



SU/BOS/Science/09

Date: 02/01/2024

To,

The Principal, All Concerned Affiliated Colleges/Institutions Shivaji University, Kolhapur	The Head/Co-ordinator/Director All Concerned Department (Science) Shivaji University, Kolhapur.
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Subject: Regarding syllabi of M.Sc. Part-II (Sem. III & IV) as per NEP-2020 (1.0) degree programme under the Faculty of Science and Technology.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of M.Sc. Part-II (Sem. III & IV) as per NEP-2020 (1.0) degree programme under the Faculty of Science and Technology.

M.Sc.Part-II (Sem. III & IV) as per NEP-2020 (1.0)			
1.	Computer Science	7.	Biochemistry (HM)
2.	Data Science	8.	Biotechnology (HM)
3.	Information Technology (Entire)	9.	Biotechnology
4.	M.C.A.	10.	Medical Information Management
5.	Food Science & Nutrition	11.	Environmental Science
6.	Food Science & Technology	12.	

This syllabus, nature of question and equivalence shall be implemented from the academic year 2024-2025 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in NEP-2020 (Online Syllabus)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2024 & March/April 2025. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Dy Registrar
Dr. S. M. Kubal

Copy to:

1	The Dean, Faculty of Science & Technology	8	P.G. Admission/Seminar Section
2	Director, Board of Examinations and Evaluation	9	Computer Centre/ Eligibility Section
3	The Chairman, Respective Board of Studies	10	Affiliation Section (U.G.) (P.G.)
4	B.Sc. Exam/ Appointment Section	11	Centre for Distance Education

M.Sc. Environmental Science

Programme Structure and Syllabus (Level 6.5)

M.Sc. Part II

Choice Based Credit System (CBCS) with Multiple Exit
option (NEP 2020)

ACADEMIC SESSION
(w. e. f. 2024-2025)



DEPARTMENT OF ENVIRONMENTAL SCIENCE,
SHIVAJI UNIVERSITY, KOLHAPUR

A. Adhew

**Choice Based Credit System with Multiple Entry and Multiple Exit Option
(NEP-2023)**

M.Sc. Environmental Science Programme

M.Sc. Part – II

(Level-6.5)

Sem. III (Duration Six Months)

Sr. No.	Course Code	Title of the course	Credits
1.	CC-301	Energy Studies	4
2.	CC-302	Environmental Toxicology and Nanotechnology	4
3.	CC-304	Research Project (Phase I)	4
4.	DSC-301	1. Climate change, Adaptation and mitigation 2. Global Environmental Issues	4
5.	CCPR-305	Environmental Science Practical V	4
6.	CCPR-306	Environmental Science Practical VI	2

M.Sc. Part II

Sem. IV (Duration Six Months)

Sr. No.	Course Code	Title of the course	Credits
1.	CC-401	Environmental Impact Assessment and Environmental Audit	4
2.	CC-402	Environmental Laws, Environmental Management System and Life Cycle Assessment	4
3.	CC-403	Disaster Management and Industrial Safety	4
4.	DSC-401	1. Environmental Biotechnology 2. Restoration Ecology and Watershed Management	4
5.	CC-405	Research Project (Phase II)	6

CC-301: Energy studies

After completion of the course, the students are able to

CO1: Classify the energy resources into renewable and non-renewable resources.

CO2: Recognise the power and applications of solar energy

CO3: Get acquainted with the knowledge of biomass energy.

CO4: Make aware about the energy generation from ocean, tides and hydel power plant.

CO5: Illustrate the mechanism and types of methods for watershed management

Syllabus

Unit- 1

(15)

a) Introduction to energy resources

Energy use pattern in developed and developing Energy crises; Energy use pattern in India; Sources of energy and their classification; Energy forms and transformation, role of IREDA and MEDA in energy generation.

b) Fossil Fuels:

Fossil fuels – classification, composition, physiochemical characteristics; Energy content of coal, petroleum and natural gas; Formation, reserves, exploration/ mining and uses of Coal, Oil and Natural gas; Environmental problems associated with exploration/mining, processing, transportation and uses

Unit- 2

(15)

a) Solar Energy

Sun as source of energy: Nuclear fusion on sun, Solar spectrum, solar radiation – absorption, reflection, scattering and diffusion in the atmosphere, Albedo, Measurement of solar radiation, Harnessing of solar energy, Solar collectors and concentrators, Solar thermal energy, Solar electricity generation, Solar heaters, dryers and cookers; Photovoltaic

b) Biomass Energy

Biomass composition and types; Conversion processes – pyrolysis, charcoal production, compression, gasification and liquefaction; Energy plantation;

Biogas – production and uses, anaerobic digestion; Types of digesters, Environmental constraints; Energy from solid wastes - Sources, types, energy production

Unit- 3

(15)

a) Energy from water:

Principles of generation of hydroelectric power, hazard related to hydropower generation and distribution, environmental impacts, Energy from oceans- OTEC, Tidal energy, wave energy.

b) Wind Energy:

Wind power, Harnessing of wind energy, Power generation – wind mills, concentrators, wind characteristics and siting, environmental considerations; Wind energy potential in India.

Unit- 4

(15)

a) Geothermal energy:

Sources – crust, high temperature aquifers, low temperature aquifers, reserves; Harnessing of geothermal energy – problems and prospect; Geothermal energy prospect in India.

b) Nuclear energy:

Fission and fusion, Nuclear fuels, – Mining and processing of Uranium –concentration, refining, enrichment, fuel fabrication and fuel cycle; Nuclear reactors and radioactive waste; Magneto Hydro Dynamic (MHD) power generation, Fuel cells.

References:

1. Remote Sensing and GIS - M. Anji Reddy.
2. Environmental Remote Sensing - F. Mark Danson.
3. Principles of GIS for Land - Burrough P.A. Resources Assessment.
4. Renewable Energy Environment and Development, Maheswar Dayal Konark Publishers pvt. Ltd.
5. Renewable Energy Programmes in India: some recent developments, Sinha P.C., Natural Resource Forum, 18 (3), 1994.
6. Renewable Energy Resources: Basic Principles And Applications Tiwari, G.N., Narosa Publishing House.
7. Conventional and Non-conventional Energy sources G. D Rai.

CC-302 Environmental Toxicology and Nanotechnology

Students are able to

CO1: Classify the sources of toxicants in the environment.

CO2: Aware the concepts in Environmental Nanotechnology.

CO3: Understand the fate of toxicants and transport of toxicants in food chain.

CO4: Know the dose response relationship of toxicants.

Syllabus

Unit – 1

a) Introduction to Environmental Toxicology (15)

Definition, classification, Sources of toxicants in environment, Evaluation of toxicity, Bioassay, factors affecting toxicity, mutagenesis, spermatogenesis, carcinogens, hallucinogens, phyto-toxins, animal toxins.

Unit – 2 (15)

a) Ecotoxicology

Principles of toxicology, Nature of toxic effects, Acute and Chronic, Toxic substances in the environment, Industrial toxicants and hazardous materials, Routes of toxicants to human body – entry through inhalation, skin absorption, indigestion and injection; Response to toxin exposures -Dose response, Frequency response and cumulative response; Lethal and sub-lethal doses.

b) Analysis of NOEL, LD 50, LC 50 and MLD; Detoxification in human body - detoxification mechanisms, organs of detoxification, Effects of heavy metals and pesticides, Ecosystem influence on the fate and transport of toxicants by air and water; Transport through food chain - bio-transformation and bio-magnification

Unit – 3 (15)

Environmental Nanotechnology:

Overview - Definition, Historical perspectives, Scope, Environmental applications

Types, Structures of Nanomaterials:

Different types of nanomaterials: Silver, Gold, Zinc, Iron, Silica, Titanium, Carbon-based nanomaterials, metal oxide nanomaterials; nano-membranes, nano-wires, nano-needles, nano-cones, nano-rods, nano-combs, nano-walls

Synthesis and Characterization of Nanoparticles: Basics of nanoparticle synthesis techniques (Chemical, Physical and Biological synthesis); Functionalization of nanoparticles
Techniques for characterization: UV-Visible Spectrophotometry, Scanned electron microscope (SEM), Transmission electron microscope (TEM), X-ray diffraction (XRD)

Unit – 4

(15)

Environmental Nanoremediation:

Definition, current applications of nanotechnology for environmental clean-up such as use of non-zerovalent iron (nZVI), bimetallic nanoparticles, titanium dioxide Nano membranes, carbon nanotubes for wastewater, groundwater and soil remediation;

Implications of Environmental Nanotechnology: Risks associated with nanomaterial applications to human health and ecology; Environmental protection laws, rules and regulations to prevent hazardous impact of nanotechnology; Solutions and alternatives.

References:

1. Environmental Sanitation, Ehlers, V.M., add Steel, E.W., McGraw-Hill Book Co., Inc.
2. Toxic Chemicals, health and the Environment, Lave, L.B and Upton, A.C. 1987. The Hopkins Press Ltd., London.
3. Basic Environmental Toxicology, Lorris G. Cockerham and Barbara S. Shane, CRC Press.
4. Introduction to Environmental Toxicology Wayne G.Landi Ming-Ho Yu.
5. Patty's Industrial Hygiene and Toxicology, Ed.by Lewis J.Cralley, Lester V. Cralley, James S. Bus.

DSC-301 a) CLIMATE CHANGE AND CURRENT ISSUES

Students are able to

CO1: Understand the concept of greenhouse effect, enhanced greenhouse effect and climate change

CO1: Aware about the impact of climate change at various levels such as, local, regional and global.

CO2: Understand the mitigation techniques for sustainable future.

CO3: Design for the adaptation strategy for vulnerable sectors

CO4: Understand the global scenario about climate change and its politics

Syllabus

Unit – 1

(15)

a) Introduction to climate change

Origin and evolution of the earth's atmosphere. Atmospheric Chemistry; Overview of key concepts – weather and climate; Climatic classification – Koppen's climatic classification;

b) **Climatic variability** - temperature, rainfall, wind speed & direction. El-Niño, La Nino and their impacts. Effect of various anthropogenic activities on earth's atmosphere.

Unit – 2

(15)

a) **Greenhouse Effect:** Global warming and greenhouse effect – major greenhouse gases, sources and sinks of greenhouse gases; global warming potentials of GHG's, CO₂ equivalents, CO₂ emissions and the Earth's carbon reservoirs Urban Heat Islands; Ozone layer depletion, issues and advance research to protect the Ozone layer and consequences; ground level ozone and air pollution;

b) Impact of Climate change:

Climate change impacts on: fresh water resources-surface and groundwater, drought and soil moisture, wetlands, glaciers melting, terrestrial ecosystem-geographic shifts in terrestrial habitats, vegetation-climate interaction, loss of biodiversity, agriculture and food supply, marine environment- sea level rise, ocean current and circulation, ocean acidification, coastal lives, marine ecosystem. Carbon footprints, Tipping points: ice sheet collapse, large-scale coral reef die-off, changes in Atlantic Ocean circulation, etc.

Unit – 3

a) Climate change Mitigation strategies:

Climate change mitigation: concept and methods, Sources identification, Emission reduction, Energy efficiency, Science based targets, Net zero, Carbon neutrality, Use of renewable energy, nuclear energy Carbon pools, Carbon sequestration: vegetation, soil, ocean, Carbon Sinks

(15)

b) Climate change and policy frameworks – History of international climate change policies. United Nation Framework Convention on climate change (UNFCCC) – Key provisions of the UNFCCC, its structure, and different party groups under the convention - Annex I, Annex II and Non Annex I countries. The Kyoto protocol and its associated bodies. Overview of Conference of Parties (CoP). Main climate change negotiations evolved over the past years and highlights of some key issues relevant to future climate change regime.

Unit – 4

(15)

a) Adaptation strategies:

Adaptive capacity, adaptation to climate change, zero carbon future, temperature stabilization, vulnerable sectors, vulnerable communities, Resilience building,

b) National climate initiatives and Sustainable development goals:

MoEFCC, nationally determined Contributions (NDCs) under Paris agreement, National Action Plan on Climate change: National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining the Himalayan Ecosystem, National Mission for a Green India, National Mission for Sustainable Agriculture, National Mission on Strategic Knowledge for Climate Change

References:

Abhishek Tiwary and Jerem Colls, 2010. Air Pollution: Measurement, Modelling and Mitigation. III Edition, Routledge Publication.

2. Dey.A.K. 2005. Environmental Chemistry, V Ed., New Age International Publishers.

3. Donald Ahrens.C. 2008. Essentials of Meteorology: An Invitation to the Atmosphere. Cengage Learning publication.

4. Frederick K. Lutgens, Edward J. Tarbuck. 1995. The atmosphere: an introduction to meteorology. Prentice Hall publication.

5. IPCC. 2006. Guidelines for National Greenhouse gas Inventories. Published by the Institute for Global Environmental Strategies (IGES), Hayama, Japan on behalf of the IPCC.
6. John E. Oliver, John J. Hidore. 2002. Climatology: An Atmospheric Science, Second Edition. Prentice Hall publication.
7. John T. Hardy. 2003. Climate Change: Causes, Effects and Solution. John Wiley & Sons publications.
8. Jonathan I. Lunine, Cynthia J. Lunin. 1999. Earth: Evolution of a Habitable World. Cambridge University Press. Great Britain.
9. Nicholas Stern. 2008. The Economics of Climate Change: The Stern Review. Cambridge University Press. Great Britain.
10. Pal Arya.S. 1998. Air Pollution Meteorology and Dispersion. Oxford University Press.
11. Agarwal K.M, Sikdar P.K. and Deb S.C. 2002. A text book of Environment – MacMiller India Ltd., Calcutta
12. Tyler Miller Jr. Living in the Environment – Principles, Connections and Solutions.

DSC-301 b. Global Environmental Issues

After completion of the course, the students are able to

CO1: Get acquainted with the scope and multidisciplinary nature of environmental science.

CO2: Familiarise with the global environmental issues and Climate change.

CO3: Get acquainted with National & Global Environmental Initiatives.

CO4: Understand the basics of environmental education.

Syllabus

Unit -1

a) Introduction to Environmental Science: (15)

Meaning, scope and interdisciplinary nature of Environmental Science, Principles, background and scope of Environmental Science, Applications of Environmental Science, environmental ethics, Environmental consciousness, Western and Eastern views

b) Environmental Education

Environmental Education: history, concept, goals, objectives and guiding principles, Strategies for EE development, Models for future EE System, Awareness and action through environmental education.

Unit- 2 Global Warming and Climate Change: (15)

a) Global warming: introduction, greenhouse gases, greenhouse effect, Global warming, possible impacts of global warming,

b) Climate Change: Climate change and Clean Development Mechanism, Carbon Sequestration, Concept of Carbon trading and Carbon credits.

Unit -3 Ozone problem and other environmental problems: (15)

a) Ozone in the atmosphere, Ozone depletion process, Ozone hole, Consequences of Ozone depletion.

b) Acid rain, Biodiversity loss, Desertification: causes, effects and remedies, El-Nino, La-Nina, Impacts of El-Nino.

International Initiatives towards Environmental Protection: Stockholm Conference, Earth Summit, World Summit on Sustainable Development, Rio+20, Ramsar Convention, Vienna Convention, Montreal Protocol, Kyoto Protocol; Sustainable Development Goals; Eco-mark Scheme

References:

1. Environmental Science - Arms Karen, Holt McDougal, 1996.
2. Principles of Environmental Science-Watt, K. E. F. (1973) McGraw-Hill Book Company.
3. Environmental Science –Noble, B .J. Kormandy, E.J.(1981),The way world works, Prentice-Hall Inc., N .J.
4. Environmental Science-Turk A., Turk J. Wittes J.T. and Wittes, R.E.
5. Environmental Issues: Measuring, Analyzing, Evaluating, Abel, Daniel C. McConnell, Robert L. Abel, Daniel C. Edi. 2 Prentice Hall Publication.
6. Environmental Science, S.C. Santra, New Central agency Pvt. Ltd.

CC-401 Environmental Impact Assessment and Environmental Audit

After completion of the course, the students are able to

CO1: Understand the concept of Environmental Impact Assessment

CO2: Bring in to light the procedure of Environmental Impact Assessment for various category projects

CO3: Aware the importance of Environmental Audit with its procedure.

CO4: Bring in to light the procedure of Environmental Impact Assessment for various category projects

CO5: Aware the importance of Environmental Audit with its procedure.

Unit 1:

a) Introduction to EIA:

Concept of EIA within the frameworks of sustainable development, History of EIA , EIA – Definition, and Objective/purpose , Reasons for using EIA ,Core Values of EIA – Comprehensive study, sustainability integrity and utility, The Eight Guiding Principles of EIA

b) EIA Policy and Legislation in India

Prevailing EIA notification and important provisions under the same e. g. a) terms of reference, b) categorization of projects, c) public hearing/consultation procedure, d) validity of terms of reference, environmental monitoring, public hearing, and environmental clearance, etc.

Unit 2:

a) EIA processes:

Screening Procedure (as per prevailing EIA notification) including project lists for screening, Other types of Screening, Criteria for determination of the need for, and level of EIA, Purpose of Scoping , Approaches to Scoping , Scoping Methods: Adhoc, Checklist, overlay mapping, network, simulation and modelling technique, matrix method , EIA Terms of Reference

b) Baseline Environmental data collection: methodology

a. Ambient Air Quality b. Water including ground and surface c. Soil Conservation d. Noise and Vibrations e. Hydrology, f. Geology g. Ecology and Bio-diversity h. Socio-Economic environment i. Traffic and other data

Unit 3:

a) Impact Analysis/Assessment, Mitigation and Management

i. Impact Identification ii. Impact Analysis/Prediction: methodology iii. Characteristics of Environmental Impacts - Activity – Impact Characterisation iv. Social Impact Assessment

(SIA): introduction and methodology v. Evaluation of Impact Significance vi. Significance Criteria

Impact assessment for:

- a. Land Use b. Air Pollution Monitoring, Prevention and Control c. Meteorology, Air Quality Modelling and Prediction d. Water Pollution Monitoring, Prevention and Control e. Ecology and Bio-diversity f. Noise and Vibrations g. Socio-Economic h. Hydrology, Groundwater and Water Conservation and Geology i. Soil Conservation j. Risk Assessment and Hazard Management
- k. Solid and Hazardous Waste Management

Public hearing: an important step in EIA

- a. The Process b. Notice of Public Hearing c. Supervision and presiding over the hearing d. Proceedings e. Time period for completion of public hearing f. Arguments for and against public involvement

b) Final Appraisal of project

- a. Grant or Rejection of Prior Environmental Clearance b. Validity of Environmental Clearance
- c. Post Environmental Clearance Monitoring

Documentation of EIA

- a. EIA report / report writing - Typical Elements of an EIA Report (as per prevailing EIA notification)
- b. Case studies: for EIA report a) coal based thermal power plants, b) cement, c) infrastructure such as road/highways, construction of dam, d) sugar, e) distillery

c. Impact assessment statement

d. Environmental Management Plan

- e. Post Project monitoring-

Unit 4:

Environmental Audit

Definition of environmental audit and its importance for industries. Environment Compliance Audit. Basic structure of audit. Elements of an audit process and its importance with respect to Form-V. Environment Audit in India – Development of environmental auditing in India, Concept of ISO 14000, requirements of Rule 14 for environmental audit under Environmental Protection Act, 1986. Definitions –signatory, consumption audit, pollution audit, hazardous audit, solid waste audit, disposal audit, cost audit, investment audit, voluntary

References:

- 1. EIA notification published by Ministry of Environment, Forests and Climate Change, Government of India

2. Environmental Impact Assessment, Canter R.L., McGraw Hill International Edition.
3. Environmental Impact Assessment: Practical Guide for Professional Practices by Rath AKA, Publisher: Gujarat Akar Unlimited, 2016
4. Environmental Impact Assessment, Canter, L.W., 1977, McGraw Hills, New York.
5. Environmental Impact Assessment, Peter Wathern, Unwin Hywin, London
6. Environmental Impact Assessment, P. R. Triwedi, APH Publishing Corporation, New Delhi
7. A Handbook of EIA, V.S. Kulkarni, S.N. Kaul and R. K. Trivedi, Scientific Publication (India).

CC401 - Environmental Laws, Environmental Management System and Life Cycle Assessment

Students are able to

CO1: Familiarise with the international treaties and agreements for environmental conservation.

CO2: Recognise the role of National Green Tribunal, MoEFCC CPCB, SPCB for environmental management.

CO3: Aware about the legislative provisions for environmental protection.

CO4: Understand the concept of Environmental Management System

CO5: Recognise the concept Life Cycle Assessment

Syllabus

Unit – 1

a) International Environmental Policies Agreements and Treaties (15)

Stockholm Conference (1972), Rio Conference (UNCED, 1992), Agenda 21. Johannesburg treaty, CITES, Basel convention, Montreal Protocol, Kyoto Protocol, COP under UNFCCC, Ramsar Convention

b) National Policies on Environment: National Green Tribunal, MoEFCC, CPCB and SPCB and their role in environmental protection

Unit – 2

a) Environmental Legislation (15)

Article 48(A), fundamental duties of citizen, Art. 51A (g) directive principles of state policy, The Water (Prevention and Control of Pollution) Act, 1974.

The Air (Prevention and Control of Pollution) Act, 1981.

The Environment (Protection) Act, 1986,

The Environmental (Protection) Rules, 1986 (as amended to date),

Sec. 12 of Mining Act, 1952.

The Forest (conservation) Act, 1980, The Wildlife (Protection) Act, 1972,

The biodiversity (Protection) Act, 2002

Coastal Regulation Zone (CRZ) Notification (as amended to date),

The National Green Tribunal Act, 2010,

Hazardous Waste Management Rules, 2016

Unit – 3 Environmental Management System (15)

Environmental Management Systems Definition and scope, Goals and purposes of EMS, Planning, Implementation, Review and Improvement (Plan, do, check, act model), Benefits of EMS-

Environmental benefits, economic benefits, Costs associated with EMS ISO 14000 series of standards

Unit – 4 Life Cycle Assessment

Life Cycle Assessment Definition, Goals and purpose, Stages in product LCA, Procedure for LCA- defining the goal and scope, analyzing the inventory, assessing the environmental impact and evaluating the environmental profiles, LCA uses and tools, Variants of LCA- cradle to grave, cradle to gate, cradle to cradle, gate to gate, well to wheel, Benefits and limitations of conducting LCA

References:

1. Environmental Law and Policy of India, Diwan, S. and Rosencranz, A,2001, Oxford University Press.
2. Environmental Policy in India, Shekhar Singh, IIPA, New Delhi
3. Declaration of: The Stockholm Conference, Rio, Rio+5 and Rio +10
4. Our Common Future, WECD,1991
5. Universal Environment and Pollution Law Manual, S. K. Mohanty,1998
6. Legal Aspects of Environmental Pollution and Management, S. M. Ali,1992
7. Environmental management” Capital Publishing Bala Krishnamoorthy Vijay Kulkarni and T V Ramchandra.
8. “Environmental Management: text & case studies” PIH learning
9. ISO14001 standard for EMS

CC-403 Disaster Management and Industrial Safety

Students are able to

CO1: Familiarise the concepts of safety and health hazards in industrial and development projects

CO2: Get acquainted with the natural disasters like earthquake, volcanoes, tsunami, land Slides, etc.

CO3: Aware the different Strategies for mitigation disaster management.

Syllabus

Unit – 1: Environmental Disasters

(15)

a) Earthquake:

Causes of occurrences, consequences, measurement, distribution of earthquake in world and India, mitigation.

Volcanoes: Origin and types of volcanic activities, Volcanic belts; causes of occurrences, consequences, distribution in world and Indian subcontinent, mitigation. **Tsunami:** causes of occurrences, consequences, distribution in world, mitigation,

Landslides: Causes and types, human induced; Landslide prone areas in India distribution, rock/soil type, protective measures

b) Cyclones and Epidemics:

Cyclones – types -tropical and temperate, distribution in world and India, role in Indian subcontinent,

Storms - causes of occurrences, distribution in world, consequences, mitigation.

Epidemics - types and causes and major epidemics in India.

Unit – 2

(15)

a) Floods and Droughts

Floods – occurrences, Floodplains and Flood-Prone Areas; nature and frequency of flooding; urbanization and flooding; Flood hazard assessment - environmental effects of flooding, role of man and nature, Consequences, Mitigation.

Draught - reason of occurrences, draught prone areas in India and world, consequences, mitigation

b) Disaster management

Strategies for mitigation – warning system, forecasting, Emergency Preparedness,

Education and Training Activities, planning for Rescue and Relief works, National and state level planning for hazards mitigation, Engineered structure /structural strengthening techniques- Hazard zonation and mapping- Risk Reduction Measures.

c) Disaster management plan

Use of remote sensing in disaster management, Disaster management plan, Social and economic impacts of disasters.

Unit-3:

15

a) Health & Safety Management:

Occupational Health and Safety Management System,

Definition, goals, needs, Principles & Practices of industrial safety

Role of Management in Industrial Safety.

Safety Planning:

Definition, purpose, nature, scope and procedure

Strategic planning and tools of implementation. Employee Participation in Safety.

Industrial Safety Auditing & Safety Monitoring:

Concept & Importance of Safety Audit, Types of Safety Audit, and Standards on Safety Audit:

Health & Safety Monitoring: ISO 45001: 2018 (Occupational Health & Safety Management System)

b) OH & S Policy Formulation, Types of Accident & Accidents Prevention:

Leadership: Role, functions and attributes of a leader.

Leadership & commitment, Organizational roles, responsibilities and authorities, Concept of OH & S Policy, Policy formulation and implementation. Definition: Incident, Accident, Injury, Dangerous Occurrences, Unsafe Acts, Unsafe Conditions, Hazards, Near Miss Situations, Hazard Identification and Risk Assessment (HIRA), Accident Investigation, Cost of Accident- Direct & Indirect, Accidental Reporting, Emergency Evacuation Plan. Accident Prevention: Major Theories, Principles of accident Prevention

Unit – 4: Fire Safety Management:

15

Chemistry of fire, Factors contributing towards fire, Classification of fires. Common causes of industrial fires. Prevention of fire. Portable Fire Extinguishers (Water type, Carbon-dioxide Type, Foam Type, Dry Chemical Type Extinguishers, ABC type), Maintenance of Fire Extinguishers. Special Industrial fire detection and alarms. Sprinkler systems. Special safety precautionary measures for control of fire and explosion in handling/ processing flammable liquids, gases, vapours, mists and dusts etc. Fixed Fire Fighting Installations (Hydrant/ Sprinklers/ Major Foam pourer/ Steam Drenching/ CO2 flooding/ DCP spraying) Fire Emergency Action Plan,

References:

1. Environmental Hazards: Assessing Risk and Reducing Disaster Smith, Keith, Routledge Publication
2. Environmental Geology, K. Valdia, Tata McGraw Hill Publishing House
3. Lal D. S. Climatology, Parag Pustak Bhavan, Allahabad
4. Hillary, Sir Edmand, Ecology, 2000, The changing face of Earth, Multimedia Publication, 1984 disaster

DSE-401 Environmental Biotechnology

Students are able to

CO1: Introduce the role of biotechnology in Environmental Science.

CO2: Aware about the innovative practices bioleaching, bio-absorption and bioremediation.

CO3: Get aware with use of biotechnology in agro-industry and forestry.

CO4: Familiarise with use of biotechnology for industrial pollution control.

CO5: Understand the applications of genetic concept in environment management

Syllabus

Unit -1

(15)

a) Role of biotechnology in environmental science

Introduction to biotechnology, concept of environmental biotechnology, public perception of biotechnology.

b) Applications of some important technologies

Genetic engineering, Genetic concept in environment management, Concept of bio-safety, Fate of GEM'S in the environment, Role of biotechnology in conservation of species.

Unit- 2

(15)

a) Use of biotechnology in innovative practices

Concept of bio-leaching, methods of bioleaching, microorganisms involved, advantages and disadvantages of bioleaching.

Concept of bio-absorption, factors affecting bio absorption, mechanism of bacterial metal resistance, limitations of bio absorption.

Concept of bioremediation, microorganisms involved, bioremediation processes and technologies, landfill technologies

Cell immobilization as a tool in waste treatment, Techniques of cell immobilization, Advantages of cell immobilization, Environmental applications of immobilized cells.

Unit -3

(15)

a) Use of different technologies

Aerobic Vs anaerobic degradation, testing of biodegradability, Bio-oxidation of phenolic compounds, Bio-degradation of specific hazardous wastes, biodegradation of hydrocarbons.

b) Biotechnology in agro-industry and forestry

Plant biotechnology, biological control, Organic farming, Bio-fertilizers - types and production technology, Fermentation technology, Tissue culture, Animal biotechnology, applications of biotechnology in forestry, Concept of biofuel, advantages, production. Animal Biotechnology and its application, vermi-technology.

a) Microbial degradation of chemical pesticides.

Important micro-organisms in degradation of chemical pesticides mechanism of degradation of chemical pesticides and herbicides, concept and types of bio-pesticides and their significance.

b) Biotechnology for industrial pollution control

Application of biotechnology in wastewater treatment - Tanning industry, Distilleries, Dairies, Dye industries, Pulp and paper industry, sugar industry.

References

1. Introduction to Environmental Biotechnology, A. K. Chatterji, Prentice Hall of India Pvt. Ltd, New Delhi
2. Environmental Biotechnology-Basic Concepts and Applications Indu Shekhar Thakur, I.K. International Pvt. Ltd. New Delhi.
3. Environmental Biotechnology S.K. Agawal, APH Publishing Corp., New Delhi.
4. Elements of Biotechnology, P. K. Gupta, Rastogi Publishing House, New Delhi.
5. Environmental Biotechnology, Jogdand S.N., Himalaya Publishing House, New Delhi.
6. Biotechnology, B.D. Singh, Kalyani Publishers, New Delhi
7. Molecular Biotechnology- Principles and Applications of Recombinant DNA, Glick and Pasternak. Panima Publishing Corporation, New Delhi
8. A Text Book of Biotechnology, R.C. Dubey, S. Chand and Company Ltd., New Delhi.

