

knowledge digital library (TKDL), biopiracy, bioterrorism and biowarfare.

UNIT IV (13 hours)

Biotechnological approaches for the degradation of waste – pesticides, plastic, hydrocarbons, petrochemicals, tannery wastes, textiles, dyes, detergents, distillery and paper. Mariculture-mollusc culture, crustacean culture, seaweed culture, finfish culture, biomolecules from marine organisms. Biofertilizer - importance and classification, vermicomposting. Microbial mining, biofilms, biofouling and its prevention, microbial influenced corrosion and remedies.

References:

1. Arora, D.R. and Aora, B. 2012. Text Book of Microbiology, CBS Publ. & Dist. Pvt. Ltd., New Delhi.
2. Brock, T.B. and Madigon, M.T. Biology of microorganisms, Prentice Hall.
3. Cambell, R. Microbial Ecology. Blackwell Scientific Publ., London.
4. Dubey, R.C. Text book of Biotechnology.
5. Indu Shekhar Thakur. Text book of Environmental Biotechnology.
6. Pelzar. Text book of Microbiology.
7. Pradipta Kumar Mohapatra. Text book of Environmental Biotechnology.
8. Sharma, P.D. Environmental Microbiology.
9. Singh S.N. and Tripathi R.D. Environmental bioremediation technologies.
10. Singh, B.D. Text book of Environmental Biotechnology.

SOFT CORE COURSES

ESS414 ENVIRONMENTAL STATISTICS

39 hrs.

Course Outcomes:

CO1 Learn applications of matrices in environmental impact assessment and management.

CO2 Gain the knowledge of fundamental aspects of environmental statistics.

CO3 Learn the statistical packages available for environmental data analysis.

CO4 Learn sampling techniques in the field of Environmental Science.

UNIT I (13 hours)

Types of sampling. Descriptive vs. Inferential Statistics. Measures of location - mean, median, mode. Measures of dispersion - variance, standard deviation, range and interpercentile ranges. Dispersion Percentages, skewness, concepts of outliers. Bi-variate data and scatter diagram. Simple (linear) correlation and regression. Coefficient of correlation and regression and their properties. Fitting of regression line. Multiple and partial correlations and regressions. Graphs and Displays-Introduction, z-Scores and Percentile Ranks, Stem and Leaf Displays.

UNIT II (13 hours)

Matrices and Determinants: Types of matrices, addition and subtraction of matrices. Multiplication of a matrix by a scalar. Products of matrices. Evaluation of 2×2 determinants. Inverse of 2×2 matrices. Combinations of transformations. Eigenvalue. Applications of

matrices in Environmental Impact assessment.

UNIT III (13 hours)

Probability: Definition, random variables, expected value. Probability Distributions - Normal, Binomial and Poisson Distributions. Statistical hypothesis testing-basic approach, alternative hypotheses. One sample tests - Z-test on a mean with known variance, T-test on a mean with unknown variance, Z-test for non-zero correlation. Two sample tests- T-test on unpaired means with unknown variance. T-test on paired means with unknown variance. F-test for equal variances, Z-test for unpaired equal correlations, Chi Square test, ANOVA.

References:

1. Aslam Mahmood. Statistical Methods in Geographical Studies, Rajesh Publications, New Delhi.
2. Gupta, S.C. and Kapoor, V.K. 2012. Fundamentals of Mathematical Statistics, S. Chand & Co.
3. Medhi, J. Statistical Methods: An Introductory Text, New Age International Ltd. Publishers.
4. Singh, Practical Statistics, Vol. 1 and 2, Atlantic Publishers.
5. Ott, W. R., Environmental Statistics and data analysis, Lewis Publishers, New Jersey.
6. Piegorsh, W.W. and Bailer A. J. Statistics for Environmental Biology and Toxicology.
7. Singh, Practical Statistics, Vol. 1 and 2, Atlantic Publishers.
8. Snedecor, G. W. and Cochran, W.G. Statistical Methods.

ESS415 ENVIRONMENTAL LAWS AND POLICIES

39 hrs.

Course Outcomes:

- CO1 Study environmental legislations in detail.
CO2 Describe the role of nodal agencies in environmental protection.
CO3 Learn various Acts related to air and water pollution.
CO4 Study the scheme of labelling of environment friendly products.

UNIT I (13 hours)

Current status of environment; Environmental Challenges-Causes and Impacts; Environmental protection-scope and objectives; Principles, Strategies and Actions under National Environment Policy; The constitution of India-Article 21, Article 38, Article 48, Article 51 in detail; Role of nodal agencies in India for environmental protection- Ministry of Environment, Forest and Climate Change (MOEFCC).

UNIT II (13 hours)

The Water (Prevention and Control of Pollution) Act, 1974; The Water (Prevention and Control of Pollution) Rules, 1975; The Water (Prevention and Control of Pollution) Cess Act, 1977; The Water (Prevention and Control of Pollution) Cess Rules, 1978; The Air (Prevention and Control of Pollution) Act, 1981; 1982; The Air (Prevention and Control of Pollution) (Union Territories) Rules, 1983.