



KERALA UNIVERSITY OF FISHERIES AND OCEAN STUDIES

SYLLABUS

M.Sc.REMOTE SENSING AND GIS

SCHOOL OF FISHERIES ENVIRONMENT

Fisheries Station Puthuvype Campus, Kochi-682508, Kerala

**KERALA UNIVERSITY FOR FISHERIES AND OCEAN STUDIES,
DEPARTMENT OF REMOTE SENSING AND GIS
SCHEME OF EXAMINATION (EFFECT FROM 2014-2015 ONWARDS)**

Sl. No.	SUBJECT	No. of Credits	Internal Marks	External Marks	Total
SEMESTER – I					
RS2101	Remote sensing	C4	50	50	100
RS2102	Geographical Information System & GPS	C4	50	50	100
RS2103	Photogrammetry and Cartography	C4	50	50	100
RS2104	Digital Image Processing	C4	50	50	100
RS2105	Statistical Methods (SME 531 Applied Statistics)	E4	50	50	100
RS2106	Oceanography	E4	50	50	100
RS2107	Practical : Satellite Image Processing and GIS Analysis	P4	50	50	100
SEMESTER – II					
RS2201	Microwave and Hyperspectral Remote Sensing and its Applications	C4	50	50	100
RS2202	Geological Remote Sensing and Techniques	C4	50	50	100
RS2203	Geospatial Techniques for Disaster Management	C4	50	50	100
RS2204	Geospatial Techniques for Coastal and Marine Environments	C4	50	50	100
RS2205	Marine Meteorology	E4	50	50	100
RS2206	Geospatial Techniques for Water Resource Management	E4	50	50	100
RS2207	Practical: Geospatial Technology Applications and Modelling	P4	50	50	100
SEMESTER – III					
RS2301	DBMS for GIS	C4	50	50	100
RS2302	LIDAR Remote Sensing and Applications	C4	50	50	100
RS2303	Satellite Meteorology, Agriculture and Forestry	C4	50	50	100
RS2304	Mini Project	C4	50	50	100
RS2305	Coastal Zone Management	E4	50	50	100
RS2306	Marine Survey and GIS	E4	50	50	100
RS2307	Practicals:	P4	50	50	100
SEMESTER – IV					
RS2401	Major Project and Viva-voce		18	100

First Semester: 24 Credits
Third Semester: 24 Credits

Second Semester: 24 Credits
Fourth Semester: 18 Credits

Total = 90 Credits

SEMESTER - I

RS2101: Remote sensing

Unit – 1

Introduction to Remote Sensing – Energy sources and Radiation principles, Energy equation, EMR and Spectrum – EMR interaction with Atmosphere – Scattering, Absorption – EMR interaction with Earth surface features reflection, absorption, emission and transmission – Spectral response pattern – Vegetation, Rocks, Soil, Water bodies – Spectral properties and characteristics.

Unit – 2

Introduction - Terrestrial and Aerial photographs - vertical and oblique photographs - height determination contouring - photographic interpretations- stereoscopy – parallax bar- Flight Planning- Photo Interpretation, Applications of aerial Photos-Photo theodolite

Unit – 3

Data acquisition – Procedure, Reflectance and Digital numbers- Intensity-Reference data , Ground truth, Analog to digital conversion, Detector mechanism-Spectro - radiometer-Ideal remote sensing system – Characters of real and successful remote sensing system- Platforms and sensors- orbit types– Resolution

Unit – 4

Land observation satellites, characters and applications, IRS series, LANDSAT series, SPOT series, High resolution satellites, character and applications, CARTOSAT series, IKONOS Series, QUICKBIRD series, Weather/Meteorological satellites, INSAT series, NOAA, GOES, NIMBUS Applications, Marine observation satellites OCEANSAT

Unit – 5

Introduction- Active, Passive, Optical Remote sensing, Visible, Infrared, thermal, Sensors and characters. Microwave Remote sensing sensors, Concept of Microwave Remote sensing, SLAR, SAR Scattro meter – Altimeter, Characteristics, Image interpretation characters.

REFERENCES

1. Paul Jude Gibson, Introductory Remote Sensing: Principles and Concepts, Routledge, 11 New Fetter Lane, Landon, UK. 2000. ISBN: 0-415-17024-9
2. M. Anji Reddy, Textbook of Remote Sensing and Geographical Information systems, BS Publications, Hyderabad. 2011. ISBN: 81-7800-112-8
3. A.M. Chandra and S.K. Gosh. Remote Sensing and GIS, Narosa Publishing Home, New Delhi 2009.
4. Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman, Remote sensing and image interpretation John Wiley & Sons, 2008
5. George Joseph , Fundamentals of Remote Sensing Universities Press, Hyderabad 2005.
6. Prithvish Nag, M. Kudrat, Digital Remote Sensing, Concept Publishing Company, India, 1998.
7. Kali Charan Sahu, Textbook of Remote Sensing and Geographical Information Systems, Atlantic Publishers, New Delhi, India, 2008.

RS2102: Geographic Information Systems and GPS

Unit – 1

Introduction to Geographical Information Systems: Maps and Spatial information – Computer Assisted Mapping and Map Analysis. Components of Geographical Information System – Future Directions and Trends in GIS. Introduction – GPS satellites – Components – Satellite Ranging – Codes - Basics of Geodesy – Branches, Applications and Observations of Geodesy. GPS – DGPS - GPS Receiver and its Features – Receiver selection – Enhancement of receiver - GPS processor Software – GPS Data – Processing of GPS data and types. GPS Field Survey Techniques – Advantages – Characteristics – Positioning modes – Static surveying – Kinematics surveying. Doppler Effect and basic positioning concept – Dilution of Precision – Types – Multipath Effect – Field practices.

Unit – 2

Map projections in GIS – Coordinate System – Georeferencing – Data Structures for Geographic Information Systems – GIS Entities – Point, Lines and Polygon. Definition of a map – Geographic Data in the Computer – File and Data Processing – Data Base Structures – Perceived Structures and Computer Representation of Geographical data. Data model – Raster data model, Vector data model for geographical entities. Data structures for thematic maps – Difference of Raster and Vector model. Digital Elevation Models: TIN – DEM - Methods of representing DEM – Image methods – Data Sources and Sampling Methods for DEM – Use of DEM. Data Products derived from DEM. Use of DEM – Automated Landform Delineation from DEM.

Unit – 3

Data input, verification, storage and output: Data input - Data verification, Correction and Storage. Data output – Data output format – Thematic maps, Charts and Graphs – User Interfaces. Methods of Data Analysis and Spatial Modeling: Geoprocessing – Definition – GIS Data Analysis – Simple Data Retrieval. Map overlay – Cartographic modeling using natural language commands. Linking command sequences into cartographic models – advantages and disadvantages of cartographic model in land evaluation and planning.

Unit – 4

Data Quality, Errors and Natural Variation: Sources of error – Errors resulting from natural variation and original measurements. Errors arise through processing – Problems and Errors arising from overlay and boundary intersections – Errors resulting in raster and vector map – Errors associated with overlaying two or more polygon networks. The nature of boundaries – The statistical nature of boundaries. Combining attributes from overlaid maps – Classification methods: Classification – Multivariate analysis and Classification – Allocating individuals to existing classes. Classification methods in Geographical Information Systems – Expert systems for Geographical Information Systems

Unit – 5

Methods of Spatial interpolation: The available methods for interpolation – Global methods of interpolation – location interpolators, optimal interpolation methods using spatial auto covariance. Extensions of kriging to large areas – Comparing kriging with other interpolation techniques. Choosing a Geographic Information System – Designing the needs for GIS. The procedure of Geographical Information System model building. Tools for Map analysis: Single maps – Map reclassification – Operations and attribute tables – Spatial topological and geometric modeling and operations on spatial neighborhood. Tools for map Analysis: Map pairs – map overlay and map modeling correlation between two maps – Multiple maps, types of models, Boolean logic models – Index overlay models – Fuzzy logic methods.

REFERENCES

1. Principles of Geographical Information System for Land Resource Assessment, P.A. Burrough, Clarendon Press, Oxford, 1986.
2. Geographic Information Systems, T.R. Smith & Piquet, London Press, 1985.

3. Principles of data base systems, J.D. Ullman, Computer Science Press.
4. Santheesh Gopi., Global Positioning System – Principles and Applications, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
5. Seeber, G., Satellite Geodesy, Walter de Gruyter, Berlin, 1993.
6. Alfred Leick, GPS Satellite surveying, John Wiley and Sons, 1995. Hofmann Wellenhof, B. Lichtenegger, H. and Collins, J., Global Positioning System, SorinQer - Verlag, New York, 1994.
7. Otto Huisman and Rolf A. de By (Editors) Principles of Geographical information Systems - An Introductory Text Book, ITC, The Netherlands, 2009. ISBN: 978-90-6164-269-5

RS2103: Photogrammetry and Cartography

Unit – 1

Evolution of Photogrammetry - analog, analytical, digital-Advantages - Auto - Imation - accuracy - Representation of digital images - 8/ W. RG8, CMYK, HLS. EMR - Band designation - Microwave interaction with atmospheric constituents, Earth's surface, vegetation, and ocean. Digital Cameras - CCD Camera - Full frame CCD Frame transfer CCD, CCD cameras 1 with piezo shift, Interline transfer CCD, Time delay integration CCD sensor - Spectral Sensitivity of CCD sensor, Geometric problems of CCD images - line jitter, blooming, warm up effect, Tailing - Typical CCD systems, line scanners - SPOT, MOMS Data.

Unit – 2

Analog to digital conversion - Scanner - flat bed, drum type – Sensor characteristics - Scanner resolutions - Scanner calibration -Video Cameras - Frame Grabber - Typical Scanner systems and Video cameras. Merits, demerits - Stereo viewing - Spatial, spectral and temporal methods - Image measurement - Coordinate system - Image movement -fixed image, moved image - Image transformation - Geometrical transformation, Radiometric transformation - Concepts of Interior, Relative and Absolute orientation. DTM generation - Image correlation - Image matching - Digital Orthophoto generation - Automated aero-triangulation - Link between GIS and Digital Photogrammetry.

Unit – 3

History and development of Cartography, Definition, scope and concepts of cartography. Characteristics of Map. Categories of maps.. Methods of mapping, relief maps, thematic maps. Trends in Cartography. Geodesy, Map projection, classification principles of construction of common projections, cylindrical, conical, azimuthal and globular projections. Properties & uses of projection. The spheroid, Map scale, and co-ordinate system. Plane co-ordinates in UTM system, projection used in Survey of India topographic sheets.

Unit – 4

Sources of Data-Ground Survey and positioning, Remote sensing, Census and sampling, Data processing-image processing, digital database, Geographic and cartographic database, basic Statistical processing, Design of color and pattern, typography and lettering the map.

Unit – 5

Processing and generalizing geographic data, Simplification and Classification, computer assisted cartographic processes, symbolization, mapping with point, line and area symbols-Portraying the land surface form. Map Compilation – Analog and Digital Compilation. Map reproduction. Methods of Few Copies and Many Copies. Map production: Form of Art Work-Construction Method-Output option - Digital cartography, Geographic Information System.

REFERENCES

1. Krauss, J., Photogrammetry, Vol. IIV Edition, Springer–Verlag Publishers, 1993
2. International Archives of Photogrammetry and Remote Sensing, ISPRS, Volume XXIX, B5, Commission 5, 1995 Proceedings of Annual Convention of ASPRS, 1993-96
3. Robinson A. H., Morrison, J. L, Muehrcke, A. C., Kimerling, A. J. and Guptill, S. C., Elements of Cartography. 6th Edition, John Wiley and Sons, 1995.
4. Cromley, R. G., Digital Cartography. Prentice-Hall of India, New Delhi, 1992.
5. Dent, B. D., Cartography – Thematic Map Design. 5th Edition, W C B McGraw-Hill, Boston, 1999.
6. Muller, Advances in Cartography, ISBN: 1851666036, Elsevier Science Publications
7. R.W. Anson and F.J. Ormeling, Basic Cartography for students and Technicians. Vol., I, II and III Elsevier Applied Science publishers 2nd Edition, 1995.
8. Rampal, K.K., Mapping and Compilation. Concept Publishing Co., New Delhi, 1993.

RS2104: Digital Image Processing**Unit 1**

Image acquisition and format - Satellite data acquisition, DN characters-kernels- storage devices, CC, CDisk, Optical disk. Data retrieval. Export and import, Data formats, BSQ, BIL, BIP, Run length encoding, Image Compression Data products, hard copy, digital products, Image display system, requirement.

Unit 2

Image distortion and rectification - Introduction-Sensor model, Preprocessing and Post processing Geometric distortion, sources and causes for distortion, rectification, GCP, Resampling, Image registration, transformation, Radiometric distortion, sources and causes, Computation of radiance, Computation of reflectance, cosmetic operations, Noise removal, atmospheric correction.

Unit 3

Image enhancement - Satellite image statistics, Univariate and multi-variate statistics. Basics of Histogram, noise models, image quality, contrast manipulation, grey level thresholding, level slicing, contrast stretching- Spatial feature manipulations, spatial filtering, convolution Low pass, high pass, edge enhancement, edge detection, Fourier analysis.

Unit 4

Image classification - Introduction, Classification techniques, feature extraction, Supervised, training stage, classification stage, scatterogram, minimum distance to mean classifier, Parallelepiped classifier, Gaussian maximum Likelihood classifier, unsupervised classification, Hybrid classifier, classification of mixed pixel-fuzzy classification, output stage, classification accuracy, error matrix.

Unit 5

Image analysis - Digital Image interpretation, Pattern recognition, shape analysis, Textural analysis, Decision concepts, fuzzy sets and Evidential reasoning, Change detection, multitemporal data merging, multi sensor image merging-merging image data with ancillary data, Expert system, Artificial Neural Network; Integration with GIS.

REFERENCES

1. M. Anji Reddy, Textbook of Remote Sensing and Geographical Information systems, BS Publications, Hyderabad. 2011. ISBN : 81-7800-112-8
2. Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman Remote sensing and image interpretation John Wiley & Sons, 2008

3. John R. Jenson "Introducing Digital Image Processing" - Prentice Hall, New Jersey 1986
4. Robert A. Schowengerdt, "Techniques for Image Processing and Classification in Remote Sensing"; 1984. ISBN 13: 9780126289800

RS2105: Statistical Methods (SME 531 Applied Statistics)

SME 531 Applied Statistics

Unit: 1

Descriptive statistics: Basic Concepts of statistics. Methods of summarization of statistical data Average, Dispersion, skewness and Kurtosis. Correlation and regression- Linear, Partial and multiple correlation, rank correlation, curve fitting, method of least squares, linear and multiple regression (13 hrs)

Unit: 2

Probability and distributions: Probability _ logical, empirical and subjective theories , random variables and probability distributions. Expectations and moments. Binomial , position , Normal , exponential , weibull, Extreme value , Rayleigh and Log-Normal distributions.(definition and properties only) (8 hrs)

Unit: 3

Sampling distribution, standard error, sampling distribution of sample mean, variance and central limit theorem (statements only), Chi-square, Students *t* and F distributions (5 hrs)

Unit: 4

Statistical inference: Point and interval estimation – requisites for a good estimator. Confidence interval for the mean and proportion tests of significance concerning mean, proportions and variance. Non-parametric procedures- chi – square tests, kolmogorove-smirnov test and run test. Analysis of variance – one way and two way classification. (13 hrs)

Unit: 5

Applied statistics: Time –series Analysis – components of time – series , Estimation of trend and seasonal variations autocorrelation , Harmonic analysis.

(13 hrs)

RS2106: Oceanography

Unit 1

History and development of Marine Sciences; general characteristics of oceans, exploration, survey tools and methods, Navigation and positioning systems.

Unit 2

Physical Oceanography: Physical properties of seawaters; temperature, salinity, density, T-S diagram, stability, acoustics, optics. Waves-generation, wave transformation, shoreline transformation energy. Currents-Wave generated, thermohaline, turbidity currents (gravity), Coriolis force, large-scale (gyres) oceanic circulation, . Dimensions of Oceans. Water masses. Currents: General characteristics, effects of fields of pressure, gravity and mass. Relative currents, wind currents, upwelling and sinking. Tides: tide-producing forces and tide characteristics. Circulation patterns and currents in the India Ocean. Major currents of the world oceans. Ocean-land-atmospheric interactions: Monsoons, cyclones, anticyclones, Oceanography – Remote sensing techniques.

Unit 3

Chemical Oceanography: Water and Salts in the Sea, Major Constituents, Simple Gases & CO₂ System, , Trace Elements, Nutrients, Colloid and Particulate chemistry; Marine Biogeochemistry; Dissolved and Particulate Carbon, Radioactive & Stable Isotopes, Organic Molecules, Drugs from Sea, Anoxic Environments, Exchange at Boundaries, Chemical Evolution of oceans

Unit 4

Biological Oceanography: The sea as a Biological environment: classification of marine environment; general characters of the populations of the primary biotic divisions (plankton, nekton and benthos). Introduction of plankton; general classification and composition of plankton; floating mechanism of plankton. Collection of plankton; general account of instruments and nets employed; methods of fixation and preservation of plankton; analysis of samples, methods of estimating standing crop of plankton. Plankton in relation to fisheries; general account. Distribution of plankton in space and time; horizontal distribution; neritic and oceanic plankton; geographical distribution; indicator species. distribution of plankton, vertical migration ; seasonal changes in plankton.

Unit 5

Marine Pollution: Definition by GESAMP, major sources of pollution, dynamics, transport paths and agents. Toxicology: Lethal and sub lethal effects of pollutants on marine organisms, evaluation of toxicity tolerance, bioassay. Enzymatic removal of hazardous organic substances from aqueous effluents. Sewage: composition and fate in the marine environment, toxicity and treatment methods, sewage disposal system. Environmental Impact Assessment Methods of aquaculture activities. Oil pollution: Sources and fate of oil, composition and toxicity of oil, biological effects treatment procedures. Thermal and radioactive pollutants: Source and characteristics, strategies for disposal of RNA and Heated effluents, biological effects and alternative uses of waste dumping, mining and dredging operations, their effects on the organisms and marine environment.

RECOMMENDED BOOKS:

1. Svedrup H.U, Johnson, M.W. & R.H. Fleming (1942) The Oceans, Prentice Hall,
2. Tait, R.V (1972) Elements of Marine Ecology, 2nd edition, Butterworths
3. Pickard. G.L (1963) Descriptive physical – Oceanography, Pergamon Press,
4. King, C.A.H., (1975) Introduction to Physical and Biological oceanography, ELBS Ltd., London
5. Angel, M.V (1975) Biological Oceanography, Methuen
6. Nair, N.B. & D.M. Thampy (1980) A Text Book of Marine Biology, Macmillan
7. Ryamont, J.E.G., (1980) Plankton and productivity in Oceans. Vol. 1: Phytoplankton, Vol.II, Zooplankton, Pergamon Press
8. Parsons, T.R. Takahashi, M. and B. Hargrave (1977) Biological Oceanographic processes, Pergamon
9. Broecker W.S., (1974) Chemical Oceanography. 2nd edition Harcourt Brace, Jovanovich,
10. Riley O.P. & G.S. Skirrow (1975) Chemical Oceanography, 2nd edition, Vols. I-IV, Academic Press,
11. A.M. Chakravarthy (1928) Biodegradation and detoxification of Environmental pollutants, CRC Press,
12. O.Kinne: (1984) Marine Ecology, Vol. V. Ocean Management 3&4, John Wiley & Sons,
13. Johnston R. (Ed.): (1976). Marine Pollution, Academic Press
14. Patin. S.A (1982) Pollution and Biological resources of the Oceans Butterworth & Co. Ltd.
15. Venugopalan, V.K. (1991) Pollution and Toxicology, CAS in Marine Biology
16. Hilary B. Moore (1958) Marine Ecology, John Wiley & Sons

RS2107: Practical I: Satellite Image Processing and GIS Analysis

Remote Sensing

1. Aerial photograph interpretation
2. Visual interpretation of multispectral and Panchromatic Image
3. Histogram stretching, linear, non linear stretching, histogram equalization
4. Image rectification
5. Image classification, supervised and unsupervised classifications
6. Image Fusion
7. Stitching of Images
8. Change Detection from Multi-Temporal imagery

Geographical Information System

1. Analog to Digital Conversion – Scanning methods
2. Introduction to GIS software
3. GIS Entities and Feature Data Base– Point features, Line features, and Polygon features
4. Data Editing-Removal of errors – Overshoot & Undershoot, Snapping
5. Data Collection and Integration, Non-spatial data attachment working with tables
6. Dissolving and Merging
7. Clipping, Intersection and Union
8. Buffering techniques
9. Spatial and Attribute query and Analysis
10. Contouring and DEM
11. Advanced Analyses – Network analyses
12. Layout Generation and report

Digital Cartography

1. Construction of different types of scales
2. Construction of different types of map projection: Conical projection, Cylindrical Projection, WGS 84
3. Preparation of UTM grid
4. Base Map
5. Designing and Symbolization
6. Analog to Digital Conversion
7. Analysis of Toposheet
8. Updation of maps from Satellite Imagery.

Global Positioning System

1. Introduction to GPS and initial setting
2. Creating codes and attribute table for GPS receiver
3. Point Data collection using GPS with different datum
4. Line data collection using GPS and measurements
5. GPS data collection for area calculation
6. GPS Data collection in DGPS mode.
8. Post processing of the GPS data
9. GPS and GIS integrations output preparation

SEMESTER – II**RS2201: Microwave and Hyperspectral Remote sensing and its applications****Unit 1**

Basics of microwave remote sensing - Fundamentals – EMR-Electromagnetic Spectrum - Microwave Band Designation Microwave interaction with atmospheric constituents, Earth's surface, vegetation, and ocean. Radiometry & antenna systems - Basics - Theory of Radiometry - Sensors applications in atmosphere, ocean and land. Antenna –Types and Functions of different types of antenna.

Unit 2

Radar-Real and synthetic aperture radars, - Principles - different platforms and sensors, System parameters, Target parameters, Radar equation measurement and discrimination, Airborne Data products and selection procedure - SEASAT, SIRA, SIRB, ERS, JERS, RADARSAT missions. Radar data processing - Radar grammetry, Image processing, SAR Interferometry – Polarimetry- Interpretation of microwave data - Physical mechanism and empirical models for scattering and emission, volume scattering. Applications of microwave remote sensing - Geological interpretation of RADAR –sites-default-files, Application in Agriculture -forestry, Hydrology - ice studies – land use mapping and ocean related studies

Unit 3

Multispectral and hyperspectral remote sensing, Comparison of Multispectral and Hyperspectral Image Data, Spectral Signatures and BRDF in the Visible, Near Infrared and Shortwave Infrared regions of EMR, Hyperspectral Issues. Sensors and hyperspectral imaging devices - Scanner types and characterization - specifications of various sensors Spectrographic imagers- hyperspectral sensors, Design tradeoffs. Data formats and systems, AVIRIS, CASI, NASA Terra Moderate Resolution Imaging Spectrometer (MODIS), Hyperion.

Unit 4

Preprocessing of hyperspectral data - Hyperspectral Data Cube, Hyperspectral Profiles, Data Redundancy. Problems with Dimensionality, Principal Component, Minimum Noise Fraction (MNF), Atmospheric Correction, Atmospheric Correction Measures, Flat Field Correction, Empirical Line Calibration, Empirical Flat Field Optimized, Reflectance Transformation (EFFORT), Continuum Removal, Spectral Feature Fitting.

Unit 5

Hyperspectral data analysis - Derivative spectral analysis, techniques for analysis of hyperspectral data, first-order and second- order derivative spectra, Theoretical basis and relevance, Methods of generating derivative spectra, electronic, electromechanical, numerical techniques, case studies. Applications - Applications of Hyperspectral Image Analysis Forestry to Mineral exploration, soil mapping, coastal water quality studies, quantification of biophysical parameters

REFERENCES

1. Charles Elachi and Jakob Van 2y, Introduction to the Physics and Techniques of Remote Sensing, Wiley Interscience, A John Wiley and sons Inc., 2006
2. Robert M. Haralick and Simmonett, Image processing for remote sensing 1983
3. Robert N. Colwell. Manual of Remote Sensing Volume 1, Americal Society of Photo - grammetry 1983
4. Travett. J. W. Imaging Radar for Resources Surveys. Chapman and Hall, London 1986
5. Ulaby, F.T., Moore, R.K, Fung, A.K, Microwave Remote Sensing; active and passive, Vol. 1,2 and 3, Addison – Wesley publication company 2001

6. Schowengerdt, R.A., 1997. Remote Sensing -Models and Methods, for Image Processing, Academic Press, London.
7. Jensen, J. R. 1996. Introductory Digital Image Processing: A Remote Sensing Perspective. Prentice Hall, 2nd Edition.
8. Mather, P. M., 1987. Computer processing of remotely sensed images- An introduction, St. Edmundsbury Press Ltd.
9. Thomas M. Lillesand & Ralph W. Keifer, 2000. Remote Sensing and image interpretation (John Wiley & sons, Inc).
10. Pramod K. Varshney and Manoj K. Arora, 2004 “Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data”, Springer publication.

RS2202: Geological Remote sensing and Techniques

Unit 1

Spectral properties of rocks and minerals - Reflectance Properties of Rocks, minerals in visible, NIR, MIR, SWIR, TIR and Microwave regions Laboratory spectroscopy - laboratory and field spectral data comparative studies, Spectral reflection curves for important Rocks, Minerals.

Unit 2

Geological structure and applications - Significance of Geological structures, Role of aerial photographs, Photo interpretation characters of photographs and satellite images, structural mapping, Fold, fault, Lineaments, Direction circular features. Intrusive rocks, rock exposure, Fractures and Joints, Rose diagram. Digital image processing for structural mapping.

Unit 3

Lithological mapping - Introduction on Igneous rocks, sedimentary rocks, metamorphic rocks, mapping of regional scale lithological units, Image Characters of igneous rocks, sedimentary and metamorphic rocks, examples. Digital image processing of various rock types, resolution and Scale of lithological mapping and advantages.

Unit 4

Geomorphological mapping - Significance of landform, Geomorphological guide, interpretation and image/photo characters, Tectonic landforms, Fluvial landforms, Denudational landforms, Volcanic landforms- Aeolian landforms, Coastal landforms. Importance of ground truth and geological field data collection.

Unit 5

Geological survey techniques and data integration - Geophysical survey, surface investigation, subsurface investigation, Gravity survey, Seismic survey, refraction methods, reflection methods, applications, Magnetic survey and Electrical resistivity survey, self potential methods, potential drop methods, resistivity values, data interpretation, Curve fitting, GIS data generation , integration and analysis.

REFERENCES

1. John J. Qu , Wei Gao, Menas Kafatos , Robert E. Murphy, Vincent V. Salomonson, Earth Science Satellite Remote Sensing, Springer 2007
2. Gupta, R.P Remote sensing Geology, Springer, 2003.
3. Jean-yves scanvk, Aerspatial Remote Sensing in Geology, A.A. Balakarma, Netherlands, 1997
4. Drury, S. A. Image interpretation in Geology,. Chapman and Hall, London. 1993
5. Pandey, S. N. Principles and applications of Photogeology, Wiley eastern. 1987

RS2203: Geospatial techniques for disaster management**Unit 1**

Hydrological & geological disasters - Basic concepts and principles - Hydrological and geological disasters, Role of Government administration, NGO's - International disaster assistance - Sharing technology and technical expertise.

Unit 2

Prediction & mitigation - Needs and approach towards prevention - Principles and components of mitigation - Disaster legislation and policy - Cost effective analysis - Utilisation of resources - Training - Education - Public awareness - Roles of media.

Unit 3

Cyclones & floods - Dams, Bridges, Hospitals, Industrial structures, Disaster resistant structures - Low cost housing for disaster prone areas - Cyclone shelter projects and their implications - Reconstruction after disasters.

Unit 4

Remote sensing monitoring & analysis - Remote Sensing Application - Risk assessment - Damage assessment - Land use planning and regulation for sustainable development - Use of Internet - Communication Network - Warning system - Post disaster review - Case studies.

Unit 5

Role of GIS in disasters - Vulnerability analysis of infrastructure and settlements - Pre-disaster and post disaster planning for relief operations - Potential of GIS application in development planning and Disaster management plan - Case studies.

REFERENCES

1. Bell, F.G. Geological Hazards: Their assessment, avoidance and mitigation. E & FN SPON Routledge, London. 1999.
2. David Alexander, Natural Disasters, UCL Press, London, Research Press, New Delhi, 1993.
3. Nick Carter. W. Disaster Management -A Disaster Manager's Handbook. Asian Development Bank, Philippines. 199.
4. Mitigating Natural Disasters, Phenomena, Effects and options, A Manual for policy makers and planners, United Nations. New York, 1991.
5. George G. Penelis and Andras J. Kappos -Earthquake Resistant concrete Structures. E & FN SPAN, London, 1997

RS2204: Geospatial techniques for coastal and marine environment**Unit 1**

Oceans and coasts - Introduction- origin- ocean importance, boundaries, continental margins and ocean basin, shelves, slopes, canyon, and rises, deep ocean basins, ridges, seamounts, abyssal plain, sedimentation processes- Coastal processes circulation, current Measurement, Waves, Surface waves, reflection, diffraction and refraction, wave generated currents, Tides, sediment drift.

Unit 2

Seawater physical and chemical properties - Water molecules, salinity, components, sources, concentration, mixing, dissolved gases, acid-base balance, Study of physical properties of sea water and parameters -heat and temperature, thermodynamic effects, density, ocean surface conditions- refraction, light and sound, -sea level rise - coastal zone

Unit 3

Sensors for coastal and ocean applications - Use of Microwave data - SeaWiFS, OCR, CZCs studies –chlorophyll production index -sea surface temperature (SST) sensors -NIMBUS, RADARSAT, CASI - MESSR, OCTS ATSR - Sensors OCEANSAT ATSR on ERS TOPEX/Poseidon satellite.

Unit 4

RS and GIS applications in coastal studies - Role of remote sensing, advantages, resolutions, scale parameters, regional studies, coastal regulation zone mapping, Issues, Coastal Hydrodynamic, Coastal erosion and protection, salt water intrusion studies, Estuaries and their impact on coastal process wetland mapping, Thematic data base generation in GIS and analysis, mangroves and coastal zone management.

Unit 5

RS and GIS applications in ocean studies - Tsunami impact assessment, wave dynamics, ocean resources ocean circulation studies, sea level changes and impact, Tide dynamics, wave dynamics, Plankton and marine plant studies, Changes in marine communities, -open ocean, sea ice studies, Global warming applications.

REFERENCES

1. Tang, Danling Remote sensing of the changing ocean, Springer, 2011
2. Seelye Martin, An Introduction to Ocean Remote Sensing University of Washington Cambridge, ISBN:9780521802802 2004
3. Deepak, A. Remote Sensing of atmospheres and oceans. Academic press, San Francisco, 1986.re (SST), - Mangroves coral reefs mapping
4. Michael Hord, R. Remote Sensing methods and application, John Wiley and Sons, New York, 1986
5. Alasdair J. Edwards, Remote Sensing Hand book for Tropical Coastal Management, UNESCO Publication 2000.

RS2205: Marine Meteorology

Unit-1:

Introduction: Scales of weather systems (Meso, Synoptic and Planetary scales) – Network of observatories - Surface, upper air and special observations (satellite, radar, aircraft etc.) – Map projections - Representation and analysis of fields of meteorological elements on synoptic charts - Wind and pressure analysis – Isobars on level surface and contours on constant pressure surface – Isotherms, thickness field - Geostrophic, gradient and thermal winds – Jet streams - - Streamline and isotach analysis. – ITCZ – Subtropical Anticyclones – Trade winds – Hadley and Walker circulations – Subtropical Jetstream – Easterly waves – Convective clouds – thunderstorms – Synoptic conditions favorable for thunderstorm - Hail storm, Tornado, Squall - clouds associated with ITCZ

Unit-2:

Tropical cyclone: Cyclone Genesis Parameters - Intensification of Cyclones – T-number – Movement of cyclones – Land fall – Cyclone- Life cycle, Surface wind field– Vertical structure in wind, temperature – Eye, Wall Cloud and Spiral cloud bands - - Storm surge

Unit-3

Monsoon onset over south Asia- Active and Break monsoon phases – Monsoon trough – Cross equatorial Low Level Jetstream – Tibetan Anticyclone – Tropical Easterly Jetstream – Monsoon depression – Mid Tropospheric Cyclone – Offshore troughs/vortices– Intra-seasonal variability of Monsoon and role of ocean – Tropospheric Biennial Oscillation – Monsoon and the Indian ocean – Somali upwelling – Summer monsoons of Africa and Australia

Unit-4:

Ocean – Atmosphere Interaction: Atmospheric boundary layer over the ocean – Wind stress and its curl – Sea Surface Temperature – Air-sea temperature difference - Oceanic Mixed Layer – coastal and open ocean upwelling – Sensible and Latent heat fluxes – short and long wave radioactive fluxes– Coupling of Ocean and Atmosphere – El Nino Southern Oscillation – Indian ocean Dipole – relation between SST and convection, ocean and Climate.

Unit-5:

Short range weather forecasting: Persistence, climatology and tearing - Prediction of individual weather elements - Prediction of visibility- sea waves and swell – Interpretation and use of numerical model outputs in weather forecasting

References

Tropical Meteorology – 2 volumes by G.C.Asnani

Cloud Dynamics (1993) by R.A.Houze Jr

Tropical Cyclones, their evolution, structure and effects(1982) by R.A.Anthes

Monsoon – 2 volumes (2012) by India Meteorological Department

Meteorology of the Tropical Ocean (1978) by D.B.Shaw (Ed)

Mesoscale Atmospheric Circulations (1981) by B.W. Atkinson

El Nino, La Nina and the Southern Oscillation by (1990) G.S. Philander

Atmospheric Science – an introductory survey (2006) by John Wallace and Peter Hobbs

RS2206: Geospatial techniques for water resource management

Unit 1

Hydrological components - Hydrological cycle, Estimation of various components of hydrological cycle, rainfall, runoff, evaporation, transpiration, evapotranspiration, crop evapotranspiration, depression and interception loss, infiltration and percolation losses.

Unit 2

Watershed characters - Watershed, types, divide, catchment, command area, stream types, influent, effluent, ephemeral, non perennial. Drainage network, different pattern, morphometric analysis, linear, area, relief aspects. GIS applications for watershed analysis

Unit 3

Hydrological studies - Hydrological aspects- mapping and monitoring, management Mapping of snow covered area and glacial outburst, soil moisture estimation, Optical and microwave remote sensing techniques , drought zonations, Agricultural, meteorological and hydrological, flood mapping pre and post flood area estimation and control measures –GIS applications for hydrological disaster studies

Unit 4

Ground water resources applications - Types of Aquifers formations confined and unconfined aquifers Assessment of Groundwater potential zones and Groundwater mapping. Site selection for recharge structures- Hydrogeological Mapping GIS applications to ground water studies

Unit 5

Surface water resources applications - Surface water bodies, lakes, reservoirs, ponds, rivers , channels ,mapping change detection , Water harvesting structures, in-situ and Ex-situ , Mapping and monitoring of catchment and command area, Water logging and salt affected area mapping, Reservoir Sedimentation, sedimentation control. GIS applications to surface water studies

REFERENCES

1. H.M. Raghunath. Hydrology – Principles – Analysis – Design. New Age International Publishers, New Delhi. 2006
2. Ramasamy, SM., Remote sensing in water resources Rawat publications, New Delhi, 2005
3. V.V.N. Murty. Land and Water Management Engineering, Kalyani Publishers, New Delhi – 2002.
4. C.S. Agarwal and P.K. Garg. Text Book on Remote Sensing in Natural Resources, Monitoring and Management. 2000. Wheeler publishing Co & Ltd., New Delhi.

RS2207: Geospatial Technology Applications and Modelling

1. Introduction to ERDAS IMAGINE/ ENVIS/ GEOMEDIA/ ESRI-ArcGIS etc.
2. Study of the marginal information given on the C.D. Rom/Digital data
3. Import / Export of files using ERDAS IMAGINE Geo-reference of the toposheet and imageries
4. Display, Analysis and interpretation of black & white images and FCC
5. Study of various contrast enhancement techniques
6. Low Pass Filter: Compression of the high frequency component & enhancement of the low frequency component
7. High Pass Filter: Compression of the low frequency component and enhancement of the high frequency component
8. Sub-setting of area of interest from the satellite image
9. Principal Component Analysis
10. Resolution Merging
11. Unsupervised Classification
12. Supervised Classification
13. Map composition

Disaster Management

1. Flood prone area mapping using satellite images and ancillary data.
2. Forest fire risk mapping using satellite images and GIS.
3. Landslide mapping and risk evaluation.
4. Multivariate analysis and application of Geoinformatics model for landslide hazard zonation
5. Drought prone area mapping using satellite images
6. Spatial variation of climatic data using GIS techniques for drought prediction
7. Terrain mapping in coastal region for coastal hazards prediction
8. Multiple hazard mapping using satellite images and modeling risk in GIS.

GIS Modelling and Applications

1. Satellite image based hydro-geomorphological interpretation for ground water targeting. Open cast mining impacts on land resources using satellite images.
2. Mapping flood hazards in a region using satellite images
3. Mapping landslide hazards in a region using satellite images
4. Urban sprawl mapping of a township using satellite images
5. Utility-facility mapping for regional development analysis in GIS
6. Application of Geoinformatics for identification of waste disposal sites.
7. Digital terrain models for selection of dam site and road infrastructure.

Water Resources Management

1. Delineation of river catchments on satellite image- topographical sheets and their codification as per Watershed Atlas of India.
2. Evaluation of various drainage morphometric parameters for watershed characterization.
3. Hydro-geomorphological mapping for ground water exploration in alluvial terrain.
4. Hydro-geomorphological mapping for ground water exploration in hard rock terrain
5. Flood inundation mapping in alluvial plain areas using satellite images
6. Locating surface water harvesting structures like check dams, de-siltation tanks, and nullah bunds etc. using satellite image
8. Location of high dams and tunnels in hard rock terrain for large irrigation projects
9. Creation of flow direction, flow length, flow accumulation in a watershed based on
10. contours using Arc-View GIS
11. Study of snow covered areas for evaluation of its water resources using satellite images.
12. Rainfall run-off modeling using Geoinformatics approach.

Natural Resource Management

1. LU-LC mapping at level I and Level II using 1:50,000 satellite image.
2. Forest Types Mapping using satellite images.
3. Delineating on satellite image various surface water resources and identify potential sites for WR conservation.
4. Delineation of surface mining zones and impact on land resources of the area using satellite image
5. NDVI and density slicing of digital satellite data for forest density classification.
6. Supervised classification for mapping agriculture and forest resources.
7. Soil erosion modeling using Geoinformatics approach
8. Natural resource mapping and change detection study using temporal satellite data

SEMESTER - III

RS2301: DBMS for GIS

Unit 1

Data -Types -Database – Attribute – Types - Hardware and Software requirements -Database Management Systems -Types of DBMS - Hierarchial, Network, Relational Models - Distributed Databases - Client Server Databases - Knowledge Based Systems -Geographic Databases - E-R diagram

Unit 2

Normalization - File Organization -Sequential, Index Sequential, Random, Multikey file Organisation -advantages -Relational Database Management System - Normalization -First, Second, Third, Boyce-Codd, Fourth and Fifth normalizations.

Unit 3

Oracle operators - Arithmetic, Comparison, Logical Operators – Operator Precedence -Privilege commands - SQL functions -Single row, data, character and numeric functions -Group functions - Count functions- Triggers in Oracle.

Unit 4

SQL – TCL, DDL, DML – Data types – basic constraints – change statements – basic queries in SQL – Complex SQL queries – Nested, correlated Nested queries – joined tables – Insert, Delete, update Statements in SQL.

Unit 5

Oracle developer 2000 - Oracle forms – Object Navigator – Triggers – Hierarchical levels – Alerts – Blocks – Items – Editors – Record groups – LOVs – Object Groups – Menus – Query – Oracle reports – Data model Editor – Layout Editor

REFERENCES

1. Remez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Fourth Edition, Published by Pearson Education (Singapore) Pvt. Ltd.. 2004.
2. Bipin C. Desai, An Introduction to Database Systems, Galgotia Publications PVT LTD First edit 1993
3. Michael Abbey and Michael J Corey, ORACLE 8 -A Beginner's Guide, Tata Mc.Graw Hill, 1998
4. C.J. Date, An Introduction to Database Systems, Addison Wesley, sixth edition, 1995

RS2302: LIDAR Remote sensing and Applications

Unit 1

LIDAR system design - Introduction to Lasers and LIDAR – Definitions - History of Lidar Development - LIDAR System Components - LIDAR sensors single-return, multireturn, waveform, photon-counting, Characteristics of LIDAR Data - interaction of laser energy with earth surface features - LIDAR Systems

Unit 2

LIDAR remote sensing platforms - Introduction to the LIDAR remote sensing platform - Historical development of LIDAR remote sensing platforms Airborne platforms, Laser Scanning, Fixed- Wing Platforms, Rotary-Wing Platforms - Terrestrial, airborne, and spacebar types – Space borne platforms – orbits- Bathymetric Mapping

Unit 3

Georeferencing and calibration of LIDAR data - Geodesy, Datums, Map projections and Coordinate Systems – Direct Georeferencing Technology - Boresight Calibration - LIDAR Data Preprocessing - Project Coverage Verification - Review LIDAR Data against Field Control - LIDAR data errors and rectifications, - processes calibration of LIDAR data - artifacts and anomalies - LIDAR Error Budget.

Unit 4

Automated classification - Noise Removal and other sensor-related artifacts - Layer Extraction - Automated Filtering - Manual Editing and Product Generation – Surface Editing - Hydrologic Enforcement – Lidargrammetry - Terrain Data Products, definitions, DEM, DSM -TIN, Breaklines, Contours, Specifications, Terrain Products from LIDAR - Quality Assurance, Control, and Accuracy Assessment.

Unit 5

LIDAR Applications - Topographic Mapping, , flood inundation analysis, line-of-sight analysis – Forestry, various types of LIDAR sensors-, vegetation metric calculations - specific application software - corridor mapping system, data processing and quality control procedures.

REFERENCES

1. Floyd M. Henderson; Principles & Applications of Imaging Radar, John Wiley & Sons, New York, 1998.
2. Alexay Bunkin & Konstantin Volia.K, - Laser Remote Sensing of the Ocean Methods & Publications. John & Wiley & Sons, New York, 2001.
3. Raymond M. Measures; Laser Remote Sensing: Fundamentals and Applications, John Wiley & Sons, New York, 1984.
4. Robert M. Haralick and Simmonett, Image processing for remote sensing 1983.
5. Cracknell, Arthur P.; Hayes, Ladson. Introduction to Remote Sensing (2 ed.). London: Taylor and Francis 2007.

RS2303: Satellite Meteorology, Agriculture and Forestry**Unit 1**

Fundamentals of Remote Sensing in Meteorology, Meteorological satellite characteristics and their orbits, TIROS, NIMBUS, NOAA, TIROS N, SEASAT, GOES, METEOSAT, INSAT. Role of LANDSAT, SPOT and IRS in collecting meteorological, agricultural and oceanographic data. Measurement of Earth and Atmospheric energy and Radiation budget parameters from satellites. Atmospheric temperature retrieval techniques and surface radiation studies. Wind measuring techniques from satellite data.

Unit 2

Cloud classification techniques. Satellite Remote Sensing System of use in rainfall monitoring and monitoring methods: Cloud indexing method, Life-history method and Bio-spectral methods. Interpretation of Satellite meteorological images for weather systems and cyclones. Remote Sensing techniques for estimation of soil moisture and evapotranspiration. Spectral behavior of different crops and vegetation in VIS, NIR, MIR, TIR and Microwave regions.

Unit 3

Spectral characteristics of leaf - Structure of leaf - Spectral behavior of leaf – Vegetation indices – NDVI, TVI, SVI, PCA – Vegetation classification and mapping - Estimation of Leaf area index, Biomass estimation –

Estimation of terrestrial carbon assimilation in forests - case studies. Forest mapping - Forest type and density mapping and forest stock mapping using RS technique -factors for degradation of forests – deforestation/afforestation/. Change detection in forests - case studies. Biodiversity characterization mapping - Forestry – Forest taxonomy – Linnaeus classification – Biodiversity characterization – Forest fire risk zonation – wildlife habitats suitability analysis - case studies.

Unit 4

Agricultural applications - Identification of crops -acreage estimation -production forecasting - pests and disease attacks through remote sensing -crop stress detection due to flood and drought - catchments and command area monitoring. Water management in command areas - monitoring, assessing crop water availability, demand and utilization pattern through Remote Sensing.

Unit 5

Soil applications - Soil survey and land use classification - water logging - characters of saline, alkali soils - soil erosion – types – Estimation of soil loss from USLE using Remote sensing and GIS - Wasteland development.

REFERENCES

1. Steven, M.D and Clark, J.A., "Applications of Remote Sensing in Agriculture", Butterworths, London 1990.
2. Remote Sensing Applications Group, Space Applications Centre, Crop Acreage and production Estimation (CAPE): An Anthology from January 1986 - June 1996. (Publications in Journals, Seminars I Symposium proceedings), Ahmedabad, August 1996.
3. Negi, S.S., A Handbook of forestry. International Book distributors, Dehradun, 1986. Space Applications Centre, Manual of procedure for Forest mapping and Damage Detection using satellite data, Ahmedabad, 1990

RS2304: Mini Project

RS2305: Coastal Zone Management

Unit 1.: Marine and Coastal Zone Management:

Coastal environments, processes and management strategies. Climate change and sea-level rise, Coastal biota as environmental proxies. The Indian coastlines. Defining the coastal zone. Importance of the coastal zone and the need for management. Environmental consideration and coastal dynamics. Preparation of action plans and implementations. Coastal Zone Management Framework and coastal management planning process. Expectations of Integrated Coastal Zone Management (ICZM). Local and international constraints/challenges of ICZM, policy, legislation and institutional framework.

Unit 2. Remote Sensing in Environmental Management

Introduction to remote sensing, nature and definition of remote sensing. Remote Sensing (Non-Photographic Imaging Systems) - principles and scope. The remote sensing process- remote sensing of the environment, in situ data collection, remote sensing data collection. Characteristics of major imaging sensor systems – the remote sensing systems. Elements of Image Interpretation. Interaction characteristics of electromagnetic radiation with: vegetation, soils, water and human settlements. Application of remote sensing data for environmental resources mapping and degradation assessment. Field visit for ground truth survey. Aerial photography and platforms; geometric properties of aerial photographs; Photo-interpretation; application of photo-interpretation for drainage pattern, relief, land use and vegetation mapping. Using Google Earth image for data collection.

Unit 3. Climate policy and economic assessments and Implications on coastal ecosystem services - Analysis, projections, models and evaluation of climate change impact and extremes on coastal ecosystems. Adaptation and mitigation strategies for hydrological and hydrogeological risks. Adaptation and mitigation strategies for the management of coastal resources.

Translation of the interactions between climate and the processes concerning coastal ecosystems into economic values. Planning and evaluation of strategies for adaptation and mitigation policies. Assessment of the impacts of climate extremes and climate change on coastal public health. Implications of climate change on cultural heritage preservation, analysis and assessment of the vulnerability of cultural heritage related to climate change and potential strategies for adaptation and mitigation.

Unit 4 : Climate Change Impacts, Adaptation and Mitigation

Climate change- science and policy. Current and possible future global climatic changes. Bio-physical and social impacts of climate change on marine ecosystem. Social and biophysical vulnerabilities to climate change - Mitigation and adaptation to climate change. Policies and measures for minimizing the impacts of climate change. Climate change and global/national coastal economies. Mitigation- technological options, policies, and socio-economic impacts of mitigation measures. Climate change and coastal responses. Carbon financing (REDD, CDM, PES).

Unit 5. : Planning for Coastal Disaster Preparedness and Management

Coastal Disaster Risk Management (DRM) - Introduction and definitions. Theories, observations, and models of the dynamics of atmospheric and oceanic fluids - climate change, rapid environmental changes. Coastal Disaster Risk Management Framework, Disasters and vulnerability analysis. Environmental profiling for risk assessment. PRA Tools and field mapping. Hazard monitoring and evaluation. Mainstreaming Disaster Risk Management into development: (institutional and legal arrangements for disaster risk management). Disaster Risk Reduction and building resilient coastal communities. Forecasts and projections of mesoscale processes and extreme events. Establishment of Early Warning System for DRM. Indigenous Knowledge Systems for EWS. Planning for Coastal Disaster Risk Management. Community Centered Human Resource Management. Vulnerable groups focused DRR (gender, child, disabled, etc).

Unit 6 : Marine Environmental Policy and Law

Definitions of terminologies. Concept, evolution, purpose and structure of Marine Environmental Law. International Agreements, Conventions and Treaties in Marine Environmental Law. Environmental Law and International action on Management of coastal resources. International Agreements and covenants on transboundary Resource Management. The institutionalization of Marine Environmental Policy, planning and management. Legislation on coastal environmental policy, planning and development. Case studies of contemporary and emerging coastal environmental legal issues.

RS2306: Marine Surveys and GIS

Unit 1: Geodesy:

Definition and classification - geometry of ellipsoid – various co-ordinate systems – spherical excess – geoid and deflection of vertical, various height systems – rectangular and polar coordinates. Geodetic computation.

Unit 2: Control Surveying:

Basic parameters of survey measurements – time, distance and angles – use of optical systems, electro-optical systems and electronic systems – Total station.

Unit 3: Satellite systems – GPS, Differential GPS, GLONASS – static and kinematics GPS surveys – software modules – applications of GPS. Horizontal and vertical controls – methods.

Unit 4: Tides:

Theory of Tides – tidal datum – tide gauges – processing land and marine survey datum.

Unit 4: Soundings:

Acoustic Positioning, long, short and ultra short base line systems – constructions, basic measurements, calibration and maintenance. Sounding boat, lead lines, echo sounding – different methods, sensors (bathymetric, geophysical and physical) – single beam, multi-beam echo sounder – side scan sonar, sub-bottom profiler, magnetometer, sound velocity profiler, current meters. Locating sounding – use of GPS – reduction of sounding and plotting.

RS2307: Practical

DBMS