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UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY CHENNAI : : CHENNAI 600 025

REGULATIONS - 2009

CURRICULUM I TO IV SEMESTERS (FULL TIME)

M.TECH. REMOTE SENSING

SEMESTER I

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	MA9105	Probability and Statistical Methods	3	1	0	4
2	RS9101	Principles of Remote Sensing	3	0	0	3
3	RS9102	Photogrammetry	3	0	0	3
4	RS9103	Cartography	3	0	0	3
5	RS9104	Geographic Information System	3	0	0	3
PRACTICAL						
6	RS9105	GIS Lab	0	0	3	2
7	RS9106	Remote Sensing and Photogrammetry Lab	0	0	4	2
		TOTAL	**15**	**1**	**7**	**20**

SEMESTER II

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	RS9121	Digital Image Processing	3	0	0	3
2	RS9122	Electronic Surveying	2	2	0	3
3	RS9123	Geographic Information System Applications	3	0	0	3
4	E1	Elective I	3	0	0	3
5	E2	Elective II	3	0	0	3
6	E3	Elective III	3	0	0	3
PRACTICAL						
7	RS9124	Image Processing Lab	0	0	3	2
8	RS9125	Seminar	0	0	2	1
		TOTAL	**17**	**2**	**5**	**21**

SEMESTER III

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	GM9131	Digital Cadastre and Land Management System	3	0	0	3
2	E4	Elective IV	3	0	0	3
3	E5	Elective V	3	0	0	3
PRACTICAL						
4	RS9132	Practical Training (4 Weeks)	0	0	0	1
5	RS9133	Project Work Phase I	0	0	6	3
		TOTAL	**9**	**0**	**6**	**13**

SEMESTER IV

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	RS9141	Project Work Phase II	0	0	30	15
		TOTAL	**0**	**0**	**30**	**15**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 69

UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY CHENNAI : : CHENNAI 600 025

REGULATIONS - 2009

CURRICULUM I TO VI SEMESTERS (PART TIME)

M.TECH. REMOTE SENSING

SEMESTER I

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	MA9105	Probability and Statistical Methods	3	1	0	4
2	RS9101	Principles of Remote Sensing	3	0	0	3
3	RS9102	Photogrammetry	3	0	0	3
PRACTICAL						
4	RS9106	Remote Sensing and Photogrammetry Lab	0	0	4	2
		TOTAL	**9**	**1**	**4**	**12**

SEMESTER II

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	RS9121	Digital Image Processing	3	0	0	3
2	RS9122	Electronic Surveying	2	0	2	3
PRACTICAL						
3	RS9124	Image Processing Lab	0	0	3	2
		TOTAL	**5**	**0**	**5**	**8**

SEMESTER III

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	RS9103	Cartography	3	0	0	3
2	RS9104	Geographic Information System	3	0	0	3
3	E1	Elective I	3	0	0	3
PRACTICAL						
4	RS9105	GIS Lab	0	0	3	2

TOTAL	**9**	**0**	**3**	**11**

SEMESTER IV

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	RS 9123	Geographical Information System Applications	3	0	0	3
2	E2	Elective II	3	0	0	3
3	E3	Elective III	3	0	0	3
PRACTICAL						
4	RS 9125	Seminar	0	0	2	1
		TOTAL	**9**	**0**	**2**	**10**

SEMESTER V

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	E4	Elective IV	3	0	0	3
2	E5	Elective V	3	0	0	3
3	GM9131	Digital Cadastre and Land Management System	3	0	0	3
PRACTICAL						
4	RS9132	Practical Training (4 weeks)	0	0	0	1
5	RS9133	Project work Phase – I	0	0	6	3
		TOTAL	**9**	**0**	**6**	**13**

SEMESTER VI

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	RS9141	Project work Phase – II	0	0	30	15
		TOTAL	**0**	**0**	**30**	**15**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 69

ELECTIVES FOR M.TECH. (REMOTE SENSING)

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	RS9151	Microwave Remote Sensing	3	0	0	3
2	RS9152	Close Range Photogrammetry	3	0	0	3
3	RS9153	Air Borne Laser Terrain Mapping (ALTM)	3	0	0	3
4	RS9154	Automated Cartography	3	0	0	3
5	RS9155	Space Geodesy	2	0	2	3
6	RS9156	Remote Sensing and GIS for Hydrology and Water Resources	3	0	0	3
7	RS9157	Remote Sensing and GIS for Earth Sciences	3	0	0	3
8	RS9158	Remote Sensing and GIS for Agriculture and Forestry	3	0	0	3
9	RS9159	Remote Sensing and GIS for Environmental Engineering	3	0	0	3
10	RS9160	Remote Sensing and GIS for Ocean Engineering and Coastal Zone Management	3	0	0	3
11	RS9161	Remote Sensing and GIS for Urban Planning and Management	3	0	0	3
12	RS9162	Remote Sensing and GIS for Disaster Mitigation and Management	3	0	0	3
13	RS9163	Satellite Payloads and Communication system	3	0	0	3
14	GM9160	Advanced Soft Computing	3	0	0	3
15	GM9159	Digital Photogrammetry	3	0	0	3
16	GM9101	Decision Support System	3	0	0	3

MA 9105 PROBABILITY AND STATISTICAL METHODS L T P C
3 1 0 4

OBJECTIVE:

- To teach about the probability and Random variable of the various functions. It also helps to understand the various statistical methods including the Design of experiments.

UNIT I ONE DIMENSIONAL RANDOM VARIABLES 9+3

Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT III ESTIMATION THEORY 9+3

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines.

UNIT IV TESTING OF HYPOTHESES 9+3

Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V MULTIVARIATE ANALYSIS 9+3

Covariance matrix – Correlation Matrix – Multivariate Normal density function – Principal components – Sample variation by principal components – Principal components by graphing.

TOTAL (L:45 + T:15) : 60 PERIODS

REFERENCES :

1. Richard Johnson. ”Miller & Freund’s Probability and Statistics for Engineers”, Prentice – Hall of India, Private Ltd., New Delhi, 7th Edition, 2007.
2. Richard A. Johnson and Dean W. Wichern, “Applied Multivariate Statistical Analysis”, Pearson Education, Asia, 5th Edition, 2002.
3. Gupta, S.C. and Kapoor, V.K. ”Fundamentals of Mathematical Statistics”, Sultan and Sons, New Delhi, 2001.
4. Jay L. Devore, “Probability and statistics for Engineering and the Sciences”, Thomson and Duxbbury, Singapore, 2002.
5. Dallas E Johnson et al., “Applied multivariate methods for data analysis”, Thomson and Duxbbury press, Singapore, 1998.

RS 9101	PRINCIPLES OF REMOTE SENSING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- The objective of this course is to familiarize about the principles of remote sensing and the data acquisition and analysis of satellite data.

UNIT I PHYSICS OF REMOTE SENSING 9

Introduction of Remote Sensing - Electro Magnetic Spectrum, Physics of Remote Sensing- Effects of Atmosphere- Scattering – Different types –Absorption-Atmospheric window- Energy interaction with surface features – Spectral reflectance of vegetation, soil ,and water –atmospheric influence on spectral response patterns- multi concept in Remote sensing.

UNIT II DATA ACQUISITION 9

Types of Platforms – different types of aircrafts-Manned and Unmanned spacecrafts – sun synchronous and geo synchronous satellites – Types and characteristics of different platforms – LANDSAT,SPOT,IRS,INSAT,IKONOS,QUICKBIRD etc - Photographic products, B/W, colour, colour IR film and their characteristics – resolving power of lens and film - Opto mechanical electro optical sensors – across track and along track scanners – multi spectral scanners and thermal scanners – geometric characteristics of scanner imagery - calibration of thermal scanners.

UNIT III SCATTERING SYSTEM 9

Microwave scatterometry – types of RADAR – SLAR – resolution - range and azimuth – real aperture and synthetic aperture RADAR. Characteristics of Microwave images-topographic effect - different types of Remote Sensing platforms –airborne and space borne sensors – ERS, JERS, RADARSAT, RISAT - Scatterometer, Altimeter- LiDAR remote sensing, principles, applications.

UNIT IV THERMAL AND HYPER SPECTRAL REMOTE SENSING 9

Sensors characteristics - principle of spectroscopy - imaging spectroscopy - field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing – thermal sensors, principles, thermal data processing, applications.

UNIT V DATA ANALYSIS 9

Resolution – Spatial, Spectral, Radiometric and temporal resolution- signal to noise ratio- data products and their characteristics - visual and digital interpretation –Basic principles of data processing –Radiometric correction –Image enhancement – Image classification – Principles of LiDAR, Aerial Laser Terrain Mapping.

TOTAL: 45 PERIODS

REFERENCES:

1. Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, VI edition of John Wiley & Sons-2000.
2. John R. Jensen , Introductory Digital Image Processing: A Remote Sensing Perspective , 2nd Edition, 1995.
3. John A.Richards, Springer –Verlag, Remate Sensing Digital Image Analysis 1999.
4. Paul Curran P.J. Principles of Remote Sensing, ELBS; 1995.
5. Charles Elachi and Jakob J. van Zyl , Introduction To The Physics and Techniques of Remote Sensing , Wiley Series in Remote Sensing and Image Processing, 2006.
6. Sabins, F.F.Jr, Remote Sensing Principles and Image interpretation, W.H.Freeman & Co, 1978.

RS 9102	PHOTOGRAMMETRY	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To introduce basics and concepts of aerial photography, acquisition and mapping from aerial photographs using different types of stereo plotters.

UNIT I BASICS OF PHOTOGRAMMETRY 6

History and development – types of aerial photo- classification of aerial cameras – optics for photogrammetry, camera calibration – photographic process.

UNIT II GEOMETRY OF AERIAL PHOTOGRAPHS 10

Scale – overlaps – stereoscopy – concepts – viewing and measuring systems – image and object co-ordinates – floating mark – parallax equation – height information – Tilt – Rectification – Displacement.

UNIT III PROJECT PLANNING, GROUND CONTROL AND MOSAIC 8

Flight planning – computation for flight plan – photo control – cost estimation – aerial mosaics – types.

UNIT IV ANALOGUE, ANALYTICAL AND DIGITAL PHOTOGRAMMETRY 12

Concepts of interior, relative, absolute orientation – object, image relation – linearization – effect of orientation elements – scaling and leveling – analytical procedures – map compilation using stereo plotters – Introduction to digital photogrammetry.

UNIT V AERO-TRIANGULATION AND TERRESTRIAL PHOTOGRAMMETRY 9

Elements of Aero triangulation and analytical method – strip deformation, strip and block adjustment – Terrestrial photogrammetry – Geometry & products – orthophoto – mapping.

TOTAL: 45 PERIODS

REFERENCES:

1. Gottfried Konecny, Geoinformation: Remote Sensing, Photogrammetry and Geographic Information Systems, Second Edition, CRC; 2 edition, 2009.
2. Paul R.Wolf, Elements of Photogrammetry, McGraw-Hill Science, 2001. Karl Kraus, Photogrammetry, Vol 1&II , 4th ed., Dümmler, 1997.
3. Edward M. Mikhail , James S. Bethel , J. Chris McGlone, Introduction to Modern Photogrammetry ,Publisher: Wiley, 2001.
4. Ron Graham and Roger, Mannual of Aerial survey:primary data acquisition, CRC press, 20

RS 9103	CARTOGRAPHY	L	T	P	C
		3	0	0	3

OBJECTIVE:

- The main objective of this course is to introduce cartography, and its elements as the art and science of map making. The course also describes the connections with the communication science and Digital computer as structured need based information of spatial data

UNIT I BASICS OF CARTOGRAPHY 9

Cartography today – Nature of cartography – History of cartography – Cartographic - Visualization – Web Cartography – Graticules – Cartometry – Map characteristics – Modern Trends.

UNIT II EARTH 9

Earth Map relations – Basic geodesy – Map projections – Scale – Reference and coordinate system – Transformation – Basic Transformation - Affine Tranformation.

UNIT III SOURCES OF DATA 9

Sources of data – Ground survey and positioning – Remote sensing data collection – Census and sampling – data – Models for digital cartographic information – Map digitizing- Data quality assesment.

UNIT IV PERCEPTION AND DESIGN 9

Cartographic design – color theory and models – color and pattern creation and specification – color and pattern – Topography and lettering the map – Map compilation – Demography and Statistical mapping.

UNIT V CARTOGRAPHY ABSTRACTION 9

Selection and Generalisation principles – Symbolisation – Topographic and thematic maps – Map production and reproduction – Map series - 3D Visualization of geodata.

TOTAL: 45 PERIODS

REFERENCES:

1. Anson R.W. and F.J. Ormeling, Basic Cartography for students and Technicians. Vol.I, II and III Elsevier Applied Science Publishers 3rd Edition, 2004.
2. Arthur, H. Robinson, Elements of Cartography, Seventh Edition, John Wiley and Sons, 2004.
3. ohn Campbell, introductory Cartography Third Edition, Wm.C. Brown Publishers 2004.
4. Alan M. MacEachren, How Maps Work: Representation, Visualization and Design, The Guilford Press; first edition 2004.
5. Michael P. Peterson, Interactive and Animated Cartography Prentice Hall, 1995.
6. Menno – Jan Kraak & Ferjan Ormeling ,Cartography Visualization of Geospatial Data, Second Edition, Pearson, 2004.

RS 9104	GEOGRAPHIC INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To provide exposure to data models and data structure used in GIS and to introduce various Raster and Vector Analysis capabilities of GIS also expose the concept of quality and errors in GIS.

UNIT I BASICS 8

Maps: Types – Characteristics – Coordinate systems – Map projections – Definition of GIS – Evolution – Components of GIS – Data : Spatial and Non-spatial – Spatial Data: Point, Line, Polygon/Area and Surface – Non-Spatial Data: Levels of measurement – Database Structures.

UNIT II DATA MODEL AND INPUT 9

Raster Data Model – Grid – Tessellations – Geometry of Tessellations –– Data Compression – Vector Data Model – Topology – Topological consistency – Vector data input– Raster Vs. Vector comparison – File Formats for Raster and Vector – Vector to Raster conversion- raster formats

UNIT III DATA ANALYSIS AND OUTPUT 10

Raster Data Analysis: Local, Neighborhood and Regional Operations – Map Algebra – Vector Data Analysis: Non-topological analysis, Topological Analysis, Point-in-Polygon, Line-in-polygon, Polygon-in-polygon – Network Analysis – buffering – ODBC – Map Compilation.

UNIT IV SPATIAL MODELING 9

Modeling in GIS – types – Digital Elevation Models: Generation, Representation, Applications – ALTM.

UNIT V DATA QUALITY AND MISCELLANEOUS TOPICS 9

Data quality analysis – Sources of Error – Components of Data Quality – Meta Data – Open GIS consortium – Customisation in GIS – Object Oriented GIS – WebGIS-GIS system evaluation and bench marking.

TOTAL: 45 PERIODS

REFERENCES:

1. Lo. C P and Yeung, Albert K W, “Concepts and Techniques of Geographic Information Systems”, Prentice Hall of India, 2002.
2. Robert Laurini and Derek Thompson, “Fundamentals of Spatial Information Systems”, Academic Press, 1996.
3. Peter A Burrough, Rachael A Mc.Donnell, “Principles of GIS”, Oxford University Press, 2000.
4. Allan Brimicombe, GIS Environmental Modeling and Engineering, Taylor & Francis, 2003.

RS 9105	GIS LAB	L	T	P	C
		0	0	3	2

OBJECTIVE:

- The exercises are designed to give practical exposure to the students to data input, data storage, data analyses and data output capabilities of a standard GIS software.

1.	Digitization - Point, Line, Polygon and Surface Data	**6**
2.	Building topology – measuring distance and area	**3**
3.	Adding attribute data – querying on attribute data	**3**
4.	Onscreen digitization - Data Conversion – Vector to Raster, Raster to Vector	**6**
5.	Generation of DEM: from contours, spot heights	**3**
6.	Vector Analysis – Buffering, Overlay and Network analysis	**9**
7.	Raster Analysis – Measurement - Arithmetic overlaying, Logical overlaying	**9**
8.	Data Output: Bar charts, Map compilation	**3**
9.	Customisation and scripting	**3**

TOTAL: 45 PERIODS

RS 9106 REMOTE SENSING AND PHOTOGRAMMETRY LAB

L	T	P	C
0	0	4	2

OBJECTIVE:

- To provide exposure in handling equipment like stereoscope, parallax bar, analog stereo plotter, analytical stereo plotter and semi analytical stereo plotter.

PHOTOGRAMMETRY EXERCISES

1. Testing stereovision with test card
2. Finding stereoscopic acquity.
3. Mirror stereoscope- base lining and orientation of aerial photographs.
4. Use of parallax bar to find the height of point.
5. Orientations in Double projector
6. Orientations in Planicart
7. Orientation and mapping in semi analytical stereo plotter.
8. Demonstration of stereo metric camera, orthocomp, and analytical plotter.

REMOTE SENSING EXERCISES

1. Spectral reflectance observation of the following using handheld spectro radiometer.
   i) Vegetation. ii) Soil iii) Water
2. Map reading of Survey of India topo sheets.
   Visual interpretation of different satellite data and aerial photographs for the preparation of following;
3. Land use/land cover map.
4. Soil map.
5. Geology and geomorphology maps.
6. Slope maps.
7. Watershed delineation.

TOTAL: 60 PERIODS

RS 9121	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- The objective of the course is to describe about the procedure of satellite data acquisition and analysis.

UNIT I SATELLITE DATA 9

Satellite systems and data –acquisition - storage - orbits – Data formats –Data products –Image display system- current missions.

UNIT II SENSOR AND DATA MODEL 9

Sensor model –Resolutions- pixel characters- Image formation –Univariate & multi variable image statistics –spatial statistics –Geometric and radiometric correction- noise models.

UNIT III IMAGE ENHANCEMENTS 9

Spectral signatures –Image characteristics, feature space scatterogram- point, local and regional operation –Fourier transform, scale- space transform, wavelet transform – principle component analysis- orthogonal rotation transformation

UNIT IV INFORMATION EXTRACTION 9

Image registration and ortho rectification, resampling, multi-image fusion, Classification – feature extraction, training –Supervised, Unsupervised and Hybrid training, Non-parametric, and sub-pixel classification, Hyper – spectral image analysis.

UNIT V IMAGE ANALYSIS AND UNDERSTANDING 9

Pattern recognition, boundary detection and representation, textural and contextual analysis, decision concepts- Fuzzy sets, evidential reasoning, Expert system, Artificial Neural Network, Integration of data.

TOTAL: 45 PERIODS

REFERENCES:

1. W.G.Rees - Physical Principles of Remote Sensing, Cambridge University Press, 2nd edition, 2001.
2. Robert Shcowebgerdt , Remote sensing models & methods for image processing, III edition, 2004.
3. Digital Image Processing (3rd Edition) Rafael C. Gonzalez , Richard E. Woods Prentice Hall, 2007.
4. John A.Richards, Springer –Verlag, Remate Sensing Digital Image Analysis 1999.
5. John R. Jensen , Introductory Digital Image Processing: A Remote Sensing Perspective , 2nd Edition, 1995.

RS 9122	ELECTRONIC SURVEYING	L	T	P	C
		2	0	2	3

OBJECTIVE:

- To understand the working of Electronic Total station equipment and solve the surveying problems.

UNIT I BASICS OF ELECTRONIC SURVEYING 8

Methods of measuring distance – Basic principles – Historical development classifications – Applications and comparison with conventional surveying – Fundamentals of electronics – Oscillators (Crystal controlled and Gunn diode) Kerrcell / Pockels's modulator – frequency mixing, Modulation and demodulation - Measurement of phase differences – reflectors (Corner, parabolic) Transducers and power sources.

UNIT II ELECTROMAGNETIC WAVES 8

Classification and application of electromagnetic waves – Propagation properties – wave propagation at lower and higher frequencies – Refractive index, factors affecting RI – Computation of group refractive index for light and near infrared waves at standard conditions and ambient conditions – Computation of RI for microwaves – Reference refractive index – Real time application of first velocity correction – Measurement of atmospheric parameters – Mean refractive index – Second velocity correction – and total atmospheric correction – Use of temperature and pressure transducers.

UNIT III ELECTRONIC TOTAL STATION 8

Electro-optical system – measuring principle – working principle – sources of errors – infrared and laser instruments – Microwave system – measuring principle – working principle – sources of errors – Microwave instruments – Comparison between Electro-optical and microwave system – Applications – Care and maintenance of instruments- Modern positioning systems.

UNIT IV SURVEY ERROR ANALYSIS AND ADJUSTMENT 6

Concepts of measurement and error – Elementary concepts in probability – Reliability of measurements – Significant figures – Error propagation and linearization – The concept of adjustment- Simple adjustment methods – The least squares method – Preanalysis procedure – Horizontal angle measurement with a Theodolite – Distance measurement by Total station – Elevation difference by direct levelling and survey tolerances.

UNIT V FIELD WORK 30

Methods of measuring Distance – Study of different Total stations - map compilation – Setting out works – Base line measurement – Traversing - observations and computation of area – Trilateration.

TOTAL (L: 30 + P: 30): 60 PERIODS

REFERENCES:

1. Burnside, C.D.Electromagnetic distance measurement, Crosby Lock wood staples, 1991.
2. Rueger, J.M. Electronic Distance Measurement, Springer – Verlag, Berlin, 2005.
3. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993.
4. Walter Whyte, Raymond Paul, Basic Surveying, Fourth Edition Laxton's, 1997.
5. James M Anderson, Edward M Mikhail, Surveying: Theory and Practice, McGraw-Hill Science/Engineering/Math; 7th edition 1997.
6. Soastamoinen, J.J.Surveyor's guide to Electro-magnetic Distance Measurement, Adam Hilger Ltd, 1997.

RS 9123 GEOGRAPHIC INFORMATION SYSTEM APPLICATIONS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide exposure to applications of GIS in various application domains through case studies.

UNIT I NATURAL RESOURCE MANAGEMENT APPLICATIONS 9

Forestry: Resource inventory, Forest fire growth modeling – Land: Land use planning, watershed management studies – Water – Identification of ground water recharge – Resource information system – Wetlands Management, Wildlife habitat analysis.

UNIT II DISASTER MANAGEMENT & FACILITY MANAGEMENT APPLICATIONS 9

Disaster management: Use of GIS in Risk assessment, mitigation, preparedness, Response and recovery phases of Disaster management – Utilities – Water utility applications – Electric utility Application – Telecommunication: Tower spotting, route optimization for meter reading for utilities – Other utilities.

UNIT III LOCATION BASED SERVICES APPLICATION 9

Vehicle Tracking: Automatic vehicle location (AVL), Components of AVL: Invehicle Equipment, Various communication channels, Web server, Client – Vehicle tracking alarms used in Vehicle tracking, Fleet management – Vehicle navigation – Emergency call: Address geocoding, Distress call application.

UNIT IV LAND INFORMATION SYSTEM & WEB GIS APPLICATIONS 9

Land information system (LIS) – Tax mapping – Mobile mapping - Other LIS applications – Web GIS: Architecture of Web GIS, Map server, Web GIS applications.

UNIT V BUSINESS, HEALTH AND OTHER APPLICATIONS 9

Business applications: Sitting a new facility, Customer Loyalty studies, Market penetration studies – Health application: Disaster Surveillance, Health information system – Crime Mapping: Mapping Crime data, Hot Spot Analysis – 3D GIS.

TOTAL: 45 PERIODS

REFERENCES:

1. Paul Longley, Michael F. Goodchild, David J.Maguire, David W.Rhind, Geographic Information Systems and Science, John Wiley and Sons, 2005.
2. Uzair M.Shamsi GIS Tools for Water, Wastewater, and Stormwater Systems, ASCE Press, 2002.
3. Alan L, MD Melnick, Introduction to Geographic Information Systems for Public Health, Aspen Publishers, first edition, 2002.
4. Amin Hammad, Hassan Karimi, Telegeoinformatics: Location- based Computing and Services, CRC Press, 2004.

5. Allan Brimicombe, GIS Environmental Modeling and Engineering, Taylor & Francis, 2003.
6. Van Dijk, M.G. Bos, GIS and Remote Sensing Techniques in Land-And-Water-Management, Kluwer Academic Publishers, 2001.

RS 9124	IMAGE PROCESSING LAB	L	T	P	C
		0	0	3	2

OBJECTIVE:

- This course will facilitate the students to have hands on experience on different steps of satellite image processing using various softwares.

Sl.No.	Exercises	Hours
1.	Reading and Displaying satellite data from BIL, BSQ and BIP Formats	3
2.	Generating False Colour Composite (FCC)	3
3.	Extracting area of Interest (AOI)	3
4.	Generating Histogram of various bands	3
5.	Georeferencing the base image	3
6.	Geometric correction of satellite image	3
7.	Enhancement using Band ratio and NDVI	3
8.	Enhancement using different Filtering techniques	3
9.	Principal Component Analysis (PCA)	3
10.	Fourier analysis	3
11.	Unsupervised Classification	3
12.	Supervised Classification	3
13.	Classification using Neural Network and Fuzzy Logic	3
14.	Accuracy Assessment	3
15.	Change detection study	3

TOTAL: 45 PERIODS

GM 9131 DIGITAL CADASTRE AND LAND MANAGEMENT SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the concepts of coordinate- based digital form of parcel and related Land records, complexities of urban Land records, continuous updating of Cadastre and Land rights; future Land management in general and Urban Land in particular using high resolution current data in 3D environment for efficient functioning of administration, for Disaster management, utility management, coastal zone land management as examples.

UNIT I INTRODUCTION TO CADASTRAL PRACTICES IN INDIA 9

Definition of Cadastre, Historical background, Graphic and Numeric Cadastre, Legal aspects, Land Records and Title Registration, Mutation, Boundary demarcation and Dispute Redressal System, Municipal Cadastral Systems.

UNIT II CONCEPT OF CO-ORDINATE BASED DIGITAL CADASTRE 9

2D Cadastre from Revenue records (review of NIC projects in India); 3D Cadastre-Data generation through Re-survey and Settlement, Use Of Soft Copy Photogrammetry, High Resolution Satellite Imagery and ALTM, Use of GPS and Electronic Total Station; Case Studies of A-N project of Orissa , Bhu-Bharati project of Andra Pradesh and C-STAR programme of Tamil Nadu.

UNIT III MULTI-DIMENSIONAL CADASTRAL SYSTEM FOR THE CITIES 9

3D and 4D Cadastral Systems, Modernization programs in INDIA - Case Studies of Delhi, Chennai, Mumbai & Ahmedabad; Systems in USA, CANADA,SWEDAN,U.K. &GERMANY.

UNIT VI LAND MANAGEMENT AND LIS 9

Concepts of Land Reforms, Land Consolidation, Guarantee of Land Title and Automated Title Registration, e-Governance and LIS; Disaster Management, Coastal Zone Land Management Systems, Emerging systems and future trends.

UNIT V STUDY OF AVAILABLE SOFTWARE PACKAGES 9

NIC software, A-N Software, PEM package of Arc Info – Import/Export of Cadastre Data with various commercially available GIS packages.

TOTAL: 45 PERIODS

REFERENCES:

1. Nancy von Meyer, GIS and Land Records: The Parcel Data Model 2004.
2. Peter F.Dale & John D.Melaugliu; Land information management, Oxford press, 2000.
3. Gerhard Larsson, Land Registration and Cadastral Systems: Tools for Land Information and Management, 1991.
4. A. Rajabifard, I. Williamson, D. Steudler, and Binns; Assessing the worldwide comparison of cadastral systems [An article from: Land Use Policy], 2007.
5. S.M. Cashin and G. McGrath; Establishing a modern cadastral system within a transition country: [An article from: Land Use Policy], 2006.
6. Peter F. Dale and John D. Melaughlin I, Land Administration(spatial information system), Oxford Press, 2000.
7. Proceedings of FIG Congress 2002. (USA) Commission 7 – Cadastral Innovation I (TS7.1), Cadastral Innovation II (TS 7.2), Global Survey of Cadastral Experiences (TS 7.3), Land Consolidation (TS 7.4), GPS for Cadastral Application (JS 2)
8. User Manual of A-N Technology, R&D Directorate, SOI, 2002.

RS 9151 MICROWAVE REMOTE SENSING L T P C
3 0 0 3

OBJECTIVE:

- To impart the knowledge of Microwave Remote sensing and its applications.

UNIT I FUNDAMENTALS AND RADIOMETRY 6

Introduction and early history, Basic concepts, plane waves, antenna systems, radiometry, microwave interactions with atmospheric constituents, Earth's surface and vegetation, Radiometric systems, Sensors, Data products and its applications.

UNIT II RADAR REMOTE SENSING 9

Radar Basics, Radar interaction with Earth surface and vegetation, Surface scattering theory. Radar equation , fading concept, Measurement and discrimination, Physical mechanisms and empirical models for scattering and emission, Geometry of Radar images, Radar return and image signature, Resolution concepts, SAR, Speckle in radar imagery, concept of roughness, geometry of targets, resonance, dielectric constant, surface and volume scattering, signal penetration and enhancement.

UNIT III AIRBORNE AND SPACEBORNE RADAR SYSTEMS 9

Airborne, Spaceborne, different platforms and sensors, Data products and selection procedure, SEASAT,SIRA,SIRB,ERS,JERS,RADARSAT missions, Doppler radar, JASON,TOPEX/POSEIDON, Aircraft: AirSAR, C/X SAR, E-SAR, STAR-1.

UNIT IV APPLICATION OF RADAR REMOTE SENSING 12

Applications in Agriculture, Forestry, Geology, Hydrology, ice studies, landuse mapping and ocean related studies, military and surveillance applications, search and rescue operations, ground and air target detection and tracking.

UNIT V SPECIAL TOPICS IN RADAR REMOTE SENSING 9

SAR interferometry-Basics- differential SAR interferometry, Radar polarimetry-Radargrammetry and applications-Altimeter and its applications, scatterometer and its applications.

TOTAL: 45 PERIODS

REFERENCES:

1. Ulaby,F.T.,Moore,K.R. and Fung, Microwave remote sensing vol-1,vol-2 and vol- Addison-Wesley Publishing Company,London,1986.
2. Floyd.M.Handerson and Anthony,J.Lewis "Principles and applications of Imaging RADAR", Manual of Remote sensing, Third edition, vol.2, ASPRS, Jhumurley and sons, Inc,1998.
3. Philippe Lacomme,Jean clande Marchais,Jean-Philippe Hardarge and Eric Normant, Air and spaceborne radar systems-An introduction, Elsevier publications 2001.
4. Iain H.woodhouse, Introduction to microwave remote sensing, 2004.
5. Roger J Sullivan, Knovel, Radar foundations for Imaging and Advanced Concepts, SciTech Pub, 2004.
6. Ian Faulconbridge, Radar Fundamentals, Published by Argos Press, 2002.
7. Eugene A. Sharkov,Passive Microwave Remote Sensing of the Earth: Physical Foundations, Published by Springer, 2003.

RS 9152 CLOSE RANGE PHOTOGRAMMETRY L T P C
3 0 0 3

OBJECTIVE:

- To provide exposure to Non-Topographic and terrestrial mapping applications of photogrammetry in various fields

UNIT I BASICS OF NON-TOPOGRAPHIC PHOTOGRAMMETRY 9

Definition – Non-topographic photogrammetry – Brief History – Potential of close range photogrammetry – Instrumentations for Data Acquisition – Phototheodolite, Metric, Camera, Non-Metric camera, Stereo metric camera, Digital camera-Instrumentation for Data Analysis – Analog and Analytical Stereo plotters – Software in Non-topographic photogrammetry

UNIT II ARCHITECTURE 9

Applications in Architecture and Archaeology – Survey of Historic monuments – their conservation and preservation – Photomontage by inverse Photogrammetry for visualization of proposed construction – virtual 3D model for walk through simulation.

UNIT III INDUSTRIAL AND ENGINEERING APPLICATIONS 9

Aerospace Industry, Automobile Industry – Measuring communication Antennas – Measurement of Storage Tanks and Cooling Tower, Model studies – Hologram metric applications for vibration and stress concentration studies.

UNIT IV APPLICATIONS IN MEDICINE 9

Biomedical Application Using X-ray Photogrammetry Systems, Principles point location in Radiographs – Stereo X-ray Photogrammetry- Analysis – Bio-stereo metrics – Whole body form, trunks and limbs – Electron Microscopy – Systems and applications using SEM & Tem.

UNIT V APPLICATIONS IN CRIMINOLOGY 9

Forensic Photogrammetry Applications – Mapping Crime scene using conventional photogrammetry – Reverse Projection Techniques in Accident Investigations under Water Photogrammetry – Case studies.

TOTAL: 45 PERIODS

REFERENCES:

1. Thomas Luhmann, Stuart Robson, Stephen Kyle, Ian Harley, Close Range Photogrammetry: Principles, Techniques and Applications,Wiley, 2007
2. Wilfried Karel, VDM Verlag Dr. Muller Aktiengesellschaft , Co. KG, Creating Architectural Photo Models Using Close Range Photogrammetry 2008 .
3. Karl Kraus, Photogrammetry by Walter de Gruyter 2007.
4. Wilfried Linder, Digital Photogrammetry: A Practical Course, Springer; 2nd edition, 2006.
5. A. Ardeshir Goshtasby, 2-D and 3-D Image Registration: for Medical, Remote Sensing, and Industrial Applications, Wiley-Interscience; 1 edition 2005.

RS 9153 AIR BORNE LASER TERRAIN MAPPING (ALTM)

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide exposure to LiDAR mapping and its applications

UNIT I BASICS OF AIRBORNE LASER TERRAIN MAPPING 9

LASER , LiDAR – Principles and properties – Different LiDAR system – Applications – Advantages, Disadvantages – Space borne and airborne LiDAR missions – Typical parameters of a LiDAR system.

UNIT II LIDAR 9

Principle of Laser Altimetry – Components of the system – GPS, IMU LASER, LiDAR data formats – Terrain Mapping Laser Configuration – Ocean bathymetry Laser Configuration - Limitations of the system.

UNIT III LIDAR DATA PROCESSING 9

GPS and IMU data processing – Strip Adjustment – Geometric Correction – Data quality enhancement – Digital Surface Model – Filtering – Ground Point Filtering – Digital Elevation Model.

UNIT IV LIDAR MAPPING AND MODELING 9

Hydrology, Disaster Mitigation and Management – 3D city models – Telecommunication Modeling – Urban planning – Coastal Zone Bathymetry Mapping – Feature extraction, vectorisation – Surface and landuse classification.

UNIT V LIDARGRAMMETRY 9

Orthophoto rectification using LiDAR – Integrated LiDAR and Digital Photogrammetry Techniques – Integration of LiDAR DEM with other hyper spectral data.

TOTAL: 45 PERIODS

REFERENCES:

1. Mathias Lemmens, Laser Altimetry: Principles and Applications, CRC Press 2006.
2. Yves Egels and Michel Kasser, Digital Photogrammetry, Taylor & Francis, 2001.
3. Roger Read and Ron Graham, Manual of Aerial Survey: Primary Data Acquisation, Whittles Publishing, 2002.
4. Zhilin Li Qing Zhu, Chris Gold, Christopher Gold, Digital Terrain Modeling: Principles and Methodology, CRC Press, 2004.

RS 9154 AUTOMATED CARTOGRAPHY L T P C
3 0 0 3

OBJECTIVE:

- This subject deals with the recent advancement in the field of Digital Cartography and the Rapid technological development in the electronic dissemination of spatial information. It also helps to gather and evaluate digital cartographic information.

UNIT I MANAGING DATABASES 8

Data organization – Data Compression – Data measurement – Basic Statistical processing – Geographic information system – The measuring of GIS to Cartography.

UNIT II DATA PROCESSING 9

Computer system for the processing of graphic data – Hardware – Software - Digitising of Cartographic Presentation – Structuring and storage of data – Cartographic data processing – Output of cartographic – Examples and Applications.

UNIT III MODELLING IN DIGITAL CARTOGRAPHY 10

Fundamentals of Modelling, graph theory, topology – Digital planimetric modeling – Digital Relief modeling – Quality of digital landscape models – Topographic model generalization, Map revision – Web Cartography – Dynamic and Static Web Maps.

UNIT IV MAP DESIGN 10

Theory of communication, information and signs – MAP SHOP CONCEPT,Digital atlases design of cartographic expressions – computer assisted evaluation of geo data for thematic maps – information landscaping

UNIT V TECHNIQUES OF MAP PRODUCTION 8

Modern techniques in map production – Dynamic and interactive mapping – animation – navigation system – simulation – interactive cartography – map as interface – Expert systems and Web Maps – Electronic Atlas – Trends for future developments.

TOTAL: 45 PERIODS

REFERENCES:

1. Robert G. Cromley, Principles of Digital Cartography, Prentice Hall,2001.
2. Robert McMaster,Generalization in Digital Cartography Prentice Hall,2002.
3. Jonathan M. Williams, Digital Cartography from Space, Ellis Horwood, 1990.
4. Michael A Domaratz, Digital cartography (Geological Survey circular - 895), 1982.
5. Robert B, McMaster, K. Stuart Shea, Generalization in Digital Cartography, Association of American geographers, 1992.
6. E.Stefanakis, Geographic hypermedia : concepts and systems first edition 2006.

RS 9155	SPACE GEODESY	L	T	P	C
		2	0	2	3

OBJECTIVE:

- The objective of this course is to teach the fundamentals of space geodesy, the observation and processing of the GPS data for different applications.

UNIT I BASICS **6**

Definition – fundamentals of geodesy – Basic concepts – Historical perspectives – Development - Applications in space geodesy – Geoid and Ellipsoid - satellite orbital motion – keplerian motion – Keplar's law – perturbing forces – Geodetic satellites.

UNIT II DIFFERENT TECHNIQUES **6**

Determination of Direction By Photography – SECOR – electronic observation techniques- Doppler effect – positioning concept – development of TRANSIT satellites

UNIT III GLOBAL POSITIONING SYSTEM **6**

GPS – different segments – space, control and user segment – satellite configuration – GPS signal structure – orbit determination and orbit representation, Anti spoofing and selective availability – task of control segment – GPS receiver- main receiver component- example of GPS receiver.

UNIT IV GPS DATA PROCESSING **6**

GPS observables – code and carrier phase observation – linear combination and derived observables – concept of parameter estimation – data processing – software modules – solutions of cycle slips, ambiguities, RINEX format. Concepts of rapid static methods with GPS - semi kinematic and pure kinematic methods – basic constellation of satellite geometry and accuracy measures.

UNIT V APPLICATION OF SPACE GEODESY **6**

Geodetic control surveys, cadastral surveying, photogrammetry and remote sensing, engineering applications and monitoring – GIS. GLONASS satellite configuration comparison – satellite laser ranging & applications – concept of satellite altimetry.

FIELD WORK **30**

Study of different GPS – Static, Kinematic observations – Downloading and Processing the GPS data.

TOTAL (L: 30 + P: 30): 60 PERIODS

REFERENCES:

1. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.
2. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer – Verlag, Berlin, 2003.
3. Seeber G.Satellite Geodesy, Walter De Gruyter, Berlin, 1998.
4. Ahmed ei-rabbany, Introduction to GPS, the global positioning system, Artech house publishers, 2002.
5. Mohinder s.Grewal, Lawrence R.Weill, Angus P.Andrews, Global positioning systems, Inertial Navigation and integration, Wiley-Interscience, 2000.
6. Bradford W.Parkinson, James J.Spilker, GPS: Theory & Applications progress in astronautics and aeronautics, American Institute of Aeronautics, 1996.
7. D.Kalpan & christoper hegarthy, Understanding GPS: principles and application, Artech house publishers, 2005.
8. B.Hofmann-wellenhof, H.Lichenegger, J.Collins, Global positioning system theory and practice, Fifth revised edition, Springer wien, NewYork, 2001.

RS 9156 REMOTE SENSING AND GIS FOR HYDROLOGY AND WATER RESOURCES

L	T	P	C
3	0	0	3

OBJECTIVE:

- This subject deals with the basics of hydrology and also various remote sensing and GIS applications in the field of hydrology and water resources.

UNIT I BASICS OF HYDROLOGY 12

hydrological cycle – estimation of various components of hydrology cycle – clouds – rainfall – runoff – evaporation – transpiration – evapo–transpiration – interception – depression storage – spectral properties of water – GIS application in surface water modeling – case studies.

UNIT II DRAINAGE BASIN 6

Watershed divide – stream networks – Delineation and codification of watersheds morphometric analysis – linear – areal –relief aspects – Rainfall- runoff modeling – urban hydrology – case studies.

UNIT III AREAL ASSESSMENT 5

Mapping of snow covered area – snow melt runoff – flood forecasting, risk mapping and flood damage assessment soil moisture area – drought forecasting and damage assessment – GIS application in aerial assessment – case studies

UNIT IV GROUND WATER AND WATER QUALITY 10

Ground water prospects – surface water indicators – vegetation , geology, soil aquifer – aquifer parameters – well hydraulics – estimation of ground water potential – hydrologic budgeting – mathematical models – GIS application in ground water modeling – study on sea water intrusion – modeling of sea water intrusion – water quality parameters – physical, chemical, biological properties. Water quality mapping and monitoring – correlation model for pollution detection and suspended sediment concentration– case studies

UNIT V IRRIGATION AND WATERSHED MANAGEMENT 12

Project investigation, implementation, maintenance stage- location of storage/ diversion works – canal alignment –depth-area capacity curve generation, - conjunctive use of surface and ground water – Mapping and monitoring the catchment command area – artificial recharge of groundwater – water harvesting structures – sediment yield – modeling of reservoir siltation – prioritization of watershed –modeling of sustainable development – Development of information system for Natural resource management – case studies.

TOTAL: 45 PERIODS

REFERENCES:

1. Eric C. Barrett, Clare H.Power, Satellite Remote Sensing for Hydrology and Water Management, gordon @ Breach Science publications - new york 1990,
2. Dr. David Maidment, Dr. Dean Djokic, Hydrologic and Hydraulic Modeling Support with Geographic Information Systems, Esri Press 2000,
3. Wilfried Brutsaert, Hydrology: An Introduction Cambridge University Press, 2005,
4. Andy D. Ward and Stanley W. Trimble, Environmental Hydrology, second edition, Lewis Publishers, 2004,
5. U.M. Shamsi, GIS Applications for Water, Wastewater, and Stormwater Systems,CRC; first edition 2005,

RS 9157 REMOTE SENSING AND GIS FOR EARTH SCIENCES

L	T	P	C
3	0	0	3

OBJECTIVE:

- The objective of the course is to impart knowledge about the various geological structures and Geomorphic Landforms. The students will be exposed to various Remote Sensing Applications to earth Sciences.

UNIT I LITHOLOGY AND STRUCTURE 9

Introduction – Rocks and Minerals, image characters of igneous, sedimentary and metamorphic rocks - Lithological mapping using aerial and satellite data- Structural Geology, introduction, Mapping structural feature such as folds, Lineaments / faults, fractures image characters of folds, faults, lineaments etc., - Digital techniques for lithological and structural analysis – case studies.

UNIT II SPECTRA OF ROCKS AND MINERALS 9

Spectral properties of geologic features in different regions of Electromagnetic Spectrum, Elemental composition and nature of the spectra of rocks and minerals, Optimal spectral windows – Geologic Remote sensing and its significance in Geologic mapping - case studies.

UNIT - III GEOMORPHOLOGY 9

Geomorphic Landforms, Drainage network and patterns classification and implications of drainage patterns, geomorphic mapping using, aerial and satellite data - Landform analysis in natural resources and management case studies.

UNIT IV SUBSURFACE EXPLORATIONS 9

Different types of Geophysical Surveys - Electrical resistively surveys - aeromagnetic surveys - Electromagnetic surveys - Seismic surveys - Planning Geophysical surveys using satellite data - Applications of different types of geophysical surveys in resource mapping - case studies.

UNIT V REMOTE SENSING AND GIS APPLICATIONS 9

Introduction - Applications of Remote Sensing and GIS for Resource mapping, monitoring and management - Preparation of thematic layers - Integration of all relevant primary and secondary data using GIS in Surface and groundwater studies - Engineering Geology, Mineral exploration and Petroleum exploration - Disaster Management studies like Droughts, Floods-Case studies.

TOTAL: 45 PERIODS

REFERENCES:

1. Frederic k. lutgens, kennth G.pinzke and Edward j. tarbuck Applications and Investigation in Earth science 2008.
2. Glencoe science, Physical science with earth science, 2005.
3. Sebins, F.Remote Sensing principles and interpretation' W.H.Freeman and company Newyork 1987.
4. Parbin Singh 'Engineering and General Geology' Ketson Publication House 1987
5. Drury, S.A. image interpretation in Geology, Chapman and Hall London 1993
6. Michael N.Demers Fundamentals of GIS, John Wiley & sons, inc 1999.
7. C.P.L.O and Albert KW Yeung Prentice- Hall of India Pvt. Ltd., New Delhi, 2002

RS 9158 REMOTE SENSING AND GIS FOR AGRICULTURE & FORESTR

L	T	P	C
3	0	0	3

OBJECTIVE:

- The content of this course enable the students to understand the application potentialities of remote sensing data separately and in combination with GIS techniques for Agriculture and Forestry.

UNIT I CROPS ACREAGE AND YIELD ESTIMATION 9

Introduction – Spectral properties of crops in optical & TIR region, Microwave backscattering behavior of crop canopy – crops identification and crop inventory – crop acreage estimation – vegetation indices – Yield modeling – crop production forecasting through digital analysis – crop condition assessment – command area monitoring – land use and land cover analysis – Microwave RS for crop inventory – Case studies

UNIT II SOIL MAPPING AND CONSERVATION 9

Introduction – soil genesis, Soil morphological characters, Soil pedology – Soil survey, Types and methods of soil surveys – Soil classifications – Hydrological Soil grouping – Characteristics of saline & alkaline Soils – Factors influencing soil reflectance properties – principle component analysis and orthogonal rotation transformation-Soils mapping using RS data - Problem soil identification and mapping – land evaluation – Soil sedimentation & erosion – Soil loss assessment – Soil conservation – Case studies.

UNIT III DAMAGE ASSESSMENT 9

Detection of pest & diseases – Flood mapping and Assessments of crop loss – Remote sensing capabilities & contribution for drought management – Land degradation due to water logging & Salinity – crop stresses reflectance properties of stressed plants and stress detection.

UNIT IV FORESTRY 9

Introduction – Forest taxonomy – inventory of forestlands – forest types and density mapping using RS techniques – Forest stock mapping – factors for degradation of forest – Delineation of degraded forest - Forest change detection and monitoring – Forest fire mapping & damage assessment – LiDAR remote sensing for Forest studies.

UNIT V INTEGRATED SURVEYS 9

Introduction – Integrated surveys for agriculture & forest development – RS & GIS for drawing out action plans – water shed approach – Rule of RS & GIS for watershed management – Land use planning for sustainable development – Precision forming - Case studies.

TOTAL: 45 PERIODS

REFERENCES:

1. John G. Lyon, Jack MCcarthy, Wetland & Environmental application of GIS,1995.
2. Margareb Kalacska, G. Arturosanchez, Hyper spectral RS of tropical and sub tropical forest, 2005.
3. Shunlin liang , Advances in land RS: System, modeling invention and applications, 2001.
4. Joe Boris dexon, Soil mineralogy with environmental application, Library of congress catalog, 2004.
5. James B, Introduction of Remote sensing, Third edition Campbell, third edition Guilford Press, 2002.

RS 9159 REMOTE SENSING AND GIS FOR ENVIRONMENTAL ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

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

UNIT I REMOTE SENSING APPLICATIONS TO ENVIRONMENTAL STUDIES 9

Introduction ,Environmental satellites GEOS, NOAA, AVHRR, CZCR Monitoring land, water, atmosphere and ocean using Remote Sensing Data, case studies.

UNIT II SOIL DEGRADATION STUDY 9

Taxonomical classification of soils, soil survey interpretation and mapping, impact of agricultural and industrial activity on soil properties. soil salinity/alkalinity, erosion studies, Applications of GIS in assessing soil salinity, erosion productivity etc.

UNIT III WATER QUALITY AND GROUND WATER POLLUTION 9

Classification of water quality for various purposes. Data base creation and quality modeling using GIS. Database Creation and maintaining water supply network, sewerage network using GIS. Case studies. Aquifer Vulnerability Intrinsic and specific vulnerability, DRASTIC, SINTACS MODELS MODFLOW, MT3D, contaminant transport model. Case studies using AHP techniques.

UNIT IV AIR QUALITY MODELLING 9

Atmosphere: Chemicals, Particulate matters present in the atmosphere, allowable limits, Remote Sensing technique to monitor atmosphere constituents, air pollution due to industrial activity, modeling using GIS. Case Studies.

UNIT V ENVIRONMENTAL MANAGEMENT 9

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

TOTAL: 45 PERIODS

REFERENCES:

1. Ian L.Pepper, charles P.Gerbaand Mark L.Brusseau, Environmental and pollution science 2006.
2. Savigny.D De and Wijeyaratne .P GIS for Health and Environment, Stylus publication, 1994.
3. Reger D.Griffin, Air Quality Assessment andMmanagement (second edition), 2006.
4. Donald L.Wise, Remediation for Hazardous waste contaminated soils 1994.
5. Integrated Solid Waste Management Techobanoglous George, Hilary Theisen, Samuel Vigi,Mc Graw – Hill Inc, Singapore. 1993.
6. Michele Campagna, GIS for sustainable development, 2005.

RS 9160 REMOTE SENSING AND GIS FOR OCEAN ENGINEERING AND COASTAL ZONE MANAGEMENT **L T P C**
3 0 0 3

OBJECTIVE:

- This Course deals with the fundamental of physical, chemical and Biological oceanography and the various RS applications to coastal zone management.

UNIT I OCEAN ENGINEERING 10

Costal processes – Oceanic circulation – Upwelling and sinking - current Measurement – Waves – surface waves - Water motion in waves – reflection, diffraction and refraction – wave generated currents – catastrophic waves – Tides – Tidal forces – sediment drift – salinity intrusion.

UNIT II OCEAN GENERAL STUDIES 6

Study of physical properties of sea water and parameters – chemistry of sea water – Biological parameters – Oceanographic instruments – collection of water samples – current measuring devices – deep sea coring devices – dredges.

UNIT III COASTAL ENGINEERING 7

Coastal Hydrodynamic – Coastal erosion and protection – different Coastal protection works – design of Breakwaters – Estuaries and their impact on coastal process – Hydrodynamics of pollution dispersion.

UNIT IV REMOTE SENSING APPLICATION 10

Use of Microwave data – CZCS studies – chlorophyll production idex – various sensors used for coastal application – physical oceanographic parameter estimation – sea surface temperature – significant wave height – wind speed and direction – coastal Bathymetry – sea level rise.

UNIT V COASTAL ZONE MANAGEMENT 12

Introduction – Major issues/problem – Thematic maps on coastal resources, - wetland classification – creation of CZIS – Coastal Regulation zone – Coastal aquifer modelling using GIS – Integrated coastal Management using GIS.

TOTAL: 45 PERIODS

REFERENCES:

1. Johnb.Herbich, Handbook of Costal Engineering, McGraw-Hill Professional; 1 edition 2000.
2. D. J. Tritton , Physical Fluid Dynamics,Publisher: Oxford University Press, USA; edition 1988.
3. Robert G. Dean, Robert A. Dalrymple , Water Wave Mechanics for Engineers & Scientists, Publisher: World Scientific Publishing Company 1990.
4. J. William Kamphuis , Introduction To Coastal Engineering And Management , World Scientific Publishing Company, 2000.
5. Biliana Cicin-Sain Gunnar Kullenberg, Integrated Coastal and Ocean Management: Concepts And Practices (First edition), Island Press, 1998.

RS 9161 REMOTE SENSING AND GIS FOR URBAN PLANNING AND MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- This course describes the various mapping techniques used for urban mapping including transportation planning.

UNIT I INTRODUCTION 9

Remote sensing for detection of urban features – Scale and resolution – Scope and limitations – Interpretation from Aerial and satellite images – Digital image processing techniques – Image fusion – Case studies.

UNIT II SETTLEMENT MAPPING 9

Classification and settlement – settlement structure – Segmentation of Built-up areas – Classification algorithms – Land use/ Land cover mapping – change detection – high resolution remote sensing – case studies.

UNIT III ANALYSIS AND PLANNING 9

Urban morphology – Housing typology – Population estimation from remote sensing – Infrastructure demand analysis – Urban renewal Land suitability analysis – Plan formulation – Regional, Master and detailed development – Use of remote sensing and GIS in plan preparation – Urban information system – Web GIS – case studies.

UNIT IV TRANSPORTATION PLANNING 9

Mapping transportation network – Classification – Optimum route/ shortest route – Alignment planning – Traffic and parking studies – Accident analysis – case studies.

UNIT V CURRENT TRENDS 9

Urban growth modeling – Expert systems in planning – 3D city models – ALTM – Land use Transportation interaction models – Intelligent transportation systems – case studies

TOTAL: 45 PERIODS

REFERENCES:

1. Juliana Maantay, John Ziegler, John Pickles, GIS for the Urban Environment, Esri Press 2006.
2. Allan Brimicombe, GIS Environmental Modeling and Engineering, CRC; 1 edition 2003.
3. Paul Longley, Michael Batty, Spatial Analysis: Modeling in a GIS Environment Wiley,1997.
4. Michael F. Goodchild, Louis T. Steyaert , Bradley O. Parks, Carol Johnston, David Maidment, Michael Crane , Sandi Glendinning, GIS and Environmental Modeling: Progress and Research Issues (Hardcover) by,Publisher: Wiley; 1 edition, 1996.
5. Roland Fletcher, The Limits of Settlement Growth: A Theoretical Outline (New Studies in Archaeology) (First edition), Cambridge University Press; 2007.

RS 9162 REMOTE SENSING AND GIS FOR DISASTER MITIGATION MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To teach about the various principles involved and also the various mitigation to be adopted during the disasters.

UNIT I DISASTER PRINCIPLES 9

Basic concepts and principles – Hydrological and geological disasters, characteristics crisis and consequences – Role of government administration, University research organization and NGOs-International disaster assistance – Sharing technology and technical expertise.

UNIT II LONG TERM MITIGATION MEASURES 9

Needs and approach towards prevention – principles and components of mitigation Disaster legislation and policy – Insurance – Cost effective analysis – Utilisation of resource – Training – Education – Public awareness –Role of media.

UNIT III SAFETY RATING 0F STRUCTURES 9

Slope stability of Ghat roads – Structural safety of Dams,Bridges,Hospital, Industrial structures – Low cost housing for disaster prone areas – Cyclone shelter projects and their implications – Reconstruction after disasters: Issues of practices.

UNIT IV SPACE SCIENCE INPUT IN DISASTER MANAGEMENT 9

Remote sensing in Hazard evaluation – Zonation – Risk assessment –Damage assessment – Land use planning and regulation for sustainable development – Communication satellite application – network – Use of Internet _ Warning system –Post disaster review –Case studies.

UNIT V EMERGENCY PLANNING USING SPATIAL AND NON-SPATIAL DATA 9

Information system management – Spatial and non-spatial data bank creation-Operational emergency management – Vulnerability analysis of infrastructure and settlements –Pre-disaster and post disaster planning for relief operations – Potential of GIS application in development planning – Disaster management plan – Case studies,

TOTAL: 45 PERIODS

REFERENCES:

1. Sisi zlatanova & Andrea Fabbri jonathanli, Geometrics solutions for Disaster management, Springer Verlag, 2007.
2. C.Emdad Haque, Mitigation of natural Hazards & disasters, Klwuer Acadamic publishers group, 2005.
3. Linda C. Bottersll & ponald A.wilhite, From Disaster response to Risk management. Klwuer Acadamic publishers group, 2005.
4. Gerard Blokdijk, Disaster recovery planning and services, Gennaio publishers, 2008.
5. Mohamed Gad Large scale disasters:prediction, control and mitigation, Cambridge university press, 2008.

RS 9163 SATELLITE PAYLOADS AND COMMUNICATION SYSTEM **L T P C**
3 0 0 3

OBJECTIVE:

- To cover the most relevant aspects of satellite sensors and communications, with emphasis on the most recent applications and developments

UNIT I INTRODUCTION **9**

Overview of Remote Sensing- History of evolution of satellites - Radiation Properties and Atmospheric Interactions – target interaction-Orbit types- Equations of motion –Kepler's Equation and Kepler's Problem.- Coordinate and Time Systems.

UNIT II SATELLITE ORBIT AND ATTITUDE SYSTEMS **9**

Orbit Properties - Attitude Properties- Space-Based Orbit, Attitude, and Timing Systems- Geometry on the Celestial Sphere- Spacecraft Position and Attitude Systems- Full-Sky Spherical Geometry- Earth Coverage- Satellite Relative Motion - Viewing and Lighting Conditions- Orbit Selection and Design-Constellation Design- Operations Considerations in Orbit Design Launch.

UNIT III ROCKETS AND LAUNCH VEHICLES **9**

Introduction- Basic design-Materials for rockets and spacecraft- Ignition system in rockets - Combustion system –Propellant system-Thermal control subsystem – Power supply subsystem - Forces acting on rockets during launch – trajectories – Launch sequence - Multistaging of rockets- Transfer to geo-synchronous orbit – station keeping- Attitude dynamics and control – Satellite launch vehicles-Ariane, SLV space shuttle-PSLV, GSLV-Launch stations- International space station – Tracking – Telemetry – command subsystem – Antenna subsystem.

UNIT IV SATELLITE SENSOR TECHNOLOGY **9**

Principles of sensor system-Active and Passive sensors-optical, microwave, thermal and infrared sensors – Multispectral and Hyperspectral sensors - Sensor characteristics – photodetectors- CCDs-sensor signal-to-noise ratio-imaging optics and geomtery-radiometry of imaging-data products- system design for satellite sensors-microcontrollers- signal processing.

UNIT V SATELLITE COMMUNICATION SYSTEM **9**

Sub systems of communication satellite; Spectrum allocation and Bandwidth considerations; Propagation characteristics, Satellite transponders and other sub systems; Earth station technology; Analog and Digital link design; Multiple access techniques-FDMA, TDMA, SS-TDMA; Interference in FDMA systems- INTELSAT systems, VSAT networks, GPS, GLONASS,GEO, MEO and LEO mobile communications, Broadband and Multimedia Systems- data security standards and policies, principles, risk management, controls, cryptography methods, process, issues, security governance.

TOTAL: 45 PERIODS

REFERENCES:

1. Anil k.Maini and Varsha Agrawal, Satellite Technology, John Wiley, 2007.
2. Dennis Roddy, Satellite Communications, Fourth edition, McGraw-Hill, 2006.
3. Barry George Evans, Satellite Communication Systems, Institution of Electrical Engineers, 1999.
4. Pratt, Bostian and Allnutt, Satellite Communications , Wiley, 2003.
5. Cornelisse, J.W.., " Rocket Propulsion and Space Dynamics ", J.W., Freeman & Co., Ltd., London,1982.
6. Graham M. Brooker, “Introduction to sensors for Ranging and Imaging”, Scitech publishing, 2008.

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GM 9160 ADVANCED SOFT COMPUTING L T P C
3 0 0 3

OBJECTIVE:

- To impart the concepts of the ANN network with the fuzzy logic in the geomatics system.

UNIT I INTRODUCTION 9

Artificial Neural Systems – Perceptron – Representation – Linear separability – Learning – Training algorithm – The back propagation network – The generalized delta rule – Practical considerations – BPN Geomatic applications.

UNIT II STATISTICAL METHODS 9

Hopfield nets – Cauchy training – Simulated annealing – The Boltzmann machine. Associative memory – Bidirectional Associative Memory Network – Geomatic Applications.

UNIT III COUNTER PROPAGATION NETWORK AND SELF ORGANIZING MAPS 9

CPN building blocks – CPN data processing. SOM data processing - Adaptive Resonance Theory network - Geomatic Applications

UNIT IV FUZZY LOGIC 9

Fuzzy sets and Fuzzy reasoning – Fuzzy matrices – Fuzzy mebership functions – Operators Decomposition – Fuzzy automata and languages – Fuzzy control methods – Fuzzy decision making

UNIT V NEURO – FUZZY MODELING 9

Adaptive networks based Fuzzy interface systems – Classification and Regression Trees – Data clustering algorithms – Rule based structure identification – Neuro-Fuzzy controls – Simulated annealing – Evolutionary computation - Geomatic Applications.

TOTAL: 45 PERIODS

REFERENCES:

1. James Freeman A. and David Skapura M.Neural Networks – Algorithms, Applications & Programming Techniques Addison Wesley, 1999.
2. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill, 1997.
3. Yegnanarayana B., Artificial Neural Networks, Prentice Hall of India Private Ltd., New Delhi, 1999.
4. Lqurene Fausett, “Fundamentals of Neural Networks”, Prentice Hall, 1994.
5. Jang J.S.R., Sun C.T. and Mizutani E, “Neuro-Fuzzy and soft computing”, Prentice Hall 1998.

GM 9159 **DIGITAL PHOTOGRAMMETRY** **L T P C**
3 0 0 3

OBJECTIVE:

- To impart knowledge in digital camera, scanners, photogrammetric Workstation and its Application with GIS and Remote Sensing.

UNIT I BASICS **9**

Evolution of digital photogrmmetry – Phases of Photogrammetry - comparison of analog, analytical &digital systems – advantages – automation – accuracy- representation of digital images B/W – RGB – HIS - image source – analog and digital cameras

UNIT II DIGITAL CAMERAS AND SCANNERS **9**

Digital cameras- CCD camera- full frame, frame transfer, interline CCD camera - Time delay integration- spectral sensitivity of CCD sensor – geometric problem of CCD image – line jitter, blooming,warm up effect – tralling – types of CCD systems - Linear array line scanner – use of CCD scanner in high resolution satellites, SPOT,MOMS,IRS,IKONOS and Quickbird.

UNIT III DIGITAL IMAGE HANDLING **9**

Image Generation - Data Compression - formats - Data procuring concepts – Georeferencing - Stereo viewing - Display modes - image matching techniques - Image measurements - symbol library - feature coding.

UNIT IV DIGITAL PHOTOGRAMMETRIC PROCEDURES **9**

Review of space resection & intersection - interior & exterior orientation - Automatic tie point generation - Automatic Block triangulation, feature collection and plotting annotation - editing – various formats of map data.

UNIT V APPLICATIONS **9**

DEM Generation - accuracy of DEMs, Orthorectification - regular & irregular data collection methods - contour generation - watershed delineation - satellite photogrammetry principles – missions - stereo image products - issues - stereo satellite missions.

TOTAL: 45 PERIODS

REFERENCES:

1. Wilfried Linder, Digital Photogrammetry: A Practical Course Springer; 2nd ed. edition 2006.
2. Ghosh, Sanjiv.k, Fundamentals of Computational Photogrammetry, concept publishing, New Delhi, 2005.
3. Junichi Nakamura, Image Sensors and Signal Processing for Digital Still Cameras, CRC, 2005.
4. Zhilin Li, Qing Zhu, Chris Gold, Digital Terrain Modeling: Principles and Methodology CRC; third edition, 2004.
5. John A. Richards, Xiuping Jia Remote Sensing Digital Image Analysis: An Introduction, Springer; 4th ed. edition 2005.

GM 9101 DECISION SUPPORT SYSTEM L T P C
3 0 0 3

OBJECTIVE :

- To impart the knowledge of Expert Systems for Geomatics and its Applications.

UNIT I STRUCTURE 6

Definition – Features, needs, components – characteristics – players - Structure and phases of building ES – Types – Rule based, Frame based & Hybrid – Design, Planning, monitoring.

UNIT II KNOWLEDGE ACQUISITION 9

Knowledge Acquisition stages – Representation schemes, Rule, Semantic network, frames and logic – Inference Techniques – Types of Reasoning deductive, inductive, adductive, analogical and non-monotonic – conflict resolution - types of inference: forward and backward chaining - search techniques

UNIT III RULE BASED EXPERT SYSTEMS 8

Evolution – Architecture – Examples – backward and forward chaining - rules and meta rules – rule based systems – Case studies: MYCIN, PROSPECTOR

UNIT IV INEXACT REASONING 10

Bayesian theory, examples – Certainty theory: overview, uncertain evidence, rule inferencing - certainty factors – Fuzzy sets – Representation, hedges inference & fuzzy logic – Rule base for interpretation of RS data.

UNIT V OBJECT BASED EXPERT SYSTEM 12

Overview, anatomy of class, sub class, instance, properties, inheritance, Facets methods, encapsulation, rules interaction with object, design methodology for frame based system – domain, classes, instances, rule – communications, design interface.

TOTAL: 45 PERIODS

REFERENCES:

1. Peter Jackson, “Introduction to Expert systems”, Pearson Education, 2004.
2. Turban E., “Expert Systems and Applied Artificial Intelligence”, Macmillan, 2004.
3. Donald A.Waterman., “A Guide to Expert systems”, Pearson Education, 2001.
4. Durkin.J., “Expert Systems Design and Development”, Prentice Hall, 1994
5. Dan.W.Patterson, “Introduction to Artificial Intelligence and Expert systems”, Prentice Hall, 2003.
6. Ermine.J.I, “Expert Systems: Theory and Practice”, Prentice Hall, 2003.