AFFILIATED INSTITUTIONS

ANNA UNIVERSITY , CHENNAI

REGULATIONS - 2009

CURRICULUM I TO IV SEMESTERS (FULL TIME)

M.TECH. REMOTE SENSING

SEMESTER I

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	MA9316	Probability and Statistical Methods	3	1	0	4
2	RS9311	Principles of Remote Sensing	3	0	0	3
3	RS9312	Photogrammetry	3	0	0	3
4	RS9313	Cartography	3	0	0	3
5	RS9314	Geographic Information System	3	0	0	3
PRACTICAL						
6	RS9317	GIS Lab	0	0	3	2
7	RS9318	Remote Sensing and Photogrammetry Lab	0	0	4	2
		TOTAL	**15**	**1**	**7**	**20**

MA 9316 PROBABILITY AND STATISTICAL METHODS L T P C
3 1 0 4

OBJECTIVE:

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

UNIT I ONE DIMENSIONAL RANDOM VARIABLES 9+3

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

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9+3

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

UNIT III ESTIMATION THEORY 9+3

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

UNIT IV TESTING OF HYPOTHESES 9+3

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

UNIT V MULTIVARIATE ANALYSIS 9+3

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

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

REFERENCES :

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

RS 9311 PRINCIPLES OF REMOTE SENSING L T P C
3 0 0 3

OBJECTIVE:

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

UNIT I PHYSICS OF REMOTE SENSING 9

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

UNIT II DATA ACQUISITION 9

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

UNIT III SCATTERING SYSTEM 9

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

UNIT IV THERMAL AND HYPER SPECTRAL REMOTE SENSING 9

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

UNIT V DATA ANALYSIS 9

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

TOTAL: 45 PERIODS

REFERENCES:

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

RS 9312	PHOTOGRAMMETRY	L T P C 3 0 0 3

OBJECTIVE:

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

UNIT I BASICS OF PHOTOGRAMMETRY 6

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

UNIT II GEOMETRY OF AERIAL PHOTOGRAPHS 10

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

UNIT III PROJECT PLANNING, GROUND CONTROL AND MOSAIC 8

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

UNIT IV ANALOGUE, ANALYTICAL AND DIGITAL PHOTOGRAMMETRY 12

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

UNIT V AERO-TRIANGULATION AND TERRESTRIAL PHOTOGRAMMETRY 9

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

TOTAL: 45 PERIODS

REFERENCES:

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

RS 9313 CARTOGRAPHY L T P C
3 0 0 3

OBJECTIVE:

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

UNIT I BASICS OF CARTOGRAPHY 9

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

UNIT II EARTH 9

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

UNIT III SOURCES OF DATA 9

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

UNIT IV PERCEPTION AND DESIGN 9

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

UNIT V CARTOGRAPHY ABSTRACTION 9

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

TOTAL: 45 PERIODS

REFERENCES:

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

RS 9314	GEOGRAPHIC INFORMATION SYSTEM	L T P C 3 0 0 3

OBJECTIVE:

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

UNIT I BASICS 8

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

UNIT II DATA MODEL AND INPUT 9

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

UNIT III DATA ANALYSIS AND OUTPUT 10

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

UNIT IV SPATIAL MODELING 9

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

UNITV DATA QUALITY AND MISCELLANEOUS TOPICS 9

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

TOTAL: 45 PERIODS

REFERENCES:

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

RS 9317	GIS LAB	L	T	P	C
		0	0	3	2

OBJECTIVE:

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

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

TOTAL: 45 PERIODS

RS 9318 REMOTE SENSING AND PHOTOGRAMMETRY LAB L T P C
0 0 4 2

OBJECTIVE:

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

PHOTOGRAMMETRY EXERCISES

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

REMOTE SENSING EXERCISES

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

TOTAL: 60 PERIODS