M.TECH (REMOTE SENSING)

OBJECTIVES :

The course is designed to fulfill the following objectives

1. To provide exposure to students in gaining knowledge on concepts and applications leading to modeling of earth resources management using Remote Sensing
2. To acquire skills in storing, managing digital data for planning and development.
3. To acquire skills in advance techniques such as hyper spectral, thermal and LiDAR scanning for mapping, modeling and monitoring.

OUTCOME:

1. Fully equipped with concepts, methodologies and applications of Remote Sensing Technology.
2. Prepare the candidates for National and Global Employability
3. Acquire skills in handling instruments, tools, techniques and modeling while using Remote Sensing Technology
4. It empowers the candidate with confidence and leadership qualities.

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M.TECH. REMOTE SENSING

CURRICULUM AND SYLLABUS I TO IV SEMESTERS (FULL TIME)

SEMESTER I

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	RS8101	Optical Remote Sensing and Photogrammetry	3	0	0	3
2.	RS8102	Total Station and GPS Surveying	3	0	2	4
3.	MA8161	Statistical Methods for Engineers	3	1	0	4
4.	RS8151	GIS and Digital Cartography	3	0	0	3
5		Elective I	3	0	0	3
PRACTICAL						
7	RS8111	Remote Sensing and Photogrammetry Laboratory	0	0	4	2
8	RS8162	GIS and Digital Cartography Laboratory	0	0	4	2
		TOTAL	**15**	**1**	**10**	**21**

SEMESTER II

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	RS8152	Satellite Image Processing	3	0	0	3
2	RS8251	Microwave Remote Sensing	3	0	0	3
3	RS8252	Thermal and Hyperspectral Remote Sensing	3	0	0	3
4		Elective II	3	0	0	3
5		Elective III	3	0	0	3
6		Elective IV	3	0	0	3
PRACTICAL						
7	RS8211	Digital Image Processing Laboratory	0	0	3	1
8	RS8212	Microwave Remote Sensing Laboratory	0	0	3	1
9	RS8213	Seminar	0	0	2	1
		TOTAL	**18**	**0**	**8**	**21**

SEMESTER III

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	RS8301	Scripting and Customization	2	0	2	3
2		Elective V	3	0	0	3
3		Elective VI	3	0	0	3
PRACTICAL						
4	RS8311	Practical Training	-	-	-	1
5	RS8312	Project Work Phase I	0	0	12	6
		TOTAL	**8**	**0**	**14**	**16**

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SEMESTER IV

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	RS8411	Project Work Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 70

ELECTIVES FOR M.TECH. REMOTE SENSING

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	RS8001	Demographic and Utility Application of GIS	3	0	0	3
2.	RS8002	Remote Sensing Applications for Agricultural & Forestry	3	0	0	3
3.	RS8003	Remote Sensing Applications for Earth Sciences	3	0	0	3
4.	RS8004	Remote Sensing Applications for Environmental Impact Assessment (EIA) & Risk Assessment	3	0	0	3
5.	RS8005	Remote Sensing Applications for Ocean Engineering and Coastal Zone Management	3	0	0	3
6.	RS8071	Open source GIS	3	0	0	3
7.	RS8072	Remote Sensing Applications for Disaster Mitigation and Management	3	0	0	3
8.	RS8073	Remote Sensing Applications for Meteorology	3	0	0	3
9.	RS8074	Remote Sensing Applications for Water Resources Management	3	0	0	3
10.	RS8075	Remote Sensing Technology for Urban & Regional Planning	3	0	0	3
11.	GM8071	Airborne Laser Terrain Mapper (ALTM)	3	0	0	3
12.	GM8072	Geomatics in Environmental Engineering	3	0	0	3
13.	GM8073	Object Oriented Information System	3	0	0	3
14.	GM8251	Decision Support System	3	0	0	3

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M.TECH. REMOTE SENSING

CURRICULUM AND SYLLABUS I TO VI SEMESTERS (PART TIME)

SEMESTER I

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	MA8161	Statistical Methods for Engineers	3	1	0	4
2.	RS8101	Optical Remote Sensing and Photogrammetry	3	0	0	3
3.		Elective I	3	0	0	3
		TOTAL	**9**	**1**	**0**	**10**

SEMESTER II

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	RS8152	Satellite Image Processing	3	0	0	3
2.	RS8251	Microwave Remote Sensing	3	0	0	3
3.	RS8252	Thermal and Hyperspectral Remote Sensing	3	0	0	3
PRACTICAL						
4.	RS8211	Digital Image Processing Laboratory	0	0	3	1
5.	RS8212	Microwave Remote Sensing Laboratory	0	0	3	1
		TOTAL	**9**	**0**	**6**	**11**

SEMESTER III

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	RS8151	GIS and Digital Cartography	3	0	0	3
2.	RS8102	Total Station and GPS Surveying	3	0	2	4
PRACTICAL						
3.	RS8162	GIS and Digital Cartography Laboratory	0	0	4	2
4.	RS8111	Remote Sensing and Photogrammetry Laboratory	0	0	4	2
		TOTAL	**6**	**0**	**10**	**11**

SEMESTER IV

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.		Elective II	3	0	0	3
2.		Elective III	3	0	0	3
3.		Elective IV	3	0	0	3
PRACTICAL						
4.	RS8213	Seminar	0	0	2	1
		TOTAL	**9**	**0**	**2**	**10**

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SEMESTER V

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	RS8301	Scripting and Customization	2	0	2	3
2.		Elective V	3	0	0	3
3.		Elective VI	3	0	0	3
PRACTICAL						
4.	RS8311	Practical Training	-	-	-	1
5.	RS8312	Project Work Phase I	0	0	12	6
		TOTAL	**8**	**0**	**14**	**16**

SEMESTER VI

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1.	RS8411	Project Work Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL NO. OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 70

ELECTIVES FOR M.TECH. REMOTE SENSING

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	RS8001	Demographic and Utility Application of GIS	3	0	0	3
2.	RS8002	Remote Sensing Applications for Agricultural & Forestry	3	0	0	3
3.	RS8003	Remote Sensing Applications for Earth Sciences	3	0	0	3
4.	RS8004	Remote Sensing Applications for Environmental Impact Assessment (EIA) & Risk Assessment	3	0	0	3
5.	RS8005	Remote Sensing Applications for Ocean Engineering and Coastal Zone Management	3	0	0	3
6.	RS8071	Open source GIS	3	0	0	3
7.	RS8072	Remote Sensing Applications for Disaster Mitigation and Management	3	0	0	3
8.	RS8073	Remote Sensing Applications for Meteorology	3	0	0	3
9.	RS8074	Remote Sensing Applications for Water Resources Management	3	0	0	3
10.	RS8075	Remote Sensing Technology for Urban & Regional Planning	3	0	0	3
11.	GM8071	Airborne Laser Terrain Mapper (ALTM)	3	0	0	3
12.	GM8072	Geomatics in Environmental Engineering	3	0	0	3
13.	GM8073	Object Oriented Information System	3	0	0	3
14.	GM8251	Decision Support System	3	0	0	3

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RS8101 OPTICAL REMOTE SENSING AND PHOTOGRAMMETRY L T P C
3 0 0 3

OBJECTIVES:

- To introduce the student to the physical principles of Remote Sensing and Photogrammetry as a tool for mapping
- To inform him of the data products, their properties and methods of preparing thematic information.

UNIT I INTRODUCTION TO REMOTE SENSING 9

Introduction of Remote Sensing ,Electro Magnetic Spectrum - Effects of Atmosphere- Scattering – Absorption-Atmospheric window- Energy interaction with surface features – Spectral reflectance of earth objects and land covers – Resolution concepts – types – Satellites, orbits and missions.

UNIT II DATA ACQUISITION IN DIFFERENT PLATFORMS 9

Historical development – Opto mechanical electro optical sensors – across track and Along track scanners – multi spectral scanners – characteristics of different types of platforms – medium and high resolution missions – Future Missions - Data products and characteristics – formats

UNIT III DATA ANALYSIS 9

Sources of Errors – scene, sensor and atmospheric causes - correction: geometric and Radiometric – visual and digital interpretation- elements of interpretation – interpretation keys - digital analysis and classification – image formation, visualization : Image enhancement, filters–Baye's theorem - Image classification: unsupervised and supervised – thematic mapping - accuracy assessment.

UNIT IV INTRODUCTION TO PHOTOGRAMMETRY 9

Principles – aerial photo-aerial camera -Scale – overlaps – stereoscopy – concepts – viewing and measuring systems – image and object co-ordinates – transformation - floating mark – parallax equation – height information - Flight planning – computation for flight plan – photo control

UNIT V PHOTOGRAMMETRY AND MAPPING 9

Concepts of interior, relative, absolute orientation – direct georeferencing – object, image relation - collinearity and coplanarity conditions – effect of orientation elements - Elements and principles of Aerotriangulation – orthorectification - ortho mosaic - Introduction to digital photogrammetry- - comparison with analytical systems - DP workstations.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Acquire knowledge about concepts of Remote sensing, sensors and their characteristics.
- Gain skills in image analysis and interpretation in preparing thematic maps.
- Acquire knowledge in basic concepts of Photogrammetry and Mapping.

REFERENCES:

1. Robert A. Schowengerdt, Remote Sensing,: Models and Methods for Image Processing, 3rd Edition, Academic Press, 2007, ISBN-13: 978-0123694072

2. Gottfried Konecny, Geoinformation: RS, Photogrammetry and Geographic Information Systems, Second Edition, CRC; 2nd edition, 2009. ISBN 0 - 415 23795 – 7.

3. Paul R.Wolf, Elements of Photogrammetry, McGraw-Hill Science, 2001, ISBN 0070713464, 9780070713468

4. Karl Kraus, Photogrammetry, Fundamentals and standard processes, Dümmler, 2000, ISBN 978 3 11019007 6

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5. W.G.Rees, Physical principles of remote sensing, second edition, Cambridge University Press, 2001, ISBN 0 - 521 66034 3.
6. Emilio Chuvieco; Alfredo Huete; Fundamental of Satellite Remote Sensing, December 2009, CRC Press
7. Edward M. Mikhail, James S. Bethel, J. Chris McGlone; Introduction to Modern Photogrammetry, 2001, John Wiley & Sons Inc

RS8102 TOTAL STATION AND GPS SURVEYING L T P C
3 0 2 4

OBJECTIVE :

- To understand the working of Total Station and GPS equipment and solve the surveying problems.

UNIT I FUNDAMENTALS OF TOTAL STATION AND GPS 9

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying. Basic concepts of GPS - Historical perspective and development - applications - Geoid and Ellipsoid- satellite orbital motion - Keplerian motion – Kepler's Law - Perturbing forces - Geodetic satellite - Doppler effect - Positioning concept – GNSS

UNIT II ELECTROMAGNETIC WAVES 9

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

UNIT III ELECTRO OPTICAL AND MICRO WAVE SYSTEM 9

Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments. Modern positioning systems – Traversing and Trilateration.

UNIT IV GPS SATELLITE SYSTEM 9

GPS - Different segments - space, control and user segments - satellite configuration - GPS signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - GPS receivers.

UNIT V GPS DATA PROCESSING 9

GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation – downloading the data -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 & accuracy measures - applications- long baseline processing- use of different softwares available in the market.

FIELD WORK **30**

Study of Total Station, Distance and Coordinate Measurement, Missing Line Measurement, Remote Elevation Measurement, Resection, Setting out: Point and Line, Taking Offsets, Area Measurement, Total Station Traversing, Study of Hand held GPS, Study of Geodetic GPS, Static and semi kinematics survey, Differential Positioning, Precise Positioning and GPS Traversing

(L:45, P:30) TOTAL : 75 PERIODS

OUTCOMES:

On completion of this course students shall be able to

- Understanding the concepts of Electromagnetic waves and impact of RI
- Work with Electro optical and microwave Total Station and understand error sources**.**
- Understand the advantages of electronic surveying over conventional surveying methods
- Understand the working principle of GPS , it's components, signal structure, and error sources
- Understand various GPS surveying methods and processing techniques used in GPS observations
- Familiarise various areas of GPS applications and new developments.

REFERENCES :

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th edition, 1996
2. Satheesh Gopi, rasathishkumar, N.madhu, " Advanced Surveying , Total Station GPS and Remote Sensing " Pearson education , 2007 isbn: 978-81317 00679
3. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993.
4. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin, 2003.
5. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.
6. Seeber G, Satellite Geodesy, Walter De Gruyter, Berlin, 1998

MA8161 **STATISTICAL METHODS FOR ENGINEERS** **L T P C**
3 1 0 4

OBJECTIVES:

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

UNIT I ESTIMATION THEORY **9+3**

Estimators: Unbiasedness, Consistency, Efficiency and Sufficiency – Maximum Likelihood Estimation – Method of moments.

UNIT II TESTING OF HYPOTHESIS **9+3**

Tests based on Normal, t, X^2 and F distributions for testing of means, variance and proportions – Analysis of r x c tables – Goodness of fit.

UNIT III CORRELATION AND REGRESSION **9+3**

Multiple and Partial Correlation – Method of Least Squares – Plane of Regression – Properties of Residuals – Coefficient of multiple correlation – Coefficient of partial correlation – Multiple correlation with total and partial correlations – Regression and Partial correlations in terms of lower order co-efficient.

UNIT IV DESIGN OF EXPERIMENTS **9+3**

Analysis of variance – One-way and two-way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT V MULTIVARIATE ANALYSIS 9+3

Random vectors and Matrices – Mean vectors and Covariance matrices – Multivariate Normal density and its properties – Principal components: Population principal components – Principal components from standardized variables.

L: 45 + T : 15 TOTAL : 60 PERIODS

OUTCOME:

- On completion of this course the students will be able to solve various problems in the field of engineering employing probability and statistical methods.

REFERENCES:

1. Gupta.S.C., and Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan Chand and Sons,11th Edition, 2002
2. J.E. Freund, Mathematical Statistical", 5th Edition, Prentice Hall of India, 2001.
3. Jay L.Devore, "Probability and statistics for Engineering and the Sciences", 5th Edition, Thomson and Duxbury, Singapore, 2002
4. Murray.R. SpiegelandLarry J.Stephens, "Schaum'sou Tlines- Statistics", 3rd Edition, Tata McGraw-Hill, 2000
5. R.A.Johnson and C.B.Gupta, "Miller & Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007
6. Richard A.Johnson and Dean W.Wichern, "Applied Multivariate Statistical Analysis", Pearson Education, Asia, 6th Edition, 2007

RS8151 GIS AND DIGITAL CARTOGRAPHY L T P C
3 0 0 3

OBJECTIVE:

- Expose the students with concepts of cartography as major components of input and output related to cartography. To provide exposure to data models and data structures in GIS and to introduce various Raster and Vector Analysis capabilities. To expose the concept of quality and design of cartographic outputs in open GIS environment.

UNIT I MAPAND CARTOGRAPHIC PRINCIPLES 9

Map: Definition, Classification based on Function, Scale, Characteristics –Shape of Earth – Ellipsoid and Geoid – Projections and Co-ordinate System - Rectangular and Geographic Coordinates – UTM and UPS - Types of Map Projections – Basics of 2D transformations – Affine transformation - Choice of Map Projection –Evolution of cartography- Geo-Spatial, Spatial and Non-spatial data – Definition of GIS – Evolution GIS – Components of GIS

UNIT II GIS; DATA INPUT AND DATA MODELS 9

Concepts of Point, Line Polygon / Area, elevation and surface –Concepts of Tessellations- Attributes and Levels of Measurement - Data Sources – Ground and Remote Sensing survey – Collateral data collection – Input: Map scanning and digitization, Registration and Georeferencing – Concepts of RDBMS - Raster Data Model – Grid – Data Encoding - Data Compression – Vector Data Model – Topological properties – Arc Node Data Structure – Raster Vs. Vector Comparison – File Formats for Raster and Vector – Data conversion between Raster and vector**.**

UNIT III RASTER AND VECTOR DATA ANALYSIS 9

Raster Data analysis: Local, Neighborhood and Regional Operations – Map Algebra – Vector Data Analysis: Topological Analysis, point-in-polygon, Line-in-polygon, Polygon-in-Polygon – Proximity Analysis: buffering, Thiessen Polygon – Non-topological analysis: Attribute data Analysis- concepts of SQL– ODBC

UNIT IV NETWORK ANALYSIS AND DATA MANAGEMENT 9

Network – Creating Network Data - Origin, Destination, Stops, Barriers – Closest Facility Analysis, Service Area Analysis, OD Cost matrix analysis, Shortest Path Analysis – Address Geocoding – Surface Analysis – Point data to Surface: Various methods of interpolation-DEM: View shed Analysis

UNIT V DATA OUTPUT AND WEB BASED GIS 9

Map Compilation – Cartographic functionalities for Map Design – Symbolization – Conventional signs and symbols - Meta Data – Web based GIS: Definition, Merits - Architecture – Map Server – Case Studies - Open Source GIS – Import and Export of spatial data

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Familiarize with concepts of choosing map projections, 2D transformation
- Understand the data models and data structures used for spatial data
- Perform geospatial analysis and network analysis
- To understand the web based GIS architecture and concepts of Map server

REFERENCES:

1. C.P. Lo, Albert K.W.Yeung, Concepts and Techniques of Geographic Information Systems, 2nd Edition, Prentice Hall, 2006, ISBN-13: 9780131495029
2. Kang-tsung Chang, Introduction to Geographic Information Systems with Data Set CD-ROM, 6th Edition, Mc Graw Hill, 2011, ISBN-10: 0077465431,. ISBN-13: 978-0077465438
3. John Jensen, Ryan Jensen, Introductory Geographic Information Systems, International Edition**,** Pearson Publishers, 2012, ISBN-10: 0136147763, ISBN-13: 9780136147763
4. Menno-Jan Kraak, Ferjan Ormeling, Cartography : Visualization of Spatial Data, 2009, 3rd Edition, Pearson Publishers.
5. Terry A. Slocum, Robert B McMaster, Fritz C. Kessler, Hugh H. Howard, "Thematic Cartography and Geovisualization:International Edition", Pearson Education, ISBN: 9780138010065 **Year ?**
6. Borden Dent, Jeff Torguson, Thomas Hodler, "Cartography: Thematic Map Design", Tata McGraw Hill, 2009, ISBN 9780072943825.

RS8111 REMOTE SENSING AND PHOTOGRAMMETRY LABORATORY 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. Mirror stereoscope- base lining and orientation of aerial photographs.
3. Use of parallax bar to find the height of point.
4. Orientations in analogue stereo plotter
5. Orientation and mapping in semi analytical stereo plotter.
6. Orientations using digital photogrammetric workstation.

REMOTE SENSING EXERCISES

1. Spectral reflectance observation of the following using 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. Geology and geomorphology maps.
5. Slope maps.
6. Watershed delineation.

TOTAL: 60 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Understand the concept of stereoscopy and its use to determine height by parallax measurements
- Perform orientations using analogue, semi-analytical and digital photogrammetric workstations
- To obtain spectral signature of various objects using spectroradiometer
- To visually interpret satellite imagery for generation of various thematic maps

RS8162 GIS AND DIGITAL CARTOGRAPHY LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- 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.
- It also adds skills in mapping techniques and map outputs.

1. Spatial Referencing and Rectification of Scanned Map 3
2. Database Creation and Onscreen Digitization 3
3. Projection and Reprojection of spatial data. Data Conversion – V Vector to Raster, Raster to Vector 3
4. Adding attribute data – querying on attribute data 3
5. Generation of DEM: from contours, spot heights, GRID and TIN, Isometric mapping 6
6. Vector Analysis – Buffering, Overlay and Network analysis, flood mapping 6
7. Raster Analysis – Measurement - Arithmetic overlaying, Logical overlaying, Class interval selection, choropleth maps 6
8. Map Output - Bar charts, and located symbols 3
9. Map compilation 3
10. Modelling spatial variability 3
11. Weighted theisson polygon and districting 3
12. Customization and scripting 3

TOTAL: 60 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Perform the georeferencing and rectification of geospatial database
- Project and reproject using different map projections
- Perform raster and vector analysis on geospatial data
- Gain skills in scripting for customization of GIS

RS8152 **SATELLITE 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 FUNDAMENTALS **9**

Satellite systems and data – acquisition - storage - orbits – Data formats –Data products - Image display systems - future missions - Elements of visual perception – Image sampling and quantization - Basic relationship between pixels.

UNIT II SENSOR AND DATA MODEL **9**

Sensor model – Resolutions - pixel characters - Image formation – Histogram -Types- Uni-variate & multi-variate 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 – contrast, spatial feature and multi image manipulation techniques - Fourier transform - principle component analysis - Optimal Rotation Transformation – scale-space transform, wavelet transform.

UNIT IV INFORMATION EXTRACTION **9**

Image registration and ortho rectification – resampling - multi-image fusion - Baye's Theorem – parametric Classification and training sites - Supervised, Unsupervised and Hybrid classifiers – other Non - parametric classifiers - sub-pixel and super-pixel classification – Hyper-spectral image analysis – Accuracy assessment.

UNIT V IMAGE ANALYSIS **9**

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

TOTAL: 45 PERIODS

OUTCOME:

On completion of this course, the student shall be able to

- Get familiarized about various image enhancement and image processing techniques

REFERENCES:

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

RS8251 **MICROWAVE REMOTE SENSING** **L T P C**
3 0 0 3

OBJECTIVE:

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

Attested

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UNIT I PASSIVE SURVEY SYSTEM 9

Introduction - History, plane waves, antenna systems, Resolution Concepts, Radiometry - Passive microwave sensing components – Emission laws - Roughness and Dielectric Constant - Radiometers – Components - Brightness temperature - Antenna temperature - Power - temperature correspondence, passive microwave interaction with atmospheric constituents - Emission characteristics of various earth features – Passive missions - Data products and Applications

UNIT II ACTIVE SURVEY SYSTEM 9

Basics - RADAR operation and measurements - RADAR equation - RAR - frequency bands - SLAR Imaging Geometry - Geometric Distortions, SAR – Concepts - Doppler principle & Processing System Parameters and fading concepts, Target Parameters. Interaction with Earth surface and vegetation - Physical Scattering Models - Surface and Volume Backscattering,

UNIT III PLATFORMS, SENSORS AND DATA PROCESSING, 9

Airborne, Space borne and Indian missions, Data products and selection procedure, SAR Image Processing software - Measurement and discrimination - Backscatter Extraction - Preprocessing and speckle filtering - Image Interpretation, SAR Image Fusion.

UNIT IV APPLICATIONS 9

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

UNIT V IMAGING AND NON IMAGING METRICS 9

SAR interferometry - Basics - differential SAR interferometry, SAR polarimetry - Polarisation Types - Polarimetric parameters-Information Extraction, Radargrammetry, Altimetry - Principle - Location systems - applications, scatterometer – Types - Calibration- applications.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Understand concepts of passive and active microwave system
- Gain knowledge in the principles of Microwave image analysis and interpretation
- Understand the various application domains of microwave satellite data
- Gain exposure to Interferrometry and Polarimetry concepts

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, 3rd 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, CRC Press; 1st edition, ISBN-13: 978-0415271233
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.

RS8252 THERMAL AND HYPERSPECTRAL REMOTE SENSING L T P C
3 0 0 3

OBJECTIVE:

- To make the post graduate students understand principles, processes and applications of thermal and hyper spectral remote sensing for earth resources.

UNIT I FUNDAMENTALS OF THERMAL REMOTE SENSING 9

Radiation science basics - Thermal radiation principles, thermal interaction behavior of terrain elements, thermal sensors and specifications – MUST (Medium Scale Surface Temperature Missions) infrared sensors and radiometers - aerial thermal images - Image characters, spatial and radiometry-sources of image degradation –radiometric and geometric errors and correction – interpretation of thermal image

UNIT II THERMAL IMAGE AND INTERPRETATION 9

Extraction of environmental variables – LST retrieval methods – mapping of surface energy balance components – surface flux studies – thermal and optical RS for plant biophysics – hydrology, Forestry and Agriculture applications - case studies.

UNIT III FIELD AND IMAGE SPECTROMETRY 9

Spectral radiometry - Diffraction principles- imaging spectrometry : considerations - experimental design and instrumentation – factors affecting the field spectrum – hyperspectral sensor systems-imaging spectrometry – scattering principles - BDRF and hemispherical reflectance –models; MODTRAN - Sensors and platforms – data characteristics

UNIT IV HYPERSPECTRAL IMAGE ANALYSIS 9

Virtual dimensionality – representation systems - hypercube – red edge – indices - Hughes phenomenon - multivariate analysis for data reduction - data calibration, normalization – spectral library – response functions – MNF transformation – Kalman filters- library matching, spectral angle mapper, BBMLC-spectral mixture analysis – endmember extraction – spectral unmixing- MIA analysis concepts - PCF, PCA, WPCA spectral transformation – band detection, reduction and selection principles -data compression

UNIT V HYPERSPECTRAL IMAGE APPLICATIONS 9

Application to lithology, mineral exploration – agricultural crop systems – stress detection, plant production, vegetal bio physics and bio chemistry, soil moisture , soil characteristics, degradation status - forestry canopy characters, ecosystem, forest health, biodiversity, Gap dynamics, environmental and resource management.

TOTAL 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Understand the principles and properties of Hyperspectral and Thermal Remote Sensing.
- Acquire skills in analysing Thermal and Hyperspectral Remote Sensing data for various thematic mapping and its applications.

REFERENCES:

1. Dale A Quattarochi and Jeffrey C Luvall, “Thermal Remote Sensing in Land surface Processes” e-book, 2005 Taylor & Fancis, ISBN 0 203 50217 5
2. John A. Richards and Xiuping Jia, “Remote sensing digital Image Analysis – an introduction” fifth edition, Springer Verlag., 2012 ISBN 978 3 642 30061 5.
3. Chein I Chang, “Hyperspectral Imaging: Techniques for Spectral Detection and Classification”, Kluwer Academic/Plenum Publishers, New York, N.Y., 2003.(ISBN: 0-306-47483-2)
4. Marcus Borengasser and William C., Hungate and Russel Watkins Hyper spectral Remote sensing: principles and application” CRC, 2008, ISBN 13: 978 1 56670 654 4

5. Chein I Chang, “Hyperspectral Data Exploitation: Theory and Applications, Wiley Inter Science, 2006 (ISBN: 9780470124628)
6. Chein I chang, “Recent advances in hyper spectral signal and image processing“, Transworld network, 2006 (ISBN: 81-7895-218-1)
7. Lillesand, “Remote Sensing And Image Interpretation, 5th Ed”, John Wiley & Sons, 2007, ISBN: 8126513357, 9788126513352
8. www.oksi.com,http://ccrs.nrcan.gc.ca/optic/hyper

RS8211 DIGITAL IMAGE PROCESSING LABORATORY L T P C
0 0 3 1

OBJECTIVES:

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

1. Reading and Displaying satellite data from BIL, BSQ and BIP Formats
2. Generating False Colour Composite (FCC)
3. Extracting area of Interest (AOI)
4. Generating Histogram of various bands
5. Georeferencing the base image
6. Geometric correction of satellite image
7. Enhancement using Band ratio and NDVI
8. Enhancement using different Filtering techniques
9. Enhancement using Image Fusion
10. Principal Component Analysis (PCA)
11. Fourier analysis
12. Unsupervised Classification
13. Supervised Classification
14 Classification using Neural Network and Fuzzy Logic
15. Accuracy Assessment and Change detection study

TOTAL: 45 PERIODS

OUTCOME:

On completion of this course, the student shall be able to

- Acquire skills to carry out the Lab Exercises independently on various Visual and digital Image processing techniques.

RS8212 MICROWAVE REMOTE SENSING LABORATORY L T P C
0 0 3 1

OBJECTIVE :

- To provide the exposure for the students with hands on experience into the Microwave Image Processing Using softwares

1. Reading, displaying and header extraction of SAR images and to Generate Multilook Images. 3
2. Geocoding with Dem and without DEM 3
3. Speckle Filtering Techniques and Backscatter extraction 3
4. Visual Image Interpretation and SAR Image fusion with Optical data 3
5. Scattering Matrix and Scattering properties retrieval 6
6. Polarimetric Classification 6
7. Interferometric processing-Base line estimation and Registration 3
8. Interferogram Generation and Phase values extraction 3

9. Phase unwrapping and Interferogram Interpretation. 3
10. Altimetry Processing- To import and display from Netcdf format 3
11. Correction methodologies and Sea surface height calculation 3
12. Scatterometry- reading and displaying the backscatter values 3
13. Retrieval of Wind parameters from backscatter values. 3

TOTAL = 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Geocode the SAR images and to perform Filtering
- Analyse the polarimetry and interferrometry microwave data
- Phase Unwrap the image for interpretation
- Process the scatterometer and altimeter data

RS8301 SCRIPTING AND CUSTOMIZATION L T P C
2 0 2 3

OBJECTIVE:

- Scripting is fundamental for providing services using GIS technology. The course provides skills in learning a set of scripts and their applications.

UNIT I FUNDAMENTALS 6+6

Customisation of GIS – Definition – Need – Advantages – Scripting Languages used for Customisation – Automated tools available for Customisation – Linking external Models: Loose Coupling, Tight Coupling and Embedded Coupling

UNIT II ARC GIS MODEL BUILDER 6+6

Model Builder – Model elements: Tools, Variables, Connectors - Setting up Models – Executing Model – Model Validation – Model builder to create Tools – Advance techniques in Model Builder – Geoprocessing Techniques in Model Builder

UNIT III PYTHON PROGRAMMING 6+6

Introduction to Python – built- in data types and control flow - Modules and packages - Concepts – iterators, generators, decorators, and meta-classes - String manipulation, Regular Expressions, input and output, file management – Geoprocessing Python Scripts: Intersection, Union and Buffering

UNIT IV .NET FRAMEWORK FOR SERVICE INTEGRATION 6+6

Concept of .NET framework – Common Language Infrastructure(CLI): execution, including functions for exception handling, garbage collection, security, and interoperability – Base Class Library(BCL) and Framework Class Library(FCL) – Customisation using .NET

UNIT V WEB GIS CUSTOMISATION 6+6

Web GIS – Web Server, Map Server and Data Server – Scripting for serving maps, map editing and geoprocessing functionalities – Open Source Map Server Customisation.

TOTAL = 30 + 30 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Familiarize with various methods of coupling external models with GIS
- Implement small scale GIS models with Model Builder
- Write scripts for small scale spatial functionalities with Python and .NET framework
- Write scripts for web services using Open Source Map Server

REFERENCES:

1. Shaw, Zed A., 2012. Learn Python the Hard Way, Second Edition, Shavian Publishing,LLC, 183 p
2. Zeiler M, 2010. Geoprocessing with models and scripts, ESRI, Redlands 266-279.
3. Manuals of Map server and Geo server
4. David W. Allen, Getting to Know ArcGIS ModelBuilder, ESRI Press, 2011, ISBN: 978-1589482555
5. Marcus Heege, "Expert Visual C++/CLI: .NET for Visual C++ Programmers (Expert's Voice in .NET)" , Apress, 1st Edition (2007)
6. "Beginning MapServer: Open Source GIS Development (Expert's Voice in Open Source)", Apress; 1st edition (2005), ISBN: 978-1590594902

RS8001 DEMOGRAPHIC AND UTILITY APPLICATION OF GIS L T P C
3 0 0 3

OBJECTIVE:

- Utility design is an important component for providing services to the population. The skills in handling health, routing, power management, crime and accident mapping are necessary for providing manageable utility. The course prepares the students with mapping modelling skills of utility management. Mobile devices are part of Geospatial technology and the student is expected to equip in implementing mobile GIS.

UNIT I HEALTH APPLICATIONS 9

Health Infrastructure Mapping Studies – Disease Mapping: Spatio-temporal visualization of disease pattern and trends – Geostatistical Analysis for Health studies - Epidemiological Studies – Spatial analysis of Vector borne Diseases

UNIT II CRIME MAPPING AND ACCIDENTS 9

Hot spots and Cluster Analysis – Statistical methods for cluster determination – Identifying Spatial and Temporal Patterns of Crime - Geospatial data for Crime Mapping – Geo Profiling – Crime Mapping and Management software – Distress Call Management studies.

UNIT III ROUTING OF UTILITIES 9

Cost, distance and barriers in routing - Least Cost Path Analysis: Accumulated Cost Surface, Cost weighted Distance and Direction bias - Routing of Transmission Line: – Bee Line, Geospatial database for alignments of Corridor and evaluation of alternative alignment –– Highway Alignment – Pipe Line Alignment – Case Studies

UNIT IV POWER, TELECOMMUNICATION AND ASSET MANAGEMENT STUDIES 9

Power distribution and outage management - Signal Strength Mapping and line of sight analysis - mobile tower for planning, signal strength coverage mapping – Asset Management of Power /Electric, Telecommunication Utilities – asset management in PWD.

UNIT V MOBILE GIS 9

Mobile Devices – Mobile GIS software and services – Geospatial Data format and Storage- Location Based Services using Mobile devices – Open Source Mobile GIS software-Geospatial web services for mobile GIS – Case Studies

TOTAL = 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Perform geostatistical analysis of demographic data for various health, crime and accident management applications
- Understand the least cost path analysis for routing of utilities
- Acquire skills in asset management of utilities
- Familiarise with Location Based Services using Mobile Devices

REFERENCES :

1. Spencer Chainey, Jerry Ratcliffe , GIS and Crime Mapping, Wiley Publishers , 2005
2. Kristen S. Kurland, Wilpen L. Gorr, GIS tutorial for Health, 4th Edition, ESRI Press, 2012
3. Empowering Electric and Gas Utilities with GIS (Case Studies in GIS), ESRI Press, 2007
4. Z.-R. Peng and M.-H. Tsou, Internet GIS: Distributed Geographic Information Services for the Internet and Wireless Networks, Wiley Publishers, 2003.
5. Donald Albert GIS/GPS in Law Enforcement Master Bibliography 2nd Edition, 2003
6. Dynamic And Mobile Gis: Investigating Changes in Space And Time Volume 10 of Innovations in Gis,Jane Drummond,Publisher CRC Press, 2007,ISBN0849390923, 9780849390920

RS8002 REMOTE SENSING APPLICATIONS FOR AGRICULTURE AND FORESTRY

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

Spectral properties of crops in optical & TIR region, Microwave backscattering behavior of crop canopy – crops identification and crop inventory – crop acreage estimation – vegetation indices and biophysical model – Yield modeling – crop condition assessment – command area monitoring and management – Microwave RS for crop inventory – Case studies

UNIT II SOIL MAPPING 9

Soil classifications – Soil survey, Types and methods – Hydrological Soil grouping - Factors influencing soil reflectance properties – Characteristics of saline & alkaline Soils –principle component analysis and orthogonal rotation transformation - Soil mapping - watershed management - Problem soil identification – land evaluation – Case studies.

UNIT III DAMAGE ASSESSMENT 9

Detection of pest & diseases – Flood mapping and Assessments of crop loss – drought assessment – Land degradation – Soil erosion & sedimentation – Soil loss assessment – Soil conservation – Agriculture damage prediction modeling.

UNIT IV FORESTRY 9

Forest taxonomy – inventory of forest land – forest types and density mapping – Forest stock mapping – factors influencing degradation of forest – Delineation of degraded forest - Forest change detection and monitoring – Forest fire mapping & damage assessment –– biomass estimation - carbon storage – ALTM for Forest studies – urban forestry issues.

UNIT V CLIMATIC IMPACT OF AGRICULTURE AND FORESTRY 9

Concepts of Integrated surveys– global effects and climatic changes: land degradation and desertification, extreme events, - effect on forest produces health, forest hazards, sustainable forest Management and practice - biodiversity issues – invasive biotics – mitigation and adaptation – RS & GIS for drawing out action plans – watershed approach – landuse planning for sustainable development – precision farming – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Understand the concepts involved in mapping of crop acreage and yield estimation
- Understand the principles space based input for crop damage assessment
- Gain skills in various applications of Forestry and sustainable watershed management

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, 3rd edition Guilford Press, 2002.
6. David H. White, S. Mark Howden, Climate Change: Significance for Agriculture and Forestry, Springer,1994.

RS8003 REMOTE SENSING APPLICATIONS 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

Rocks and Minerals, image characters of igneous, sedimentary and metamorphic rocks - Lithological mapping by aerial and satellite data - Mapping structural features - Lineaments / faults, fractures, folds - Digital techniques for lithological and structural analysis.

UNIT II SPECTRA OF ROCKS AND MINERALS 9

Spectral properties - Elemental composition and spectra of rocks and minerals – physical properties and spectra - Optimal spectral windows – Geologic Remote sensing and mapping.

UNIT III GEOMORPHOLOGY 9

Landforms and Geomorphic processes – Structural, denudational landforms – fluvial, Aeolian, coastal, glacial and volcanic landforms - Drainage network and patterns - geomorphic mapping by aerial and satellite data - Landform analysis for natural resource management - case studies.

UNIT IV SUB-SURFACE EXPLORATIONS 9

Types of Geophysical Surveys - Electrical resistively surveys - aeromagnetic surveys - Electromagnetic surveys - Seismic surveys and GPRS - Planning Geophysical surveys - Geophysical surveys in resource mapping and monitoring.

UNIT V REMOTE SENSING AND GIS APPLICATIONS 9

Preparation of thematic layers – mapping standards – Integration of data for Surface and groundwater studies - Engineering Geological studies - Mineral exploration and Petroleum exploration - Disaster Management: Droughts, Floods, landslides and coastal hazards - Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Understand mapping lithological and structural features
- Understand the concepts involved in Geomorphic Mapping
- Understand the geophysical / geomagnetic surveys for subsurface exploration
- Get exposed to various earth sciences applications

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.
8. Remote Sensing and image interpretation by Thomas M.Lilles and Ralph E.Kiefer John Wiley & Sons, inc 2004.
9. Remote Sensing for the earth sciences Vol.3 edited by Andrew Rencz American Society of Photogrammetry and Remote Sensing John Wiley & sons inc 2004
10. Clark J.Handbook for coastal zone Management NY and London Lewis Publishers Kenchington R et.al. (Eds)
11. Nancy Hoalst-Pullen, Mark W. Patterson; Geospatial Technologies in Environmental Management (Geotechnologies and the Environment), 2010, Springer
12. A. Ganesh ; Applications of Geospatial Technology, 2006
13. Thakur, J.K.; Singh, S.K.; Ramanathan, A.; Prasad, M.B.K.; Gossel, . Geospatial Techniques for Managing Environmental Resources

RS8004 REMOTE SENSING APPLICATIONS FOR ENVIRONMENTAL IMPACT ASSESSMENT (EIA) & RISK ASSESSMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

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

UNIT I INTRODUCTION **9**

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

UNIT II COMPONENTS AND METHODS FOR EIA **9**

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

UNIT III EIA MANAGEMENT **9**

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

UNIT IV TOOLS AND METHODS FOR RISK ASSESSMENT **9**

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

Attested

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UNIT V RISK MANAGEMENT 9

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

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

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

REFERENCES:

1. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey, 2003.
2. Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science, London, 1999.
3. Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
4. Kasperson, J.X. and Kasperson, R.E. and Kasperson,R.E., Global Environmental Risks, V.N.University Press, New York, 2003.
5. Mark Burman, Risks and Decisions for Conservation and environmental management, Cambridge University Press. 314 p. ISBN 0521835348.2005.
6. Susan L |Cutter, “Environmental Risks and Hazards” Prentice Hall of India, New Delhi, 1999.
7. Joseph F Louvar and B Diane Louver, Health and Environmental Risk Analysis fundamentals with applications, Prentice Hall, New Jersey, 1997.
8. Lintz, J. and Simonet, Remote sensing of Environment, Addison Wesley Publishing Company, New Jersey, 1998.

RS8005 REMOTE SENSING APPLICATIONS 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 9

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

UNIT II OCEAN GENERAL STUDIES 9

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

UNIT III COASTAL ENGINEERING 9

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

UNIT IV OCEANOGRAPHIC APPLICATIONS 9

Use of Microwave data – CZCS studies – chlorophyll production index – various sensors used for coastal application – physical oceanographic parameter estimation – sea surface temperature –

significant wave height – wind speed and direction – Oceanic circulation – Tidal variation – sea level rise - coastal Bathymetry

UNIT V COASTAL ZONE APPLICATIONS 9

Introduction – Major issues/problem – wetland classification - Thematic maps on coastal resources – site suitability analysis for aquaculture – Coastal Regulation zone – Coastal aquifer modelling using GIS – Integrated coastal Zone Management – conflict analysis – Resources association.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Get exposed to the basics of Ocean and Coastal Engineering
- Acquire knowledge about various satellites and sensors in the domain of Ocean and Coastal applications.

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.
6. Dawn J. Wright, Darius J Barlett; Marine and Coastal Geographical Information Systems, 2000 CRC Press
7. David R. Green, Stephen D. King; Coastal and Marine Geo-Information Systems: Applying the Technology to the Environment, Springer, 2003

RS8071 OPEN SOURCE GIS L T P C

3 0 0 3

OBJECTIVE:

- Promoting open source software is basic for research and providing cost effective solutions. The students equip with concepts and uses of Open source GIS facilities.

UNIT I FUNDAMENTALS 9

Concepts of free and proprietary software – free, shareware and open source software - Levels of open source licensing - Role of open source software in remote sensing and GIS implementation - OGC, OSGeo and GDAL oraganisations - Open Source Standards - FOSS and FOSS4G

UNIT II GENERAL ARCHITECTURE 9

Development environment: C and Java - C family , software and software tools - Java , portability and Web - Interoperability - Concepts of Desktop systems, Servers, Map Server, Database Services and Web Services – Integrated GIS and Domain specific software

UNIT III DATABASE ENGINES AND GIS 9

Open Source Database Engines (MySQL, SQLite Oracle and PostgreSQL) - Spatial referencing (Oracle Spatial, Spatialite and PostGIS) - Server and clients - Server setup and administration (PgAdmin) – server managing and monitoring - SQL in Queries, Views and Triggers.

UNIT IV GEOSPATIAL SERVER, WEB SERVICES AND SCRIPTING 9

Concepts of WMS, WCS, WFS and WPS - Sensors standards - GeoSpatial services and GeoWeb - Integration of Data, base map and analysis functions - Image and map rendering and web services - scripts in GIS data and WEB applications (PHP, Perl, Python, Java and Ajax)

Attested

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UNIT V OPEN SOURCE SOFTWARE AND SERVICES 9

OS Remote Sensing software (Eg: ILWIS, OSSIM, ORFEO, OpenEV) - Desktop systems (Grass, gvSIG, QGIS and SAGA) - Map Servers and Web Services (GeoServer and Map Server) - Embedded scripts for GIS services (HTML with PHP and Python) - Geo Statistical operations and Open Statistical tools - R environment and R spatial - standards in GIS documents.

TOTAL = 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Understand the important of Open source technology in GIS and various options available in its implementation.
- Acquire skills in using open source software along with the principles of handling licenses and source code modification.

REFERENCE:

1. Mapserver - Opensource GIS Development - Bil Kropla - Apress - 159069-490-8 - 2005.
2. The GeoSpatial Desktop Open source GIS and Mapping - Gary Sherman - Locate Press - 978-0-9868052-1-9 – 2012.
3. Manuals for GRASS, gvSIG, SAGA, R and GeoServer.
4. Gary E Sherman, Desktop GIS: Mapping the Planet with Open Source Tools, Pragmatic Bookshelf publication 1st edition,2008, ISBN-10: 1934356069

RS8072 REMOTE SENSING APPLICATIONS FOR DISASTER MITIGATION AND 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

Concepts and principles – Hydrological, climatological 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 OF STRUCTURES 9

Slope stability of Ghat roads – Structural safety of Dams, Bridges, Hospital, Industrial structures – planning seawalls and groynes - 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 and vulnerability – Damage assessment – Land use planning and regulation for sustainable development – satellite communications during disasters: networks, use of Internets, Warning system - rehabilitation - 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 infrastructures, settlements and population – Pre-disaster and post disaster planning for relief operations – Potential of GIS application in disaster mapping – Disaster management plan – Case studies,

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Understand the fundamentals and measurements of disaster management
- Gain knowledge in concepts of long term mitigation measures
- Gain exposure to various space based input for disaster management
- Understand the use of spatial data for emergency planning

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

RS8073 REMOTE SENSING APPLICATION FOR METEOROLOGY L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge in Concepts in Meteorology, Radio and Satellite Meteorology and its Applications

UNIT I GENERAL CONCEPTS IN METEOROLOGY 9

Weather and Climate- composition of atmosphere- weather elements and characteristics - Global temperature, pressure and wind belts - scales of atmospheric processes, Land/Ocean Coupling, Vegetation types and climate, climatic classification by Koppen and Thornthwaithe, energy in the atmosphere - Indian monsoons - weather systems and seasons, Indian Climatology - Radiation transfer- radiation spectrum – Absorption and emission of radiation by molecules- Radiation laws-scattering principles – atmospheric particles and radiations - Mechanism of cloud formation- Types of Clouds- Precipitation processes-weather stations, data, maps and symbols.

UNIT II RADIO METEOROLOGY 9

Principles and classifications of Radar- Meteorological Applications of radar – atmosounding Radio Sonde - pilot balloons - Wind estimation through Radar - Rawin Sonde - Doppler techniques for precipitation estimation – Precipitation Radar (PR) - Global Precipitation Measurement (GPM), Ozone soundings – principle and satellite measurements of ozone – Aerosol soundings Tracking of weather Thunderstorms, Tropical cyclones, Tornadoes through Radar – Hydro meteorological Applications of Radar - Applications to aviation meteorology – TIROS Operational and Vertical sounder – Retrieval methods and algorithms.

UNIT III SATELLITE METEOROLOGY 9

Orbital dynamics of satellite – Critical velocities – Polar and Geostationary weather satellites - Active and passive sensors (Radar/Lidar/Radiometery,scatterometer and altimeter) - Absorption bands of atmospheric gases - Design and characteristic of different types of sounders and imagers used in Meteorological satellites – Viewing geometry - INSAT/Icachana Meteorology - Data Processing System (IMDPS), IRS series – APT – AVHRR - Need for Remote Sensing techniques in weather forecasting and Numerical Weather Prediction (NWP) - imaging and non imaging techniques in Meteorology.

UNIT IV METEOROLOGICAL APPLICATIONS 9

Precipitation – soil moisture - estimation and their Applications – Normalised Difference Vegetation Index – Ocean Colour monitoring – Coastal zone mapping - Satellite communication systems in operational meteorological Applications (Cyclone Warning Dissemination system / Automatic Weather stations – Meteorological data dissemination) - Estimation of snow and ice cover – Water body boundary mapping – aerosols – Dust storms and Volcanic ash clouds and fires – maritime, dwelt, floods and agriculture.

UNIT V GLOBAL METEOROLOGICAL APPLICATIONS 9

Global and subglobal events – tracking of large weather system – Cloud motion vector – Dvorak's techniques of Cylone Intensity estimation - T-phi and other climatic charts - T number and current intensity No. – Applications to storm surge estimation - Satellite soundings – Global Warming – Sealevel changes and Consequences.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Understand the concepts of Meteorology and various application areas of Meteorology.
- Gain knowledge on Radio and Satellite meteorology
- Acquire knowledge about various climatic charts

REFERENCES:

1. Kidder and VonderHarr, "Satellite Meteorology: An introduction", 1995, Academic Press, San Diego, CA
2. Arthur P. Cracknell, "The Advanced Very High Resolution Radiometer (AVHRR)", 1997, CRC Press, ISBN: 9780748402090.
3. Smith and Schreiner, "Advances in Remote Sensing", Deppak Publications
4. Asnani, G.C "Tropical Meteorology", Vol. I and II, 1993
5. Richard J. Doviak, Dusan S. Zrnic, "Doppler Radar and Weather observations", Dover Publications; 2nd Edition (2006), ISBN: 978-0486450605
6. Ellingson, "Satellite Data Applications: Weather and Climate", Proc.of AO I Symp., COSPAR, Birmingham, UK, Elsevier, MD, USA. Pergamon Pr; 1st Edition (1997)
7. Sauvageot, 1992, "Radar Meteorology", Artech House Publishers, Norwood, MA. 1992
8. Hartwig Dobesch, Pierre Dumolard, Izabela Dyras, "Spatial Interpolation for Climate Data: The Use of GIS in Climatology and Meteorology", Wiley Publication, (2007 – Print), (2010 – Online)
9. S. Raghavan, "Radar Meteorology", Springer, 2003, ISBN: 9781402016042

RS8074 REMOTE SENSING APPLICATIONS FOR WATER RESOURCES MANAGEMENT

L	T	P	C
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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 FUNDAMENTALS OF HYDROLOGY 9

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

UNIT II DRAINAGE BASIN ASSESSMENT 9

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

UNIT III IRRIGATION AND WATER QUALITY 9

Project investigation – implementation - maintenance stage - location of storage / diversion works – canal alignment – depth - area capacity curve generation - water quality parameters – physical, chemical, biological properties - water quality mapping and monitoring – correlation model for pollution detection and suspended sediment concentration– case studies.

UNIT IV GROUND WATER 9

Ground water prospects – surface water indicators – vegetation, geology, soil – aquifer parameters – well hydraulics – estimation of ground water potential – hydrologic budgeting – mathematical models – ground water modeling – sea water intrusion – modeling.

UNIT V WATERSHED MANAGEMENT 9

Mapping and monitoring the catchment and command area – conjunctive use of surface and ground water – artificial recharge of groundwater – water harvesting structures – erosivity and erodability - Universal Soil Loss Equation – sediment yield – modeling of reservoir siltation – prioritization of watershed – modeling of sustainable development – information system for Natural resource management – case studies.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course students shall be able to

- Understand the assessment of Basin and its hydrology using Geospatial technology.
- Get exposure to the Groundwater and Watershed Management aspects of GIS

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, 2nd edition, Lewis Publishers, 2004,
5. U.M. Shamsi, GIS Applications for Water, Wastewater, and Storm water Systems, CRC; Ist edition 2005.
6. Hoalst-Pullen, Nancy; Patterson, Mark W; Geospatial Technologies in Environmental Management, 2010, Springer.

RS8075 REMOTESENSING TECHNOLOGY FOR URBAN AND REGIONALPLANNING

L T P C
3 0 0 3

OBJECTIVES:

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

UNIT I FUNDAMENTALS 9

Concepts of Urbanization and Urban Areas - concept of regions - formal and functional regions - census classification of urban areas - Planning Goals: Natural Resources Management; socio-economic management and infrastructure planning - Planning physical structures and functional domains - data and information for urban and regional planning by Remote Sensing - Planning goals for urban areas and regions.

UNIT II INVENTORY AND MAPPING 9

Digital and image records of the Urban areas and Regions – classification of settlement patterns and structures – Segmentation of Built-up areas – Classification algorithms – Inventory of resources and measurements - Land use/ Land cover mapping – Deduction of sprawl, renewal and morphological changes – resolution of RS data in feature extraction and object delineation - mapping resources, developments and demography by choropleth and isopleth techniques - high resolution remote sensing data in urban analysis..

UNIT III ASSESSMENT OF POTENTIALS 9

Urban morphology – Housing typology – Population estimation from remote sensing – Infrastructure demand analysis – Land suitability analysis for Urban renewal – Plan formulation for sectoral and regional, development – Use of remote sensing and GIS in assessment, estimation and projections - Design of Urban and regional information systems – revenue and tax collection GIS - planning facilities and amenities..

UNIT IV LOCATION-ALLOCATION AND TRANSPORTATION PLANNING 9

Site specific GIS: Housing development, parks and social facilities planning – urban and regional transportation corridors - wholesale and retail trade interactions - commuting-Classification of traffic – Optimum route and plans / shortest path – Alignment planning – Traffic and flow management – Accident analysis – case studies.

UNIT V MODELLING TECHNIQUES 9

Urban growth modeling – GIS modelling - local and regional interaction potential- Expert systems in AM/FM planning – 3D city models – digital terrain of the urban areas and regions- DEM and socio-economic – Land use Transportation interaction models – Intelligent transportation systems –Risk, vulnerability models in crime, accidents and disasters - case studies .

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course students shall be able to

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

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. CRC Press, 2nd Edition, 2009, ISBN: 978-1439808702
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; 1st edition, 1996.
5. Roland Fletcher, The Limits of Settlement Growth: A Theoretical Outline (New Studies in Archaeology) (First edition), Cambridge University Press; 2007.
6. Said Easa, Yupo Chan, “Urban Planning and Development Applications of GIS”, Amer Society of Civil Engineers, 1999, ISBN: 978-0784404614

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7. Harvey J. Miller, Shih-Lung Shaw, “Geographic Information Systems for Transportation: Principles and Applications (Spatial Information Systems)”, Oxford University Press, USA (2001) , ISBN: 978-0195123944
8. David J Maguire, Michael F Goodchild, Michael Batty, “GIS, Spatial Analysis, and Modeling”, ESRI Press, 2005.

GM8071 AIRBORNE LASER TERRAIN MAPPER (ALTM) **L T P C**
3 0 0 3

OBJECTIVE:

- To provide exposure to LiDAR mapping and its applications

UNIT I LASER AND SPACE BORNE LASER PROFILERS **9**

LASER, Components of LASER: Active Material, Energy Source, Reflection Mirror – LASER Production- LASER Classification: Eye Safety, Class I to Class IV Lasers - Comparison of Various methods of deriving terrain height – LASER RANGING- Types of LiDAR: Range Finder LiDAR, Doppler LiDAR, DIAL – Principles of Laser Ranging: Pulse Laser, Continuous Wave Laser – Space Borne Laser Missions – Geo Science Laser Altimeter System (GLAS), LiDAR In-Space Technology Experiment (LITE), Chandrayan

UNIT II AIR BORNE LASER SCANNERS **9**

Components of Airborne Laser Scanning System – GPS, IMU, LASER Scanner, Position and Orientation System(PoS) – Types of Scanning Mechanism and Ground Measuring Pattern – Synchronisation of Laser Scanner and PoS- LASER Scanners Specification and Salient Features – Concept of Multi return – 3D Cloud Points – Reflectivity of Ground features – Range Correction Factor

UNIT III LIDAR DATA PROCESSING **9**

Pre Processing: Direct Georeferencing, Combining Inertial and Navigation Data - Determination of Flight Trajectory - Data processing – Co-ordinate Transformations – Geolocating Laser Foot Prints – Strip Adjustment – Digital Surface Model to Digital Elevation Model : Filtering, Ground Point Filtering – Flight Planning – Quality Control Parameters – Preparation of flight plan

UNIT IV LIDAR DATA MANAGEMENT AND APPLICATIONS **9**

Airborne Laser Scanner Error Sources - LiDAR data format: ASCII vs Binary, LAS Format – Software used for LiDAR data processing and management – Merits of Airborne Laser Terrain Mapping - Overview of LiDAR Applications - 3D city models – Road and Building Extraction – Forestry Applications – Power Line Mapping.

UNIT V TERRESTRIAL AND BATHYMETRIC LASER SCANNER **9**

Terrestrial Lidar: Static and Mobile (Vehicle Mounted) LiDAR -Terrestrial LASER Scanner Specification – Applications of Terrestrial LASER Scanning –Bathymetric LASER Scanner – Specification – Depth of Penetration: Secchi Depth – Applications of Bathymetric LASER Scanner

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Understand the components of Airborne Laser Scanning System
- Plan for Airborne Laser Scanning data Acquisition
- Understand the concepts for generating DEM from Digital Surface Model by filtering
- Get exposed to various domain applications of Airborne Laser Scanner data

REFERENCES:

1. Jie Shan and Charles K., Topographic laser ranging and scanning : principles and processing, CRC Press, Taylor & Francis Group, 2008
2. Mathias Lemmens, Laser Altimetry: Principles and Applications, CRC Press 2006.
3. Roger Read and Ron Graham, Manual of Aerial Survey: Primary Data Acquisition, Whittles Publishing, 2002.
4. Zhilin Li Qing Zhu, Chris Gold, Christopher Gold, Digital Terrain Modeling: Principles and Methodology, CRC Press, 2004.
5. Zhilin Li, Jun Chen, Emmanuel Baltsavias, Advances in Photogrammetry, Remote Sensing and Spatial Information Sciences, CRC Press; 1 edition, 2008

GM8072 GEOMATICS IN 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 SATELLITE FOR ENVIRONMENTAL MANAGEMENT 9

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

UNIT II WATER QUALITY MANAGEMENT 9

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

UNIT III AIR QUALITY AND NOISE MANAGEMENT 9

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

UNIT IV SOLID WASTE MANAGEMENT 9

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

UNIT V GLOBAL PROSPECTIVE 9

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

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Acquire knowledge of various components of environment and assessment of their quality
- Gain exposure to current and future satellite missions used for environmental assessment and modeling

REFERENCES:

1. Ian L.Pepper, Charles P.Gerbaand Mark L.Brusseau, Environmental and Pollution science, Academic Press, 2nd Edition, 2006. ISBN : 978-0125515030
2. David N.Miclsen, Environmental Site Characterization and Ground water Monitoring, 2nd edition, CRC Press, 2005, ISBN: 978-1566705899
3. Roger D.Griffin, Principles of Air Quality Management, Second edition, 2006, CRC Press
4. Donald L.Wise, Remediation for Hazardous waste contaminated soils, CRC Press; 1st Edition (1994)
5. Michele Campagna, GIS for sustainable development, CRC Press; 1st Edition, 2005.
6. Tchobanoglous George, Hilary Theisen, Samuel Vigi, Integrated Solid Waste Management, Mc Graw – Hill Inc, Singapore. 1993.
7. Dr Owen Harrop, "Air Quality Assessment & Management", CRC Press; 1st edition (2001)
8. Robert Scally, "GIS for Environmental Management", ESRI Press (2006)

GM8073 OBJECT ORIENTED INFORMATION SYSTEM L T P C
3 0 0 3

OBJECTIVE:

- This course will facilitate the student to understand the concept of object oriented programming, software reuse, different object oriented methodologies and object oriented systems. This course will help the student to develop software in C++.

UNIT I PRINCIPLES OF OOP 9

Motivation for OOP-Objects and Classes, Abstraction and Encapsulation, Message passing, Inheritance, Overriding, Multiple inheritance, Dynamic Binding, Virtual Methods, polymorphism, Abstract classes, Virtual classes, Dynamic binding mechanisms in Smalltalk and C++,object oriented notations.

UNIT II PROGRAMMING IN C++ 9

Introduction to C++ - Keywords, Identifiers-Data types –Variables-operators-Manipulators-Classes and Object -Member Functions-Private and Public Member function –Nesting of Member Functions – Array of objects- pointer to members –Constructors-Destructors-Type conversions-Exercises.

UNIT III INHERITANCE AND WORKING WITH FILES IN C++ 9

Inheritance –base class – derived class – visibility modes – single inheritance – multi level inheritance – multiple inheritance – file – opening and closing – file modes – file pointers – random access – error handling – exercises – comparative study of object oriented languages.

UNIT IV OBJECT ORIENTED ANALYSIS AND DESIGN 9

CRC method for defining classes, inter class relationships – introduction to object oriented software engineering, use case analysis, object diagrams, dynamic models – object interaction diagrams and state diagrams, functional models, from analysis to design to relevant topics from various methodologies such as Jacobson, Rum Baugh, Booch and unified methodology. Elements of design reuse – object oriented patterns.

UNIT V DATABASE MANAGEMENT SYSTEM 9

Data – Information – Database – models – database management systems – types of DBMS – hierarchical, network, relational data model – E-R, EER Diagram – classification of database based on modeling capability, based on tools/usage, based on server configuration, Knowledge based systems – File organization – Sequential – Index sequential – random – multikey file organization – Concepts of Active database, temporal database, spatial database and multimedia database – object oriented database.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course students shall be able to

- Acquire skills in Object Oriented Programming and Problem Solving
- Gain knowledge in C++ Programming Language and Data Base Management System

REFERENCES:

1. Ali Bahrami, Advance in object oriented information system, Lecture notes in computer science, Springer verlag, 2002.
2. Balagurusamy.E., Object Oriented Programming with C++, Tata Mc.Graw Hill Publications, 2001.
3. Timothy Budd, Introduction to Object Oriented Programming, Addison-Wesley, 2001.
4. Nilolai Josuttis, Object oriented programming in C++, John Wiley and sons, 2002.
5. Mike O.Docherty, Object oriented analysis and design, John Wiley and sons, 2005.
6. A.R.Harriger & A.R Harriger Jack J.purdum, An information system approach to object oriented programming using Microsoft visual c#.net, Cengage Learning, 2005.
7. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Addision Wesley Longman(Singapore) Pte Ltd. 3rd Indian reprint, 2000.

GM8251 DECISION SUPPORT SYSTEM L T P C

3 0 0 3

OBJECTIVE :

- To impart the knowledge of Expert Systems, Fuzzy logic and concepts of Object oriented programming for Geomatics and its Applications.

UNIT I FUNDAMENTALS 9

Definition - Features, needs, components – characteristics – players - Expert system vs Conventional programming - Basic activities of ES - Structure and phases of building ES – Types – Rule based, Frame based & Hybrid – Concepts of Operations Research: linear programming and location-allocation concepts.

UNIT II KNOWLEDGE ACQUISITION 9

Knowledge Engineering – scope and levels of Knowledge – Methods of Knowledge Acquisition – Representation schemes - Rule, Semantic network, frames and logic – Inference Techniques – Types of Reasoning - deductive, inductive, adductive, analogical and non-monotonic - Case and model based reasoning – conflict resolution - types of inference: forward and backward chaining.

UNIT III RULE BASED EXPERT SYSTEMS 9

Evolution – Architecture – Examples – backward and forward chaining - rules and meta rules – rule based systems – Case studies: MYCIN, PROSPECTOR – Integration of Rule based Expert system with GIS and Image Processing.

UNIT IV INEXACT REASONING 9

Inferencing with uncertainity- Bayesian theory – Dempster Shafer Theory of evidence - examples – Certainty theory: overview, uncertain evidence, rule inferencing – certainty factors -– Fuzzy sets – Representation, hedges inference & fuzzy logic – image classification using fuzzy logic.

UNIT V OBJECT BASED EXPERT SYSTEM 9

Concepts of Object Oriented programming - Overview, anatomy of class, sub class, instance, properties, inheritance, encapsulation, rules interaction with object, design methodology for frame based system – domain, classes, instances, rule – communications, design interface – C++ Programming – case studies in Geomatics.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Understand the concepts of knowledge acquisition, storage and analysis
- Understand rule based and frame based expert system
- Use fuzzy logic concepts for artificial intelligence and decision support
- Use object based concepts for decision support system

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.
7. Ramanathan Sugumaran, John DeGroote; Spatial Decision Support Systems: Principles and Practices, 2010 CRC Press
8. Prithvish Nag and Smita Sengupta; Introduction To Geographical Information Systems, 2007, Concept Publishing Company**.**