Generation of False Color Composite (FCC)
3. Georeferencing the Satellite image
4. Extracting area of Interest
5. Generating Histogram of various bands
6. Geometric correction of satellite image
7. Enhancement using Band ratio
8. Enhancement using different Filtering techniques
9. Spectral Indices – NDVI, NDWI, NDBI,
10. Principal Component Analysis (PCA)
11. Fourier Analysis
12. Unsupervised Classification
13. Supervised Classification
14. Accuracy Assessment
15. Classification using Neural Network and Fuzzy Logic
16. Change detection study

(Above experiments has to be carried out using both ERDAS/ENVI & ILWIS/GRASS)

References:

1. ERDAS IMAGINE 2018 user manuals

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

II Semester	GEOSPATIAL SIMULATION LABORATORY	L	T	P	C
		--	--	4	2

COURSEOBJECTIVE

This course aims to make the students:

- Experience the 3-D modelling and analysis
- Understand various models
- Program on R-software

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Differentiate between various Interpolation methods
CO2	Delineate watersheds based on DEM and SWAT models
CO3	Build models using Model Builder in ArcGIS & QGIS
CO4	Perform various analysis on Hydrology using Hydrological models
CO5	Program on R software and Python scripting

LIST OF EXPERIMENTS

1. **Spatial Interpolation**- IDW,ANOVA, Thessien, Krigging methods
2. **DEM Applications**
    a. Slope & Aspect
    b. Viewshed Analysis
3. **Watershed Analysis**
    a. Flow Direction
    b. Flow Accumulation
    c. Stream Network
    d. Stream Ordering
    e. Watershed Delineation
4. **Geospatial Models**
    a. Model Builder tools (ArcGIS/QGIS)
    b. Applications: Groundwater Potential Zones, Soil Erosion Zone, etc.,
5. **Hydrological Modeling / Analysis**
    a. HEC-RAS, HEC-HMS, HEC-GeoHMS
    b. SWAT model
    c. Groundwater Modeling System (GMS)
6. **Programming**
    a. Python Script (ArcGIS/QGIS)
    b. R programming Applications: Visualization & Analysis, Model building.

References:

1. ArcPy Introductory Tutorial Nick Eubank May 28, 2014
2. An Introduction to R, W. N. Venables, D. M. Smithand the R Core Team, 2018
3. https://www.hec.usace.army.mil/software/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

		L	T	P	C
II Semester	**MINI PROJECT WITH SEMINAR**	--	--	4	2

II Semester	AUDIT COURSE 2: MANUSCRIPT WRITING AND EDITING	L	T	P	C
		2	0	0	0

UNIT I: INTRODUCTION

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

UNIT II: COMPONENTS

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT III: REVIEW OF LITERATURE

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. 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

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: SUBMISSION

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

TEXT BOOKS:

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

II Semester	AUDIT COURSE 2: DISASTER MANAGEMENT	L	T	P	C
		2	0	0	0

UNIT I- INTRODUCTION

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT II- REPERCUSSIONS OF DISASTERS AND HAZARDS:

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III- DISASTER PRONE AREAS IN INDIA

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

UNIT IV- DISASTER PREPAREDNESS AND MANAGEMENT

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT V- RISK ASSESSMENT

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. Disaster Mitigation- Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

TEXT BOOKS

2. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.

REFERENCES

1. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

2 . Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep
Publication Pvt. Ltd., New Delhi.

II Semester	AUDIT COURSE 2: BIOSAFETY	L	T	P	C
		2	0	0	0

UNIT I INTRODUCTION

Introduction to biotechnology entrepreneurship: strategies in biotechnology led ventures, biotechnology driven business opportunities, major hurdles and barriers in biotechnology driven ventures and their solutions,

UNIT II COST BUDGET AND INVEST

Understanding company Law and commercial knowhow for biotechnological ventures, costing and capital budgeting in biotechnological ventures. Investing in biotechnology driven business, concept of biotechnology incubation center for knowledge-based industry.

UNIT III INTELLECTUAL ISSUES

Biotechnology and Intellectual issues: Introduction to Biotechnology in agriculture, medicine and industry, Biotechnology and its development in developing countries, patent eligibility issues in life science innovations: case study, checks and balances in biotechnology related patents, the importance of entrepreneurship in biotechnology, Intellectual property issues in agriculture, industrial and Pharmaceutical Biotechnology.

UNIT IV BIOHAZARD IDENTIFICATION

Biohazard identification: microbial flora of human and microbial virulence factors, indigenous and pathogenic agents of research animals, laboratory, growth chamber and green house microbial safety,

UNIT V EPIDEMIOLOGY

Epidemiology of laboratory associated infections, biohazard assessment, risk assessment of biological hazards, biohazard control, administrative control, special considerations for Biosafety.

TEXT BOOKS:

1. Craig Shimasaki, Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies, Academic Press, 2014
2. James F. Jordan, Innovation, Commercialization, and Start-Ups in Life Sciences, CRC Press; 1 edition 2014
3. Frank S. David, The Pharmagellan Guide to Biotech Forecasting and Valuation, Pharmagellan; 1st edition, 2017
4. Harikesh Bahadur Singh, Intellectual Property Issues in Biotechnology, CABI 1st edition, 2016
5. Kshitij Kumar Singh, Biotechnology and Intellectual Property Rights: Legal and Social Implications, Springer Nature; 2015 edition
6. Matthew Rimmer, Intellectual Property & Biotechnology: Biological Inventions, Edward Elgar, 2008
7. Goel and Parashar, IPR, Biosafety and Bioethics, Pearson Education India; First edition 2013 Diane O. Fleming (Editor), Debra L. Hunt, Biological Safety: Principles And Practices, ASM Press, 4th Edition

II Semester	AUDIT COURSE 2: VALUE EDUCATION	L	T	P	C
		2	0	0	0

UNIT I- INTRODUCTION

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

UNIT II- VALUES

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature,Discipline

UNIT III- PERONALITY DEVELOPMENT

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT IV- COMPETENCE

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence,Humility, Role of Women.

UNIT V- IMPLEMENTATIONS

All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

TEXT BOOKS

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

II Semester	AUDIT COURSE 2: CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

UNIT I- INTRODUCTION

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working**).** Philosophy of the Indian Constitution: Preamble Salient Features

UNIT II- CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES:

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies Directive Principles of State Policy, Fundamental Duties.

UNIT III- ORGANS OF GOVERNANCE:

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT IV- LOCAL ADMINISTRATION:

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT V- ELECTION COMMISSION:

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

TEXT BOOKS

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.

REFERENCES:

2. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

II Semester	AUDIT COURSE 2: PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0

UNIT I- INTRODUCTION AND METHODOLOGY:

Aims and rationale, Policy background, Conceptual framework and terminology. Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

UNIT II- THEMATIC OVERVIEW

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT III- EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES.

Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV- PROFESSIONAL DEVELOPMENT:

Alignment with classroom practices and follow-up support.Peer support Support from the head teacher and the community. Curriculum and assessment. Barriers to learning: limited resources and large class sizes

UNIT V- RESEARCH GAPS AND FUTURE DIRECTIONS

Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment. Dissemination and research impact

TEXT BOOKS

1 Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.

2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education
research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

REFERENCES:

1. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education.
Oxford and Boston: Blackwell.

2. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

3. www.pratham.org/images/resource%20working%20paper%202.pdf.

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II Semester	AUDIT COURSE 2: STRESS MANAGEMENT BY YOGA	L	T	P	C
		2	0	0	0

UNIT I- INTRODUCTIONS
Definitions of Eight parts of yog. (Ashtanga)

UNIT II- PARTS
Yam and Niyam.

UNIT III- DO`S AND DON'T'S IN LIFE.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT IV- BREATHING EXERCISES
Asan and Pranayam

UNIT V- TYPES
i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects-Types of pranayam

TEXT BOOKS
1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur

REFERENCES:
1. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

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II Semester	AUDIT COURSE 2: ROAD MAP FOR PATENT CREATION	L	T	P	C
		2	0	0	0

UNIT I INTRODUCTION
Introduction to patent – Defination and concepts

UNIT II- ANALYTICS
Patent analytics- Introduction, How to a read patent?

UNIT III RESEARCH GAP AND PLANNING
Use of patent data for research gap analysis Identification of potential patent - various tools Research planning and patent -ling activity

UNIT IV TYPES AND MAINTENANCE
Types of patent and patent timelines Maintenance of laboratory notebook and patenting activity

UNIT V INTERACTIONS
Interaction with patent attorney at various stages of patenting and related timelines to be followed

TEXT BOOKS:
1. Petherbridge, L. (2007). Road map to revolution-patent-based open science. *Me. L. Rev.*, *59*, 339.

III Semester	SOFT COMPUTING TECHNIQUES	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
- To implement soft computing-based solutions for real-world problems.
- Learn techniques of Web GIS and Mobile applications.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1	Identify and describe soft computing techniques and their roles in building intelligent machines
CO2	Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering
CO3	Apply genetic algorithms to combinatorial optimization problems
CO4	Evaluate and compare solutions by various soft computing approaches for a given problem

COURSESYLLABUS

UNIT 1 : INTRODUCTION TO SOFT COMPUTING

Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

UNIT 2 : FUZZY LOGIC

Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT 3 : NEURAL NETWORKS

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.

UNIT 4 : GENETIC ALGORITHMS

Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

UNIT 5 : RECENT TRENDS

Recent Trends in Deep learning, various classifiers, Neural Networks and Geneticalgorithm.

Textbooks:

1. Chakraborty, Udit; Roy, Samir, “Introduction to soft computing: neuro-fuzzy and genetic algorithms”, Pearson, 2013.
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro:Fuzzy and Soft Computing”, Prentice Hall of India, 2003
3. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic: Theory and Applications”, Prentice Hall, 1995.

References:

1. Sang-Yong Rhee, Jooyoung Park, Atsushi Inoue (eds.), “Soft Computing in Machine Learning”, Springer, (2014).
2. Zoran Gacovski, “Soft computing and machine learning with Python”, Arcler Press, (2019).

III Semester	ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT USING RS & GIS	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- To understand the various remote sensing and GIS technological applications in Environmental Impact Assessment and Risk Assessment.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1 Understand the concepts of Environmental Impact Assessment
CO2 Understand the principles involved in EIA management
CO3 Get exposed to various methods of risk assessment and management

COURSESYLLABUS

UNIT 1 : INTRODUCTION

Environmental Impact Assessment (EIA) – Principles and Concepts - Historical development - EIA in Project Cycle - Legal and Regulatory aspects in India - perspectives and requirements - Sources of Environmental hazards – Environmental and ecological risks – Environmental risk assessment framework – Environmental Auditing – Satellites for Environmental Applications

UNIT 2 : COMPONENTS AND METHODS FOR EIA

Methods: Matrices, Networks, Checklists, Overlay – Connections and combinations of processes - Cost benefit analysis – Analysis of alternatives – Software packages for EIA – Expert systems in EIA - Prediction tools for EIA – Mathematical modeling for impact prediction.

UNIT 3 : EIA MANAGEMENT

Assessment of impacts: Air, Water, Soil, Noise, Biological — Impact mapping using RS and GIS - Cumulative Impact Assessment preparation using GIS – Documentation of EIA findings – organization of information and visual display materials – Types of Reports and Reporting – Planning - Decision making – case studies.

UNIT 4 : TOOLS AND METHODS FOR RISK ASSESSMENT

HAZOP and FEMA methods – Cause failure analysis – Event tree and fault tree modeling and analysis – Multimedia and multi pathway exposure modeling of contaminant migration for estimation of contaminant concentrations in air, water, soils, vegetation and animal products – Estimation of carcinogenic and non carcinogenic risks to human health – Methods in Ecological risk assessment: Probabilistic risk assessments – radiation risk assessment – Data sources and evaluation.

UNIT 5 : RISK MANAGEMENT

Risk communication and Risk Perception – comparative risks – Risk based decision making – Risk based environmental standard setting – Risk Cost Benefit optimization and tradeoffs – Emergency Preparedness Plans using GIS – Design of risk management programs – risk based remediation; Risk communication, adaptive management, precaution and stake holder involvement – Case studies.

Textbooks:

1. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey, 2003.
2. Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science, London, 1999.
3. Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
4. Kasperson, J.X. and Kasperson, R.E. and Kasperson,R.E., Global Environmental Risks, V.N.University Press, New York, 2003.

References:

1. Mark Burman, Risks and Decisions for Conservation and environmental management, Cambridge University Press. 314 p. ISBN 0521835348.2005.
2. Susan L |Cutter, “Environmental Risks and Hazards” Prentice Hall of India, New Delhi, 1999.
3. Joseph F Louvar and B Diane Louver, Health and Environmental Risk Analysis fundamentals with applications, Prentice Hall, New Jersey, 1997.
4. Lintz, J. and Simonet, Remote sensing of Environment, Addison Wesley Publishing Company, New Jersey, 1998.

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III Semester	URBAN &REGIONAL PLANNING USING GEOSPATIAL TECHNOLOGIES	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- To introduce the concepts of urban and regional planning
- To explore the use of the geospatial technology in advanced analysis in planning.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1 Gain knowledge of urban and regional planning concepts, the use of geomatics technology in planning and management in urban areas and regions.
CO2 Familiarize with case studies, inputs from Remote Sensing and GIS.
CO3 Get exposure in modelling in urban land use and its forecasting.

COURSESYLLABUS

UNIT 1 : INTRODUCTION

Terminology in Urban planning; Town planning Practices in Developing Countries; Urban & Regional Planning Models; Urban Area delineation Rules; New Towns

UNIT 2 : PLANNING AND DEVELOPMENT

Process of Preparation of Development/Master/Zonal plans; Norms in Urban planning and Building bye-laws; urban Housing, Demand & supply; Types of Housing.

UNIT 3 : IMAGE INTERPRETATION OF URBAN AREAS

Basic Principles; basic reason for applications; factors governing interpretability; Elements of Image interpretation; Techniques of Interpretation; Sequence of activities; Convergence of evidence for urban areas analysis.

UNIT 4 : URBAN LAND USE PLANNING

Issues in urban land use mapping; Urban land use classification system; Rules of classifications; Various Scales; Accuracy assessment.

UNIT 5 : BASE MAPS AND CADASTRAL MAPS FOR URBAN AREAS

Characteristics of Base maps; Scale of base maps; base maps for regional/district planning; Photo-maps; Ortho-photo maps; cadastral mapping; Preparation of foot-print map; RS and GIS for Property tax assessment.

Textbooks:

1. Bracken, Ian (1981). Urban Planning Methods, Research and Policy Analysis. Mathew and Co., USA.
2. Manual of Remote Sensing, Vol.5:"Remote Sensing of Human Settlements", 2006.
3. Subudhi, A.P., Sokhi, B. S. and Roy, P. S. (2001). Remote Sensing and GIS Applications In Urban and Regional Studies, Human Settlement Analysis Division, Indian Institute of Remote Sensing, Dehradun.
4. Thakur, B. et. al. (Ed.) (2007) "City, Society and Planning", Concept Publishing Co., New Delhi.

References:

1. "Manual-National Land Use Land Cover Mapping using Multi-Temporal Satellite Data". National Remote Sensing Agency, Department of Space, Government of India, (2006)
2. "Urban Development Plans Formulation & Implementation (UDPFI) Guidelines, Vol. 1", Ministry of Urban Affairs & Employment, Government of India, (1996).
3. Rhind, David and Hudson, Ray (1980) "Land Use", Methuen Publishers New Delhi.
4. Landen, David(1966). "Photomaps for Urban Planning", Photogrammetric Engineering, Vol. 31, No.1, pp36-146
5. United Nations Economic and Social Commission for Asia and Pacific. "Manual on GIS for Planners and Decision Makers".

III Semester	FUNDAMENTALS OF REMOTE SENSING & GIS	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- Introduce the basic principles of Remote Sensing and GIS techniques.
- learn various types of sensors and platforms
- learn concepts of visual and digital image analyses
- understand the principles of spatial analysis
- appreciate application of RS and GIS to Civil Engineering

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1 Be familiar with ground, air and satellite based sensor platforms.
CO2 interpret the aerial photographs and satellite imageries
CO3 create and input spatial data for GIS
CO4 apply RS and GIS concepts for application

COURSESYLLABUS

UNIT 1 : REMOTE SENSING

History of Remote Sensing, Electromagnetic Radiation, Electromagnetic Spectrum, Energy Interaction with Atmosphere, Energy Interaction with the Earth Surfaces,

Sensors: Characteristics of Remote Sensing Systems, Sensor Resolutions - Advantages & Limitations - Types of Sensors, Airborne Remote Sensing, Spaceborne Remote Sensing.

Platforms: IRS, LANDSAT, SPOT & Recent satellite.

UNIT 2 : DIGITAL IMAGE ANALYSIS

Introduction, Image Data Characteristics, Digital Image Data Formats - Band Interleaved by Pixel (BIP), Band Interleaved by Line (BIL), Band Sequential (BSQ), Elements of Visual Interpretations.

Digital Image Processing: Introduction, image preprocessing, image enhancement, image classification, supervised classification, unsupervised classification.

UNIT 3 : GEOGRAPHIC INFORMATION SYSTEM

Basic Principles, Components, Application areas of GIS, Map projections.

Data entry and preparation: Spatial Data Structures, Raster and Vector Data Formats, Data Inputs, Data Manipulation, Data Retrieval, Data Analysis and Data Display.

UNIT 4 : SPATIAL DATA ANALYSIS

Introduction, Overlay Function-Vector Overlay Operations, Raster Overlay Operations, Arithmetic Operators, Comparison and Logical Operators, Conditional Expressions, Overlay using a Decision Table, Network Analysis-Optimal Path Finding, Network Allocation, Network Tracing.

UNIT 5 : REMOTE SENSING & GIS APPLICATIONS

Land Cover and Land Use, Agriculture, Forestry, Geology, Geomorphology, Urban & Transportation, Flood zoning and mapping, Groundwater prospects, Watershed management.

Textbooks:

1. Bhatta B (2008). 'Remote sensing and GIS', Oxford University Press.
2. Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2013) 'Remote Sensing and Image Interpretation', Wiley India Pvt. Ltd.
3. George Joseph (2013) 'Fundamentals of Remote Sensing', Universities Press.
4. Demers, M.N, (2013) 'Fundamentals of Geographic Information Systems', Wiley India Pvt. Ltd

References:

1. Schowengerdt, R. A (2006) 'Remote Sensing', Elsevier publishers.
2. Narayan LRA, (2012) 'Remote Sensing and its Applications', Universities Press.
3. Burrough P A and R.A. McDonnell, (1998) 'Principals of Geographical Information Systems', Oxford University Press.
4. Chor Pang Lo and Albert K W Yeung, (2006) 'Concepts and Techniques of Geographical Information System', Prentice Hall (India).
5. Kang-Tsung Chang, (2009) 'Introduction to Geographic Information Systems', McGraw Hill Higher Education.
6. Kumar S, (2005) 'Basics of Remote sensing & GIS', Laxmi Publications.

III Semester	APPLICATION OF REMOTE SENSING IN ENVIRONMENTAL MANAGEMENT	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- To understand the various remote sensing and GIS technological applications in the field of Environmental Engineering.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1 Acquire knowledge of various components of environment and assessment of their quality.

CO2 Gain exposure to current and future satellite missions used for environmental assessment and modelling.

COURSESYLLABUS

UNIT 1 : SATELLITE DATA FOR ENVIRONMENTAL MANAGEMENT

Introduction - Environmental satellite Mission: GEOS, NOAA, AVHRR, CZCS, Oceansat, Kalpana and others – Spectral characteristics - Data Products – Analysis Tools - Monitoring land, water, atmosphere and ocean using Remote Sensing Data

UNIT 2 : WATER QUALITY MANAGEMENT

Classification of water quality - Sampling procedure - Quality analysis and GIS modeling Pipe Network Design using GIS - Spectral responses of clear and contaminated water – Aquifer Vulnerability: Intrinsic and specific vulnerability - DRASTIC, SINTACS – Ground Water Quality Modelling: MODFLOW, MT3D – Sea water Intrusion Modelling – pollution diffusion model in river - Case studies.

UNIT 3 : AIR QUALITY AND NOISE MANAGEMENT

Air Quality Standards – Chemical and Physical Components - Sampling – Mapping of atmospheric pollution - Air pollution due to industrial activity - Plume behaviors - Dispersion model: Gaussian Plume model - Remote Sensing to monitor atmosphere constituents - Case Studies. Noise pollution: Standards - Measurement of noise and its intensity - Sources -Effects – noise modeling.

UNIT 4 : SOLID WASTE MANAGEMENT

Definition – sources – identification of storage and collection location – Geospatial analysis of collection route - Site selection: Transfer station, Disposal site – case studies.

UNIT 5 : GLOBAL PROSPECTIVE

Prevention and Control measures – Carbon footprints and sinks, carbon trading, carbon credits and marketing, Indian and international status - case studies.

Textbooks:

1. Diofantos G. Hadjimitsis (Ed), “Remote Sensing of Environment-Integrated Approaches”, Intechopen, (2013).
2. Qihao Weng (ed) “Advances in Environmental Remote Sensing - Sensors, Algorithms, and Applications”, CRC Press, 2011.
3. Eric C. Barrett, Leonard F. Curtis, “Introduction to Environmental Remote Sensing”, 4th Edition, Routledge-Taylor and Francis, (2013).
4. Robert Scally, “GIS for Environmental Management”, ESRI Press (2006).

References:

1. Ian L.Pepper, Charles P.Gerbaand Mark L.Brusseau, "Environmental and Pollution science", Academic Press, 2nd Edition, 2006. ISBN : 978-0125515030
2. David N.Miclsen, "Environmental Site Characterization and Ground water Monitoring", 2nd edition, CRC Press, 2005, ISBN: 978-1566705899.
3. Roger D.Griffin, Principles of Air Quality Management, 2nd edition, 2006, CRC Press.
4. Tchobanoglous George, Hilary Theisen, Samuel Vigi, "Integrated Solid Waste Management", Mc Graw – Hill Inc, Singapore. 1993.
5. Michele Campagna, "GIS for sustainable development", CRC Press; 1st Edition, 2005.

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III Semester	INTERNET OF THINGS	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- To introduce the concepts of Internet of Things (IOT)
- To understand interconnection and integration of the physical world and the cyber space.
- to understand the design principles of IOT Devices.

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1 Able to understand the application areas of IOT.
CO2 Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
CO3 Able to understand building blocks of Internet of Things and characteristics.

COURSESYLLABUS

UNIT 1 : INTRODUCTION

Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT,

Sources of the IoT, M2M Communication, IoT Examples.

UNIT 2 : DESIGN PRINCIPLES

Machine to Machine, IoT/M2M systems layers and design standardization, Difference between IoT and M2M, Softwaredefine Network

UNIT 3 : HARDWARE FOR IOT

Sensors, digital sensors, actuators, radio frequency identification (RFID) technology, wirelesssensor networks, participatory sensing technology.

UNIT 4 : NETWORK & COMMUNICATION ASPECTS IN IOT

Wireless medium access issues, MAC protocol survey, Survey routingprotocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

UNIT 5 : IOT APPLICATIONS – SMART CITY

Smart metering, e-health, city automation, automotive applications, home automation, smartcards, Communicating data with H/W units, mobiles, tablets, smart street lights.

Textbooks:

1. Jeeva Jose, “Internet of Things”, Khanna Publishing; First edition 2018.
2. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
3. Michael Miller “The Internet of Things” Pearson Education India; 1st edition 2015

References:

1. Raj Kamal “INTERNET OF THINGS”, McGraw-Hill, 1ST Edition, 2016
2. Adrian McEwen,Hakin Cassimally, “Designing the Internet of Things”,Wiley,2015.
3. Olivier Hersent,DavidBoswarthick, Omar Elloumi, “The Internet of Things key applications and protocols”, Willey,2nd edition ,2012.

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III Semester	BUSINESS ANALYTICS	L	T	P	C
		3	0	--	3

COURSEOBJECTIVE

This course aims to make the students:

- The main objective of this course is to give the student a comprehensive understanding of business analytics methods.

COURSEOUTCOMES

After completion of course,

CO1 Students will demonstrate knowledge of data analytics.

CO2 Students will demonstrate the ability of think critically in making decisions based on data and deep analytics

CO3 Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making

CO4 Students will demonstrate the ability to translate data into clear, actionable insights

COURSESYLLABUS

UNIT 1 : Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst.

Stakeholders: the project team, management, and the front line, Handling Stakeholder Conflicts.

UNIT 2 : Life Cycles: Systems Development Life Cycles, Project Life Cycles, ProductLife Cycles, Requirement LifeCycles.

UNIT 3 : Forming Requirements: Overview of Requirements, Attributes ofGoodRequirements, Types of Requirements, Requirement Sources,Gathering Requirements from Stakeholders, Common RequirementsDocuments.

UNIT 4 : Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN),

Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

UNIT 5 : Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements.

Managing Requirements Assets: Change Control, Requirements Tools

RecentTrendsin:Embeddedandcollaborativebusinessintelligence,Visualdatarecovery, Data Storytelling and Data Journalism.

References:

7. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, DaraG. Schniederjans, Christopher M. Starkey, Pearson FTPress.
8. Business Analytics by James Evans, personsEducation.

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III Semester	INDUSTRIAL SAFETY	L	T	P	C
		3	0	--	3

COURSESYLLABUS

Unit-1: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards,types, causes and preventive steps/procedure, describe salient points of factories act 1948 for healthand safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc,Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit-2: Fundamentals of maintenance engineering: Definition and aim ofmaintenanceengineering, Primary and secondary functions and responsibility of maintenancedepartment,Types of maintenance, Types and applications of tools used for maintenance, Maintenancecost& its relation with replacement economy, Service life ofequipment.

Unit-3: Wear and Corrosion and their prevention: Wear- types, causes, effects, wearreductionmethods, lubricants-types and applications, Lubrication methods, general sketch, workingandapplications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv.Gravitylubrication,v.Wickfeedlubricationvi.Sidefeedlubrication,vii.Ringlubrication,Definition, principle and factors affecting the corrosion. Types of corrosion,corrosionpreventionmethods.

Unit-4: Fault tracing: Fault tracing-concept and importance, decision treeconcept, needandapplications,sequenceoffaultfindingactivities,showasdecisiontree,drawdecisiontree forproblems in machine tools, hydraulic, pneumatic,automotive, thermal andelectricalequipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internalcombustionengine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their generalcauses.

Unit-5: Periodic and preventive maintenance: Periodic inspection-concept andneed,degreasing, cleaning and repairing schemes, overhauling of mechanicalcomponents,overhauling of electrical motor, common troubles and remedies of electric motor,repaircomplexitiesanditsuse,definition,need,stepsandadvantagesofpreventivemaintenance.Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii.Aircompressors, iv. Diesel generating (DG) sets, Program and schedule of preventivemaintenanceof mechanical and electrical equipment, advantages of preventive maintenance. Repaircycleconcept andimportance

References:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da InformationServices.
2. Maintenance Engineering, H. P. Garg, S. Chand andCompany.
3. Pump-hydraulic Compressors, Audels, Mcgrew HillPublication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & HallLondon.

III Semester	OPERATIONS RESEARCH	L	T	P	C
		3	0	--	3

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1 Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
CO2 Students should able to apply the concept of non-linear programming
CO3 Studentsshouldabletocarryoutsensitivityanalysis
CO4 Studentshouldabletomodeltherealworldproblemandsimulateit

COURSESYLLABUS

Unit1:

Optimization Techniques, Model Formulation, models, General L.R Formulation, SimplexTechniques, Sensitivity Analysis, Inventory ControlModels.

Unit2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dualsimplex method - sensitivity analysis - parametricprogramming.

Unit3:

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - maxflowproblem -CPM/PERT.

Unit4

Scheduling and sequencing - single server and multiple server models - deterministicinventory models - Probabilistic inventory control models - GeometricProgramming.

Unit5

Competitive Models,Single and Multi-channel Problems, Sequencing Models, DynamicProgramming, Flow in Networks, Elementary Graph Theory, Game TheorySimulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI,2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi,1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub.2009
5. Pannerselvam, Operations Research: Prentice Hall of India2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India2010

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III Semester	COST MANAGEMENT OF ENGINEERING PROJECTS	L	T	P	C
		3	0	--	3

COURSEOUTCOMES

After completion of course, students would be ableto:

CO1 Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
CO2 Students should able to apply the concept of non-linear programming
CO3 Studentsshouldabletocarryoutsensitivityanalysis
CO4 Studentshouldabletomodeltherealworldproblemandsimulateit

COURSESYLLABUS

Unit1:

Introduction and Overview of the Strategic Cost Management Process.

Unit2:

Costconceptsindecision-making;Relevantcost,Differentialcost,IncrementalcostandOpportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operationalcontrol; Provision of data forDecision-Making.

Unit3:

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

Unit4:

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit5:

Quantitative techniques for cost management, Linear Programming, PERT/CPM,Transportation problems, Assignment problems, Simulation, Learning CurveTheory

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, NewDelhi
2. Charles T. Horngren and George Foster, Advanced ManagementAccounting
3. Robert S Kaplan Anthony A. Alkinson, Management & CostAccounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheelerpublisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co.Ltd.

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III Semester	COMPOSITE MATERIALS	L	T	P	C
		3	0	--	3

COURSESYLLABUS

Unit1:

INTRODUCTION: Definition – Classification and characteristics of Compositematerials. Advantages and application of composites. Functional requirements of reinforcement and matrix.Effect ofreinforcement(size,shape,distribution,volumefraction)onoverallcompositeperformance.

Unit2:

REINFORCEMENTS:Preparation-layup,curing,propertiesandapplicationsofglassfibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers,particlereinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule ofmixtures. Isostrainand Isostressconditions.

Unit3:

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusiontechnique,Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of CeramicMatrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties andapplications.

Unit4:

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compoundsand prepregs – hand layup method – Autoclave method – Filament winding method – Compressionmoulding – Reaction injection moulding. Properties andapplications.

Unit5:

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximumstrain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insightstrength;Laminate strength-ply discount truncated maximum strain criterion; strength design using capletplots; stress concentrations.

Text books:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, WestGermany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted byR. Balasubramaniam, John Wiley & Sons, NY, Indian edition,2007.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, NewDelhi
2. Charles T. Horngren and George Foster, Advanced ManagementAccounting
3. Robert S Kaplan Anthony A. Alkinson, Management & CostAccounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheelerpublisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co.Ltd.

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III Semester	WASTE TO ENERGY	L	T	P	C
		3	0	--	3

COURSESYLLABUS

Unit1:

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

Unit2:

BiomassPyrolysis:Pyrolysis–Types,slowfast–Manufactureofcharcoal–Methods-Yields andapplication–Manufactureofpyrolyticoilsandgases,yieldsandapplications.

Unit3:

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers– Fluidized bed gasifiers – Design, constructionand operation – Gasifier burner arrangement forthermalheating–Gasifierenginearrangementandelectricalpower– Equilibriumandkineticconsiderationin gasifieroperation.

Unit4:

BiomassCombustion:Biomassstoves–Improvedchullahs,types,someexoticdesigns,Fixedbed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, constructionand operation - Operation of all the above biomasscombustors.

Unit5:

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technologyandstatus - Bio energy system - Design and constructional features - Biomass resources andtheir classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion- biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion -Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urbanwaste to energy conversion - Biomass energy programme inIndia.

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