University of Pune
Department of Environmental Science
Structure of the Syllabus for M.Sc.(Environmental Science)
Revised Syllabus from July 2010

Semester I

EVS 101	Fundamentals of Environmental Biology	4 Credits
EVS 102	Environmental Chemistry	4 Credits
EVS 103	Essentials of Geosciences	4 Credits
EVS 104	Atmospheric Science	4 Credits
EVS 105	Practicals I	6 credits

Semester II

EVS 201	Environmental Pollution and control I	4 Credits
EVS 202	Environmental Statistics	4 Credits
EVS 203	Biodiversity and Natural Resources	4 Credits
EVS 204	Remote Sensing, Image processing and GIS	4 Credits
EVS 205	Practicals II	6 Credits

Semester III

EVS 301	Environmental Impact Assessment and Environmental Management	4 Credits
EVS 302	Water and Waste water Engineering	4 Credits
EVS 303	Restoration Ecology	4 Credits
EVS 304	Environmental Pollution and Control II	4 Credits
EVS 305	PracticalsIII	6 Credits

EVS 306	Summer training and seminars	3 credits

Elective paper any one from the following

EVS 307	Environmental Economics	4 Credits
EVS 308	Environmental Education	4 Credits

Semester IV

EVS 401	Watershed Management	4 Credits
EVS 402	Industrial Safety and toxicology	4 Credits
EVS 403	Hazardous waste management	4 Credits
EVS 404	Environmental laws, rules and regulations	4 Credits
EVS 405	Project	7 Credits

Elective paper any one from the following

EVS 406	Advanced treatment processes	4 Credits
EVS 407	Man and Environment	4 Credits

EVS 101 Fundamentals of ENVIRONMENTAL BIOLOGY Credits 4

1. ENVIRONMENTAL BIOLOGY: Concepts and Scope. (4 lectures)

***** Biosphere as an ecosystem, its ecological processes and life support systems.

***** Anthropogenic impact on the biosphere and its life support systems (including Flora, Fauna, soil, climate, atmosphere, terrestrial and aquatic ecosystems).

* Role of biological processes in remedial measures and restoration.

2. FUNDAMENTAL CONCEPTS OF ECOLOGY. (8 lectures)

- Ecology: definition, development and scope. Ecology as an experimental science.
- Ecosystems: concept, components and functioning.
- Energy Fixation (photosynthesis and chemosynthesis) and energy flow through food chains (grazing and detrital) and webs.
- Ecological efficiencies and pyramids. Trophic levels.
- Influence of environmental factors (including temperature, light, moisture, soil, nutrients) on organisms and their adaptations in response to them.
- Liebig's Law of the Minimum and Shelford's Law of Tolerance.

3. ECOLOGY OF POPULATIONS AND COMMUNITIES. (8 Lectures)

(a) Population Ecology:

- Factors determining the abundance and distribution of a species
- Factors leading to the commonness, rarity and vulnerability of extinction of a species.
- Population Dynamics: Patterns of survival, age distribution, dispersal and rates of change.
- Attributes of K- selected and r-selected species.
- Population Growth.

(b) Community Ecology:

- Competition, Exploitation (including herbivory, predation, parasitism), Mutualism (including commensalism, cooperation, symbiosis)
- Food webs and concepts of niche and keystone species.
- Nutrient cycling and retention. Biogeochemical cycles.
- Succession, development, climax and stability of ecosystems

4. INTRODUCTION TO PLANT AND ANIMAL BEHAVIOUR. (8 Lectures)

- Feeding Behaviour: Herbivores, Carnivores, Parasites, Saprophytes. Response of prey / plants (deterrence, defence, reward).
- Animal Architecture and use of tools.
- Circadian and other rhythms.
- Migration, orientation, navigation, and homing.
- Communication (including visual, olfactory, tactile, auditory, chemical)
- Aggression, Territoriality, Altruism.
- Reproductive Behaviour : Courtship, Mating, Parental care, Breeding systems.
- Instinct and Learning: Genotype and phenotype behaviour.

- Ethology and socio-biology: Insect and Vertebrate Societies. Associations.

5. TERRESTRIAL BIOMES. (8 Lectures)

- Climatic and edaphic factors of terrestrial biomes. Heinrich Walter's Biome Climate Diagrams.
- Classification of land biomes with their soil, climate and vegetation characteristics. Their natural history, wildlife, geography and human influences.
- Mountain Biome: Replication of latitudinal changes in the altitudes of high mountains.
- Terrestrial biomes, ecosystem diversity, forest and vegetation types in India.

6. FRESHWATER AND MARINE BIOMES. (8 Lectures)

- Challenges and adaptations of life in aquatic biomes (freshwater: still and flowing, marine).
- Freshwater Biomes (Rivers, streams, lakes, ponds) and their natural history
- Marine Biomes (including mangroves, coral islands, kelp forests, saltwater marshes, seashores, estuaries) and their natural history
- Wetlands – definitions, types, ecological functions and resources.

7. BIOGEOGRAPHY & BIOLOGICAL DIVERSITY: India & World. (8 Lectures)

- Continental Drift: Its causes and consequences for distribution of life on earth.
- India's biogeographical history, current geographical position and their impact on biodiversity.
- India's faunal regions, forest and vegetation types and Protected Area Network.
- Conservation Initiatives at Governmental and NGO level in India and the world.

8. ENVIRONMENTAL MICROBIOLOGY (8 Lectures)

- Classification of microbes and their metabolism and ecology
- Micro-organisms and their association with man , animals and plants.
- Role of microbes in bio-remedial processes, ecological restoration and other environmental applications.
- Environmental factors affecting microbes, their cultivation and growth.

EVS 102 Environmental Chemistry Credits 4

Introduction to environmental chemistry: Concept of Environmental Chemistry :**,** Composition of atmosphere, Segments of environment, and various reactions occurring in these segments
Biogeochemical cycles
(10)
Introduction to soil chemistry: Definition of soil, life on soil, composition of soil, mineral matter in soil, organic matter in soil, soil respiration, process of soil formation, factors affecting soil, saoil profile, soil microorganisms, types of soils, micro and macro plant nutrients, nutrient functions (6)
Chemistry of Biologically Important Molecules: Chemistry of Water: Unusual physical properties, hydrogen bonding in biological systems, unusual solvent properties, changes in water properties by addition of solute. Protein structure and biological functions, enzymes, enzyme metabolism, biosynthesis of DNA and RNA, mutations and Gene control during embryogenesis (6)
Physico-chemical methods for analysis of environmental samples - Estimation of various elements at major, minor trace, ultra trace level concentrations : choice of a technique, principle, merits and demerits of the techniques - neutron activation analysis, isotope dilution analysis, colorimetry, atomic absorption spectroscopy, ICPAES, gas chromatography, HPLC, ion exchange chromatography and polarography
(18)
Chemistry of Various Organic and Inorganic Compounds. Carcinogenic compounds and their effects
(2)
Hydrocarbons: Chemistry of hydrocarbon decay, environmental effects, effects on macro and micro organisms (3)
Surfactants: Cationic, anionic and nonionic detergents, modified detergents (3)
Pesticides: Classification, degradation, analysis, pollution due to pesticides and DDT problems (3)
Synthetic Polymers: Microbial decomposition, polymer decay, ecological and consideration, Photosensitize additives
(3)
Lead and its compounds: Physical and chemical properties, behavior, human exposure, absorption, influence (3)
Destruction of some hazardous substances: Acid halides and anhydrides, alkali metals, cyanides and cyanogens bromides, chromium, aflotoxins, halogenated compounds (3)

EVS 103 ESSENTIALS OF GEOSCIENCE Credits 4

Dynamics and structure of the Earth: Structure and composition of Earth. Geochemical cycle. Earth's material: Rocks and minerals. Uniformitarianism; geological time scale. Earthquakes, volcanoes and Earth's interior. Continental drift, sea floor spreading and plate tectonics (15)

Hydrology: The Hydrologic Cycle and the Hydrologic Budget., Drainage basins. Catchment hydrology – precipitation, infiltration, evapo-transpiration and runoff. Surface water and groundwater (aquifers) (5)

Earth surfaces processes and landforms: Weathering and soils, Mass wasting. Geomorphology of fluvial tracts, arid zones, coastal regions, karst landscapes and glaciated regions (15)

Oceanography: Ocean basins and physical structure of the ocean floor. Properties of sea water and energy transfer, Thermohaline circulation and the global conveyor belt, ocean Currents, upwelling, tides and waves. El Niño and Southern Oscillation. Tsunami (5)

Geological and geomorphic hazards. Floods, landslides and slope failures, earthquakes, river and coastal erosion. Desertification, waterlogging, salinization and soil degradation. Impact of anthropogenic activities such as urbanization, mining, river-valley projects, excess withdrawal of ground water, etc (10)

Remote sensing in landform and land use mapping, lithological and structural mapping, hydrogeological studies and mineral exploration (5)

Land use Planning: The land use plan. Soil formation, soil profile, soil classification, genesis, factors, soil fertility, etc. Soil surveys in relation to land use planning. Land capability classification. Land use planning and sustainable development (5)

Books

1. Lutgens F. K., Tarbuck, E. J. and Tasa, D. 2008. Essentials of Geology, Prentice Hall Publishers,

2. Bell F. G., 1998. Environmental geology: principles and practice. Blackwell Sc.. Oxford

3. Thurman, H.V. and Trujillo, A.P., 2004, Introductory Oceanography, Prentice Hall

4. Randolph, J. 2004 Environmental land use planning and management, Island Press, Washington

5. Strahler, A.H and Strahler A.N (2002): Modern Physical Geography, John Wiley and Sons

6. Kale, V. S. and Gupta, A. 2001. Introduction to Geomorphology, Orient Longman, Calcutta.

7. Chamley, H. and Chamley, H. 2003. Geosciences, Environment and Man Elsevier Science & Technology

8. Bloom, A. L. 2002. Geomorphology: A systematic analysis of late Cenozoic landforms.

9. Prentice-Hall of India, New Delhi

10. Valdiya, K. S. 1987. **Env**ironmental Geology, Indian Context, Tata McGraw-Hill Pub C

11. Barrett, E. C. and Curtis, L. F. 1999. Introduction to environmental remote sensing. Chapman and Hall

12. Gupta, R. P. 2003. Remote sensing geology, Springer, New York

13. Kusky, T. M. 2003. Geological Hazards, Greenwood Press, Westport, Conn. London

14. Keller, E. A. 1999. Environmental Geology, Charle E Merrill Pub. London

EVS 104 - Introduction to Atmospheric Sciences Credits 4

Introduction to atmospheric sciences: Atmosphere as a part of biosphere ecosystem, Elements of weather and climate, Evolution of atmosphere, Atmosphere and environmental issues, Composition and structure of the atmosphere, Need of atmospheric studies in environmental science (8)

Insolation and energy balance: The energy system, Flux of solar energy in the biosphere, Insolation, Mechanism of solar radiation, Distribution of Insolation, Factors affecting the distribution of Insolation, Heat budget, Net radiation and latitudinal heat balance, Green house effect and Human influence on radiation balance. (8)

Temperature measurements and controls: Lapse rate and Inversion of temperature, Types of inversion, Horizontal and vertical distribution of temperature (8)

Atmospheric pressure and winds: Pressure measurement and distribution; Wind observation, measurement, Factors affecting wind; Geostrophic wind and gradient wind, Local winds, Models of general circulation of the atmosphere, Jet Stream, El-Nino, La-Nina Phenomena, Walker circulation (8)

Atmospheric moisture: Forms of condensation; Precipitation, Hydrological cycle (8)

Stable and unstable atmosphere: Environmental lapse rate, Dry and wet adiabatic lapse rate and atmospheric stability (6)

Air masses and Fronts: Classification and modifications of air masses, Characteristics and types of fronts (8)

Atmospheric hazard: Thunderstorm, Tropical cyclone hurricanes, Global warming, Ozone depletion and droughts (6)

REFERENCE BOOKS –

1) The Atmosphere. 7th Edition - Lutgens, Frederick K and Edward J. Tarbuck. Englewood Cliffs N. J. Prentice- Hall, 2005
2) Climatology - Lal D. S. (1998) Chaitanya Publishing House, Allahabad
3) Climatology - Savindra Singh (2005) Prayag Pustak Bhavan, Allahabad
4) Synoptic Climatology - Barry and Perry (1973) Methun and Co. Ltd. London
5) Weather and Weather Forecast - A. A. Rama Shetty, IMD
6) Introduction to Meterology - Peterson Sverre (1969) McGraw Hill Publishing, New York

7) Applied Climatology: Principles and Practice - Thomson R. D. and Allen P., Routledge, London
8) Climate and Man's Environment: An introduction to Applied Climatology - Oliver John E. (1973), John Wiley & Sons, New York & London
9) Climatology: Fundamentals and Applications - Mather J. R. (1974), McGraw Hill, New York
10) Climatology: Selected Applications - Oliver John E. (1981), V. H. Winston & Sons, London
11) Meteorological Monograph Synoptic Meteorology No. 1 Southwest Monsoon - Y. P. Rao (1976)
12) The Monsoons - P. K. Das (1991), National Book Trust, New Delhi
13) The Physics of Monsoon - Keshavamurty K. N. (1992), Allied Publishers Ltd. New Delhi
14) Monsoons - Fein J. S. and Stephens P. L. (1987), John Wiley & Sons, New York
15) Climate of South Asia - Pant and Rupkumar
16) Lutgens, Frederic K. & Tarbuck, Edward J. (1995): 'The Atmosphere: An Introduction to
Meteorology', Prentice Hall, New Jersey
17) Lal, D. S.(1998): 'Climatology', Chaitanya Publishing House, Allahabad
18) Savindra Singh (2005): Climatology , Prayag Pustak Bhawan, Allahabad

EVS 105 Practicals I Credits 6

Practicals based on environmental microbiology

1. Two season visits to a sacred grove to assess its biodiversity and steps for ecological restoration in the vicinity using its gene pool. Vegetation studies by line and belt transects and quadrats. Monitoring a wetland especially for its vegetation and birdlife.
2. Microscopy. Preparation of media for microbial culture. Isolation and culturing of microbes from soil / water samples, Gram Staining.

Practicals based on Environmental Chemistry

1) Estimation of halides in water samples by Potentiometry
2) Estimation of Co^{2+} and Ni^{2+} by Colorimetry / Spectrophotometry
3) Estimation of sulfates by Turbidometry
4) Estimation of alkali metals in various samples by Flame-photometry
5) Water analysis for physico-chemical characteristics
6) Estimation of heavy metals in various samples by AAS
7) Determination of half-life period of a given radionuclide

Soil Analysis

8) Measurement of Bulk density
9) Calculate Specific gravity of given soil sample
10) estimation of Water content,
11) Determine the Conductivity of Soil sample
12) Estimation of pH
13) Estimation of Alkalinity
14) Measurement of Soluble ion from different soil sample
15) Determination of Nitrogen
16) Estimation of Phosphorus
17) Determination of Sulphur

Practicals on Geoscience and Atmospheric science

1. Drainage basin and network morphometry
2. Slope and aspect maps
3. Critical slope for specified activities
4. Profiles
5. Climatic maps and diagrams: circular graph, climograph, waterbudget, wind roses (simple and compound)
6. Station Model – Coding decoding and plotting of synoptic data
7. Exercises based on adiabatic lapse rates

EVS 201 Environmental Pollution and control I Credits 4

1.0 Fresh Water Pollution (20)

. Types of Fresh water sources & their quality. Surface water - River, Lakes, Manmade dams, Streams.

. Underground water - Open well & bore well

. Types of Solids in water. Soluble, insoluble, organic, inorganic, biodegradable & non biodegradable.

. Impact of solids on water quality & usage like Drinking, Domestic, agricultural, & fishery

. Solids in water & its removal by available treatment methods

. Water Quality : physicochemical parameters and Standards, BIS & WHO for drinking & agricultural water

. Tropic levels of water.

Eutrophication process- natural & accelerated by manmade activities, Indicators of eutrophication, measurement of eutrophication, Restoration of Lakes - Case studies

. Thermal pollution of Surface water- Sources & impact aquatic life, Case studies..

. Type of Pollutant discharged from untreated & treated sewage into receiving water bodies. Listing out the manmade chemicals being added through the sewage due to Change in Quality of life. The fate of chemicals once discharged into water

. River water quality assessment by Streeter - Phelps Oxygen sag analysis

. Types of pollutant discharged from industries like Dairy, sugar, textile, fertilizer.

. Impact of pollutants (Suspended solids, Inorganic soluble solids, biodegradable organic solids, pesticides etc) on flora & fauna of fresh water,

. Problems in treatment required for utilization of polluted fresh

water for drinking.

. Case studies - Status of Polluted rivers like Mula & Mutha, Ujani dam & Pashan lake etc,

2.0. Marine water Pollution (10)

. Specifications for disposal of sewage & industrial waste into sea

. Disposal of sewage & wash water from MV cargo & ships.

. Brief review of Impact of biodegradable organic matter, toxic chemicals & solids dump on marine life

. Impact & control, & remedial measures of oil spillages from tankers & offshore well in sea

. Concentration of pollutant in the food chain with reference to mercury.

. Impact of pollution on mangroves in wet land.

3.0 Soil pollution (10)

. Introduction to basic Properties of soil like, soil structure, types of soil, soil composition, permeability rate,

. Standards for disposal of sewage & effluent on land for irrigation & ground water recharge.

. Impact of inorganic turbidity, excess nutrients, biodegradable organic matter, sodium, & boron on soil structure due to usage of waste water for irrigation.

. Measurement of Impact on the ground water quality due to solid & liquid waste disposal on the land

. Case studies of irreversible damages of the soil due to manmade activities.

. Methodology of waste water disposal on land in India. (20)

. Review of current methods of disposal of MSW on the land. Impact & mitigation

. Industrial solid waste (fly ash from thermal power station, lime sludge from pulp & paper mills, biodegradable organic waste from Food Processing industry) disposal on land & its impact

. Secured land filling of hazardous solid waste (heavy metals, toxic organic compounds) on land & its monitoring.

. Deterioration of soil due to deforestation, construction & mining activities (Open cast coal mining, Manganese & copper ore extraction)

. Restoration of Contaminated soil - Case studies

. Case study of Restoration of land due to a. disposal of MSW, fly ash & overburden in iron ore mining.

Reference

1.Waste Water Engineering Met Calf & Eddy INC Tata Mc Graw Hill

2.Global Ecology M I Budyko Progress Publishers, Moscow

3.Principle of water Quality control T H Y Tebbut Pergamon Press

4.Water Pollution S. K Agarwal A.P.H Publishing Corporation

EVS 202 Environmental Statistics Credits 4

1. Univariate Data. (20)
   Concepts of Population and Sample.
   Concepts of random variable, random observation, and random selection,
   Simple random sampling, collection and analysis of sample data.
   Presentation of Sample Data: Summary Statistics, graphical methods.
   Properties of a frequency distribution (including Skewness and Kurtosis),
   Measures of central tendency (mean, median, mode), measures of dispersion (range, variance, standard deviation, coefficient of variation).
   Histogram, Frequency curve, Ogive curves.
2. Bivariate data. (10)
   Measuring two variables on a single sampling unit to obtain bivariate data.
   Summary statistics for bivariate data (means, s.d.s and covariance / correlation).
   Significance of correlation coefficient.
   Scatter plots and their interpretation.
3. Statistical Models. (20)
   a. Distribution Models: Normal distribution and its properties. Fitting of normal distribution. Calculating probabilities of different events for normal distribution. Standardization of data and approximation by normal distribution.
   b. Cause–and–effect models: Linear and non linear regression models, fitting a regression line and parabolic curve, estimating regression coefficients. Calculation of fitted values and residuals.
   Tests based on Chi-Squsre: Goodness of fit, Independence of attributes.
4. Statistical Models in Environmental Science: Population Models, Catch model, Cohort projections, Pope's approximation. (10)

References:

1. Environmental Statistics: Methods and Applications (2004) Vic Barnett.
2. Environmental Statistics and Data Analysis (1995) Wayne R. Ott
3. Biostatistical Analysis (1997) Zar Jerrold H., Prentice Hall of India.
4. Statistics for Environmental Science and Management (2001) Bryan F. J. Manly.
5. Case Studies in Environmental Statistics (1998) Douglas Nychka and Walter W. Piegorsch.
6. Statistics for Engineers and Scientists (1993) Walpole R. and R. Myem.

EVS 203 Biodiversity and natural resources credits 4

1. INVENTORY OF BIO – RESOURCES: Global and National. (8 lectures)

- An inventory of Global and Indian biological resources and their present and potential uses.
- Valuation of bio-resources and current and potential threats
- Traditional cultivars of crop species and their evaluation
- Traditional livestock resources and their evaluation
- Current status of exploitation of wild species (terrestrial)
- Current status of marine resources, and trends in their usage pattern
- Traditional knowledge systems (including medicine, ethno-botany, water and soil conservation and other cultural practices), their evaluation and protection under IPR regime.

2. GLOBAL AND NATIONAL BIODIVERSITY (8 lectures)

- Magnitude and distribution of Biodiversity (global and Indian) and its characterization.
- Rapid assessment of biodiversity and its valuation; skills, trained personnel and resources needed for the task.
- Evaluating nature, scale and intensity of the threats to biodiversity.
- Developing measures for conservation of biodiversity and approaches to its sustainable utilization.

3. PLANT RESOURCES. (8 Lectures)

- Role of plants in natural ecosystems and life support systems (terrestrial, freshwater and marine)
- Importance of traditional cultivars and wild species in agriculture
- Role of plants in modern and traditional medicine
- Value of plants in scientific research and technological inventions
- Plants in modern lifestyle and economy
- Approaches to conservation of plants (in situ and ex situ)

4. ANIMAL & MICROBIAL RESOURCES **(**8 lectures)

- Role of animals in conservation of natural ecosystems
- Role of wild and domesticated gene-pool in human nutrition
- Importance of wild species (terrestrial and marine) in medicine
- Animals in modern society and economy
- Importance of wild species in scientific research and inventions
- Value of microbes in medicinal, scientific and technological research, solutions and inventions.

5. ECOSYSTEM RESOURCES (8 Lectures)

- Economic value of natural ecosystems and their processes in global and national economies
- Understanding the limits to exploitation and sustainability
- Developing alternative resources / technologies / usage patterns
- Ecotourism in wilderness and protected area network

6. PEOPLE RESOURCES (8 Lectures)

- Understanding the growth of human population, its pattern, causes and consequences
- Economic development, technological inventions and their impact on lifestyle as well as environment
- Environmental cost (direct and indirect) of human conflict
- Strategy for constructive involvement of communities (urban and rural) in conservation of biological resources

7. STRATEGY FOR CONSERVATION OF BIO-RESOURCES (8 Lectures)

- International conventions and treaties for conservation of bio-resources (including WCS, CBD, CITES, IPCC, Ramsar Convention, UNCLOS, Montreal Convention and others)
- National Laws, policies and action plans for conservation of forests, wildlife, biodiversity, marine resources as well as for people's participation in conservation efforts.
- Role of NGOs in conservation of bio-resources and people's participation in such efforts at global, national and grassroot level.

8. CONSERVATION ACTION AT NATIONAL AND LOCAL LEVELS (4 Lectures)

- Environmental education at academic and non-formal levels
- Role of youth in conservation education and action
- Participation in conservation issues and action at national and local levels
- Generating, sustaining and implementing conservation action at grassroot levels (eg resource conservation, waste disposal, conservation of wildlife in populated and protected landscapes)

EVS 204 Remote Sensing, image processing and GIS Credits 4

Basics of remote sensing: Definition, EMR spectrum, Radiation laws, Active and passive remote sensing: Optical, Thermal, Microwave,Resolution in Remote sensing data: Spatial, Spectral, Radiometric and Temporal, Spectral signatures, hyper-spectral sensing (6)

Interaction of EMR with the earth's surface and atmosphere: Energy response mechanism: Reflection, Absorption, Transmission, Scattering, Refraction, Reflectance, emission and scattering, Bi-directional Reflection Distribution Function (BRDF), Sun-synchronous orbit, Atmospheric windows, (3)

Platforms, Orbits, Sensors: Types of platform; Geostationary orbit and Polar orbit; Types of Resolutions; Scanning Systems (Pushbroom and Whiskbroom); sensors- LISS III, LISS IV, PAN, WIFS, Cartosat, IKONOS, SRTM (4)

Aerial photography and Air Photo Interpretation: Basic geometric characteristics of aerial photographs. Scale, Resolution, overlaps, flight planning, Measurement of height on aerial photograph, Principal of relative tonality, minimum mapping unit, Photo interpretation elements such as tone, texture, drainage patterns, morphology and erosion features (6)

Digital Image Processing and Interpretation: Factors governing Interpretability, Elements of photo interpretation. Image Fusion, image contrast stretching and image filtering. (7)

Basics of GIS: Definition and Objectives of GIS, History of GIS, Concept of space and time, Elements of GIS, Hardware and Software requirements of GIS, Map Projection: Conical, Azimuthal and Cylindrical.LCC Projection, UTM and Polyconic projections. (8)

Data structures in GIS – Spatial: Raster data, Vector data, comparative overview. Non-spatial data - Hierarchical, Network and relational data, Geo-relational vectors with topological structure, object oriented vector data structure. (6)

Acquisition of spatial data - scanning, digitizing, error detection and correction, for topological and geometrical errors. (6)

Spatial Analysis: Vector based: Overlays operations- point in polygon, line in polygon, polygon in polygon; single layer operations and Multilayer operations. Raster based: Map algebra, Grid based operations, Local, Focal, Zonal and Global functions. Buffering, Network Analysis, Thematic maps, Terrain Analysis, Digital Terrain Models, slope and aspect maps, shaded reliefs and inter-visibility analysis, raster corridor analysis (8)

Applications of GIS in Environmental Issues: Natural hazards and hazard management, floods, landslides and other natural hazards, monitoring water quality and soil quality, Use of GIS to represent environmental status and highlight environmental issues. (6)

1. Lillisand, T. M. and Keifer, R. W. (1990): Remote Sensing and Image interpretation, John Willey and Sons, New York
2. Joseph G. (2003): Fundamentals of Remote Sensing, Universities Press, Hyderabad.
3. Haywood, Ian (2000): Geographical Information Systems, Longman
4. Chang, Kang-taung (2002): Introduction to Geographic Information Systems, Tata McGraw-Hill.
5. Burroughs, P. A (1986): Principles of Geographical Information Systems for land Resource Assessment, Oxford University Press.

EVS 205 Practicals II Credits :6

Practicals based on Environmental pollution I

1. Determination of COD in given water sample
2. Determination of BOD of given water sample
3. Removal of heavy ions by different processes

Practicals based on Biodiversity

4.Plant species diversity in a sacred grove (one season data only)
5.Species wise population count of birds in a wetland
6. List of minor forest produce used by a community living inside or in the proximity of a protected area

Practicals based on environmental Statistics

1. Grouping of data and preparation of frequency distribution. Histogram and frequency polygon
2. Calculating mean, median and mode for grouped and ungrouped data
3.Calculating variance,standard deviation and coefficient of variation for grouped and ungrouped data
4.Fitting simple linear regression. Plotting scatter diagram and regression line
5.omputing correlation coefficient and testing its significance for grouped and ungrouped data
6.Comparison between means of two independent samples. Paired t-test
7. Analysis of variance: one way classification
8. Analysis of variance: two- way classification
9.Fitting statistical model of air pollution to data

Practicals based on GIS

1) Installation of GIS Software
2) Introduction of the software
3) Georeferencing
4) Base layer preparation / Digitization
5) Preparation of Geodatabase
6) Mosaicing
7) Subsetting
8) Classification of Satellite Image
9) Preparation of Layouts
10) Point interpolation techniques like IDW and Krigging
11) Handling of GPS and use of expert GPS software
12) Applications of Google Earth in calculating ground distance, aerial distance, path and area of given features
13) Study of different layers in Google earth
14) Interpretation of aerial photographs using mirror stereoscope and pocket stereoscope
15) Use of Arc- Scene.