

ANNA UNIVERSITY TIRUCHIRAPPALLI**Tiruchirappalli – 620 024****Regulations 2008****Curriculum****M.TECH. REMOTE SENSING****SEMESTER I**

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	MA5113	Probability and Statistical Methods	3	1	0	4
2	RS5101	Principles of Remote Sensing	3	0	0	3
3	RS5102	Photogrammetry	3	0	0	3
4	RS5103	Cartography	3	0	0	3
5	RS5104	Geographic Information Systems	3	0	0	3
6	RS5105	Electronics Surveying	2	0	2	3
Practical						
7	RS5106	GIS Laboratory	0	0	3	2
8	RS5107	Photogrammetry Laboratory	0	0	3	2
Total						23

SEMESTER II

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	RS5151	Image Processing	3	0	0	3
2	RS5152	Visual Programming and Customization	3	0	0	3
3	RS5153	Geographic Information System Application	3	0	0	3
4	E1****	Elective I	3	0	0	3
5	E2****	Elective II	3	0	0	3
6	E3****	Elective III	3	0	0	3
Practical						
7	RS5154	Image Processing Laboratory	0	0	3	2
8	RS5160	Seminar	0	0	2	1
Total						21

SEMESTER III

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	E4****	Elective IV	3	0	0	3
2	E5****	Elective V	3	0	0	3
3	E6****	Elective VI	3	0	0	3
Practical						
4	RS5251	Project Work	0	0	12	6
Total						15

SEMESTER IV

S.No.	Subject Code	Subject	L	T	P	C
Practical						
1	RS5251	Project Work	0	0	24	12
Total						12

Total Credits to be Earned for the Award of the Degree = 71

ELECTIVES

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	RS5001	Microwave Remote Sensing	3	0	0	3
2	RS5002	Non-Topographic Photogrammetry	3	0	0	3
3	RS5003	Air Borne Laser Terrain Mapping (ALTM)	3	0	0	3
4	RS5004	Digital Cartography	3	0	0	3
5	RS5005	GPS Surveying	3	0	0	3
6	RS5006	Remote Sensing and GIS Applications for Hydrology and Water Resources	3	0	0	3
7	RS5007	Remote Sensing and GIS Applications to Earth Sciences	3	0	0	3
8	RS5008	Remote Sensing and GIS Applications for Agriculture and Forestry	3	0	0	3
9	RS5009	Remote Sensing and GIS Applications to Environmental Engineering	3	0	0	3
10	RS5010	Remote Sensing and GIS Applications to Ocean Engineering and Coastal Zone Management	3	0	0	3
11	RS5011	Remote Sensing and GIS Applications for Urban and Regional Planning	3	0	0	3
12	RS5012	Remote Sensing and GIS Applications in Disaster Mitigation and Management	3	0	0	3

RS5101 – PRINCIPLES OF REMOTE SENSING

L	T	P	C
3	0	0	3

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 (SPACE PLATFORMS) 9

Types of Platforms – Different types of aircrafts – Manned – Unmanned spacecrafts – Sun synchronize – Geo synchronize satellites – Characteristics of different types of platforms – LANDSAT SPOT IRS INSAT IKONOS QUICKBIRD etc.,

UNIT III DATA ACQUISITION (AERIAL PLATFORM) 9

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 thermal scanners.

UNIT IV DATA ACQUISITION (MICROWAVE) 9

Concept of microwave remote sensing – Types of RADARS – SLAR – Resolution – Range and azimuth – Real aperture and synthetic aperture RADARS characteristics of microwave images – topographic effect – Different types of remote sensing platforms – Airborne and space borne sensors – ERS – JERS – RADARSAT – Scatterometer, altimeter.

UNIT V DATA ANALYSIS 9

Resolution – Spatial – Spectral – Radiometric and temporal resolution – Signal to noise ratio – Different types of data products and their characteristics visual and digital interpretation – Basic principles of digital analog geometric correction – Radiometric correction – Image enhancement – different types – Image classification – Different types of classifications – LIDAR aerial laser terrain mapping.

Total: 45

REFERENCES

1. Paul Curran, P.J., “Principles of Remote Sensing”, ELBS, 1995.
2. Lillesand. T.M. and Kiefer, R.W., “Remote Sensing and Image Interpretation”, 4th Edition of John Wiley and Sons, 2000.
3. Sabins Jr, F.F., “Remote Sensing Principles and Image interpretation”, W.H. Freeman and Co., 1978.

RS5102 – PHOTOGRAMMETRY

L T P C
3 0 0 3

UNIT I BASICS OF PHOTOGRAMMETRY 9

History and development – Principles – Classification of aerial cameras – Optics for photogrammetry, camera calibration – Photographic process.

UNIT II GEOMETRY OF AERIAL PHOTOGRAPHS 9

Scale — Overlaps – Stereoscopy – Concepts – Viewing and measuring systems – Image and object coordinates – Floating mark – Parallax equation – Height information – Tilt – Rectification – Displacement.

UNIT III PROJECT PLANNING, GROUND CONTROL AND MOSAIC 9

Flight planning – Computation for flight plan – Photo control – Cost estimation – Aerial mosaics – Types.

UNIT IV ORIENTATION PROCEDURES 9

Concepts of interior relative absolute orientation – Object image relation – Linearisation – Effect of orientation elements – Scaling and leveling – Analytical procedures – Map compilation using stereoplotters.

UNIT V AEROTRIANGULATION & SPECIAL SYSTEM 9

Elements of aerotriangulation and analytical method – Strip deformation, strip and block adjustment – Terrestrial photogrammetry – Geometry and products – Digital photogrammetry information extraction automated system image correlation matching and orientation – Orthophoto-Mapping.

Total: 45

REFERENCES

1. Paul. R Wolf. and Bon A. DeWitt, “Elements of Photogrammetry with Application in GIS”, 3rd Edition, McGraw Hill International Book Co., 2000.
2. Mikhail, E.M., Bethel, J.S. and McGlone, J.C., “Introduction to Modern Photogrammetry”, Wiley Publisher, 2001.
3. Gollfried Konecny, “Geoinformation: Remote Sensing, Photogrammetry and Geographical Information Systems”, 1st Edition, CRC Press, 2002.

RS5103 – CARTOGRAPHY

L	T	P	C
3	0	0	3

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 – Affined transformation.

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.

UNIT IV **PERCEPTION AND DESIGN** 9

Cartographic design – Color theory and models – Color and pattern creation and specification – color and pattern – Typography 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.

Total: 45

TEXT BOOKS

1. Anson R.W. and Ormeling, F.J., “Basic Cartography for students and Technicians”, Vol. I, II and III, 3rd Edition, Elsevier Applied Science Publishers, 2004.
2. Arthur H. Robinson, “Elements of Cartography”, 7th Edition, John Wiley and Sons, 2004.
3. John Campbell, “Introductory Cartography” 3rd Edition, Wm.C. Brown Publishers, 2004.
4. Menno-Jan Kraak and Ferjan Ormeling, “Cartography Visualization of Geospatial Data”, 2nd Edition, Pearson Education, 2004.

RS5104 – GEOGRAPHIC INFORMATION SYSTEM

L T P C
3 0 0 3

UNIT I BASICS 9

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 encoding – Data compression – Vector data model – Topology – Topological consistency – Vector data input – Arc node data structure – Raster Vs Vector comparison – File formats for raster and vector – Vector to raster conversion.

UNIT III DATA ANALYSIS AND OUTPUT 9

Raster data analysis local neighbourhood 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 MODELLING 9

Modelling in GIS – types – GIS Applications – Natural resource management utility applications – Cadastral applications – Business application – Digital elevation models generation – Representation – Applications – ALTM

UNIT V DATA QUALITY AND MISCELLANEOUS TOPICS 9

Accuracy, precision – Sources of error – Components of data quality – Meta data – Open GIS – Customisation in GIS – Object oriented GIS – Web GIS

L: 45 T: 0 Total: 45

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.

RS5105 – ELECTRONIC SURVEYING

L T P C
2 0 2 3

UNIT I BASICS OF ELECTRONIC SURVEYING 8

Methods of measuring distance – Basic principles of EDM – Historical development classifications – Applications and comparison with conventional surveying – Fundamentals of electronics – Oscillators (Crystal controlled and Gunn diode) Kerrcell / Pockel's modulator – Frequency mixing modulation and demodulation measurement of phase differences – Reflectors, (Corner, Antenna) transducers and power sources.

UNIT II ELECTROMAGNETIC WAVES 8

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

UNIT III ELECTROMAGNETIC DISTANCE MEASURING SYSTEM 8

Electro-optical system – Measuring principle – Working principle – Sources of error – Infrared and laser EDM instruments – Microwave system – Measuring principle – Working principle – Sources of Error – Microwave EDM instruments – Comparison between Electro-optical and Microwave system – Total station and its applications – Care and maintenance of EDM instruments .Modern positioning systems.

UNIT IV SURVEY ERROR ANALYSIS AND ADJUSTMENT 6

Concepts of measurement and error – Elementary concepts in Probability – Reliability of measurements – Significant figures – Error propagation and Linearization – The concept of adjustment – Simple adjustment methods – The least squares method – Preanalysis Procedure – Horizontal angle measurement with a Theodolite – Distance measurement by EDM – Elevation difference by direct levelling and survey tolerances.

UNIT V FIELD WORK 30

Methods of Measuring Distance – Study of different EDM instruments and Total Station map compilation – Setting out works – Base line Measurement – EDM traversing observations and computation of area – Trilateration.

L: 30 P: 30 Total: 60

REFERENCES

1. Burnside, C.D., "Electromagnetic Distance Measurement" Crosby Lock wood staples, 1991.
2. Rueger, J.M., "Electronic Distance Measurement", Springer-Verlag, 1990.
3. Laurila, S.H., "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993.
4. Soastamoinen, J.J., "Surveyor's guide to Electro-magnetic Distance Measurement", Adam Hilger Ltd., 1997.

RS5106 – GIS LABORATORY

L	T	P	C
0	0	3	2

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

Total: 45

RS5107 – PHOTOGRAMMETRY LABORATORY

L	T	P	C
0	0	3	2

1. Interior Orientation, Relative Orientation, Absolute Orientation and Mapping using Double Projector.
2. Interior Orientation, Relative Orientation, Absolute Orientation and Mapping using Analog Stereo Plotter Planicart E3
3. Interior Orientation, Relative Orientation, Absolute Orientation and Mapping using Semi Analytical Stereo Plotter Visopret
4. Interior Orientation, Relative Orientation and Measurement of model coordinates using Visopret
5. Interior Orientation, Relative Orientation, Absolute Orientation and Mapping using Analytical Stereo Plotter Planicomp P3

Total: 45

SEMESTER II

RS5151 – IMAGE PROCESSING

L	T	P	C
3	0	0	3

UNIT I SATELLITE DATA 9

Satellite systems and data – Acquisition and storage – Data formats – Data products – Image display system – Current missions.

UNIT II SENSOR AND DATA MODEL 9

Sensor model – Resolutions – Pixel characters – Image formation – Univariate & multivariable Image statistics – spatial Statistics – Geometric and radiometric correction – noise models

UNIT III IMAGE ENHANCEMENTS 9

Spectral signatures – Image characteristics feature space scatterogram – point, local and regional operation – Fourier transform scale – space transform wavelet transform.

UNIT IV INFORMATION EXTRACTION 9

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

UNIT V IMAGE ANALYSIS AND UNDERSTANDING 9

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

L: 45 T: 0 Total: 45

REFERENCES

1. John R. Jenson, “Introductory Digital Image Processing”, Prentice Hall Series, 1996.
2. John A. Richards, Springer- Verlag , “Remote Sensing Digital Image Analysis” 1999.
3. Rafael C. Gonzalez, “Digital image processing (2nd Edition)” , Prentice Hall, 2002.

RS5152 – VISUAL PROGRAMMING AND CUSTOMISATION

L T P C
3 0 0 3

UNIT I VISUAL BASIC PROGRAMMING 10

Visual Basic Applications – Creating and using Controls – Menus and Dialogs Managing projects – Programming fundamentals – Objects and instances – Debugging – Responding to mouse events – Using grid control – Creating graphics for application – Displaying and printing information – Interacting with the environment – File system controls – Processing files.

UNIT II DATABASE CONNECTIVITY IN VISUAL BASIC 8

Accessing databases with the data controls – ADO Object Model – ODBC and data access Objects – ODBC using DAO and Remote Data Objects – Data Environment and Data Report – ActiveX Controls – Dynamic Data Exchange (DDE).

UNIT III VISUAL BASIC .NET PROGRAMMING 9

Understanding Visual Basic .NET terminology – specifications, design, code, test, and document Visual Basic .NET programs – maintenance, repair, and enhance Visual Basic .NET programs – create custom dialog boxes, clocks, menus, and animation effects – manage text files and use encryption and sorting algorithms – master programming fundamentals, including variables, decision structures, loops, and functions.

UNIT IV COMPONENT OBJECT MODELLING (COM) 9

Basics – Software Reuse – Object Model Diagram, Class diagram, Interaction diagram – ActiveX Connector – Component Object Model (COM), Dynamic Link Library (DLL) – ASP – Linking Models and GIS – Loose Coupling, Tight Coupling, Embedded Coupling.

UNIT V GIS CUSTOMISATION PROGRAMMING 9

GIS Customization – Need – Advantages of Macro Scripting – Case studies using standard GIS software

L: 45 T: 0 Total: 45

REFERENCES

1. David S. Platt, “Introducing Microsoft .NET Microsoft Press”, SAARC Edition, 2001
2. Julia Case Bradley and Anita C. Millspaugh, “Programming in Visual Basic .NET”.
3. Francesco Balena, “Programming Microsoft Visual Basic 6.0”, Microsoft Press, Indian Reprint, 2001.
4. Cornell, G., “Visual Basic 6.0”, Tata McGraw Hill, 1998.
5. Deitel, H.M., Deitel.P.J., Nieto, T. and Nieto. T.M., “Visual Basic 6, How to Program”, Prentice Hall of India, 1999.
6. Tony Stevenson, Visual Basic 6.0: The Complete Reference, Osborne/ McGraw-Hill, 2000.

RS5153 – GEOGRAPHIC INFORMATION SYSTEM APPLICATION

L	T	P	C
3	0	0	3

UNIT I NATURAL RESOURCE MANAGEMENT APPLICATIONS 9

Forestry: Resource Inventory, Forest Fire Growth modelling – Land: Land use Planning, Watershed Management studies – Water – Identification of Ground Water Recharge – Resource Information System – Wetlands Management, Wildlife Habitat Analysis

UNIT II DISASTER MANAGEMENT & FACILITY MANAGEMENT APPLICATIONS 9

Disaster Management: Use of GIS in Risk Assessment, Mitigation, Preparedness, Response and Recovery phases of Disaster Management – Utilities – Water utility applications – Electric Utility Application – Telecommunication: Tower Spotting, Route optimization for meter reading for utilities – Other utilities

UNIT III LOCATION BASED SERVICES APPLICATIONS 9

Vehicle Tracking: Automatic Vehicle Location(AVL), Components of AVL:In Vehicle Equipment, Various Communication Channels, Web Server, Client – Vehicle Tracking – Alarms used in Vehicle Tracking, Fleet Management – Vehicle Navigation – Emergency Call: Address Geocoding , Distress Call Application

UNIT IV LAND INFORMATION SYSTEM & WEB GIS APPLICATIONS 9

Land Information System (LIS) – Tax Mapping – Other LIS applications – Web GIS: Architecture of Web GIS , Map Server, Web GIS Applications

UNIT V BUSINESS, HEALTH AND OTHER APPLICATIONS 9

Business Applications: Sitting a new Facility, Customer Loyalty studies, Market Penetration studies – Health applications : Disease Surveillance, Health Information System – Crime Mapping: Mapping Crime data, Hot Spot Analysis – 3D GIS

Total: 45

REFERENCES

1. Laura Lang, “Managing Natural Resources with GIS”, ESRI Press, 1998.
2. Uzair M. Shamsi, U. M. Shamsi, “GIS Tools for Water, Wastewater, and Stormwater Systems”, Asce Press, 2002.
3. Alan L., MD Melnick, “Introduction to Geographic Information Systems for Public Health”, Aspen Publishers, 1st Edition, 2002.
4. Amin Hammad, Hassan Karimi, “Telegeoinformatics: Location-Based Computing and Services”, 1st Edition, CRC Press, 2004.
5. Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, “Geographical Information Systems”, Vol. I and II, John Wiley and Sons, 1999.
6. Van Dijk, Bos , M.G., “GIS and Remote Sensing Techniques in Land-And-Water-Management”, Kluwer Academic Publishers, 2001.
7. Laura Lang, “GIS for Health Organizations”, ESRI Press, 2000.
8. Lisa Godin, “GIS in Telecommunications Management”, ESRI Press, 1st Edition, 2001.

RS5154 – IMAGE PROCESSING LABORATORY

L	T	P	C
0	0	3	2

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

Total: 45

RS5003 – AIR BORNE LASER TERRAIN MAPPING (ALTM)

L	T	P	C
3	0	0	3

UNIT I	BASICS OF AIRBORNE LASER TERRAIN MAPPING	9
LASER, LIDAR – Principle and Properties – Different LIDAR systems – Applications – Advantages Disadvantages – Spaceborne and Airborne LIDAR missions – Typical parameters of a LIDAR system.		
UNIT II	LIDAR	9
Principle of Laser Altimetry – Components of the system – GPS IMU LASER, LIDAR data formats – Terrain Mapping Laser Configuration – Ocean bathymetry Laser Configuration – Limitations of the system		
UNIT III	LIDAR DATA PROCESSING	9
GPS and IMU data Processing – Strip Adjustment – Geometric Correction – Data quality enhancement – Digital Surface Model – Filtering – Ground Point filtering – Digital Elevation Model		
UNIT IV	LIDAR MAPPING AND MODELLING	9
Hydrology Disaster Mitigation and Management – 3D city models – Telecommunication Modelling – Urban planning – Coastal Zone Bathymetry Mapping – Feature extraction vectorisation – Surface and landuse classification		
UNIT V	LIDAR GRAMMETRY	9
Orthophoto rectification using LIDAR – Integrated LIDAR and Digital Photogrammetry techniques – Integration of LIDAR DEM with other hyperspectral data		

Total: 45

REFERENCES

1. Yves Egels and Michel Kasser, "Digital Photogrammetry", Taylor and Francis, 2001.
2. Lee-Leung Fu, Satellite Altimetry and Earth Sciences, "A Hand Book of Techniques and Applications", Academic Press, 2000.
3. Roger Read and Ron Graham, "Manual of Aerial Survey: Primary Data Acquisition", Whittles Publishing, 2002.

RS5004 – DIGITAL CARTOGRAPHY

L T P C
3 0 0 3

UNIT I MANAGING DATA BASES 9

Data organisation – Data compression – Data measurement – Basic statistical processing – Geographic information system – The measuring of GIS to cartography.

UNIT II DATA PROCESSING 9

Computer system for the processing of graphic data – Hardware –Software – SICAD – Digitising of cartographic presentation – Structuring and storage of data – Cartographic data processing – Output of cartographic presentation – Examples and applications.

UNIT III MODELLING IN DIGITAL CARTOGRAPHY 9

Fundamentals of modelling, graph theory, topology – Digital planimetric modelling – Digital relief modelling – Quality of digital landscape models – Topographic model generalisation, Map revision – Web Cartography – Dynamic and Static Web Maps.

UNIT IV MAP DESIGN 9

Theory of communication, information and signs – methods of computer assisted design of cartographic expressions – computer assisted evaluation of geo data for thematic maps – Cartographic aspects of GIS.

UNIT V TECHNIQUES OF MAP PRODUCTION 9

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

L: 45 T: 0 Total: 45

REFERENCES

1. Menno, Jan Kraak and Ferjan Ormeling, “Cartography – Visualization of Geo spatial Data”, 2nd Edition, Pearson Education, 2004.
2. Arthur. H. Robinson etal “Elements of Cartography”, 7th Edition, John Wiley and sons, 2004.
3. R.W. Anson and F.J. Ormeling, “Basic Cartography for Students and Technicians” Vol. I, II and III, 2nd Edition, Elsevier Applied Science Publishers, 2002.
4. Menno, Jan Kraak and Allan Brown, “Web Cartography Developments and Prospects, Taylor and Francis, 2001.

RS5005 – GPS SURVEYING

L	T	P	C
3	0	0	3

UNIT I **BASICS** **6**

Definition – Fundamental goals of Geodesy – Definitions – basic concepts – Historical perspective – development applications in Satellite Geodesy – Geoid and Ellipsoid satellite orbital motion – Keplerian motion – Kepler’s Law – Perturbing forces – Geodetic satellite

UNIT II **DIFFERENT TECHNIQUES** **6**

Determination of direction by photography – SECOR – Electronic observation techniques – Doppler effect – Positioning concept – Development of TRANSIT satellites.

UNIT III **SATELLITE SYSTEM** **6**

GPS – Different segments – space control and user segments – satellite configuration – GPS signal structure – Orbit determination and Orbit representation Anti Spoofing and Selective Availability – Task of control segment – GPS receivers – main receiver components – Example of GPS receivers.

UNIT IV **GPS DATA PROCESSING** **6**

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

UNIT V **APPLICATIONS OF SATELLITE GEODESY** **6**

Geodetic control surveys, Cadastral surveying, Photogrammetry & Remote Sensing, Engineering applications and Monitoring – GIS. GLONASS satellite configuration comparison – Satellite Laser Ranging & Applications – Concepts of satellite altimetry.

Total: 45

REFERENCES

1. Alfred Leick, “GPS Satellite Surveying”, 3rd Edition, John Wiley and Sons 2004.
2. Guocheng Xu, “GPS Theory, Algorithms and Applications”, Springer-Verlag, 2003.
3. Seeber G., “Satellite Geodesy”, Walter De Gruyter, 1998.

**RS5006 – REMOTE SENSING AND GIS APPLICATIONS FOR
HYDROLOGY AND WATER RESOURCES**

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UNIT I BASICS OF HYDROLOGY 12

Hydrologic cycle – estimation of various components of hydrologic cycle – clouds – rainfall – runoff – evaporation – transpiration – evapo-transpiration – interception – depression storage – Spectral properties of water – GIS application in surface water modelling – case studies.

UNIT II DRAINAGE BASIN 6

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

UNIT III AERIAL ASSESSMENT 5

Mapping of snow covered area – snow melt runoff – flood forecasting and inundated area – soil moisture area – drought affected area – GIS applications in aerial assessment – case studies.

UNIT IV GROUND WATER AND WATER QUALITY 10

Ground water potential – surface water indicators – vegetation, Geology Soil aquifer – aquifer parameters – Well hydraulics – estimation of ground water potential – hydrologic budgeting – mathematical models – GIS application in Ground Water modelling – study on sea water Intrusion – modelling of sea water intrusion – Water quality parameters – physical, Chemical Biological properties. Water quality mapping and monitoring – Correlation model for pollution detection – case studies.

UNIT V IRRIGATION AND WATERSHED MANAGEMENT 12

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

Total: 45

REFERENCES

1. Eric C. Barrett, Clare H. Pauer, “Satellite Remote Sensing for Hydrology and Water Management”, Gordon @ Breach Science Publications,1990.
2. David Maidment and Dean Djokic, “Hydrologic and Hydraulic Modelling Support with GIS”, ESRI Press, 2000.
3. Gert A. Schulitz, Edwin T. Engman, “Remote Sensing in Hydrology and Water Management”, Springer-verlay, 2000.
4. Andy D. Ward, William J. Elliot, “Environmental Hydrology”, Lewis Publisher,1995.

RS5007 – REMOTE SENSING AND GIS APPLICATIONS TO EARTH SCIENCES

L	T	P	C
3	0	0	3

UNIT I LITHOLOGY AND STRUCTURE 9

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

UNIT II SPECTRA OF ROCKS AND MINERALS 9

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

UNIT III GEOMORPHOLOGICAL APPLICATIONS 9

Introduction – Geomorphic processes and Geomorphic Landforms Geomorphic mapping using aerial photographs and satellite data – Landform analysis in Ground water studies coastal zone management and Civil Engineering projects – case studies.

UNIT IV REMOTE SENSING AND GIS APPLICATIONS 9

Thematic presentation of Lithologic structural and Geomorphic details ground truth data. Integration of all relevant data using Remote Sensing and GIS in ground water studies.

UNIT V CASE STUDIES ON RS & GIS APPLICATIONS 9

Coastal zone management Disaster Management Studies like Landslides Droughts and Floods Engineering Geology Mineral exploration and Petroleum exploration.

Total: 45

REFERENCES

1. Sabins, F., 'Remote Sensing principles and interpretation' W.H. Freeman and Company, 1987.
2. Parbin Singh, 'Engineering and General Geology', Keton Publication House, 1987.
3. Drury, S.A., Image interpretation in Geology, Chapman and Hall, 1993.
4. Michael N. Demers, "Fundamentals of GIS", John Wiley and Sons, 1999

RS5008 – REMOTE SENSING AND GIS APPLICATIONS FOR AGRICULTURE AND FORESTRY

L T P C
3 0 0 3

UNIT I CROPS 10

Introduction – spectral properties of crops in optical and TIR region, microwave backscattering behavior of crop canopy – crops identification and crop inventorying – crop acreage estimation – vegetation indices – yield modelling – crop production forecasting through digital analysis – crop condition assessment – command area monitoring – land use and land cover analysis – microwave RS for crop inventorying – case studies.

UNIT II SOILS 10

Introduction – soil genesis, soil morphological characters, soil Pedology – soil survey, types and methods of soil surveys – soil classification – hydrological soil grouping – characteristics of saline and alkaline soils – factors influencing soil reflectance properties – soils mapping using RS data – problem soil identification and mapping – Land Evaluation – soil sedimentation and erosion – soil loss assessment – soil conservation – case studies.

UNIT III DAMAGE ASSESSMENT 10

Detection of pest and diseases – flood mapping and assessment of crop loss – remote sensing capabilities and contribution for drought management – land degradation due to water logging and salinity – crop stresses reflectance properties of stressed plants and stress detection.

UNIT IV FORESTRY 10

Introduction – forest taxonomy – inventory of forestlands – forest type and density mapping using RS techniques – forest stock mapping – factors for degradation of forests – delineation of degraded forests – forest change detection and monitoring – forest fire mapping and damage assessment – Lidar remote sensing for forest studies.

UNIT V INTEGRATED SURVEYS 5

Introduction – Integrated surveys for agriculture and forest development – RS and GIS for drawing out action plans – watershed approach – role of RS and GIS for watershed management – land use planning for sustainable development – case studies.

Total: 45

REFERENCES

1. Anonymous “Remote Sensing for Natural Resources Management and Environmental Monitoring - Manual of Remote Sensing”, 3rd Edition, Vol.4, American Society of Photogrammetry and Remote Sensing/John Wiley and Sons, 2004.
2. Pete Bettinger and Michael G Wing. “Geographic Information Systems: Applications in Forestry and Natural Resources Management”, McGraw-Hill Higher Education, 2003.
3. Roy, P.S., ‘Geoinformatics for Tropical Ecosystems’, Asian Association of Remote Sensing, 2003.
4. Singh, R.P. and Vinod Tare. ‘Spatial Technologies for Natural Hazards Management’. Proceedings of ISRS National Symposium, November 21–22 IIT, Kanpur. ISRS Publications, , 2000.

**RS5009 – REMOTE SENSING AND GIS APPLICATIONS TO ENVIRONMENTAL
ENGINEERING**

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UNIT I REMOTE SENSING APPLICATION TO ENVIRONMENTAL STUDIES 9

Introduction – Environmental Satellites: GOES, NOAA, AVHRR, CZCR –Monitoring land, water, atmosphere and ocean using Remote Sensing data – Case studies.

UNIT II SOIL DEGRADATION STUDY USING GIS AND REMOTE SENSING 9

Taxonomical classification of soils – soil survey Interpretation and mapping – Impact of agricultural and Industrial activity on soil properties – Soil salinity / alkalinity, erosion studies – Application of GIS in assessing soil salinity, erosion productivity etc.,

UNIT III WATER QUALITY DATA ANALYSIS USING GIS 9

Classification of water quality for various purposes – Data base creation and quality modeling using GIS. Database creation and maintaining water supply network – sewage network using GIS – Case studies.

UNIT IV GROUND WATER POLLUTION 9

Aquifer – Vulnerability Intrinsic & Specific Vulnerability, DRASTIC, SINTACS MODELS, MOD FLOW, MT3D, contaminant transport model

UNIT V AIR QUALITY MONITORING 9

Atmosphere: chemicals, Particulate matters present in the atmosphere, allowable limits – Remote Sensing technique to monitor atmosphere constituents, air pollution due to industrial activity – monitoring of modelling using GIS.

Total: 45

REFERENCES

1. “World in transition: The threat to Soils” Annual Report of the Germon Advisory Council on Global change, Economical Verlag, 1994.
2. Sabins, F, ‘ Remote Sensing Principles and Interpretation’, W. H. Freeman and Company, 1987.
3. “Ground Water vulnerability assessment: Predicting Relative Contamination Potential Under Conditions of Uncertainty”, National Academic Press, 1993.
4. Savigny. D. and Wijeyaratne .P., ‘GIS for Health and Environment’, Stylus Publication.
5. Allaric Sample .V.,“Remote Sensing and GIS for Eco System Management”. Island Press,

**RS5010 – REMOTE SENSING AND GIS TO OCEAN ENGINEERING AND
COASTAL ZONE MANAGEMENT**

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UNIT I OCEAN ENGINEERING 10

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

UNIT II OCEAN GENERAL STUDIES 6

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

UNIT III COASTAL ENGINEERING 7

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

UNIT IV REMOTE SENSING APPLICATION 10

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

UNIT V COASTAL ZONE MANAGEMENT 12

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

Total: 45

REFERENCES

1. Vasilis D. Valavanis, “GIS in Oceanography and Fisheries”, Taylor and Francis, 2002
2. Shifrin K.S., “Physical optics of Ocean Water”, American Institute of Physics, 1998.
3. Eric C. Barrelet and Jenniter, “Remote Sensing for Hazard Monitoring and Disaster Assessment: Marine and Coastal applications in the Mediterranean Region”, Gordon and Breach Science Publications, 1991.
4. Alasdair J. Edward, “Remote Sensing Handbook for Tropical Coastal Management”, UNESCO Publishing, 2000.

