M.Tech. (Full Time)

REMOTE SENSING & GEOGRAPHICAL INFORMATION SYSTEM

Curriculum & Syllabus

2013 – 2014

FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY
SRM NAGAR, KATTANKULATHUR – 603 203

S.R.M UNIVERSITY
SCHOOL OF CIVIL ENGINEERING
M.TECH. REMOTE SENSING & GEOGRAPHICAL INFORMATION SYSTEM
(FULL-TIME)
(For students admitted from 2013 - 14 onwards)
CURRICULUM

COURSE CODE	COURSE TITLE	L	T	P	C
SEMESTER – I					
RS2001	Remote Sensing and Its Techniques	3	0	2	4
RS2002	Digital Image Processing and Techniques	3	0	2	4
RS2003	Geological Remote Sensing and technique	3	0	2	4
MA2003	Geo-Statistical methods	3	0	0	3
RSXXXX	Programme Elective 1	3	0	0	3
Total		**15**	**0**	**6**	**18**
Total Contact Hours -21					
SEMESTER – II					
RS 2004	GIS and Software	3	0	2	4
RS 2005	GIS Data Analysis	3	0	2	4
RS 2006	DBMS	3	0	2	4
XXXXXX	Inter Disciplinary Elective Course	3	0	0	3
RSXXXX	Programme Elective 2	3	0	0	3
Total		**15**	**0**	**6**	**18**
Total Contact Hours - 21					
SEMESTER – III					
RSXXXX	Programme Elective 3	3	0	0	3
RSXXXX	Programme Elective 4	3	0	0	3
RSXXXX	Programme Elective 5	3	0	0	3
RSXXXX	Programme Elective 6	3	0	0	3

RS2048	Industrial Training	0	0	1	1
RS2049	Project Work – Phase I	0	0	12	6
	Total	**12**	**0**	**13**	**19**
Total Contact Hours - 25					
SEMESTER – IV					
RS2050	Project Work – Phase II	0	0	32	16
	Total	**0**	**0**	**32**	**16**
Total Contact Hours -32					**32**
Total Credits to be earned for the award of M.Tech degree = 71					

LIST OF COURSES

COURSE CODE	COURSE TITLE	L	T	P	C
CORE COURSES					
RS2001	Remote Sensing and Its Techniques	3	0	2	4
RS2002	Digital Image Processing and Techniques	3	0	2	4
RS2003	Geological Remote Sensing and technique	3	0	2	4
RS2004	GIS and Software	3	0	2	4
RS2005	GIS Data Analysis	3	0	2	4
RS2006	DBMS	3	0	2	4
PROGRAMME ELECTIVE COURSES					
RS2101	Basics and Digital Cartography	3	0	0	3
RS2102	GPS & Electronic Surveying	3	0	0	3
RS2103	Microwave Remote Sensing and Applications	3	0	0	3
RS2104	Hyperspectral Remote sensing and Applications	3	0	0	3
RS2105	Digital Photogrammetry and Applications	3	0	0	3
RS2106	Lidar Remote sensing and Applications	3	0	0	3
RS2107	Non-Topographic Photogrammetry	3	0	0	3
RS2108	RS & GIS for Urban and Regional Planning	3	0	0	3
RS2109	RS & GIS for Hydrology and Water Resources	3	0	0	3

RS2110	RS & GIS for Agriculture and Forestry	3	0	0	3
RS2111	RS & GIS for Environmental Engineering	3	0	0	3
RS2112	RS & GIS for Ocean Engg & coastal Management	3	0	0	3
RS2113	RS & GIS for Disaster Management	3	0	0	3
RS2114	Web GIS	3	0	0	3
SUPPORTIVE COURSES					
MA2003	GEO-Statistical methods	3	0	0	3

CONTACT HOUR/CREDIT:
L: Lecture Hours per week **T: Tutorial Hours per week**
P: Practical Hours per week **C: Credit**

Course code	Course Title	L	T	P	C
RS2001	**REMOTE SENSING AND ITS TECHNIQUES**	**3**	**0**	**2**	**4**
	Prerequisite				
	Nil				
	Total Contact Hours- 75				

PURPOSE

To understand the Basic Principles of Remote Sensing and Techniques

INSTRUCTIONAL OBJECTIVES

1.	To study the basic concepts of remote sensing.
2.	To study the aerial photography and photogrammetry
3.	To study satellite remote sensing principles
4.	To study different satellites and its applications.
5.	To understand various types of satellite remote sensing and interpretation Techniques

UNIT I-INTRODUCTION AND CONCEPTS (9 hours)

Introduction of Remote Sensing – Energy sources and Radiation principles, Energy equation, EMR and Spectrum, EMR interaction with Atmosphere-scattering, Absorption, EMR interaction with earth surface features-reflection, absorption, emission and transmission, Spectral response pattern , vegetation, soil, water bodies- Spectral reflectance

UNIT II-AERIAL PHOTOGRAPHY AND PHOTOGRAMMETRY

(9 hours)

Introduction-,Terrestrial and Aerial photographs - vertical and oblique photographs - height determination contouring - photographic interpretations - stereoscopy – parallax bar- Flight Planning- Photo Interpretation, Applications of aerial Photos-Photo theodolite

UNIT III-SATELLITE REMOTE SENSING PRINCIPLES (9 hours)

Data acquisition –Procedure, Reflectance and Digital numbers- Intensity-Reference data , Ground truth, Analog to digital conversion, Detector mechanism-Spectro- radiometer-Ideal remote sensing system – Characters of real and successful remote sensing system- Platforms and sensors- orbits-types – Resolution

UNIT IV-REMOTE SENSING SATELLITES (9 hours)

Land observation satellites, characters and applications, IRS series, LANDSAT series, SPOT series, High resolution satellites, character and applications, CARTOSAT series, IKONOS Series, QUICKBIRD series, Weather/Meteorological satellites, INSAT series, NOAA, GOES, NIMBUS Applications, Marine observation satellites OCEANSAT

UNIT V-TYPES OF REMOTE SENSING AND IMAGE INTERPRETATION (9 hours)

Introduction- Active, Passive, Optical Remote sensing, visible, infrared, thermal, sensors and characters. Microwave remote sensing Sensors, Concept of Microwave remote sensing, SLAR, SAR Scattrometers,- Altimeter, Characteristics , Image interpretation characters.

Practical (30 hours)

REFERENCES

1. M. Anji Reddy, Textbook of Remote Sensing and Geographical Information systems, BS Publications, Hyderabad**.** 2011. ISBN: 81-7800-112-8
2. A.M.Chandra and S.K. Gosh. Remote Sensing and GIS, Narosa Publishing Home, New Delhi 2009.
3. Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman Remote sensing and image interpretation John Wiley & Sons, 2008
4. George Joseph , Fundamentals of Remote Sensing Universities Press, Hyderabad 2005

Course code	Course Title	L	T	P	C
RS2002	**DIGITAL IMAGE PROCESSING AND TECHNIQUES**	**3**	**0**	**2**	**4**
	Prerequisite				
	Nil				
	Total Contact Hours- 75				

PURPOSE

To understand the current remote sensing system, Digital Image processing and Integration

INSTRUCTIONAL OBJECTIVES

1.	To study the digital data, image format and extortion.
2.	To study various image distortion and rectification
3.	To study and apply various image enhancement techniques
4.	To understand image classification techniques
5.	To perform image analysis and interpretation

UNIT I-IMAGE ACQUISITION AND FORMAT (9 hours)

Satellite data acquisition, DN characters-kernels- storage devices, CC, CDisk, Optical disk.Data retrieval. Export and import, Data formats, BSQ, BIL, BIP , Run length encoding, Image Compression Data products , hard copy, digital products, Image display system, requirement.

UNIT II-IMAGE DISTORTION AND RECTIFICATION (9 hours)

Introduction-Sensor model, Preprocessing and Post processing Geometric distortion, sources and causes for distortion, rectification, GCP, Resampling, Image registration, transformation,Radiometric distortion, sources and causes, Computation of radiance, Computation of reflectance, cosmetic operations, Noise removal, atmospheric correction.

UNIT III-IMAGE ENHANCEMENT (9 hours)

Satellite image statistics ,Univariate and multi-variate statistics. Basics of Histogram, noise models, image quality,. contrast manipulation, grey level thresholding, level slicing, contrast stretching- Spatial feature manipulations, spatial filtering, convolution Low pass, high pass, edge enhancement, edge detection, Fourier analysis .

UNIT IV-IMAGE CLASSIFICATION (9 hours)

Introduction,Classification techniques, feature extraction, Supervised, training stage, classification stage, scatterogram, minimum distance to mean

classifier, Parallelepiped classifier, Gaussian maximum Likelihood classifier,unsupervised classification, Hybrid classifier, classification of mixed pixel-fuzzy classification, output stage, classification accuracy , error matrix

UNIT V-IMAGE ANALYSIS (9 hours)

Digital Image interpretation ,Pattern recognition, shape analysis, Textural analysis, Decision concepts, fuzzy sets and Evidential reasoning, Change detection, multitemporal data merging, multi sensor image merging-merging image data with ancillary data, Expert system, Artificial Neural Network; Integration with GIS.

Practical (30 hours)

REFERENCES

1. M. Anji Reddy, Textbook of Remote Sensing and Geographical Information systems, BS Publications, Hyderabad**.** 2011. ISBN : 81-7800-112-8
2. Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman Remote sensing and image interpretation John Wiley & Sons, 2008
3. John R. Jenson "Introducing Digital Image Processing" - Prentice Hall, New Jersey 1986
4. Robert A. Schowengergt, "Techniques for Image Processing and Classification in Remote Sensing"; 1984. ISBN 13: 9780126289800

Course code	Course Title	L	T	P	C
RS2003	**GEOLOGICAL REMOTE SENSING AND TECHNIQUE**	**3**	**0**	**2**	**4**
	Prerequisite				
	Nil				
	Total Contact Hours- 75				
PURPOSE					
To study the role of remote sensing and GIS Tools in Earth Sciences.					
INSTRUCTIONAL OBJECTIVES					
1.	To study the spectral characteristics of Rocks and Minerals.				
2.	To study the remote sensing for geological structures mapping				
3.	To study the remote sensing for Lithological mapping				
4.	To understand geological survey techniques and GIS integration				

UNIT I-SPECTRAL PROPERTIES OF ROCKS AND MINERALS

(9 hours)

Reflectance Properties of Rocks, minerals in visible, NIR, MIR, SWIR, TIR and Microwave regions Laboratory spectroscopy - laboratory and field spectral data comparative studies, Spectral reflection curves for important Rocks, Minerals

UNIT II-GEOLOGICAL STRUCTURE AND APPLICATIONS

(9 hours)

Significance of Geological structures, Role of aerial photographs, Photo interpretation characters of photographs and satellite images,structural mapping, Fold, fault, Lineaments, Direction circular features. Intrusive rocks, rock exposure, Fractures and Joints, Rose diagram. Digital image processing for structural mapping

UNIT III-LITHOLOGICAL MAPPING (9 hours)

Introduction on Igneous rocks, sedimentary rocks, metamorphic rocks, mapping of regional scale lithological units, Image Characters of igneous rocks, sedimentary and metamorphic rocks, examples. Digital image processing of various rock types, resolution and Scale of lithological mapping and advantages

UNIT IV-GEOMORPHOLOGICAL MAPPING (9 hours)

Significance of landform, Geomoprphological guide, interpretation and image/photo characters, Tectonic landforms, Fluvial landforms, Denudational landforms, Volcanic landforms- Aeolian landforms, Coastal landforms. Importance of ground truth and geological field data collection

UNIT V-GEOLOGICAL SURVEY TECHNIQUES AND DATA INTEGRATION (9 hours)

Geophysical survey, surface investigation, subsurface investigation, Gravity survey, Seismic survey, refraction methods, reflection methods, applications, Magnetic survey and Electrical resistivity survey, self potential methods, potential drop methods, resistivity values, data interpretation, Curve fitting, GIS data generation , integration and analysis

Practical (30 hours)

REFERENCES

1. John J. Qu , Wei Gao, Menas Kafatos , Robert E. Murphy, Vincent V. Salomonson, Earth Science Satellite Remote Sensing,Springer 2007
2. Gupta, R.P Remote sensing Geology, Springer, 2003.

3. Jean-yves scanvk, Aerospatial Remote Sensing in Geology, A.A. Balakarma,Netherlands, 1997
4. Drury, S. A. Image interpretation in Geology,. Chapman and Hall, London. 1993
5. Pandey, S. N. Principles and applications of Photogeology, Wiley eastern. 1987

Course code	Course Title	L	T	P	C
RS2004	**GIS AND SOFTWARE**	**3**	**0**	**2**	**4**
	Prerequisite				
	Nil				
	Total Contact Hours- 75				

PURPOSE	
To study and understand basic principles of GIS	
INSTRUCTIONAL OBJECTIVES	
1.	To study the basic concepts of GIS.
2.	To study the data structure in GIS
3.	To study data conversion in GIS and Meta data

UNIT I-BASICS OF GIS (9 hours)

Introduction, concepts , Information system , components of GIS, History, Geospatial data architecture, Operations, Geographic co ordinate systems, Map projections, concepts, Input data for GIS , display ,types of output products. GIS categories, Level and scale of Measurement, importance of data quality

UNIT II-VECTOR DATA & PROCESSING (9 hours)

GIS data types, data Representation, Data sources, typical GIS data sets, Data Acquisition, vector data model , topology, topology rules, Non topological vector data, object based vector data model, relationship between classes, data structure, data verification and editing spatial data models and errors – GIS database , attribute data input and management

UNIT III-RASTER DATA AND PROCESSING (9 hours)

Raster data – elements of data model, cell, value, data structure, cell by cell encoding, run length encoding, Quad tree, Header files,, format, Types of raster data, data compression, Linking and integration of vector data, Registration

UNIT IV-DATA CONVERSION AND EDITING (9 hours)

Data format conversion, Medium conversion, Spatial interpolation, measurement and analysis methods, Data accuracy and standards, Attribute data input and Management- Relational mode- Data manipulation- l eclassification techniques,

UNIT V-META DATA AND GIS MODELLING (9 hours)

Meta data – data standard- OGC- open source GIS - GIS modeling, basic elements, classification, model processing, integration, Binary models, index model, regression models, linear regression model, logistic regression model, process model.

Practical (30 hours)

REFERENCES

1. M. Anji Reddy, Textbook of Remote Sensing and Geographical Information systems, BS Publications, Hyderabad**.** 2011. ISBN : 81-7800-112-8
2. Kang tsung Chang ., Introduction to Geographical Information System, Tata McGraw Hill, 7th edition, 2010
3. Burrogh P.A., Principles of Geographical Information System for Land Resources Assessment, Oxford Publications, | ISBN-13: 978-0198545927, 1986.
4. A.M. Chandra and S.K. Ghosh. Remote Sensing and Geographical Information system. Narosa Publishing House, New Delhi. 2006
5. Paul A. Longley, Micheal F. Goodchild, David J. Magaine David J. Magaine, David W Rhind. Geographical Information System. Vol. I & II, John wiley & Sons.Inc1999.

Course code	Course Title	L	T	P	C
RS2005	GIS DATA ANALYSIS	3	0	2	4
	Prerequisite				
	Nil				
	Total Contact Hours- 75				
PURPOSE					
To familiarize with different GIS Software and functionalities. To let the student learn the versatile application capabilities of different GIS analysis techniques					

INSTRUCTIONAL OBJECTIVES	
1.	To know the Different GIS software and their capabilities.
2.	To study the various Functions tools available and Perform query operations in GIS.
3.	To study the different analysis types in GIS.
4.	To learn MCE, Weightage and Ranking capabilities of GIS.
5.	To learn the Internet Capabilities of Web GIS

UNIT I-INTRODUCTION TO GIS SOFTWARES (9 hours)

Defining GIS -introduction to Spatial Data File Formats - Basics of ArcCatalog and Arc Map, Tabular Data Design, Functions, pitfall and Reprocessing, Tables, Queries, and Basic Geoprocessing Tools, Data sources and data collection data files in ArcMap and ArcPad, The Raster Data File Format-, Overview of MAP INFO, QGIS, ERDAS IMAGINE

UNIT II-DATA ANALYSIS TOOLS (9 hours)

The Spatial Analyst Extension and Model Builder, Metadata -Georeferencing – Geocoding- Network Analyst, Interpolation and Surface Modeling ,Interpolation Methods , The Geodatabase , Building a Geodatabase, Cartographic Design .

UNIT III-SPATIAL DATA ANALYSIS (9 hours)

Spatial interpolation, measurement and analysis methods, reclassification techniques, Buffer analysis, overlay analysis, Vector over lay analysis, Topological overlay, raster over lay analysis – measurement of length, perimeter and area – queries –2D to 3 D conversion- DTM and DEM, advantages and disadvantages, Network modeling,

UNIT IV-GIS MODELLING (9 hours)

GIS modeling, basic elements – classification, model processing, integration, Binary models, index model, regression models – linear regression model, logistic regression model, process model, applications – problem identification– designing data model, project management and evaluation – implementation

UNIT V-SPATIAL ANALYSIS (9 hours)

GIS Applications in automated mapping (AM)/ Facility management (FM) Multi criteria evaluation using GIS - Techniques - case studies - use of knowledge based tools with GIS - Expert system.Object oriented GIS, web based GIS, WEB based GIS Applications.

Practical (30 hours)

REFERENCES

1. Burrogh P.A., Principles of Geographical Information System for Land Resources Assessment, Oxford Publications, 1980
2. A.M. Chandra and S.K. Ghosh 2000. Remote Sensing and GIS. Narosa Publishing House, New Delhi
3. Paul A. Longley, Micheal F. Goodchild, David J. Magaine David J. Magaine, David W Rhind. Geographical Information System. Vol. I & II, John wiley & Sons. Inc.,1999
4. Kang-tsung Chang , Introduction to Geographical Information System, , Fourth Edition, Tata McGraw Hill,2008

Course code	Course Title	L	T	P	C
RS2006	**DBMS**	**3**	**0**	**2**	**4**
	Prerequisite				
	Nil				
	Total Contact Hours- 75				

PURPOSE	
To study the data base management systems.	
INSTRUCTIONAL OBJECTIVES	
1.	To study the data, data models and database types
2.	To study the file organization and normalization
3.	To the database operations and integration with GIS

UNIT I-TYPES OF DBMS (9 hours)

Data -Types -Database – Attribute – Types - Hardware and Software requirements -Database Management Systems -Types of DBMS -Hierarchial, Network, Relational Models - Distributed Databases - Client Server Databases -Knowledge Based Systems -Geographic Databases - E-R diagram

UNIT II-NORMALIZATION (9 hours)

File Organization -Sequential, Index Sequential, Random, Multikey file Organisation -advantages -Relational Database Management System - Normalization -First, Second, Third, Boyce-Codd, Fourth and Fifth normalizations.

UNIT III-ORACLE OPERATORS (9 hours)

Oracle Operators -Arithmetic, Comparison, Logical Operators - Operator Precedence -Privilege commands - SQL functions -Single row, data,

character and numeric functions -Group functions - Count functions- Triggers in Oracle.

UNIT IV-SQL FUNCTIONS (9 hours)

SQL – TCL, DDL, DML – Data types – basic constraints – change statements – basic queries in SQL – Complex SQL queries – Nested, correlated Nested queries – joined tables – Insert, Delete, update Statements in SQL.

UNIT V-ORACLE DEVELOPER 2000 (9 hours)

Oracle forms – Object Navigator – Triggers – Hierarchical levels – Alerts – Blocks – Items – Editors – Record groups – LOVs – Object Groups – Menus – Query – Oracle reports – Data model Editor – Layout Editor

Practical (30 hours)

REFERENCES

1. Remez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Fourth Edition, Published by Pearson Education (Singapore) Pvt. Ltd.. 2004.
2. Bipin C. Desai, An Introduction to Database Systems, Galgotia Publications PVT LTD First edit 1993
3. Michael Abbey and Michael J Corey, ORACLE 8 -A Beginner's Guide, Tata Mc.Graw Hill, 1998
4. C.J. Date, An Introduction to Database Systems, Addison Wesley, sixth edition, 1995

RS2048	**INDUSTRIAL TRAINING (Training to be undergone after II semester)**	**0**	**0**	**1**	**1**
	3 week practical training in industry				
	Prerequisite				
	Nil				
PURPOSE					
To provide practical exposure in Remote sensing and Geographical information System related organizations.					
INSTRUCTIONAL OBJECTIVES					
1.	Students have to undergo three – week practical training in Remote sensing				

	and Geographical information System related organizations so that they become aware of the practical applications of theoretical concepts studied in the class rooms.

Students have to undergo three-week practical training in Remote sensing and Geographical information System related organizations of their choice but with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

Assessment process

This course is mandatory and a student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

		L	T	P	C
RS2049	**PROJECT WORK PHASE I (III semester)**	**0**	**0**	**12**	**6**
RS2050	**PROJECT WORK PHASE II (IV semester)**	**0**	**0**	**32**	**16**
PURPOSE					
To undertake research in an area related to the program of study					
INSTRUCTIONAL OBJECTIVE					
The student shall be capable of identifying a problem related to the program of study and carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society.					

M.Tech projects should be socially relevant and research oriented ones. Each student is expected to do an individual project. The project work is carried out in two phases – Phase I in III semester and Phase II in IV semester. Phase II of the project work shall be in continuation of Phase I only. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project. The method of assessment for both Phase I and Phase II is shown in the following table:

Assessment	Tool	Weightage
In- semester	I review	10%
	II review	15%
	III review	35%
End semester	Final viva voce examination	40%

Student will be allowed to appear in the final viva voce examination only if he / she has submitted his / her project work in the form of paper for presentation / publication in a conference / journal and produced the proof of acknowledgement of receipt of paper from the organizers / publishers.

Course code	Course Title	L	T	P	C
RS2101	**BASICS AND DIGITAL CARTOGRAPHY**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				
	Total Contact Hours- 45				

PURPOSE

To learn the fundamental concepts of Cartography and its advancements as Digital Cartography. The engineers will be enabling to different aspects of Map Making, Generalization, Map Production and Map Reproduction

INSTRUCTIONAL OBJECTIVES

1.	To know the basics, importance, and methods of Cartography
2.	To study the various maps projection and co-ordinate systems.
3.	To study the different aspects of design in cartography.
4.	To learn the Generalization and designing aspects of cartography.
5.	To learn the different techniques of Map production and Reproduction

UNIT I-INTRODUCTION (9 hours)

History and development of Cartography, Definition, scope and concepts of cartography. Characteristics of Map. Categories of maps.. Methods of mapping, relief maps, thematic maps. Trends in Cartography.

UNIT II-EARTH MAP RELATION (9 hours)

Geodesy,Map projection, classification principles of construction of common projections, cylindrical, conical, azimuthal and globular projections. Properties & uses of projection. The spheroid, Map scale, and co-ordinate system. Plane co-ordinates in UTM system, projection used in Survey of India topographic sheets.

UNIT III-CATROGRAPHIC PROCESS (9 hours)

Sources of Data-Ground Survey and positioning, Remote sensing, Census and sampling, Data processing-image processing, digital database, Geographic and cartographic database, basic Statistical processing , , Design of color and pattern, typography and lettering the map.

UNIT IV-CARTOGRAPHIC ABSTRACTIONS (9 hours)

Processing and generalizing geographic data,Simplification and Classification, computer assisted cartographic processes, symbolization, mapping with point, line and area symbols-Portraying the land surface form. Map Compilation-Analog and Digital Compilation.

UNIT V-MAP EXECUTION (9 hours)

Map reproduction. Methods of few copies and many copies. Map production: Form of Art Work-Construction Method-Output option- Digital cartography, Geographic Information System

REFERENCES

1. Robinson A. H., Morrison, J. L, Muehrcke, A. C., Kimerling, A. J. and Guptill, S. C., *Elements of Cartography*. 6th Edition, John Wiley and Sons, 1995.
2. Cromley, R. G., *Digital Cartography*. Prentice-Hall of India, New Delhi, 1992.
3. Dent, B. D., *Cartography – Thematic Map Design*. 5th Edition, W C B McGraw-Hill, Boston, 1999.
4. Muller, *Advances in Cartography*, ISBN: 1851666036, Elsevier Science Publications
5. R.W. Anson and F.J. Ormeling, *Basic Cartography for students and Technicians*. Vol.., I, II and III Elsevier Applied Science publishers 2nd Edition, 1995.
6. Rampal, K.K., *Mapping and Compilation*. Concept Publishing Co.,New Delhi, 1993.

Course code	Course Title	L	T	P	C
RS2102	GPS & ELECTRONIC SURVEYING	3	0	0	3
	Prerequisite				
	Nil				
	Total Contact Hours- 45				

PURPOSE	
To study the basics and fieldwork of Electronic Surveying.	
INSTRUCTIONAL OBJECTIVES	
1.	To understand the basics, classifications, and Applications of Electronic Surveying.
2.	To study the Electromagnetic waves
3.	To study the EDMS and GPS surveying and its application
4.	To study the EDMS Instruments, GPS.

UNIT I-BASICS OF GPS (9 hours)

Introduction – GPS satellites – components – Satellite Ranging – codes - Basics of Geodesy – Branches, Applications and Observations of Geodesy.

UNIT II-GPS RECEIVERS (9 hours)

GPS – DGPS - GPS Receiver and its Features – Receiver selection – enhancement of receiver - GPS processor Software – GPS Data – Processing of GPS data and types

UNIT III-TYPES OF GPS SURVEYING (9 hours)

GPS Field Survey techniques – advantages – Characteristics – Positioning modes – static surveying – kinematics surveying - Doppler effect and basic positioning concept - Dilution of Precision – Types - Multi-path effect – field practices

UNIT IV-FUNDAMENTALS OF ELECTRONIC SURVEYING (9 hours)

Refractive index. Factors affecting RI, computation of group refractive index for light and near infrared waves at standard conditions and ambient conditions.

UNIT V-TYPES OF EDM INSTRUMENTS (9 hours)

Electro-optical system, measuring principle, working principle, sources of errors, infrared EDM instruments, Laser EDM instruments and total station. Microwave system, measuring principle – field practices.

REFERENCES

1. Burnside, C.D., Electromagnetic distance measurement, Crosby Lock wood staples, U.K., 1971.
2. Rueger, J.M., Electronic distance Measurement, Springer - Verlag, Berlin, 1990.Laurila, S.H., Electronic Surveying in Practice, John Wiley & Sons, Inc, 1983.
3. Soastamoinen, J.J., Surveyor's Guide to electro - magnetic pistance Measurement, Adam Hilger Ltd., 1967.
4. Santheesh Gopi., Global Positioning System – Principles and Applications, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
5. Seeber, G., Satellite Geodesy, Walter de Gruyter, Berlin, 1993.
6. Alfred Leick, GPS Satellite surveying, John Wiley and Sons, 1995.Hofmann Wellenhof, B. Lichtenegger, H. and Collins, J., Global Positioning System, SorinQer - Verlag, New York, 1994.

Course code	Course Title	L	T	P	C
RS2103	**MICROWAVE REMOTE SENSING AND APPLICATIONS**	**3**	**0**	**0**	**3**
	Prerequisite				
	RS2001 Remote Sensing and Its Techniques				
	Total Contact Hours- 45				

PURPOSE	
To study the RS & GIS data for microwave and Remote Sensing.	
INSTRUCTIONAL OBJECTIVES	
1.	To study basics of Microwave Remote Sensing
2.	To Understand parameters of radiometry and Antena functions
3.	To understand RADAR principles
4.	To learn Microwave data processing
5.	To study Microwave remote sensing Applications

UNIT I-BASICS OF MICROWAVE REMOTESENSING (9 hours)

Fundamentals – EMR-Electromagnetic Spectrum - Microwave Band Designation Microwave interaction with atmospheric constituents, Earth's surface, vegetation, and ocean.

UNIT II-RADIOMETRY & ANTENNA SYSTEMS (9 hours)

Basics - Theory of Radiometry - Sensors applications in atmosphere, ocean and land. Antenna –Types and Functions of different types of antenna

UNIT III-RADAR (9 hours)

Radar-Real and synthetic aperture radars, - Principles - different platforms and sensors, System parameters, Target parameters, Radar equation measurement and discrimination, Airborne Data products and selection procedure - SEASAT, SIRA, SIRB, ERS , JERS, RADARSAT missions.

UNIT IV-RADAR DATA PROCESSING (9 hours)

Radar grammetry, Image processing, SAR Interferrometry – Polarimetry-Interpretation of microwave data - Physical mechanism and empirical models for scattering and emission, volume scattering.

UNIT V-APPLICATIONS OF MICROWAVE REMOTE SENSING (9 hours)

Geological interpretation of RADAR –sites-default-files, Application in Agriculture -forestry, Hydrology - ice studies – land use mapping and ocean related studies

REFERENCES

1. Charles Elachi and Jakob Van 2y, Introduction to the Physics and Techniques of Remote Sensing, Wiley Interscience, A John Wiley and sons Inc., 2006
2. Robert M. Haralick and Simmonett, Image processing for remote sensing 1983
3. Robert N. Colwell. Manual of Remote Sensing Volume 1, Americal Society of Photo - grammetry 1983
4. Travett. J. W. Imaging Radar for Resources Surveys. Chapman and Hall, London 1986
5. Ulaby, F.T., Moore, R.K, Fung, A.K, Microwave Remote Sensing; active and passive,Vol. 1,2 and 3, Addison – Wesley publication company 2001

Course code	Course Title	L	T	P	C
RS2104	**HYPERSPECTRAL REMOTE SENSING AND APPLICATIONS**	**3**	**0**	**0**	**3**
	Prerequisite				
	RS2001 REMOTE SENSING AND ITS				

	TECHNIQUES				
	Total Contact Hours- 45				

PURPOSE	
The purpose of this course is to study the state-of-the-art of hyperspectral remote sensing and applications	
INSTRUCTIONAL OBJECTIVES	
1.	To understand the hyperspectral remote sensing and data products
2.	To study the sensors and hyperspectral image devices
3.	To study the preprocessing of hyperspectral data
4.	To study the hyperspectral data analysis
5.	To study and apply the hyperspectral remote sensing and applications

UNIT I-INTRODUCTION (9 hours)

Multispectral and hyperspectral remote sensing, Comparison of Multispectral and Hyperspectral Image Data, Spectral Signatures and BRDF in the Visible, Near Infrared and Shortwave Infrared regions of EMR, Hyperspectral Issues.

UNIT II-SENSORS AND HYPERSPECTRAL IMAGING DEVICES (9 hours)

Scanner types and characterization - specifications of various sensors Spectrographic imagers- hyperspectral sensors, Design tradeoffs. Data formats and systems, AVIRIS, CASI, NASA Terra Moderate Resolution Imaging Spectrometer (MODIS), Hyperion.

UNIT III-PREPROCESSING OF HYPERSPECTRAL DATA (9 hours)

Hyperspectral Data Cube, Hyperspectral Profiles, Data Redundancy. Problems with Dimensionality, Principal Component, Minimum Noise Fraction (MNF), Atmospheric Correction, Atmospheric Correction Measures, Flat Field Correction, Empirical Line Calibration, Empirical Flat Field Optimized, Reflectance Transformation (EFFORT), Continuum Removal, Spectral Feature Fitting.

UNIT IV-HYPERSPECTRAL DATA ANALYSIS (9 hours)

Derivative spectral analysis, techniques for analysis of hyperspectral data, first-order and second- order derivative spectra, Theoretical basis and relevance, Methods of generating derivative spectra, electronic, electro-mechanical, numerical techniques, case studies.

UNIT V-APPLICATIONS (9 hours)

Applications of Hyperspectral Image Analysis Forestry to Mineral exploration, soil mapping, coastal water quality studies, quantification of biophysical parameters

REFERENCES

1. Schowengerdt, R.A., 1997. Remote cS'en!!!wg -Models and Methods ,for Image Processing, Academic Press, London.
2. Jensen, J. R.. 1996. Introductory Digital Image Processing: A Remote Sensing Perspective. Prentice Hall, 2nd Edition.
3. Mather, P. M., 1987. Computer processing of remotely sensed images-An introduction, St. Edmundsbury Press Ltd.
4. Thomas M. Lillesand & Ralph W. Keifer, 2000. Remote Sensing and image interpretation (John Wiley & sons, Inc).
5. Pramod K. Varshney and Manoj K. Arora, 2004 "Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data", Springer publication.

Course code	Course Title	L	T	P	C
RS2105	**DIGITAL PHOTOGRAMMETRY AND APPLICATIONS**	**3**	**0**	**0**	**3**
	Prerequisite				
	RS2001 REMOTE SENSING AND ITS TECHNIQUES				
	Total Contact Hours- 45				

PURPOSE	
To introduce, study the data acquisition directly and indirectly and application of GIS tools.	
INSTRUCTIONAL OBJECTIVES	
1.	To introduce digital photogrammetry
2.	To study the data acquisition and components
3.	To study data conversion techniques
4.	To understand image transformation and measurements
5.	To study digital photogrammetric applications

UNIT I-INTRODUCTION (9 hours)

Evolution of digital photogrammetry - analog, analytical, digital-Advantages - Auto - Imation - accuracy - Representation of digital images - 8/ W. RG8, CMYK, HLS. EMR - Band designation - Microwave interaction with atmospheric constituents, Earth's surface, vegetation, and ocean.

UNIT II-DIGITAL PHOTOGRAMMETRY & ITS COMPONENTS

(9 hours)

Digital Cameras - CCD Camera - Full frame CCD Frame transfer CCD, CCD cameras 1 with piezo shift, Interline transfer CCD, Time delay integration CCD sensor - Spectral Sensitivity of CCD sensor, Geometric problems of CCD images - line jitter, blooming, warm up effect, tailing - Typical CCD systems, line scanners - SPOT, MOMS Data.

UNIT III-DIGITAL CONVERSIONS **(9 hours)**

Analog to digital conversion - Scanner - flat bed, drum type - Sensor characteristics - Scanner resolutions - Scanner calibration -Video Cameras - Frame Grabber - Typical Scanner systems and Video cameras.

UNIT IV-IMAGE TRANSFORMATIONS & MEASUREMENTS

(9 hours)

Merits, demerits - Stereo viewing - Spatial, spectral and temporal methods - Image measurement - Coordinate system - Image movement -fixed image, moved image - Image transformation - Geometrical transformation, Radiometric transformation - Concepts of Interior, Relative and Absolute orientation.

UNIT V-DIGITAL PHOTOGRAMMETRIC APPLICATIONS (9 hours)

DTM generation - Image correlation - Image matching - Digital Orthophoto generation - Automated aerotriangulation - Link between GIS and Digital Photogrammetry.

REFERENCES

1. Krauss, J., Photogrammetry, Vol. I IV Edition, Springier -Verlag Publishers, 1993
2. International Archieves of Photogrammetry and Remota Sensing, ISPRS, Volume XXIX, B5, Commission 5, 1995
3. Proceedings of Annual Convention of ASPRS, 1993-96

Course code	Course Title	L	T	P	C
RS2106	**LIDAR REMOTE SENSING AND APPLICATIONS**	**3**	**0**	**0**	**3**
	Prerequisite				

	RS2001 REMOTE SENSING AND ITS TECHNIQUES				
	Total Contact Hours- 45				

PURPOSE	
The purpose of this course is to study the Lidar Mapping and applications	
INSTRUCTIONAL OBJECTIVES	
1.	To understand the Lidar remote sensing and data products
2.	To study the sensors and Lidar image devices
3.	To study the georeferencing and calibration of Lidar data
4.	To study the automated classification and project generation
5.	To study and apply the Lidar data for various applications

UNIT I-LIDAR SYSTEM DESIGN (9 hours)

Introduction to Lasers and Lidar – Difinitions - History of Lidar Development - Lidar System Components - lidar sensors single-return, multi-return, waveform, photon-counting, Characteristics of Lidar Data - interaction of laser energy with earth surface features - Lidar Systems

UNIT II-LIDAR REMOTE SENSING PLATFORMS (9 hours)

Introduction to the Lidar remote sensing platform - Historical development of lidar remote sensing platforms Airborne platforms, Laser Scanning, Fixed-Wing Platforms, Rotary-Wing Platforms - Terrestrial, airborne, and spacebar types – Spaceborne platforms – orbits- Bathymetric Mapping

UNIT III-GEOREFERENCING AND CALIBRATION OF LIDAR DATA (9 hours)

Geodesy, Datums, Map projections and Coordinate Systems – Direct Georeferencing Technology - Boresight Calibration - Lidar Data Preprocessing - Project Coverage Verification - Review Lidar Data against Field Control - Lidar data errors and rectifications, - processes calibration of Lidar data - artifacts and anomalies - Lidar Error Budget.

UNIT IV-AUTOMATED CLASSIFICATION (9 hours)

Noise Removal and other sensor-related artifacts - Layer Extraction - Automated Filtering -. Manual Editing and Product Generation - Surface Editing - Hydrologic Enforcement – Lidargrammetry - Terrain Data Products, definitions, DEM, DSM -TIN, Breaklines, Contours, Specifications, Terrain Products from Lidar - Quality Assurance, Control, and Accuracy Assessment.

UNIT V-LIDAR APPLICATIONS (9 hours)

Topographic Mapping, , flood inundation analysis, line-of-sight analysis – Forestry, various types of lidar sensors-, vegetation metric calculations - specific application software - corridor mapping system, data processing and quality control procedures.

REFERENCES

1. Floyd M. Henderson; Principles & Applications of Imaging Radar, John Wiley & Sons, New York, 1998.
2. Alexay Bunkin & Konstantin Volia.K, - Laser Remote Sensing of the Ocean Methods & Publications. John & Wiley & Sons, New York, 2001.
3. Raymond M. Measures; Laser Remote Sensing: Fundamentals and Applications, John Wiley & Sons, New York, 1984.
4. Robert M. Haralick and Simmonett, Image processing for remote sensing 1983.
5. Cracknell, Arthur P.; Hayes, Ladson. Introduction to Remote Sensing (2 ed.). London: Taylor and Francis 2007.

Course code	Course Title	L	T	P	C
RS2107	**NON-TOPOGRAPHIC PHOTOGRAMMETRY**	**3**	**0**	**0**	**3**
	Prerequisite				
	RS2001 REMOTE SENSING AND ITS TECHNIQUES				
	Total Contact Hours- 45				

PURPOSE	
To introduce Non-Topographic photogrammetry surveying	
INSTRUCTIONAL OBJECTIVES	
1.	To study Non-Topographic Surveying
2.	To study the application of NTPS
3.	To study the industrial and Engineering Applications

UNIT I-NON-TOPOGRAPHIC PHOTOGRAMETRY (9 hours)

Definition - Non-topographic photogrammetry - Brief History -Potential of Close range Photogrammetry - Instrumentation for Data Acquisition - Phototheodolite, Metric Camera, Non - metric Camera, Stereometric Camera, Digital Camera - Instrumentation for Data Analysis - Analog and Analytical Stereoplotters - Software in Non - topographic Photogrammetry.

UNIT II-APPLICATIONS OF NON TOPOGRAPHIC PHOTOGRAMETRY (9 hours)

Applications in Architecture and Archaeology - Survey of Historic monuments - their conservation and preservation - Photomontage by Inverse Photogrammetry - Electron Microscopy - Systems and Applications using SEM & TEM.

UNIT III-MEASUREMENTS & MONITORING (9 hours)

Aerospace Industry, Automobile Industry - Measuring Communication Antennas - Measurement of storage Tanks and Cooling Tower, Model Studies - Hologrammetric applications for vibration and stress concentration studies.

UNIT IV-BIO-MEDICAL APPLICATIONS (9 hours)

Biomedical Application Using X-ray Photogrammetry Systems. Principle point location in Radiographs - Stereo X-ray Photogrammetry - Analysis - Bio - Stereometrics - Whole body form, trunks and limbs. Moire topography -systems & applications.

UNIT V-FORENSIC APPLICATIONS (9 hours)

Forensic Photogrammetric Applications -Mapping Crime scene using conventional Photogrammetry -Reverse Projection Technique in Accident Investigations. Under water Photogrammetry.

REFERENCES

1. Americal Society for Photogrammetry and Remote Sensing, "Non-Topographic Photogrammetry", Second Edition, 1989.
2. Atkinson, K. B., "Developments in Close Range Photogrammetry", Applied Science Publishers.
3. Hallert, B., "X-Ray Photogrammetry", Elsevier Publishing Company

Course code	Course Title	L	T	P	C
RS2108	**RS & GIS FOR URBAN AND REGIONAL PLANNING**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				
	Total Contact Hours- 45				

PURPOSE	
To study the RS & GIS data for urban and Regional Planning	
INSTRUCTIONAL OBJECTIVES	
1.	To study the RS & GIS data
2.	To study the Mapping for Urban and Regional areas
3.	To study GIS Tool in Urban Planning

UNIT I-REQUIREMENTS FOR URBAN & REGIONAL PLANNING (9 hours)

Relevance of remotely sensed data for Urban & Regional Analysis and Planning - Identification of settlement features from aerospace images - Visual and digital analysis techniques - Scale and Resolution concepts - Scope and limitations.

UNIT II-URBAN & REGIONAL MAPPING (9 hours)

Regional Mapping - City Mapping - Intra - city Mapping-Methodology - Base map preparation - Delineation of area - Change Detection and mapping - classification - Urban fringe - CBD - Urban sprawl - Case studies.

UNIT III-SUSTAINABLE DEVELOPMENT PLANS (9 hours)

Regional plan - Master plan - Detailed Development plan - Objective and contents - Delineation of planning area - Methodology - Integrated plans - Case studies.

UNIT IV-URBAN STUDIES (9 hours)

Urban growth analysis - Slum development - House typology - Site selection for urban development - Density analysis - Population estimation - Transportation network analysis - Case studies.

UNIT V-GIS IN URBAN MODELLING (9 hours)

GIS - Data Input - Storage - Retrieval - Suitability of GIS software for Urban analysis - Modeling with GIS - Decision support systems for Urban studies.

REFERENCES

1. Brench M.C., City Planning & Aerial Information, Harvard University, Cambridge, 1971.
2. Margaret Roberts, An Introduction to Town Planning Techniques, Hutchinson, London 1980.
3. NC Gautam, Urban landuse Interpretation through Arial Photograph Interpretation, NRSA.
4. IRS RS Applications to Urban Planning and Development Institute of Remote Sensing.

Course code	Course Title	L	T	P	C
RS2109	RS & GIS FOR HYDROLOGY AND WATER RESOURCES	3	0	0	3
	Prerequisite				
	RS2003 GEOLOGICAL REMOTE SENSING AND TECHNIQUE				
	Total Contact Hours- 45				

PURPOSE

To study and understand application of RS and GIS techniques for hydrology and water resources

INSTRUCTIONAL OBJECTIVES

1.	To study the basic knowledge of hydrologic data
2.	To study the watershed characters and applications
3.	To study the hydrological disaster and role of remote sensing & GIS
4.	To study the ground water resources mapping by remote sensing & GIS
5.	To study the surface water resources mapping by remote sensing & GIS

UNIT I-HYDROLOGICAL COMPONENETS (9 hours)

Hydrological cycle, Estimation of various components of hydrological cycle, rainfall, runoff, evaporation, transpiration, evapotranspiration, crop evapotranspiration, depression and interception loss, infiltration and percolation losses.

UNIT II-WATERSHED CHARECTERS (9 hours)

Watershed, types, divide, catchment , command area, stream types, influent, effluent, ephemeral, non perennial. Drainage network, different pattern, morphometric analysis, linear, area, relief aspects. GIS applications for watershed analysis

UNIT III-HYDROLOGICAL STIDIES (9 hours)

Hydrological aspects- mapping and monitoring, management Mapping of snow covered area and glacial outburst, soil moisture estimation,Optical and microwave remote sensing techniques , drought zonations, Agricultural, meteorological and hydrological, flood mapping pre and post flood area estimation and control measures –GIS applications for hydrological disaster studies

UNIT IV-GROUND WATER RESOURCES APPLICATIONS (9 hours)

Types of Aquifers formations confined and unconfined aquifers Assessment of Groundwater potential zones and Groundwater mapping. Site selection for recharge structures- Hydrogeological Mapping GIS applications to ground water studies

UNIT V-SURFACE WATER RESOURCES APPLICATIONS (9 hours)

Surface water bodies, lakes, reservoirs, ponds, rivers , channels ,mapping-change detection , Water harvesting structures, in-situ and Ex-situ , Mapping and monitoring of catchment and command area, Water logging and salt affected area mapping, Reservoir Sedimentation, sedimentation control. GIS applications to surface water studies

REFERENCES

1. H.M. Raghunath. Hydrology – Principles – Analysis – Design. New Age International Publishers, New Delhi. 2006
2. Ramasamy, SM ., Remote sensing in water resources Rawat publications, New Delhi ,2005
3. V.V.N. Murty. Land and Water Management Engineering, Kalyani Publishers, New Delhi – 2002.
4. C.S. Agarwal and P.K. Garg. Text Book on Remote Sensing in Natural Resources, Monitoring and Management.2000. Wheeler publishing Co & Ltd., New Delhi.

Course code	Course Title	L	T	P	C
RS2110	**RS & GIS FOR AGRICULTURE AND FORESTRY**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				
	Total Contact Hours- 45				
PURPOSE					
To study the RS & GIS in agriculture and Forestry					
INSTRUCTIONAL OBJECTIVES					
1.	To study the Spectral characteristics of Vegetation				

2.	To study the integrated analysis of GIS in agriculture and forest development

UNIT I-SPECTRAL CHARACTERISTICS OF LEAF (9 hours)

Structure of leaf - Spectral behavior of leaf – Vegetation indices – NDVI, TVI, SVI, PCA – Vegetation classification and mapping - Estimation of Leaf area index, Biomass estimation – Estimation of terrestrial carbon assimilation in forests - case studies.

UNIT II-FOREST MAPPING (9 hours)

Forest type and density mapping and forest stock mapping using RS technique -factors for degradation of forests – deforestation/afforestation/. Change detection in forests - case studies

UNIT III-BIODIVERSITY CHARACTERIZATION MAPPING (9 hours)

Forestry – Forest taxonomy – Linnaeus classification - Biodiversity characterization – Forest fire risk zonation – wildlife habitats suitability analysis - case studies.

UNIT IV-AGRICULTURAL APPLICATIONS (9 hours)

Identification of crops -acreage estimation -production forecasting - pests and disease attacks through remote sensing -crop stress detection due to flood and drought - catchments and command area monitoring.

UNIT V-SOIL APPLICATIONS (9 hours)

Soil survey and land use classification - water logging - characters of saline, alkali soils - soil erosion – types – Estimation of soil loss from USLE using Remote sensing and GIS - Wasteland development.

REFERENCES

1. Steven, M.D and clark, J.A., "Applications of Remote Sensing in Agriculture", Butterworths, London 1990.
2. Remote Sensing Applications Group, Space Applications Centre, Crop Average and production Estimation (CAPE): An Anthology from January 1986 - June 1996. (Publications in Journals, Seminars I Symposium proceedings), Ahmedabad, August 1996.
3. Negi, S.S., A Handbook of forestry. International Book distributors, Dehradun, 1986. Space Applications Centre, Manual of procedure for Forest mapping and Damage Detection using satellite data, Ahmedabad, 1990

Course code	Course Title	L	T	P	C
RS2111	RS & GIS FOR ENVIRONMENTAL ENGINEERING	3	0	0	3
	Prerequisite				
	Nil				
	Total Contact Hours- 45				

PURPOSE	
To study the RS and GIS for Environmental Engineering	
INSTRUCTIONAL OBJECTIVES	
1.	To study the basic Environmental aspects and satellites
2.	To study the RS & GIS application in soil degradation
3.	To study the RS & GIS application in water pollution
4.	To study the RS & GIS application in Air quality
5.	To understand the RS & GIS application in Environmental management

UNIT I-BASICS (9 hours)

Water- Air-Land-Marine Environment Global Climatologic, urban Environment Environmental satellites GEOS, NOAA, AVHRR, CZCR Monitoring land, water, atmosphere and ocean using Remote Sensing Data. Water- Air-Land-Marine Environment Global Climatologic, urban Environment:

UNIT II-SOIL DEGRADATION (9 hours)

Spectral characteristics of soil- Soil formation- classification of soils- soil survey interpretation and mapping- impact of agricultural and industrial activity on soil properties. RS & GIS in assessing Soil salinity- alkalinity- water logging studies- soil erosion- types and estimation -control measures.

UNIT III-WATER QUALITY AND GROUND WATER POLLUTION (9 hours)

Spectral characteristics of water- classification of water quality -Data base creation and quality modeling using GIS. Aquifer Vulnerability -Intrinsic and specific vulnerability- contaminant transport model

UNIT IV-AIR QUALITY AND COASTAL STUDIES (9 hours)

Atmosphere: Chemicals, Particulate matters present in the atmosphere, allowable limits, Remote Sensing techniques - Monitoring atmosphere

constituents- air pollution - industrial activity, modeling using GIS - Ecology studies- Coastal color monitoring- marine studies.

UNIT V-ENVIRONMENTAL MANAGEMENT (9 hours)

Revenue management-environment and ecological concerns- Resource development in remote areas-Impacts of anthropogenic activity- Solid Waste management- Forest classification Mapping – Biomass estimation - Carbon footprints and sinks, carbon trading, carbon credits and marketing, Indian and international status

REFERENCES

1. Lilliesand, T.M. and Kiefer, R, W., Remote Sensing and Image Interpretation, John Wily and sons, 1994.
2. Burrough, P.A. and, McDonnell, R.A., Principles of Geograj1JhicaJ Information Systems, Oxford University Press, 1988.
3. Lintz, J. and Simonet, Remote Sensing of Environment, Addison Wesley Publishing Company, 1994.

Course code	Course Title	L	T	P	C
RS2112	**RS & GIS FOR OCEAN ENGINEERING & COASTAL MANAGEMENT**	**3**	**0**	**0**	**3**
	Prerequisite				
	RS2003 GEOLOGICAL REMOTE SENSING AND TECHNIQUE				
	Total Contact Hours- 45				
PURPOSE					
To study the RS & GIS Tools in Ocean Engg and Coastal zone Management					
INSTRUCTIONAL OBJECTIVES					
1.	To study the coastal and ocean process				
2.	To study the physical and chemical properties of ocean				
3.	To study different satellites and sensors for coastal and ocean applications				
4.	To understand remote sensing and GIS for coastal applications				
5.	To understand remote sensing and GIS for ocean applications				

UNIT I-OCEANS AND COASTS (9 hours)

Introduction- origin- ocean importance, boundaries, continental margins and ocean basin, shelves, slopes, canyon, and rises, deep ocean basins, ridges, seamounts, abyssal plain, sedimentation processes- Coastal processes- circulation, current Measurement, Waves, Surface waves, reflection, diffraction and refraction, wave generated currents,Tides, sediment drift

UNIT II-SEAWATER PHYSICAL AND CHEMICAL PRPOERTIES (9 hours)

Chemical properties- Water molecules, salinity, components, sources, concentration, mixing, dissolved gases, acid –base balance, Study of physical properties of sea water and parameters –heat and temperature, thermostatic effects, density, ocean surface conditions- refraction, light and sound, –sea level rise – coastal zone

UNIT III-SENSORS FOR COASTAL AND OCEAN APPLICATIONS (9 hours)

Use of Microwave data - SeaWiFS, OCR, CZCs studies -chlorophyll production index -sea surface temperature (SST) sensors -NIMBUS, RADARSAT, CASI - MESSR, OCTS ATSR -Sensors -OCEANSAT ATSR on ERS TOPEX/Poseidon satellite

UNIT IV-RS AND GIS APPLICATIONS IN COASTAL STUDIES (9 hours)

Role of remote sensing, advantages, resolutions, scale parameters, regional studies, coastal regulation zone mapping, Issues, Coastal Hydrodynamic, Coastal erosion and protection, salt water intrusion studies, Estuaries and their impact on coastal process wetland mapping, Thematic data base generation in GIS and analysis, mangroves and coastal zone management

UNIT V-RS AND GIS APPLICATIONS IN OCEAN STUDIES (9 hours)

Tsunami impact assessment, wave dynamics, ocean resources ocean circulation studies, seal level changes and impact, Tide dynamics, wave dynamics, Plankton and marine plant studies, Changes in marine communities, -open ocean, sea ice studies, Global warming applications Marine.

REFERENCES

1. Tang, Danling Remote sensing of the changing ocean, Springer, 2011
2. Seelye Martin, An Introduction to Ocean Remote Sensing University of Washington Cambridge, ISBN:9780521802802 2004
3. Deepak, A. Remote Sensing of atmospheres and oceans. Academic press, San Francisco, 1986.re (SST), - Mangroves coral reefs mapping

4. Michael Hord, R. Remote Sensing methods and application, John Wiley and Sons, New York, 1986
5. Alasdair J. Edwards, Remote Sensing Hand book for Tropical Coastal Management, UNESCO Publication 2000.

Course code	Course Title	L	T	P	C
RS2113	RS & GIS FOR DISASTER MANAGEMENT	3	0	0	3
	Prerequisite				
	RS2003 GEOLOGICAL REMOTE SENSING AND TECHNIQUE				
	Total Contact Hours- 45				

PURPOSE	
To study the RS and GIS for disaster mitigation and management	
INSTRUCTIONAL OBJECTIVES	
1.	To study the Basic concepts and Principle of disaster and Mitigation measures
2.	To study the application of RS & GIS for hazard Evaluation

UNIT I-HYDROLOGICAL & GEOLOGICAL DISASTERS (9 hours)
Basic concepts and principles - Hydrological and geological disasters, Role of Government administration, NGO's - International disaster assistance - Sharing techno - logy and technical expertise.

UNIT II-PREDICTION & MITIGATION (9 hours)
Needs and approach towards prevention - Principles and components of mitigation - Disaster legislation and policy - Cost effective analysis - Utilisation of resources - Training - Education - Public awareness - Roles of media.

UNIT III-CYCLONES & FLOODS (9 hours)
Dams, Bridges, Hospitals, Industrial structures, Disaster resistant structures - Low cost housing for disaster prone areas - Cyclone shelter projects and their implications - Reconstruction after disasters.

UNIT IV-REMOTE SENSING MONITORING & ANALYSIS(9 hours)
Remote Sensing Application - Risk assessment - Damage assessment - Land use planning and regulation for sustainable development - Use of Internet -

Communication Network -Warning system - Post disaster review - Case studies.

UNIT V-ROLE OF GIS IN DISSTERS (9 hours)

Vulnerability analysis of infrastructure and settlements - Pre-disaster and post disaster planning for relief operations - Potential of GIS application in development planning and Disaster management plan - Case studies.

REFERENCES

1. Bell, F.G. Geological Hazards: Their assessment, avoidance and mitigation. E & FN SPON Routledge, London. 1999.
2. David Alexander, Natural Disasters, UCL Press, London, Research Press, New Delhi, 1993.
3. Nick Carter. W. Disaster Management -A Disaster Manager's Handbook. Asian Development Bank, Philippines. 199.
4. Mitigating Natural Disasters, Phenomena, Effects and options, A Manual for policy makers and planners, United Nations. New York, 1991.
5. George G. Penelis and Andras J. Kappos -Earthquake Resistant concrete Structures. E & FN SPAN, London, 1997

Course code	Course Title	L	T	P	C
RS2114	WEB GIS	3	0	0	3
	Prerequisite				
	RS2004 GIS AND SOFTWARE				
	Total Contact Hours- 45				

PURPOSE

To familiarize with different GIS Software and functionalities. To let the student learn the versatile application capabilities of different GIS analysis techniques

INSTRUCTIONAL OBJECTIVES

1.	To understand of the Open Geospatial Consortium (OGC) web mapping standards
2.	To learn the concepts of Internet and Web GIS
3.	Explain the types of client that can be used for web mapping
4.	Deploy a working client server for an example data set

UNIT I-INTRODUCTION TO OPEN WEB MAPPING (9 hours)

Web Page Basics, Web Mapping, Geospatial Web Services, OGC-framework of open web mapping, importance of open web mapping, international open web standards as published by the Open Geospatial Consortium, explain the importance of international open standards to developers, users and businesses.

UNIT II-INTERNET CONCEPTS & WEB GIS (9 hours)

Overview of Internet concepts & features: Internet protocol, Domain Name System, Internet services, www, Web servers, Web clients. CGI,The web and GIS, Web GIS origin and Evolution, -concept-Applications

UNIT III-WEB GIS TECHNICAL BASICS (9 hours)

Fundamentals-principles-architecture-components-ThinVS thik Client architecture-design development. Geospatial web services- Website to web service-geospatial webservice function-service types-interoperability and web service standard.

UNIT IV-GEOSPATIAL MASHUPS (9 hours)

Evolution-Impact-webcontent-function and interfaces –Mashup design and implementation- challenges and prospects-uses and benefits-supporting technology-solutionand production

UNIT V-GEOPORTALS (9 hours)

Concept-uses-functions-architectures-geoportal applications-challenges and prospects.Web page design principles, HTML, XML, data formats, helper applications, Java, databases and the Web.Application of Internet services to GIS, Internet GIS software, interoperability issues & OpenGIS-GSDI and NSDI, Applications-e-business, e-government

REFERENCES

1. Burrogh P.A., Principles of Geographical Information System for Land Resources Assessment, Oxford Publications, 1980
2. Kang-tsung Chang , Introduction to Geographical Information System, , Fourth Edition, Tata McGraw Hill,2008
3. Pinde Fu and Jiulin Sun,Web GIS: Principles and applications,ISBN:9781589482456,ESRI, 2010

Course code	Course Title	L	T	P	C
MA2003	GEO-STATISTICAL METHODS	3	0	0	3
	Total contact hours 45				
	Pre- requisite				
	Nil				

PURPOSE

The course is designed to offer knowledge about the application of mathematical models for biological application. It provides fundamental ideas on the useful of data analysis, interpretation and inference including plan for future investigation based on experimental data collected from the conduct of biological experiments.

INSTRUCTIONAL OBJECTIVES

1.	To provide Theoretical Distribution on simple problems
2.	On the principles of Regression methods and Testing of hypothesis
3.	Analysis of variance its design of experiments
4.	Queuing theory application

UNIT I-THEORETICAL DISTRIBUTION (9 hours)

Binomial, Poisson and Normal distributions - Definitions, Simple problems only (Derivations not included).

UNIT II-CURVE AND CORRELATION (9 hours)

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 III-SAMPLING (9 hours)

Sampling Distributions - Tests based on Normal, t, Chi-Square and F-Distributions.

UNIT IV-ANALYSIS OF VARIANCE (9 hours)

One way and two way classification of ANOVA - Completely Randomised Design - Randomised Block Design - Latin square Design.

UNIT V-QUEUING MODELS (9 hours)

Single and multiple server markovian queueing models - M/M/1 and M/M/c queueing models and Applications (Derivations not included).

REFERENCES

1. Gupta, S.C., and Kapoor, V.K., Fundamentals of mathematical statistics, Sultan Chand and sons, Reprint 2003

2. Gupta, S.C., and Kapoor, V.K., Fundamentals of Applied statistics, Sultan Chand and sons, 2003
3. Veerarajan.T., Probability Statistics and Random processes, TMH, First reprint, 2004

AMENDMENTS

S.No.	Details of Amendment	Effective from	Approval with date