

UNIT-I

Research Formulation – Definition, scope and objective, types, approaches, significance; scientific investigation.

The research process – The broad problem area, preliminary data collection, problem, selection and definition, theoretical framework, hypothesis development and elements of research design.

Types of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical

Experimental design – The laboratory experiment, variables, validity, Types of experimental Designs, Instrumental methods of Environmental analysis.

UNIT-II

Data collection – Sources of data; data collection methods; Methods for selecting sampling locations and times; Simple random sampling, Stratified random sampling, Systematic sampling

Processing and Analysis of Data: Central tendency dispersion, Estimation of parameters; Confidence interval estimation; Measurement of the spread of data-range; Asymmetry, Normal probability distribution, Skewness and Kurtosis, Karl Pearson correlation coefficient, Correlation and regression analysis, Introduction to Statistical Software.

UNIT-III

Statistical inference- Tests of Hypotheses, Type I and Type II Errors; Level of significance Concept of standard error, Normal distribution, Tests of significance for large samples: Z test, Types of Z test (one sample and two sample), Standard error for Z test; Tests of significance for small samples: t-test (One sample, Two Sample: Independent and Dependent), Standard error for t-test, Comparison of Variance: F-test, Goodness of Fit: Chi-square test, ANOVA, Quality of data: Q test; Nonparametric tests – Sign test, Wilcoxon Signed Rank test, Kruskal-Wallis test

UNIT-IV

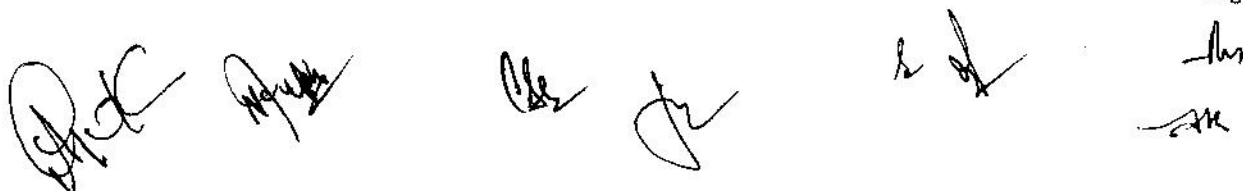
Technical writing and Report Generation: Basic concept of paper/thesis writing, Ethical issues, Copy right, Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights – Reproduction of published material – Plagiarism; Citation and acknowledgement.

References :

1. Kothari, C.R (2009) Research Methodology and Techniques, Delhi: New Age international Publisher.



2. Donald H. McBurney (2006) Research Methods, 5th Edition, Thomson Learning.
3. Donald R. Cooper, Pamela S. Schindler (2006) Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd.
4. P. Oliver, (2004) Writing Your Thesis, New Delhi: Vistaar Publications,.
5. Gregory (2005) Ethics in Research, Continuum, 2005.
6. Malkote, S.R. (1991), Communication for Development, New Delhi: Sage Publication.
7. Rosengreen, K.E. (2000), Communication: An Introduction. New Delhi: Sage Publication.

The block contains six handwritten signatures in black ink, arranged horizontally. From left to right, the signatures are: a large, stylized signature; a signature that appears to be 'H. J. ...'; a signature that appears to be 'A. ...'; a signature that appears to be 'J. ...'; a signature that appears to be 'S. ...'; and a signature that appears to be 'M. ...'. The signatures are written in a cursive, handwritten style.

Unit-I

Basics of Environmental Biotechnology: Introduction, scope and importance, Applications, Genetic engineering, GMOs and Bioethical issues

Techniques – Electrophoresis, enzyme detection-Zymography, Protein quantification, PCR, Gene probe Technology

Biomarkers, Biosensors of pollution ; Biofuels and bioplastics

Unit-II

Enzyme Technology: Introduction, enzyme specificity, enzyme catalysis, quantization of enzyme activity, enzyme characterization and Michaelis-Menten kinetics, enzyme inhibition.

Enzyme immobilization: Concept, methods of immobilization, applications of immobilized enzymes in environmental research

Industrial enzymes: Enzyme applications in food industry, paper and pulp industry, textile industry.

Unit-III

Wastewater treatment Technologies : Treatment processes, Aerobic and anaerobic treatment methods – Role of microbes, methanogens, acetogens, fermentative bacteria, biofilms,

Waste management : Solid waste composting and vermicomposting

Biodegradation of Xenobiotics: Xenobiotic compounds and their microbial degradation

Unit-IV

Bioremediation Technologies: Ex-situ and in-situ Bioremediation, microbial removal of toxic metals, Bioremediation of oil spills, Phytoremediation

Bio-sequestering techniques for carbon dioxide

Microbial leaching of ores; Microbes for enhanced oil recovery

Recommended Books:

1. Alan Scragg (2005) Environmental Biotechnology, 2nd Edition, Oxford University Press.
2. Bruce Rittman, Perry L. McCarty (2000) Environmental Biotechnology: Principles and Applications, 2nd Edition, McGraw-Hill.
3. I. S. Thakur (2011) Environmental Biotechnology: Basic Concepts and Applications. 2nd Edn, I K International Publications.
4. B.C. Bhattacharya and Rintu Banerjee (2007). Environmental Biotechnology, Oxford University Press, 2007.
5. L. Stryer (2002) Biochemistry, 5th edition, W.H. Freeman and Company.
6. N. C. Price and L. Stevens (2000) Fundamentals of Enzymology, 3rd edition, Oxford University Press, USA.
7. Wolfgang Aehle (2007) Enzymes in Industry: Productions and Applications, 3rd edition Wiley-VCH.
8. M.J. Pelczar, E.C.S Chan, N.R. Krieg, 1998. Textbook of Microbiology, 5th edition Tata McGraw Hill Publishing Co. Ltd., New Delhi.



Course Title: BASIC AND APPLIED REMOTE SENSING AND GIS

UNIT I

Remote Sensing Fundamentals

Remote sensing, definition, physical basis of remote sensing, electromagnetic spectrum, radiation laws, atmospheric effects, basics of optical, thermal and microwave remote sensing, history of remote sensing. EMR interaction with earth surface materials, Spectral signatures of vegetation, water, soil, snow etc. in different regions of EMR, ground truth data collection.

UNIT II

Platforms and Sensors

Aerial and spaceborne platforms, orbits, sensors types – optical (multispectral, hyperspectral), thermal and microwave, resolutions, Landsat, SPOT, IRS, ERS, Radarsat, RISAT, and other operational remote sensing satellites.

Data Analysis and Applications of Remote Sensing

Visual interpretation – Scale, maps and map projections, interpretation keys; image characteristics, media and formats of digital images, image enhancement, image transformations, classifiers, classification – unsupervised and supervised, accuracy estimation, change detection.

Remote Sensing Applications: Ecosystem inventory and monitoring – case studies on agriculture, forestry, wetlands, urban planning, snow and glaciers, coastal zone management, protected area management, climate change, air and water pollution; disaster management.

UNIT III

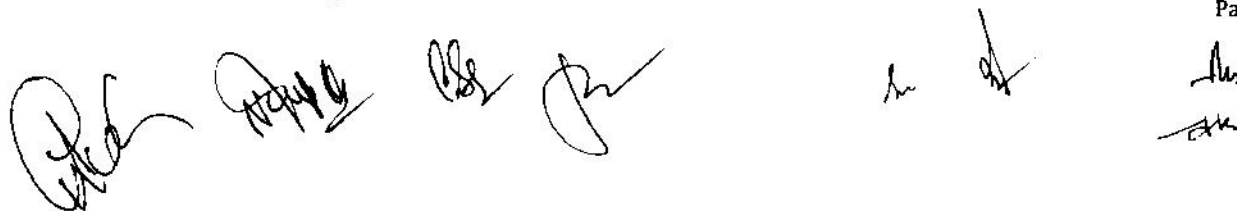
Geographical Information System, GPS and GIS Applications

Introduction, GIS definition and terminology, data types, raster and vector data, GIS database design, spatial database creation – digitization, scanning; processing of data, GIS implementation and project management. Commercial remote sensing and GIS softwares.

UNIT IV


Satellite based navigation systems (GPS, Gallelio, Glonass, IRNSS): concepts and applications; Map projections and datums, coordinate systems; Survey of India topographical map types and numbering system.

GIS Applications: Decision Support System for Forestry, Working Plan preparation, Urban Information System, WARIS (Water Resources Information System), Wetland Information System, disaster management system; Site selection- Sewage treatment Plants, Industry, Landfill sites, townships and cities; watershed management; Landslide hazard zonation; mine closure planning.



Text/References:

1. Joseph, George. 2005. Fundamentals of Remote Sensing, 2nd Edition. University Press India.
2. Lillisand, Thomas, Ralph W. Kiefer and Jonathan Chipman. 2007. Remote Sensing and Image Interpretation. Wiley India.
3. Jensen, John R. 2009. Remote Sensing of the Environment: An Earth Resource Perspective, 2nd Edition. Dorling Kindersley.
4. Lo, C.P., and Albert K.W. Yeung. 2009. Concepts and Techniques of Geographic Information Systems, 2nd Edition. PHI Learning.
5. Longley, Paul A., Michael F. Goodchild, David J. Maguire and David W. Rhind. 2005. Geographic Information System and Science, 2nd Edition. John Wiley and Sons.
6. Burrough, P.A. 2007. Principles of Geographic Information System. Oxford University Press.

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Course Title: Applied Analytical Techniques and Instrumentation**UNIT 1**

Principle, Methodology and Applications: Electrophoresis, Polymerase Chain Reaction (PCR), Real time PCR; Introduction to Molecular Markers: Allozyme, Randomly Amplified Polymorphic DNA (RAPD), Restriction Fragment Length Polymorphism (RFLP), Amplified Fragment Length Polymorphism (AFLP), Single Sequence Repeats (SSR), DNA fingerprinting, Single Nucleotide Polymorphism (SNP); Cryopreservation. Numerical methods in Phylogenetic Classification.

UNIT 2

Fundamentals of Photometry; Spectro, Electro analytical and Seperative methods, Laws governing Photometry

Chromatography : General description, definition, terms and parameter used in chromatography, Classification of chromatographic methods, criteria for selection of stationary and mobile phase nature of adsorbents , Rate theory , Band broadening: Eddy diffusion , Methodology for selection of stationary phase.

UNIT 3

Flame photometry; Principle, Construction details, fuel gases, atomiser, burner, optical system , recording system.

Atomic absorption spectrophotometer; Theoretical concepts, Instrumentation, Hollow cathode lamps, Burners and flames, Plasma excitation sources, optical and electronic systems

UNIT 4

High pressure liquid chromatography; Apparatus , Pumps, Column packing, Characteristics of liquid chromatography, detector; UV, IR , Refractometer and fluorescence detector

Gas Chromatography; Principle, Comparison of GSC and GLC instrumentation, Columns packed and tubular study of detectors , thermal conductivity, flame ionisation , electron capture and mass spectrophotometry, factors affecting and separating applications



Text / References:

1. D.A. Skoog,(2000), Principles of Instrumental analysis, fifth edition , Saunders college publication
2. D.H.Williams and J.Fleming(1995), Spectroscopic methods onn organic chemistry, Sixth edition , McGrawHill
3. B.K. Sharma (2007), Instrumental methods of chemical analysis, Krishna prakash media
4. J.Willard(1999), Instrumental methods of analysi, seventh edition , CBS publishers


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