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MARATHWADA UNIVERSITY

AURANGABAD

Syllabus

For

PET

In

Environmental Science

2016

(Section- A)
Research Methodology

Unit-1

Introduction to Research Methodology: Meaning of research, objectives of research, motivation of research, types of research, research approach, significance of research, research methods versus methodology, research and scientific methods, importance of knowing how research is done, research process, criteria of good research, problem encountered by researchers in India. Research Design : Selecting the problem, Necessity of defining the problem, technique involved in defining a problem, an illustration, conclusion. Meaning of research design, need for research design, features of good design, important concepts relating to research design, different research designs, basic principles of experimental designs.

Unit-2

Scientific Research- characteristics, types of methods, science and common sense, empiricism (positivism) vs philosophical approach, scientific research method in conducting research, characteristics of scientific research, aims of social research, steps in scientific research, types of scientific research, methods of scientific research, values of scientific research, value-free scientific research, concept to construct, the variable, the moderator variable, operationalisation of concept/variable, concept of hypothesis, Criteria of hypothesis construction, nature of hypothesis, difference between a proposition, a hypothesis and a theory, types of hypothesis, difficulties in formulating hypotheses, characteristics of a useful hypothesis, source of deriving hypotheses, functions or importance of hypotheses, testing hypotheses, criticism of hypotheses.

Unit-3

Research design and problem formation, components in research, selection of research topics, meaning of research design, functions/goals of research design, characteristics of good research design, phases in research designing, quantitative and qualitative research, design for different types of research, advantages of designing research, stages of outlining a research proposal/pilot study. Sampling and Data Collection- Concept of sampling, Sampling Techniques for Research, purposes of sampling, principles of sampling, advantages of sampling, key terms in sampling, types of sampling, sampling in qualitative research, sample size, Techniques of data collection-questionnaire and interview schedule, format of the questionnaire/schedule, arranging sequence of the questions, types of questions, pitfalls in question construction or question content, stapes in questionnaire construction, pre-testing of questionnaire, advantages of questionnaire, limitation of questionnaire, Interview methods, functions of interview, characteristics of interview, types of interview, condition for a successful interview, the interviewer, relationship between and interviewer and the respondent, process of interviewing, merits/ limitation of interview.

Unit-4

Research process and observations-Concept of observation, characteristics of observation, purposes of observation, types of observation, process of observation, the observer, factors affecting choice of observation, basic problems in observation, observation schedule, advantages of observation, limitations and weakness of observation. Collection of primary data, observation method, interview method, collection of data through questionnaires, collection of data through schedules difference between questionnaire and schedules, some other methods of data collection, collection of secondary data, selection of appropriate method for data collection,

case study. Meaning of interpretation, techniques of interpretation precautions, report writing and significance, steps in report writing, layout and types of reports mechanisms of report writing.

Data and content analysis-research examples of content analysis, characteristics of content analysis, steps in content analysis, process of content analysis, sources of data for content analysis, difference between historical methods and contents analysis, types of content analysis, objectivity in content analysis, strengths and limitation of content analysis, data processing, tabulation of data, interpretation of data, diagrammatic representation, report writing or presentation of data, data measurement and scaling techniques, scaling or assigning scores, levels of measurement or types of scales, criteria of good measurement, measuring scales.

Unit-5

Fundamental Concepts in Environmental Statistics: Statistical sampling, purpose of sampling, principles of sampling, merits of sampling, basics and types of samplings, simple random sampling, Stratified random sampling, Systematic sampling, Multistage sampling. Statistical methods for environmental systems, Primary and secondary data collection, methods of data representation, Measures of central tendency-mean and its types, median, mode, Measures of dispersion-Variance, Standard Deviation, Mean Deviation, Coefficient of Variation, range and quartile deviation, Concept and types of hypothesis, null and alternative hypotheses, tests of hypothesis- t test, f test, z test and Chi-square tests, Variables of environmental interest, Concept of Correlation, its types and application in Environmental Science, Concept of Regression lines-x on y and y on x, regression analysis, Computer applications: Introduction to computer, computer organization, concept of software and hardware, functions, capabilities and limitations of computers, Use of computer in environmental Science, applications of Windows XP, MS Word, MS Excel, MS Power Point, Adobe Page Maker, Adobe Photoshop in environmental science, access of internet in environmental science, applications of computer in environmental science.

Section-B
(Theory course)

Unit-1: Fundamentals of Environment, Management of wildlife, biodiversity, Natural Resources and Sustainable Development.

Introduction to Environment: Definition, principle and scope of environmental science, man & environment, media and people, decision making and applications in environmental science, environmental ethics, environmental consciousness. Components of Environment: Atmosphere, Lithosphere, Hydrosphere, Biosphere, composition of soil, soil formation, soil profile, properties, soil erosion, Hydrological cycles, rain water harvesting, Ecosystem dynamics, nutrient cycling, Restoration of Degraded ecosystems, Population dynamics, concept of carrying capacity ecological sustainability.

Concept of biodiversity, importance of biodiversity, components of biodiversity, causes of loss of biodiversity, protection measures, Definition and concept of wildlife, Wildlife and Management, Status of wildlife, wildlife and human conflicts, Threats and causes of loss of wildlife, wildlife trade in India, Causes of extinction of wildlife, Wildlife Conservation-In-situ and Ex-situ conservation, Wild life conservation methods- Species specific conservation methods, Community conservation methods.

Natural Resources and Environment: Definition, Classification of natural resources, Use of natural resources and human development, Limitations over exploitation and degradation of environment, Forest resources- forest products and use, deforestation, forest conservation methods, Water resource- availability and use, water conservation, rain water harvesting; Fishery resources, Grazing lands and their degradation, Mineral and Metal Resources Environmental problems due to mining, Mineral resources and population, Environmental impact of overexploitation of mineral resources, Conservation of mineral resources and associated environmental problems, Energy Resources, Energy resources-conventional energy resources (fossil fuels), Energy use patterns, Environmental problems due to use of conventional energy resources; Non conventional energy resources- solar, wind, hydroelectric, tidal energy.

Sustainable Development Concept and strategies of sustainable development, Principles of sustainable development, Mechanism and Practices of sustainable development in India, Barriers to sustainable development. Conservation of resources and sustainable development, waste management through 3-R principles, Cleaner production.

Unit-2: Environmental Pollution Studies.

Basic concepts of Environmental Chemistry, Chemistry of water and soil, Green House Effect, its causes and consequences, Ozone layer depletion-causes, consequences and effects, photochemical smog, Acid Rain-causes, consequences and impacts.

Environmental sampling, methods (selective, random, multiple), types (grab, integrated, composite), protocol of sampling, frequency of sampling, Sample preservation techniques, Air sampling Equipments, Analytical Instruments-Theory, principle, working and applications of pH meter, Conductometer, Fluorometer, Turbidometer, EC meter, DO meter, Nephlometer, Flame photometer, colorimeter, spectrophotometer (UV, IR, NMR, AAS), Chromatography, TLC, GC, HPLC.

Microbiological instruments and equipments: Theory, principle, working and applications of major equipments- Colony counter; autoclave; oven; incubator; laminar air flow; BOD incubator. Advantages and disadvantages of instruments, Trouble shooting of instruments,

Air pollution- Concept, mobile and stationary sources of air pollution, sinks of atmospheric gases, major air pollutants and their classification, air quality standards, primary and secondary air pollutants, indoor air pollution, vehicular pollution, industrial pollution, monitoring of major air pollutants, effect of air pollutants, status of air pollution in India. Control measures for controlling the air pollution, equipments used to control air pollutants and Methods for the use of Cyclone separators, Fabric filters, Electrostatic precipitors, Wet scrubbers, etc.

Water pollution-sources, types of water pollution, major pollutants, consequences of water pollution, eutrophication, oil pollution, River pollution, Thermal pollution and its Effect, Monitoring of water pollution and preventive measures.

Noise Pollution-Sources, measurement and monitoring, effects of noise pollution, Indian scenario of noise pollution, remedial measures for the noise pollution control of community noise, vehicular noise, industrial noise, preventive measures, noise standards.

Land pollution-Causes and effects of soil pollution, major soil pollutants and sources, effects, domestic, municipal, industrial and agricultural wastes and their role in soil degradation, physico-chemical and biological methods of soil reclamation, soil salination, Soil conservation measures.

Radiation pollution-concept of radiation pollution, major sources of radioactive pollutants, nuclear fusion and fission reactions, units of radiation, effects of radioactive pollution, biological impacts and health hazards; use of nuclear weapons and their consequences, Impacts of radioactive fallout on health & environment,

Sewage and Effluent Treatment in Industries-*Primary Treatment, Secondary treatment*, their principles, techniques and operational units, Oxidation and stabilization ponds, Aerated lagoons, Activated sludge process, Trickling filters, anaerobic digesters, Advance Techniques used in Industrial Effluent Treatment in various industries, Concept of Common effluent treatment plant (CETP).

Solid Waste Management-Types of solid waste biodegradable, non-biodegradable solid waste, Industrial solid waste management, Urban and Agricultural solid waste, needs of solid waste management, Compaction, Dewatering, Briquette, Size reduction, Separations of inorganic and organics like removal of metals, Loading, Collection, Storage and transportation and Disposal.

Unit- 3: Remote Sensing & GIS, EIA & Environmental Audit

Remote sensing-Introduction and scope of remote sensing, basic principles, electromagnetic radiation spectrum, remote sensing process, transmission, absorption, reflection, energy interactions with atmosphere, energy source and its characteristics, atmospheric interaction with electromagnetic radiation, absorption of ozone, atmospheric effects on spectral response patterns, energy interactions with earth`s surface materials.

Platforms and Sensors-(Visible and Near IR, Thermal- IR, Microwave and Sonic Sensors), active and passive remote sensing, remote sensing platforms and sensors, introduction satellite system, parameters viewing parameters, landsat satellite programme, spot satellite programme,

Indian remote sensing satellite(IRS), meteorological satellites, NOAA satellites, GOES satellites, NIMBUS satellites, latest trends trends in remote sensing platforms and sensors.

Meteorological Remote Sensing Satellite (Polar and Geostationary Satellites), Non Meteorological RS Satellites, Resolution, Satellite data products and selection of satellite data; Lasers and Airborn Remote Sensing System-Lidar system and Laser Flurosensing, Interpretation of Remote Sensing Data- Identification of Earth Surface Features, Digital Image Processing-Image Structure, Image Enhancement, Geographic information system, principles and scope of GIS, capabilities and advantages of GIS, use of GIS in spatial analysis, graphics output, Raster and vector data structure, fundamentals of GIS, roots of GIS, overview of information system, GIS definations and terminology, geographical entities, attributes topology, cognitive models, GIS queries, GIS architecture, components of a GIS, spatial data modeling, stages of GIS data modeling, graphic representation of spatial data taster GIS models, vector GIS models, GIS data management system, function of DBMS, components of DBMS, GIS data file management, simple list, ordered sequential files, indexed files, building GIS worlds, storage of GIS data model, the integrated data model, object based data models, organizational strategy of DBMS in GIS, Role of remote sensing in studying deforestation, soil erosion, flood mapping, flood damage assessment, drought assessment, and water shed management.

Concept of EIA, scope and objectives of EIA, origin and development of EIA, Types of EIA, types of impacts, concept of significant effect; short term versus long term effect, measurement of impact-physical, social, economical, natural impacts, Environmental Impact Assessment Methods, various components of EIA, Impact interpretation, various impact analysis methods-checklist, overly, matrix, and Adhoc methods. Assessment of Impact, concept, process and types of environmental audit.

Unit-4: Management techniques for Hazardous Waste and Disasters

Basic Aspects of Hazardous Waste Management concerns of hazardous wastes, types of hazardous wastes, Identification and Classification, potential pathways of release to the environment, management of hazardous Wastes, Treatment Technologies-thermal, physical, chemical and biological treatment technologies, Safe disposal techniques of hazardous wastes and nuclear wastes, control measures of radiation pollution, types and disposal of radioactive waste, Hazards and Disasters-definition of hazards and disaster, Fundamentals and Classification of disasters, Characteristics, Impacts and mitigation strategies for earthquakes, Tsunami, landslides, cyclones, floods, drought; disaster management plan, social and economic impacts of natural disaster and manmade hazards. Causes and consequences of industrial disasters, levels of disasters and alertness, phases of disaster and disaster responses. Need for Life Cycle Assessment, Characteristics of LCA; Application of LCA; ISO 14000 Series / Protocols for LCA ; Procedure of LCA.

Unit-5: Environmental Microbiology & Biotechnology

Introduction to environmental microbiology: History of microbiology, classification of microorganisms- prokaryotes & eukaryotes, microbial communities in nature – Microbiology of water, Microbiology of extreme environments, Microbiology of air, and Microbiology of soil. Airborne diseases, Food borne diseases, Water borne diseases, Soil borne diseases, Microbial Bio-deterioration, Principles of bioremediation, factor responsible for bioremediation, bioremediation strategies-(In-situ bioremediations & Ex-situ bioremediation), Concept of Bioleaching and bio-absorption, phyto-remidiation, Biofertilizer.