M.E. (GEOMATICS)

OBJECTIVES :

The course is design to fulfill the following objectives

1. To Prepare the student to plan and conduct field work and application of scientific methodology in handling field samples.
2. To equip the candidate with the art, science and technology of cartography and applications of GIS in Mapping Resources.
3. To develop the skills in surveying and thematic mapping.

OUTCOME :

1. Fully equipped with various surveying concepts and methods using advanced ground survey equipments.
2. Acquire skills in handling spatial data base warehousing and mining.
3. Prepare the candidates with National Global employability.
4. It empower the candidate with confidence and leadership qualities.

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M.E. GEOMATICS

CURRICULUM AND SYLLABUS I TO IV SEMESTERS (FULL TIME)

SEMESTER I

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	GM8101	Digital Photogrammetry	3	0	0	3
2	GM8102	Principles of Remote Sensing	3	0	0	3
3	GM8103	Total Station Surveying	2	0	2	3
4	MA8161	Statistical Methods for Engineers	3	1	0	4
5	RS8152	Satellite Image Processing	3	0	0	3
PRACTICAL						
6	GM8111	Digital Photogrammetry Laboratory	0	0	4	2
7	GM8112	Remote Sensing and Image Processing Laboratory	0	0	4	2
		TOTAL	**14**	**1**	**10**	**20**

SEMESTER II

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	GM8201	Geodesy	3	0	0	3
2	GM8202	GPS Surveying	3	0	0	3
3	GM8251	Decision Support System	3	0	0	3
4	RS8151	GIS and Digital Cartography	3	0	0	3
5		Elective I	3	0	0	3
6		Elective II	3	0	0	3
PRACTICAL						
7	GM8211	GPS Surveying Laboratory	0	0	3	1
8	GM8212	Seminar	0	0	2	1
9	RS8162	GIS and Digital Cartography Laboratory	0	0	4	2
		TOTAL	**18**	**0**	**9**	**22**

SEMESTER III

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	GM8301	Digital Cadastre and Land Management System	3	0	0	3
2		Elective III	3	0	0	3
3		Elective IV	3	0	0	3
PRACTICAL						
4	GM8311	Practical Training	-	-	-	1
5	GM8312	Project Work Phase I	0	0	12	6
		TOTAL	**9**	**0**	**12**	**16**

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SEMESTER IV

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	GM8411	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.E. GEOMATICS

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	GM8001	Geomatics Applications in Modelling and Simulation	3	0	0	3
2	GM8002	Geomatics in Integrated Coastal Zone Management	3	0	0	3
3	GM8003	Operation Research Applications in Geomatics	3	0	0	3
4	GM8004	Radar Image Processing	3	0	0	3
5	RS8071	Open source GIS	3	0	0	3
6	RS8072	Remote Sensing Applications for Disaster Mitigation and Management	3	0	0	3
7	RS8073	Remote Sensing Applications for Meteorology	3	0	0	3
8	RS8074	Remote Sensing Applications for Water Resources Management	3	0	0	3
9	RS8075	Remote Sensing Technology for Urban and Regional Planning	3	0	0	3
10	GM8071	Airborne Laser Terrain Mapper (ALTM)	3	0	0	3
11	GM8072	Geomatics in Environmental Engineering	3	0	0	3
12	GM8073	Object Oriented Information System	3	0	0	3
13	RS8251	Microwave Remote Sensing	3	0	0	3
14	RS8252	Thermal and Hyperspectral Remote Sensing	3	0	0	3

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M.E. GEOMATICS

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.	GM8102	Principles of Remote Sensing	3	0	0	3
3.	RS8152	Satellite Image Processing	3	0	0	3
PRACTICAL						
4.	GM8112	Remote Sensing and Image Processing Laboratory	0	0	4	2
		TOTAL	**9**	**1**	**4**	**12**

SEMESTER II

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	RS8151	GIS and Digital Cartography	3	0	0	3
2.	GM8202	GPS Surveying	3	0	0	3
3.	GM8201	Geodesy	3	0	0	3
PRACTICAL						
4.	RS8162	GIS and Digital Cartography Laboratory	0	0	4	2
5.	GM8211	GPS Surveying Laboratory	0	0	3	1
		TOTAL	**9**	**0**	**7**	**12**

SEMESTER III

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	GM8103	Total Station Surveying	2	0	2	3
2.	GM8101	Digital Photogrammetry	3	0	0	3
PRACTICAL						
3.	GM8111	Digital Photogrammetry Laboratory	0	0	4	2
		TOTAL	**5**	**0**	**6**	**8**

SEMESTER IV

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	GM8251	Decision Support System	3	0	0	3
2.		Elective I	3	0	0	3
3.		Elective II	3	0	0	3
PRACTICAL						
4.	GM8212	Seminar	0	0	2	1
		TOTAL	**9**	**0**	**2**	**10**

SEMESTER V

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1.	GM8301	Digital Cadastre and Land Management System	3	0	0	3
2.		Elective III	3	0	0	3
3.		Elective IV	3	0	0	3
PRACTICAL						
4.	GM8311	Practical Training	-	-	-	1
5.	GM8312	Project Work Phase I	0	0	12	6
		TOTAL	**9**	**0**	**12**	**16**

SEMESTER VI

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1.	GM8411	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.E. GEOMATICS

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	GM8001	Geomatics Applications in Modelling and Simulation	3	0	0	3
2	GM8002	Geomatics in Integrated Coastal Zone Management	3	0	0	3
3	GM8003	Operation Research Applications in Geomatics	3	0	0	3
4	GM8004	Radar Image Processing	3	0	0	3
5	RS8071	Open source GIS	3	0	0	3
6	RS8072	Remote Sensing Applications for Disaster Mitigation and Management	3	0	0	3
7	RS8073	Remote Sensing Applications for Meteorology	3	0	0	3
8	RS8074	Remote Sensing Applications for Water Resources Management	3	0	0	3
9	RS8075	Remote Sensing Technology for Urban and Regional Planning	3	0	0	3
10	GM8071	Airborne Laser Terrain Mapper (ALTM)	3	0	0	3
11	GM8072	Geomatics in Environmental Engineering	3	0	0	3
12	GM8073	Object Oriented Information System	3	0	0	3
13	RS8251	Microwave Remote Sensing	3	0	0	3
14	RS8252	Thermal and Hyperspectral Remote Sensing	3	0	0	3

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GM8101 **DIGITAL 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 GEOMETRY OF AERIAL PHOTOGRAPHS AND PROJECT PLANNING 9

History and development – classification of aerial cameras: film, digital – Scale, GSD – overlaps - Stereoscopy and parallax – refinement of photo co-ordinates - image and object co-ordinates: vertical, tilted – floating mark – parallax equation – height information – vertical exaggeration
Flight planning – computation for flight plan – cost estimation – aerial mosaics.

UNIT II ORIENTATION PROCEDURES AND AEROTRIANGULATION 9

Concepts of interior, relative, absolute orientation – object, image relation – collinearity and coplanarity conditions - effect of orientation elements – scaling and leveling - Elements of Aero triangulation – strip deformation, strip and block adjustment – DEM generation - orthophoto.

UNIT III IMAGE ACQUISITION AND MAPPING 9

Representation of digital images B/W – RGB – HIS - image source – scanners and digital cameras - full frame, frame transfer, interline CCD camera - Linear array line and framed scanner - quality evolution procedures – satellite photogrammetry principles- Stereo image products - image data model – colorimetry - formats – radiometric and geometric relation of imagery - image pyramids – visualization - Display modes – DP workstations and technology.

UNIT IV PLOTTING TECHNIQUES 9

Geometry of aerial photograph and image – resection & intersection - image matching techniques - Image measurements - DP workflow ; geometry, correlation and interpretation – epipolar plane - selection and methods of points of interest – homologous points - use of GPS – positioning – Automation of ATM and tie point generation.

UNIT V DIGITAL TERRAIN AND SURFACE MODELS 9

DEM generation and testing – regular & irregular data collection methods - DEM quality evaluation and stages – DSM generation – DSM reconstruction – ortho rectification – forward and backward approaches – different levels of rectification – orthomosaics - Extraction of characteristic lines – contour generation - watershed delineation – 3D city models - drained surfaces - pictometry.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Acquire knowledge about photogrammetry principles, methods and product generation strategies in both Analytical and digital Photogrammetry system.
- Understand the problem related to generation of products and solving them.

REFERENCES:

1. Paul R.Wolf, "Elements of Photogrammetry", McGraw-Hill Science, 2001.
2. Karl Kraus, "Photogrammetry, Vol 1 & II, 4th ed., Dümmler, 1997.
3. Gottfried Konecny, Geoinformation: Remote Sensing, Photogrammetry and Geographic Information Systems, 2nd Edition, CRC; 2 edition, 2009.
4. Micheal Kasser and Yves Egels,"Digital Photogrammetry", Taylor and Fancis, 2002, ISBN 0 748 40944 0
5. John A. Richards, Xiuping Jia Remote Sensing Digital Image Analysis: An Introduction, 5th edition, Springer Verlag., 2012 978 3 642 30061 5.
6. Zhilin Li, Jhun Chen and Emmanuel Baltsavias, "Advances in Photogrammtery, Remote sensing and Spatial Information systems", Taylor and Francais, 2008 9780 -415 47805

ADDITIONAL REFERENCES:

7. Edward M.Mikail and James S. Bethel, “Introduction to Modern Photogrammetry: John Wiley & sons, Inc., 2001, ISBN – 0 471 30924 9.
8. Ghosh, Sanjiv.K, Fundamentals of Computational Photogrammetry, concept publishing, New Delhi, 2005.
9. Rainer Sandau, Digital Airborne Camera: Introduction and Technology, Springer; 2010 edition, ISBN-10: 1402088779
10. Edward M. Mikhail, James S. Bethel, J. Chris McGlone, Introduction to Modern Photogrammetry, Publisher: Wiley, 2001.
11. Ron Graham and Roger, Mannual of Aerial survey: primary data acquisition, CRC press, 20

GM8102 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 ,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 – Current mission

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.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Acquire knowledge about the principles and physics of Remote sensing and data acquisition.
- Get familiarized with various data analysis techniques.

REFERENCES:

1. Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, 6th 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.

GM8103 TOTAL STATION SURVEYING L T P C
2 0 2 3

OBJECTIVE:

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

UNIT I FUNDAMENTALS 6

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying, Care and maintenance of Total Station instruments, Power sources, Modern positioning systems.

UNIT II ELECTROMAGNETIC WAVES AND REFRACTIVE INDEX 6

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

UNIT III ELECTRO OPTICAL SYSTEM 6

Measuring principle, Working procedure, Sources of Error, Infrared and Laser Total Station - Components and functions – use of temperature and pressure transducers

UNIT IV MICROWAVE SYSTEM 6

Measuring principle, working procedure, Sources of Error, Microwave Total Station – Components and functions – use of temperature and pressure transducers.

UNIT V FIELD WORK 6L+30P

Study of Total Station, Comparison between Electro-optical and Microwave system. Distance and Coordinate Measurement, Missing Line Measurement, Remote Elevation Measurement, Resection, Setting out: Point and Line, Taking Offsets, Area Measurement, Total Station Traversing and Trilateration.

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

OUTCOMES:

On completion of this course, the student 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

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

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, $\chi 2$ 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 coefficients.

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

TEXT BOOKS:

1. R. A. Johnson and C. B. Gupta, "Miller & Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2010, ISBN-10: 0321641698, ISBN-13: 978-0321641694
2. Richard A. Johnson and Dean W. Wichern, "Applied Multivariate Statistical Analysis", Pearson Education, Asia, 6th Edition, 2007.
3. Gupta, S.C. and Kapoor, V.K. "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 11th Edition, 2002.

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REFERENCES:

1. Jay L. Devore, "Probability and statistics for Engineering and the Sciences", Thomson and Duxbury, 8th Edition, 2011, ISBN-10: 0538733527, ISBN-13: 978-0538733526
2. Murray,R.SpiegelandLarryJ.Stephens,"Schaum'souTlines,-Statistics", 3rd Edition, Tata McGraw-Hill, 2000. (Pearson; 2003, ISBN-10: 0131427067, ISBN-13: 978-0131427068, Edition: 7)
3. J.E. Freund, "Mathematical Statistics", 5th Edition, Prentice Hall of India, 2001.
4. Lyman R. Ott, Micheal T Longnecker, "An Introduction to Statistical Methods And Data Analysis", Cengage Learning, 2010, 6th Edition, ISBN 0495017582, 9780495017585

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,III 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.

GM8111 DIGITAL 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. Stereo scopic acquity
3. Scale of vertical photographs
4. Photo interpretation
5. Mirror stereoscope- base lining and orientation of aerial photographs
6. Use of parallax bar to find the height of point
7. Orientations using analogue stereo plotter
8. Orientation using semi analytical stereo plotter
9. Mapping using semi analytical stereo plotter
10. Orientations using digital photogrammetric workstation.
11. Understanding of stereo metric camera.

TOTAL: 45 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

GM8112 REMOTE SENSING AND IMAGE PROCESSING LABORATORY L T P C
0 0 4 2

OBJECTIVE:

- This course will facilitate the students to have hands on experience on different steps of Visual and digital satellite image processing.

REMOTE SENSING EXERCISES

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

IMAGE PROCESSING EXERCISES

1. Reading and Displaying satellite data from BIL, BSQ and BIP Formats
2. Extracting area of Interest (AOI) and Generating Histogram of various bands
3. Georeferencing the base image and Geometric correction of satellite image
4. Enhancement using Band ratio, NDVI and different Filtering techniques
5. Principal Component Analysis (PCA) and Fourier analysis

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6. Unsupervised Classification and Supervised Classification
7. Classification using Neural Network and Fuzzy Logic
8. Accuracy Assessment and Change detection study

TOTAL : 60 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.

GM8201 GEODESY L T P C
3 0 0 3

OBJECTIVE:

- To understand the geometry of the earth and its relationship with nature.

UNIT I FUNDAMENTALS 5

Definitions - Classifications, Problem and purpose of Geodesy - Historical development and Organization of Geodesy. Reference Surfaces and their relationship. Applications, Engineering, Lunar, Planetary and Radar Geodesy – Local and International Spheroid.

UNIT II GEOMETRIC GEODESY 10

Geometry of ellipsoid - mathematical relationship of ellipsoid - Geodetic, Geocentric and Reduced latitudes and relationship - Ellipsoidal Co-ordinates in terms of Reduced, Geodetic and geocentric latitude - Radius of curvature in the meridian & prime vertical and relationship - Mean Radius of curvature in any azimuth, Length of the meridian arcs and arcs of parallel and Area of trapezium on the ellipsoid - Curves on the ellipsoid and properties of Geodesic - Astronomical, Geodetic, and Rectangular Co-ordinate System and relationship - Curvilinear Co-ordinate System - Deflection of Vertical, Spherical excess - Astro-Geodetic method of determining the reference Spheroid - Horizontal and Vertical control (methods and standards).

UNIT III PHYSICAL GEODESY 10

Basics - INGN - Significance of gravity measurements, Gravity field of earth, Concept of equipotential, Geo potential and Sphero potential Surface - Normal gravity computations - Methods of measuring Absolute and Relative gravity- Gravimeters-Reduction of gravity measurements, terrain and Isostasy corrections. Gravity anomaly and Gravity disturbance - Fundamental equation of Physical Geodesy - Gravimetric determination of Geoid and Deflection of Vertical, Height Systems: Geo potential number – Orthometric, Normal, Dynamic height and corrections – computation of orthometric height, Ellipsoidal height and its determination with a single and reciprocal observation of vertical angle - geoidal height

UNIT IV GEODETIC ASTRONOMY 10

Celestial Sphere – Astronomical triangle – celestial coordinates systems and its relationship with Cartesian Co-ordinates and Transformation - Special star positions - Major constellations- time systems (sidereal, Universal , atomic and standard) - Rising and setting of Stars with respect to Declination, hour angle and Azimuth - Culmination - Prime Vertical Crossing and Elongation - Variation in celestial co – ordinates - Determination of Astronomical Azimuth (Altitude and hour angle method) astronomical latitude and longitude determination – sources of errors and its eliminations

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UNIT V GEODETIC COMPUTATIONS 10

Rectangular and Polar Co - ordinates - First and Second geodetic problem – Similarity and Helmert's transformation- methods of point determinations – problems on intersection, resection, arc section (simple and over determination) - polar method and its extension.

(L:45)TOTAL: 45 PERIODS

OUTCOMES:

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

- Understanding of Geodetic surfaces and interrelationship
- Acquire knowledge of Gravity measurements and their use in determination of elevation
- Understand the relationship between astronomical observations and geodetic parameters
- Understand principles involved in computing of Coordinates using Geodetic Measurements.

REFERENCES:

1. Wolfgang Torge, Geodesy, Walter De Gruyter Inc., Berlin, 2001.
2. Guy Bomford"Geodesy" Nabu Press,2010,ISBN 1172029091
3. Petr Vanicek and Edward J. Krakiwsky, Geodesy: The concepts, North-Holland Publications Co., Amsterdam, 1991.
4. Tom Herring, "Geodesy ' Elsevier,2009,ISBN : 0444534601
5. Schwarze, V.S. Geodesy: The challenge of the 3rd millennium, Springer verlag, and 2002.
6. James R.Smith, Introduction to Geodesy, John wiley&Sons Inc. 1997.
7. Christopher Jekeli, Geometric Reference Systems in Geodesy, Division of Geodesy and Geospatial Science School of Earth Sciences, Ohio State University 2006
8. Mueller, I.I Spherical and Practical Astronomy as Applied to Geodesy. Frederick Ungar Publishing Co., New York. 1969
9. MONTAG, H., Ch. REIGBER, Geodesy and Physics of the Earth. IAG Symp. Proceed. 112, Springer, Berlin - Heidelberg - New York. 1993.

GM8202 GPS SURVEYING L T P C

3 0 0 3

OBJECTIVE:

- The objective of the course is to make the students to understand the basics of GPS surveying techniques

UNIT I BASICS 9

Satellite Geodesy, Geoid and Ellipsoid, Geodetic systems, Indian Geodetic System, Coordinate systems and transformation, History of GPS, Transit System, NAVSTAR, GLONASS, GALILEO, objectives and characteristics of Space, Control and User Segment, Working Principle, Advantages and Limitations of GPS.

UNIT II GPS SIGNAL STRUCTURE AND ERRORS 9

Carriers, GPS codes: C/A, P, navigational message, GPS receiver: Types and Structure of receivers, Principles of GPS position fixing: Pseudo ranging**.** Determination of GPS satellite coordinates, Types of ephemerides, GPS data formats: RINEX, SP3, types of Error: satellite dependent, receiver dependent, station dependent, GDOP, User Equivalent Range Error.

UNIT III GPS OBSERVABLES 9

Introduction to adjustment computations, Observation equations, Code-based, Carrier phase-based, Navigational solution: Code/phase based, Data Processing Models, Models for single point positioning and relative / differential positioning, Data combinations, Ambiguity resolution, Single difference, double difference, Triple difference.

UNIT IV GPS SURVEYING 9

Absolute - Relative Positioning - Planning of GPS Survey - GPS Surveying methods: Static - Fast Static - Semi Kinematic - Kinematic - Accuracy - Field Survey Procedure - Code and Carrier-based positioning - Observation strategies - Network design.

UNIT V GPS APPLICATIONS 9

Geodetic control surveys - Cadastral surveys – Photogrammetry - Remote sensing – Engineering - structural monitoring - Defense - Geographical Information System - Vehicle tracking and navigation (air, marine and satellite) - LBS and mobile mapping - Future developments in GPS.

TOTAL : 45 PERIODS

OUTCOMES:

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

- 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. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004. ISBN: 978-0-471-05930-1
2. Guocheng Xu, GPS Theory, Algorithms and Applications,Publication Date: September 14, 2007 | ISBN-10: 3540727140 | ISBN-13: 978-3540727149 | Edition: 2nd
3. Seeber G.Satellite Geodesy, Walter De Gruyter, Berlin, 1998.
4. Ahmed ei-rabbany, Introduction to GPS, the global positioning system Publication Date: August 31, 2006 ISBN-10: 1596930160 ISBN-13: 978-1596930162 Edition: 2
5. Mohinder s. Grewal, Lawrence R.Weill, Angus P.Andrews, Global positioning systems, Inertial Navigation and integration, Wiley-Interscience, 2000.
6. Elliott D. Kaplan, Christopher Hegarty, Understanding GPS: Principles and Applications, 2nd Edition, Artech House, ISBN-10: 1580538940, 2005
7. Bernhard Hofmann-Wellenhof, Herbert Lichtenegger, Elmar Wasle, GNSS - Global Navigation Satellite Systems: GPS, GLONASS, Galileo, and more, Springer; 2008 edition, ISBN-10: 3211730125

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 - 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.

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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. Timothy L. Nyerges, Piotr Jankowski; Regional and Urban GIS: A Decision Support Approach, 2010 Guilford Press.
8. Ramanathan Sugumaran, John DeGroote; Spatial Decision Support Systems: Principles and Practices, 2010 CRC Press
9. Prithvish Nag and Smita Sengupta; Introduction to Geographical Information Systems, 2007, Concept Publishing Company.

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, 2009
6. Borden Dent, Jeff Torguson, Thomas Hodler, “Cartography: Thematic Map Design”, Tata McGraw Hill, 2009, ISBN 9780072943825.

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GM8211 **GPS SURVEYING LABORATORY** **L T P C**
0 0 3 1

OBJECTIVES:

- To get familiarity of the GPS measurements.
- To understand the use of GPS in different order.
    1. Study of handheld GPS
    2. Absolute positioning using handheld and single frequency receiver.
    3. Baseline measurement using dual frequency receiver
    4. Leap frog method using dual frequency receiver
    5. Trilateration using dual frequency receiver
    6. Mapping using semi Kinematic survey
    7. Updation of maps using Kinematic survey
    8. Network adjustment
    9. GPS levelling
    10. Real time Kinematic survey

TOTAL :45 PERIODS

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

- Use various GPS equipments for field surveying and Mapping
- Process GPS observations for determination of coordinates in WGS 84 system and error adjustment

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

GM8301 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 IV 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

OUTCOMES:

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

- Understand the practices adopted for maintenance of cadastral records in India and abroad
- Gain exposure to methods for creation of cadastral database and use of Geographic Information System.

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.

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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.

GM8001 GEOMATICS APPLICATIONS IN MODELLING AND SIMULATION L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge in Modelling and simulation using Remote Sensing and GIS.

UNIT I CONCEPTS OF MATHEMATICAL MODEL 9

Concepts – types of model – examples of mathematical model – classification of mathematical model – black and white box model - Modelling assumptions – choice of equation – phenomena and model geometry – choice of variables and parameters – data and knowledge acquisition – model building – calibration and verification – results presentation - Advantages – steps to be followed in the development of model - problem associated with modelling.

UNIT II ATMOSPHERIC MODELLING 9

Study on Atmosphere – Greenhouse effect - aerosal – Natural and manmade – ozone depletion – acid rain – classification on of atmosphere – modelling of atmosphere – governing equations weather and climate modelling – numerical weather prediction model global and regional climate models – Air quality model – Gaussian dispersion model.

UNIT III HYDROLOGICAL MODELLING 9

Hydrological cycle – definition – various components – rainfall – runoff model – Groundwater model – different types; lumped and distributed – Areal extent of the model – boundary conditions – compilation of Geological & Hydrological information – model stresses – model size & discritingation - finite difference & finite element – interfacing GIS with groundwater model – modelling the effect of climate change on water resources.

UNIT IV BIOLOGICAL / ECOLOGICAL SYSTEM MODELLING 9

Environmental modelling – need for Environmental modelling – physical process – integrating forest growth model with GIS – ecological modelling, GIS & expert system – Regional fish species richness model – introduction to quantitative methods – Landscape ecology.

UNIT V SIMULATION MODEL FOR FOREST MANAGEMENT 9

Types of fires - Empirical approaches to modelling wild land fire – simulating forest fire regimes – simulation of broad – scale fire – natural forest landscape disturbance – forest fire – timber harvesting – forest management using decision support system – developing forest management strategies based on fire regimes.

TOTAL : 45 PERIODS

OUTCOMES:

On completion of this course students shall be able to

- Gain knowledge on concepts for building mathematical models
- Apply mathematical models in hydrology, Atmosphere; Biological / Ecological Domains

REFERENCES:

1. George F.Pinder,Groundwater modelling using GIS, John Wiley & Sons, New York, 2002.

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2. Michale N.Demers, GIS modelling in Raster, John Wiley & Sons, inc, 2002.
3. Keith C. Clarke/. Bradley O.Parks. Michale P.Crane, GIS & Environmental modelling, Prentice Hall, Inc.New Jersey, 2002.
4. Meyer, Walter J. : Concepts of Mathematical Modeling (ISBN 10: 0070417474 / ISBN 13: 9780070417472) 1984
5. Edward A. Bender An Introduction to Mathematical Modeling, ISBN 10: 048641180X / 0-486-41180-X , ISBN 13: 9780486411804, Dover Publication 2000

GM8002 GEOMATICS IN INTEGRATED COASTAL ZONE MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge in Remote Sensing and GIS Applications for Integrated Coastal Zone Management

UNIT I PRINCIPLES 9

Basic principles – data base management – ICZM model concept – matrix approach to coastal interactions – solution to the problems.

UNIT II COASTAL WATER QUALITY AND BATHYMETRY 9

Usefulness and limitation of Remote sensing for mapping – sediment loadings – oil pollution and Industrial wastes – sewage discharges – toxic algal blooms – eutrophication – thermal discharge – bathymetry – bathymetry using satellite data.

UNIT III SOCIO ECONOMIC AND LEGAL ASPECTS 9

Stake holder identification and analysis – role of International convention – protocols in management of ocean – coastal seas & coastal lands – legal controls which affects the use of national coastal zones – laws on costal regulation zone.

UNIT IV APPLICABLE SENSORS / PLATFORMS 9

Costal management aspects – spatial , spectral, radiometric and temporal resolutions, sensors – ETM, IKONOS, SPOT XS, sea WIFS, ERS ,Along track scanning radiometer (ASTER), OCEANSAT,RADARSAT – accuracies with different sensors, limitations.

UNIT V APPLICATIONS 9

The ICZM development process: demonstration, consolidation, extension – Coastal Biodiversity – wetland management – management – mangrove eco system – coastal environmental impact assessment – Coastal Regulation zone mapping – Resource allocation conflict – sustainable development – case studies using Geospatial Technology.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course students shall be able to

- Gain exposure to the principles of Integrated Coastal Zone Management
- Acquire knowledge about applicability of various payloads for Integrated Coastal Zone Management.

REFERENCES:

1. Edwards, A.J. (Ed.) Applications of Satellite and Airborne Image Data to Coastal Management. Coastal Region and Small Island Papers No. 4 (UNESCO, Paris), vi+ 185 pp.1999.
2 Green, E.P., Mumby, P.J., Edwards, A.J. and Clark, C.D. (Ed.A.J. Edwards) Remote Sensing Handbook for Tropical Coastal Management.Coastal Management Sourcebooks 3. UNESCO, Pairs. X + 316 pp + 24 colour plates. ISBN92,3,103736,6 (Pbk).2000.

3 Clark J. Handbook for Coastal Zone Management. NY and London: Lewis Publishers
4. Kenchington R. et al. (Eds.) ICZM Training Manual. Bangkok: UNEP Post
5. J. Lundin CG Guidelines for Integrated Coastal Zone Management. World Bank Environmentally Sustainable Development Series 1996.
6. Timothy Beatley, David Brower and Anna K. Schwab; An Introduction to Coastal Zone Management: 2nd Edition , 2002

GM8003 OPERATION RESEARCH APPLICATIONS IN GEOMATICS L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge in Operation Research Applications in Geomatics & its Applications

UNIT I FUNDAMENTALS 9

Origin of OR – Nature, Impact, significance and limitations - Models and Modeling approach – Applications and Scope, basic Operation Research models – Algorithms and Software tools.

UNIT II LINEAR PROGRAMMING 9

Problem formulation – structure and assumptions – objective functions and constraints - standard form – Graphical solutions – solution by simplex method – Dual theory – Formulations of Dual problem – Primal and Dual Relationship – Sensitivity analysis - Geomatics problems & solutions: land resources allocations and land use analysis

UNIT III DYNAMIC PROGRAMMING 9

Characteristics – Deterministic and probabilistic methods - Multistage decision process Stage coach - shortest path - Bellman's optimality criteria – Markovian property- problem formulation and solution – Forward and Backward recursive approaches – Geomatics applications : transportation planning and water resources management.

UNIT IV PROJECT MANAGEMENT 9

Project planning, Scheduling and controlling – CPM and PERT networks - Rules for constructing network – Network components and relationships – Forward and Backward pass – Time cost - trade off – Resource leveling and allocation – ERP in Geomatics: ER diagrams, *** - UML and case tools.

UNIT V SIMULATION 9

Introduction – phases of simulation - Deterministic and Stochastic simulation – Inventory Management – The classical EOQ model – Queuing and Replacement models – Investment - Role of simulation in Geomatics – case studies: urban growth modeling, forest fire and land use dynamics.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Familiarize with optimization techniques of Operation Research and its applications.
- Gain knowledge in principles of project management.

REFERENCES:

1. Hiller, F.S. and G.J. Lieberman, Introduction to Operations Research, Tata Mc Graw – Hill, 2001.
2. Hamdy A Taha "An introduction to Operation Research". Prentice hall, 6th edition, 2000.
3. R.Paneerselvam,"Operation Research". Prentice hall of India, 2002.
4. Sharma, J.K., Operations Research Theory and Applications, Mac Millan India Limited, 1998.
5. Frank S. Budnick, Dennis Mcleavey and Richard Mojena, Principles of Operations Research for Management, All India Traveler Delhi, 1988.

GM8004 **RADAR IMAGE PROCESSING** **L T P C**
3 0 0 3

OBJECTIVE:

- To impart knowledge in Radar Image Processing and its Applications.

UNIT I FUNDAMENTALS OF RADAR IMAGING 9

Introduction - History-Radar system Types - Imaging Radar – Basic instrumentation- Radar equation - Imaging Geometry - System parameters – wave length – polarization –Resolutions - SLAR and SAR – Doppler beam sharpening.

UNIT II TARGET PARAMETERS AND EARTH SURFACE INTERACTION 9

Concept of Surface Roughness - Geometry of targets and Distortions - dielectric constant, Backscattering - Surface scattering models - point targets – Facets – Bragg's resonance - Surface and Volume backscattering Theory.

UNIT III IMAGE PROCESSING OF RADAR DATA 9

SAR Image generation - processor timing and complexity versus resolution, focused and unfocussed electronic processing - Antenna and receiver gain correction - Matching system elements, motion effects, Preprocessing of SAR data; Multi look generation, Geocoding and Radiometric Calibration, Speckle filtering, Power Image generation - Grey scale image generation - Back scatter and header extraction - Image Interpretation.

UNIT IV IMAGING RADAR INTERFEROMETRY 9

Basics - Interferometry principles - Data structure – Types - Interferometric Processing-Data selection - Base line estimation - Registration Interferogram generation-Phase unwrapping – DEM generation - Differential SAR Interferometry (D-INSAR)-Interferogram selection - Change and Deformation detection - Interferometric Applications - Interferometric software.

UNIT V RADARGRAMMETRY 9

Introduction, governing equations, projection equations, relief displacement, matching radar images and digital terrain models, polarimetry - polarimetric Channels - co-polarization and cross polarization - polarimetric classification - scatterometer data processing - Wind parameters retrieval; Altimeter data processing - corrections and surface height calculation.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Acquire knowledge in Radar Imaging, characteristics, processing techniques
- Gain exposure to various applications of radar images

REFERENCES:

1. Giorgio Franceschetti, Riccardo Lanari, Synthetic Aperture Radar Processing, CRC Press, 1999.
2. Floyd.M.Handerson and Anthony,J.Lewis "Principles and applications of Imaging RADAR", Manual of Remote sensing, Third edition vol.3, ASPRS, Jhumurley and sons, Inc, 1998.
3. Ulaby,F.T.,Moore,K.R. and Fung, Microwave remote sensing vol-1,vol-2 and vol-Addision-Wesley Publishing Company, London, 2001.
4. Franz W. Leberl, Radargrammetric Image Processing, Published by Artech House Original from the University of Michigan, 2007.
5. Roger J Sullivan, Knovel Radar foundations for Imaging and Advanced Concepts, SciTech Publishers,2004.
6. Ian Faulconbridge Radar Fundamentals, Argos Press, 2002.
7. Henri Maitre; Processing of Synthetic Aperture Radar (SAR) Images, 2010, John Wiley & Sons
8. Mark A. Richards, Fundamentals of Radar Signal Processing; 2005, McGraw-Hill.

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RS8071 **OPENSOURCE 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)

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.

REFERENCES:

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 1 edition,2008, ISBN-10: 1934356069

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RS8072 REMOTERSENSING APPLICATIONS 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**

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 0F 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 REMOTERSENSING APPLICATIONS 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 Thornthwaith, 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 **S**atellite 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 REMOTERSENSING APPLICATIONS FOR WATER RESOURCES MANAGEMENT **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 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

Attested

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Centre For Academic Courses
Anna University, Chennai-600 025.

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 REMOTERSENSING TECHNOLOGY FOR URBAN AND REGIONAL PLANNING

L T P C
3 0 0 3

OBJECTIVE:

- Urban and regional planning involves use of both remote sensing and GIS for assessment and management of resources. Planning is an integral part both urban and regional planning. The course provides opportunity for understanding concepts, methodology and application of analysis in planning, urban, areas and regions.

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.

Attested

DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025.

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, the student 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. ISBN - 978-1589480827
2. Allan Brimicombe, GIS Environmental Modeling and Engineering, 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; 1 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
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 - Analysis of collection route - Site selection: Transfer station, Disposal site – Waste allocation – design of leachate and gas collection in sanitary landfills – leachate model - 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, 2nd 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.

RS8251 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 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, Third edition, vol.2, ASPRS, Jhumurley and sons, Inc, 1998.
3. Philippe Lacomme,Jean clande Marchais, Jean-Philippe Hardarge and Eric Normant, Air and space
   borne 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,
9. http://ccrs.nrcan.gc.ca/optic/hyper