SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR

SYLLABUS EFFECTIVE FROM: 2018-19
MSC (ENVIRONMENTAL SCIENCE AND TECHNOLOGY (EST))
SEMESTER - III

PS03CEST21: ENVIRONMENTAL BIOTECHNOLOGY

Single Cell Protein technology- Types of media, substrates used in Spirulina cultivation, Biofertilizer technology- Isolation, mass cultivation and application of Rhizobium, Cyanobacterium, Mycorhhizal technology- Structure and VAM- Ecto and Endo phleoic mycorhhizae, isolation and cultivation. Vermi-technology- process, Vermi compost and vermi-wash, Mushroom technology- Basic structure of mushroom, nutritional value, general process, Cultivation of edible mushroom

Enzyme technology- Selection, isolation, purification, use of industrial enzymes, immobilized enzymes and types. Fermentation technology: Microbial production of alcohol, antibiotics, fine chemicals and use of bacteria and yeast. Biogas technology- conditions for biogas production, biogas plant and commercial and laboratory type. Methane production through anaerobic fermentation. Biofuel production from Jatropa and other plants

Recombinant DNA technology: DNA and RNA structure, forms and types , Isolation of Gene, Isolation of Plasmid Vector, types of vectors, restriction enzymes, ligase, insertion of foreign DNA into vector, transfer the recombinant into bacterial cells, selection of recombinants, Gene cloning, Gene amplification through PCR and its technique. Mapping of DNA markers RFLP, RAPD, AFLP, STS.

Plant tissue culture technology and significance- Callus, embryo, anther and protoplast cultures. Pollution monitoring biotechnology- Bioremediation, phytoremediation, Biosensors, Root zone technology, bio-degradation.

Suggested Books

1. Agarwal, S.K. 2002. Environmental Biotechnology, ABH Inc.
2. Das, H.K. 2005. A Textbook of Biotechnology. Willey Publishers.
3. Evans, J.C., Furlong, C. 1998. Environmental Biotechnology: Theory & Applications. John Willey Press.
4. Gaudy, A.F. and Gaudy, E. 1983. Microbiology for Environmental Scientists and Engineers. McGraw Hill, N.Y.
5. Mc Kinnery: Microbiology for Environmental Engineering, McGraw Hill, N.Y.
6. Norris et al. 1993. Handbook of Bioremediation. CBC Press.
7. Patel, A.H. 2001. Industrial Microbiology. MCMill Print Ltd.
8. Pelczar, Chang Krieg. 2002. Microbiology. Tata McGraw Hill.
9. Purohit, S.S. 2008. Biotechnology: Fundamentals and Applications.
10. Singh, D.B. 2006. Biotechnology: Expanding Horizons. Kalyan Press.
11. Stephan, P.C. 2010. Bioremediation Methods and Protocols. Humana Press.
12. Subbarao, N.S. 1997. Biofertilizers in Agriculture and Forestry. Oxford & IBH Press.

PS03CEST22: **ENVIRONMENTAL IMPACT ANALYSIS AND LEGISLATION**

Environmental Impact Assessment: Concepts of EIA, origin, development, objectives, methodologies of impact analysis, preparing report on EIA, GPCB guidelines, MoEF updates on EIA, Procedure for obtaining environmental clearance (NOC, Industrial License, Consent, rule – 14), Sitting guideline for industries and areas to be avoided. Form V (Environmental statement), EIA Notifications & Guidelines 1994, 2006, and 2009, 2012, Stages of granting new projects (modernization, expansion, demolition)

Components of EIA, Generation of baseline data & preparation of EIA report, procedure for reviewing EIA report, Authorities/ Institutions involved in granting environmental clearance at Central & State Government levels, Environmental Clearance: Screening, Scoping, Public consultation (hearing), Appraisal & recommendations and grant of environmental clearance and its validity, Case studies: river valley projects-hydroelectric : thermal power plants: mining projects: oil refineries and petrochemicals.

Environmental management plan / system (EMP / EMS), Environmental Information System (EIS), Environmental auditing, preparing audit report, Introduction to ISO 9000 & 14000 series, cleaner production assessment (History, Basic concept, Basic requirements, environment benefits, methodology, tools and financial analysis), Green belt development.

Study of important provisions of following environmental legislations: Water (Prevention and Control) of Pollution) Act, 1974; Air (Prevention and Control of Pollution) Act, 1981; Environment Protection Act, 1986.Wildlife (Protection) Act, 1973. Energy conservation Act, 2001. Forest Conservation Act, 1972; Public liability insurance Act, 1991, Disaster management act 2005.

1. Arya & Abbasi. 2000. EIA & Legislation.
2. Gilpin, A. 2002. Environmental Impact Assessment – An Overview, Prentice & Hall Inc.
3. Hosetti & Kumar. 2002. Methodologies of EIA.
4. Mohanty, S.K. 2009. Environment & Pollution Laws.
5. Trivedi, R.K. Handbook of Environmental Laws. Vols. I & II.
6. Shukla & Srivastava. 2000. Methodology of Environmental Monitoring and Assessment. Narosa Press.
7. Kulkarni & Kaul. 1998. Handbook of EIA. Scientific Publishing.
8. Uberoi, C. 2004. Environmental Management System. Scientific Publishing.

PS03CEST23: INDUSTRIAL SAFETY AND CONTROL TECHNOLOGY

The Concept of safety management: Philosophy, Psychological factors, Behavior based safety principles. Overview of Safety Engineering: - Sitting & Layout, Machine guarding, Total Productive Management, ventilation, vibration. Overview of Safety Appraisal: Accident analysis, performance rates, Risk Assessment techniques. Industrial Safety Approaches, Overview of Safety Legislation: The Factories Act & Rules, Labor Acts and Rules (WC, ESI, Petroleum, Explosives etc.) for Safety provisions.

Chemical Hazards: Safety, Definition and types, Chemical hazards, Material Safety Data Sheet, Hazard Identification Technique (HAZOP etc.), Safety during Material handling (Manual/Mechanical), Safety during loading and unloading, Safety devices and system: Safety valve, Rupture disc. Safety Checklist, House Keeping: Statutory Provisions and Indian standards, Methods of house keeping, Management of house keeping, Japanese Concept of Five S, Housekeeping of specific industries. Accident Hazards: Definition and major accident hazards.

Work Permit concept, Safe Operating Procedures, Safety Audits, Safety Tag System, Job Safety Analysis, Electrical Safety(Electricity usefulness and hazards, statutory provisions, effects on humans, safety measures, portable electrical apparatus) and Static Electricity, Hazardous area Classification.

Fire and Explosion: Chemistry of fire, Classification of fire, Types of fire extinguisher and Explosion Phenomena. Onsite and Offsite Emergency plans: Need and Types of Emergency plans, Disaster Management Plan, Statutory Provision, Onsite and offsite plans. Risk Assessment: Qualitative and Quantitative, Types or Methods of Risk Assessment, Risk counters, Risk Control measures, Risk management activities and Risk reduction activities, Duties of Risk Manager.

Suggested Books

1. K.U. Mistry Fundamentals of Industrial safety and Health. Siddharth Prakashan, Ahmedabad
2. Browning, E. 1963. Toxicology of Industrial Organic Solvents, Chemical Publishing, N.Y.
3. Patty, F.A. Industrial Hygiene and Toxicology, Vol.I and II. Inter science, N.Y.
4. Kohn & Bisesi. 2005. Environmental Health and Safety. CRC Press.
5. Sarma, A.M. 2001. Safety & Health in Industry. BS Publications.

PS03EEST21: INDUSTRIAL POLLUTION AND CONTROL TECHNOLOGY

Industrial scenario-Types of industrial wastewater, Influent and effluent, Waste Water, definition of waste water, Constituents in wastewater, Sources of domestic and Industrial waste water, Domestic waste water-Define: Septage (septic tank), Sewage, Fluctuation in generation of domestic waste water and their quality. Characteristics of Domestic wastewater, Waste water collection point, types of sewers, types of sewerage systems, House Hold drainage system- Traps, Manholes, Waste collection Pipes, Treatment of Domestic waste Water- racks, screens, grit chamber, aeration units, primary & secondary clarifiers, activated sludge plant and trickling filter units, Low cost sanitation systems, septic tanks, soak pit, stabilization ponds.

Waste Water unit operation: CETP - concept, Objectives, advantages and disadvantages and Ownership. Physical unit operation, Chemical unit operation, Biological unit operation-Introduction to Biological Treatment: Role of micro-organisms, types of biological processes for wastewater treatment, Disposal standards, disposal of effluents (Land, water bodies). Residuals (Sludge) Management: Residuals of industrial wastewater treatment - Quantification and characteristics, treatment and disposal-Thickening, digestion, conditioning, dewatering and disposal.

Origin (Manufacturing process) and characterization, standards of industrial waste water and common and specialized treatment of industrial effluents of – Pharmaceuticals, Textile, paper and pulp, dairy industries. Noise pollution: Acoustical concepts, Sources, Measuring instruments and techniques, , Health effects , Traffic Noise index (TNI), Noise pollution level (NPL), Sound exposure level Noise standards and limits, Noise control methods (source, path and receiver end)

Radioactive pollution: Types of radiation, radiation units, types of radioactive materials, radiation sources (natural, commercial and industrial) effects and radiation protection. Radiation interaction with biological materials; Nucleic acids (DNA & RNA), proteins, carbohydrates, lipids and membranes. Thermal pollution: Sources, effects, Control and prevention.

Suggested Books

1. Besselviere, E and Schwartz. 1975. Treatment of Industrial Wastes, McGraw Hill.
2. Birdie, G.S. 2002. Water Supply and Sanitary Engineering. Dhanpatraj and Sons Press.
3. Browning, E. 1963. Toxicology of Industrial Organic Solvents, Chemical Publishing, N.Y.
4. Fair, G.M. Geyer, T.C. and Okun, D.A. 1984. Water and waste water Engineering. Vol. I and II, John Wiley and Sons.
5. Gharpure, V.N. A Text Book of Sanitary Engineering. Allied Book House.
6. Joseph A. Salvato. 2001. Environmental engineering and sanitation: (4^{th} edition).
7. Mahajan 1985. Pollution control in process industries. Tata McGraw Hill
8. Metcalf and Eddy Inc. 1979. Waste water Engineering treatment, Disposal, Reuse. Tata McGraw Hill Publ. Co. Ltd.
9. Nemwrow. N.L. 1971. Liquid waste of Industry – theories, practices and treatment, Addison Wesley.
10. Peavy, Rowe Tchobanoglous. Environmental Engineering. McGraw Hill International ed.
11. S. P. Singhal. 2004. Noise Pollution and Control Strategy.
12. Steel and Terence. 2004. Water Supply and Sewerage. McGraw Hill Book Co.
13. Trivedy & Raj. 1999. Nuclear & Thermal Pollution. Akasdeep Publications.

PS03EEST22: ENVIRONMENTAL GEOGRAPHY

Environmental geography – evolution and objectives, Man-environmental relationships – hunting gathering , fishing, mining, aqquiring, forestry, Environmental systems – System classification, open system, modification by human, Environmental degradation – Causes, resulting effects, remedies, Land uses – Types of landuse, agriculture, urbanization, changes in landuse during historical times, Environmental management – Social responses, limitations

Meteorology – Atmospheric composition circulation, Weather – Phenomena, synoptic descriptions, Radiation – Electromagnetic radiation spectrum, Insulation, Thermal environment – Radiation balance, heat transfer, seasons, Precipitation – Cloud formation, humidity, types, distribution, Climate – Types, continental and oceanic influence, importance in crop production, Indian Climate – Monsoon, rainfall pattern
Water Resources – Water budget, utilization and management of river waters for irrigation and hydroelectricity, (only example of major dams for explaining the idea of damming, diversion and canalization), ground water tapping, overuse and the need for conservation; The benefits of major river valley projects

Mineral Resources: Distribution of mineral fuels, petroleum, natural gas and atomic minerals; Distribution of the minerals as industrial raw material – iron ore, bauxite, manganese, limestone, mica; Mineral rich zones; Production, consumption and trade of important minerals; Wastage and need for conservation.

Suggested Books

1. Braun, B. (2005) Environmental issues: writing a more-than-human urban geography. Progress in Human Geography, 29(5), 635–50.
2. Briggs, D. and P. Smithson The Fundamentals of Physical Geography. (London: Routledge, 1993) [ISBN 0044458223].
3. Collard, R. The Physical Geography of Landscape. (London: Collins Educational, 1992)
4. Mayer, J. D. (2000) Geography, ecology and emerging infectious diseases. Social Science and Medicine, 50, 937–52.
5. Slaymaker, O. and T. Spencer Physical Geography and Global Environmental Change. (Harlow: Longman, 1998)
6. Waugh, D. Geography: An Integrated Approach. (Walton-on-Thames: Nelson Thornes, 2009) fourth edition

PS03CEST24: Practicals based on PS03CEST21 and PS03CEST22

Estimation of DNA and RNA; Isolation of DNA and Protein;; Amplification and visualization of DNA, Embryo and anther culture; Biosorption- Activated Charcoal test for Removal of nutrients - Phosphates/Sulphates/Nitrates, heavy metals Cr /Fe. Enzyme- Nitrate reductase. Isolation and identification of fungal and bacterial(*Rhizobium* on YEMA media) forms from air/soil /wastewater/sewage/ various concentrations of pesticides, gram staining, Determination of Standard Plant Count .

Demonstration: Separation of DNA by Agarose gel electrophoresis and protein by SDS PAGE. Vermi- technique and mushroom cultivation technique

Preparation of Environmental statements / forms, environmental audit, report, certification process, Environmental clearance, EIA forms, NOC, consent application, case study, field survey report.

Visit to be conducted to any one Environmental biotech lab/industry and report submission at the time of examination.

PS03CEST25: Practical based on PS03CEST23 and PS03EEST21

Characterization of wastewater- Sewage, industrial effluent and receiving water body for physico-chemical and biological properties: pH, conductivity, colour, temperature, total solids, dissolved solids, suspended solids, chloride, phosphate, nitrate, sulfate, hardness, Calcium, Magnesium, total alkalinity, Oil and grease, Ammonical nitrogen, phenolic compounds, BOD, COD, total acidity, Sludge Volume index, MLSS and MLVSS.
Determination of Iron, Chromium, Pb, Hg (ICP at SICART), Measurement of Noise using SLM. Visit to various industry-ETP,CETP,STP, Land Fill sites and prepare a report and submit at the time of university examination.

PS03CES26: Viva Voce