University of Pune
Department of Environmental Science
Syllabus for M.Sc.(Environmental Science) Part II from 2011-12

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 301: Environmental Impact assessment and Environmental Management

4 credits

1. Environmental Management: scope, importance, Objectives, Environmental Management tools, Environmental management system (EMS), Principles and elements, Preparation of Environmental Management Plans (EMS): Environmental management overview. Environmental management Issues and considerations. Environmental management systems (EMS) principles and elements. 8

2. ISO 14000 series: Background and development of ISO 14000 series. Developed and developing nations and ISO 14000 series. The ISO 14001 – Environmental management systems – standard. 8

3. Environmental Audit: Preamble, scope and objectives of environmental auditing, applicability of statuary, Environmental statement audit, contents of EA report, Requirements of Rule 14 for Environmental Audit under Environmental protection Act 1986, importance for industries; Concepts of a. Signatory, b. Consumption Audit, c. Pollution audit, d. Hazardous audit, d. Solid waste audit, e. Disposal audit, f. Cost audit, g. Investment audit, h. Voluntary audit. 10

4. Environmental Impact Assessment: Concept of carrying capacity, origin and development of EIA, Historical perspective & definition of EIA & EIS; Need of EIA; Scope, objectives; Negative & positive aspects & uncertainties in EIA; Impact factors, Collection of base line data for element of components (water, air, soil, noise, socio-economic etc.) of EIA; Types of environmental impacts, steps involved in conducting the EIA Studies, Environmental Impact Assessment techniques-Ad-hoc method, checklist method, overlay mapping method, network method, simulation and modeling technique, matrix method, system diagram technique, Merits and Demerits of EIA, Background of EIA, Need of EIA, EIA process, EIA Methodology, Baseline studies, assessment of Impact and management plan. 20

5. Public Participation : Methodology and approach for public participation in Environmental & development decision making, Regulatory requirements for public participation, Advantages and disadvantages of Public participation, Identification of participants and techniques for conflict management, Incorporation of results in decision makings. 6

6. Disaster management: Concept, Types of disasters: natural and manmade, Identification of possible causes of disaster, various natural and manmade disasters, preparedness for disaster, need of awareness about disaster, on site & off site management strategies, mitigation and protection measures, preparation of disaster management plan, The disaster management act 2005. **8**

EVS -302 : WATER AND WASTE WATER ENGINEERING 4 credits

1. Water Engineering 20

Water Demand: Calculation of Water demand for Domestic for rural and urban population, Commercial (Shopping complex, Hotels, Restaurant), Institutional (Schools, Hostels, Hospitals), Industrial (Dairy, Sugar, Pulp and paper etc.), Specific requirement at pilgrimage place and recreation activities. Impact of Future growth and development and change in quality of life on water requirement.

Water Sources and Water Quality: Availability and quality of Surface water (river, stream, lake and dam) and Ground water (Open well and Bore well). Types of solid (natural and manmade) in water and their impact on water quality. Water quality standards for domestic and industrial purpose, Specifications for drinking water

Water Treatment: Principle, Application and Designing parameters of the following unit operations Collection and Pumping, Aeration, flocculation, Sedimentation, Filtration, Disinfections (Chlorination, UV, Ozonization), Water Softening and Demineralization. Design of Water Treatment plant with selection of appropriate unit operations for the treatment and flow chart. Specific Water Treatment Fluoride and Iron Removal from water

2. Waste Water Engineering 20

Waste Water generation, Quantity and Quality

Sewage and Sullage generation from Domestic activities, Impact of Future growth and development and change in quality of life on sewage quality and quantity. Waste Water generation from the Industries (Dairy, Pulp and paper, Textile, Food processing, Sugar, Fertilizer and Automobile)

Quality of Waste water: Solids in waste water and the role of parameters e.g. pH, Suspended solids, Total dissolved solids (volatile and nonvolatile), nitrogen, phosphates, sulfides, sulfates, phenols etc. Role and interrelationship between Total organic carbons, Chemical oxygen Demand, Biological oxygen demand, Specification of treated wastewater for disposal into surface water, on land and for irrigation

Waste Water Treatment: Principle, Application and Designing parameters of following Unit Operation in wastewater treatment Physical - Equalization, Collection and pumping, Screen chamber Grit chamber, Oil and grease removal, sedimentation, Dissolved air

flotation, Chemical – pH adjustment (with acid and alkali), Precipitation, Biological-Principle, Role of microorganisms in biological treatment, suspended and attached growth, food to microorganism ratio, oxygen supply and oxygen demand in Aerobic process (natural, mechanical surface and diffuse aeration), ecosystem of each process given below Stabilization pond, Aerated lagoon, Activated sludge process, Trickling filter, Rotating Biological Contactor, Anaerobic treatment (conventional, complete mix and UASB etc).

3. Waste Water Treatment 20

Sewage Treatment: Generation, segregation and collection, of sewage, Design of Septic tank with Percolation Pit for small flow and Sewage Treatment plant for the large flow. Effluent Treatment for Dairy, Pulp and paper, Textile, Food processing, Sugar, Fertilizer and Automobile Source, quantity of waste water generated in the process, segregation of high strength and low strength waste effluent, quality of waste water and pollutants to be removed. Design with selection of appropriate unit operations for the treatment and process flow diagram

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Reference

1. Manual on Water Supply and Sewerage
2. Manual on sewerage and sewage Treatment
3. Ministry of Works and Housing, New Delhi
4. Waste Water Engineering, Met Calf and Eddy INC, Tata Mc Graw Hill
5. Physico- chemical; Process for Water Quality Control, W J Webber, Wiley Inter-science
6. Waste Water Treatment for Pollution control, Dr. Arceivala, Tata Mc Graw Hill
7. Indian Standard for Drinking Water, BSI, New Delhi
8. India Standards for Sewage Disposal, BSI, New Delhi
9. Disposal of Municipal waste, House Report No. 2012, Report by Sub Committee on Govt. Operation. House of representative March 24 19965 UK
10. Water Supply and Sanitary Engineering, Birdie G. S., Dhanpat Rai and Sons, New Delhi
11. Principle of water Quality control, T H Y Tebbut, Pergamon Press
12. Waste Water Treatment Plant Design 1977, A manual of practice, Water Pollution Control Federation
13. Water Works Engineering, Planning Design and Operation, Syed R. Quasim etal, Prentice Hall of India P L.
14. Sanitary Engineering by Hussain,S.K.Garg.

EVS 303 Restoration Ecology 4 Credits

1. Restoration Ecology: Definition, Scope, Methods & techniques, Scale & situations in which Restoration approach is appropriate, Comparison with the approach in conservation Biology. 7

2. Application of community ecology & population ecology in Restoration of degraded ecosystem, Process of primary & secondary succession and its role in Restoration Ecology. 10
3. Soil Ecology and its impact on terrestrial habitats, Restoration of degraded/disturbed soil ecosystem, Bioremediation techniques: Phytoremediation & Microbial Remediation. 7
4. Restoration ecology & Aquatic Ecosystems: Causes & consequences of degradation of freshwater & marine wetlands, Techniques for restoration of aquatic habitats(e.g.rivers,lakes,estuaries mangroves) 6
5. Re-establishment of Terrestrial and Aquatic Fauna. Population Ecology of endangered species in relation to its habitat & related communities. Predator – prey-vegetation dynamics in a habitat. 7
6. Restoration Strategy for Natural Resources: Causes and types of degradation of terrestrial resources (e.g. range land forests, mine spoils etc.) and aquatic resources (e.g. riverine ecosystem, lakes, estuaries mangroves etc.); Approaches to restoration of degraded resources & their sustainable use. 9
7. Projects and Case studies: Management of ecological restoration projects. 5
8. Role of Local stakeholders, NGOs and Government Agencies along with sponsoring bodies (corporate sector, international agencies and others) in ecological restoration projects, Conservation Education as a tool in eco-restoration projects. 9

References

1. Restoration ecology: Jelte van Andel, James Aronson
2. 2. Restoration ecology, William R. Jordan, Michael E. Gilpin, John D. Aber – 1990
3. Fundamentals of Restoration ecology,Donald A. Falk, Margaret A. Palmer, Joy B. Zedler – 2006
4. Restoration Ecology: Ecosystem, Society for Ecologica, Lambert M. Surhone, Miriam T. Timpledon, Susan F. Marseken – 2009
5. Restoration ecology and sustainable development, Krystyna M. Urbanska, Nigel R. Webb, Peter J. Edwards

EVS 304 Environmental Pollution and Control II 4 Credits

AIR POLLUTION

Atmosphere and its functions: The evolution of atmosphere, the components of air; characteristics and properties**,** temperature structure and atmospheric regions, pressure, density and mixing ratios**,** air, land, sea interactions 8

Atmospheric dynamics: Stability, water (clouds, rain), turbulence, general circulation 8

Air pollution: Definition, classification, sources, atmospheric reactions and formation of secondary pollutants 6

Air pollution meteorology: Effects of meteorological parameters on transport and diffusion of air pollution, effect of air pollution on climate 6
Ozone layer depletion and Green house effect 4

Air quality management: Air monitoring, air quality criteria, standards, air quality management in India 2

Air quality legislation 2

References:

1. Air pollution by Ashok Kumar Srivastava.
2. Air pollution by Rao & Rao.
3. An introduction to Air Pollution by R.K. Trivedi and P.K Goel.
4. The Science of Air, Concepts and Application by Frank R. Spellman.

Radiation Pollution

1. Radioactivity and detection : Decay types, Kinetics of decay ,Various detectors used for detection : G.M.Counter, Scintillation counter 4
2. Radiation hazards and safety ; Natural and manmade sources of radiations, internal and external radiation hazards, safe handling methods, personal dosimetry, reactor safety, the effects of Three miles and Chernobyl accidents, radiation protecting materials. 4

3. Biological effects of radiations : The interaction of radiations with biological cells,various stages, somatic and genetic effects, maximum permissible dose-ICRP recommendations (4)

4. Management of radioactive waste: liquids, solids and gases (4)

References

1. Essentials of Nuclear Chemistry: H. J. Arnikar. New Age Publication Ltd. (1995).
2. Source Book of Atomic Energy, S. Glasstone, D. Van Nostrand (1967)
3. Environmental Chemistry B.K.Sharma Goel Publishing house

Noise Pollution

Noise : definition, measurement, frequency analysis Noise sampling, sources of noise, impacts of noise, control of noise pollution: various techniques, control in the transmission path, documentation of noise measurement, regularatory guidelines, Application in EIA studies (8)

References

1. Industrial Safety and Pollution Control Handbook, Associate (Data) Publishers Pvt., Secunderabad, 1991 ed.
2. Muralikrishna, K V S G, Air Pollution and Control, Kaushal & Co., Kakinada, AP, 1995
3. Rao, P.R., Noise Pollution and Control, Encyclopedia of Environmental Pollution and Control, Vol.-2, Environmedia Publications, India, 1995 ed.
4. Jeva, R. et al, Noise Impact Assessment - an approach, Energy Environment Monitor, Vol.: 12, September 96.
5. Mathur J.S.B., Noise Control : Methods of Reduction, Industrial Effluent Treatment, Vol. : 12, Applied Science Publishers Ltd., London, 1981 ed.
6. Franken A. Peter, Community Noise Pollution, Industrial Pollution, Van Noistrand Reinhold Company, New York, 1974 ed.

EVS 305 PracticalsIII 6 Credits

1.Determination of SOx and NOx by spectrophotometry
2. Determination of particle size using respirable dust sampler
3. To study effect of distance on radion dose
4. Determination of PM 2.5 using fine particle sampler
5. Counting errors
6. Variation of dose with distance
7. Measurement of noise
8. Designing of waste water treatment plant
9.Site visit to degraded landscapes/habitats-terrestrial and aquatic.
10.Visit to restored/managed habitats & study of their practices.
11.Introduction to contour marker
12.Field use of contour Marker for alignment of contour lines on the ground
13.Visit to watershed area, to study different characteristics of watershed preferably in rainy season
14.Visit to successful Watershed Developed areas

EVS 306 Summer training and seminars 3 credits

Summer training at Institute/University/NGO/GO

EVS 307 Environmental Economics 4 Credits

Environmental Economics: Definition, Concept of externality, Solutions to correct externalities green economics, neoclassical economics, money- 3

Ecological economics: Locating ecological economics,economy in the environment,environment in economics,science & ethics,Utilitarinism,sustainable development,ecological & neoclassical economics 3

Economics of Environmental quality:General model of target level of pollution, Abatement cost, Socially efficient level of emissions,MAC Curve to profit maximization- 5

Environment and trade: Perspectives of trade & environmental development, International environmental managementMultilateral environmental agreement,Structure of the world trade organization,Impact of economical linikages,Environmental standards & competitiveness. 5

Banking for the environment: Forest clearances & agricultural intensification,Environmental degradation,A case studies Economics of environmental degradation,Reduced economic viability,Environmental cost benefit analysis,Banking economics & environmental accounting,Institutional environmental impact assessments. Macroeconomic accounting, Macro economical Policy, Micro level Policy. 8

Environmental accounting: Environmental accounting disciplines, environmental management accounting, Environmental accounting modelLife cycle of accounting system,environmental performance indicators,Accountabilities environmental performance reports 6

Environmental cost accounting: Expanding base of cost accounting,Internal & external environmental lost,Internalising externalities,Full cost environmental assessment. 6

Economics of Pollution control: Methods for reducing pollution,Emission charges & standards command & control regulation,Pollution rights,Global level pollution control,Kyoto protocol 6

Integrating environmental economics: Rural development & sustainable agriculture,Agroecology,Watershed & water quality,Biological diversity,land use & land tenure,Urbanization & migration,Conservation methods,Pollution & waste products. 8

Guideline for performing economic analyses: Conducting economic analyses,Causes of market failure Regulatory & non-regulatory approaches,Baseline specifications,multiple rules & regulating measuring environmental policy,Performing sensitive analysis Welfare considerations,cross-cutting issues- 10

References

1. Environmental Economics : A critical review – Alan Gilpin, Wilety Publications
2. Environmental Economics_Madhumita Bishwas, Mittal Publications

EVS 308 Environmental Education ` 4 Credits

1. Introduction to Environmental Education **5**
    a. What is environmental education?
        i. History of environmental education
        ii. Industrialism and environmentalism

iii. Need for environmental education

b. Sustainable development
   i. Concept of sustainable development
   ii. History of sustainable development
   iii. Environmental education and education for sustainable development
c. Traditional methods of environmental education
d. Transition to modern methods of environmental education
e. Methods of education for sustainable development
f. Need for shift to education for sustainable development

2. Current problems in environmental education: 15

   a. Ecological point of view
   b. Systems point of view
   c. Human ecology
   d. Ecology and social development, consumerism
   e. Environment from ethical perspective
   f. Anthropocentric and non-anthropocentric environmental ethics
   g. Ecocentrism, anthropocentrism and egocentrism
   h. Environment from political perspective
   i. Environment from economic perspective

3. Landmarks in environment education **3**

   a. The Stockholm Declaration
   b. The Belgrade Charter
   c. The Tiblisi Declaration

4. Outdoor education and experiential learning **4**

5. EE for school in India: an overview **5**
   a. Primary school curriculum
   b. Secondary school curriculum
   c. Teaching methodologies in use
   d. Need for divergence from present methods

6. Methods of teaching **18**
   a. Environmental approach and educational philosophy
   b. Traditions within environmental education

c. Fact-based environmental education
d. Normative environmental education
e. Education for sustainable development
f. Environmental education from a democratic perspective
g. Pluralistic environmental education

7. Practical and field visits **10**

1. **Sustainable development and learning**: Framing the issues
   William Scott, Stephan Gough Route ledge Flamer Publication 2003
2. **The Sustainability Curriculum**: The challenge for higher education John Blewitt, Cedric Cullingford Earth scan, 2004
3. **Education for Sustainable Development**
   Papers in honour of the United Nations Decade for Education for Sustainable Development 2005-2014 Routeledge, 2009
4. **Education for Sustainable Development**: Nature, School and Democracy
   Klass Sandal, Johan Őhman, Leif Őstman Studentlitteratur, 2005
5. **Higher Education and the Challenge of Sustainability**: problematic,
   Promise and practice Peter Blaze Corcoran, Arjen. E. J. Wals Springer, 2004

ENV – 401 : Watershed Management

1. Concept of Watershed Management – Defination, Principle, Objectives, Benefits and causes of deterioration, Problem identification 4
2. Characteristics of Watershed- Delineation, coding, geomorphological characteristics external factors, linear aspect, arieal and relief aspect 4
3. Resource appraisal : Watershed Survey guidelines, data requirement, institutions and critical aspect, Resouce appraisal techniques resource map, Watershed Problems, techniques for appraisal of water resources. 4
4. Watershed planning; Need, level of planning, Planning for land use and soil conservation, planning for watershed protection, Planning for rural and integrated watershed development action plan preparation, Implementation of Plan monitoring, evaluation and follow up 5
5. Peoples Participation in Watershed development and management: rational factor; Incentives, People's organization, participatory Rural Appraisal, social institutes, Role of women. Administrative requirement, traditional and improved

governance 4

6. Community Based Approach: People's Participation, Social Institutions like Gram Panchayat, selfhelp Groups for Women, farmers, co-operative lift irrigations, Watershed Development Committee 3

7. Continuous Contour Trenching (CCT) for Watershed Development; Top to Bottom Approach, Principle of CCT; benefits of CCT 2

8. Land capability classification: objectives, role of soil characteristics, external factors, climatic factors, scheme for classification, characteristics of land classes, land use. 3

9. Watershed and environment: environmental assessment, monitoring parameters, environmental impact of watershed projects, environmental impact assessment, improvement in the environmental quality, environmental regeneration. 3

10. Watershed Management: Community based approach: People's participation, Social Institutions like Gram- Panchayat, Self help groups for women, farmers, small scale irrigation systems like cooperative and lift irrigation, Watershed Development Committees. 5

11. Hydrological process in watershed: hydrological cycles, precipitation, interception, infiltration, evaporation, evapo-transpiration, surface runoff, ground water-flow, concept of hydrograph, unit hydrograph, estimation Remote sensing for Runoff estimation, flood hydrograph, S- curve. 4

12. Soil erosion process: water erosion, factors, types, measurement and estimation of soil erosion due to water, wind, types, mechanism and estimation 4.

13. Conservation measures for aerable land: Objectives, functions, nala band, storage of harvested water, traditional methods, biological measures, contour farming, strip cropping, tillage practices, mulching, vegetative ridges, mechanical measures for water erosion control, counter bunds, graded bunds, terraces, vegetative waterways, diversion drains. 4

14. Conservation measures for non-aerable lands: contour trenches, staggered, continuous gully control measures, temporary structures, reclamation of ravine land, improvement of grasslands, and rehabilitation of mined lands, GIS based spatial analysis for site suitability evaluation for soil/water conservation. 4

15. Agricultural Practices in watershed: slope and agriculture, selection of crops, cost effective use of water in agriculture, Conservation of horticulture, conservation of forestry, improved practices, agro-forestry dry farming, livestock production, energy plants, sericulture. 4

16. Farming system in watershed: watershed based farming systems, crop-production technology, dry land farming, livestock production, energy plants, and sericulture, Runoff models. 4

References

1. Watershed Planning and Management, 2nd edition, Dr. Rajvir Singh, Yash publishing house, Bikaner, India.

2. Soil and watershed conservation Engineering, 2nd edition, R. Suresh –Standard Publication Distributors, Delhi.
3. Soil and water conservation Engineering, 4th edition, G. O. Schwab, etc- John Wiley & Sons
4. Manual of Soil and water conservation practices, ICAR, soil consv.Res.st. Dehradun, ICAR Pub, Agril Min, GOI
5. Recent Publications / Notes by Department of Agri. Maharashtra
6. Hydrology and Irrigation Engg by S.K. Garg
7. Soil and Water Conservation Engg by Srinivasan
8. Principles of GIS by Burronghs

EVS 402 Industrial Safety and toxicology 4 Credits

Industrial Safety: Safety management: General principles of safety management; need for safety humanitarian; economics, legal and social consideration of industrial safety; role of management in industrial safety; safety managementprinciple and practices. 10
Safety and Housekeeping: Typical accidents due to poor housekeeping; disposal of scraps and other trade wastes; Prevention of spillage; marking of aisles. Space and other locations, use of colors as an aid for good housekeeping. Housekeeping contest. 5

Inspection and checklist. 15
a) Ventilation and heat control:
Purpose, physiology of heat regeneration. Thermal environment and its measurement. Thermal comfort. Heat stress indices. Natural and mechanical ventilation. Engineering control methods.
b) Noise and vibration
Effect of noise, measurement and evaluation of noise. Noise isolation, noise absorption techniques, silencers, control of noise. Vibration effect, measurement and control by vibration damping.
c) Hazards identification techniques:
Hazard analysis – inductive deductive. Fault tree analysis, event tree analysis
d) Factors contribution towards Fire:Chemistry of fire, Classification of fires, Common causes of industrial fires.Determination of fire load, Major industrial disaster –case studies. 10
e)Toxic chemicals and their effects. 20
1) Environmental effects
2) Biochemical effects
-Toxic metals (Cadmium, Mercury, Chromium etc.) and environmental issues.
-General safety methods to be adopted for overcoming toxicity problems.
-Hazards in storage, handling and use of chemicals.

Reference Books:
1. Toxic metals and environmental issues by Dr.V.P.Singh

2. Industrial safety and Pollution control Handbook , By National safety council publication.

EVS 403 HAZARDOUS WASTE MANAGEMENT 4 Credits

1. Classification and Rules and Regulation 15

Definition of Hazardous waste and its classification as per the Hazardous waste Management Rules 1989, Characterization of hazardous waste, Domestic and Industrial Hazardous waste generation. National and International Rules and regulation to avoid dumping of solid waste, Impact of Hazardous waste on the surrounding environment. National Waste information program, illegal dumping and remediation, Awareness program

2. Handling Treatment and Disposal of Hazardous 15

Collection Storage and Safe handling, Transportation of Hazardous waste, Various alternative methods like Recycling, Solidification with Portland Cement, Neutralization by converting to non hazardous form, , Heat Treatment – Incineration, destruction or waste to energy. Pyrolysis, Hazardous Land Fill,

3. Reduction in Hazardous waste Generation 15

Better housekeeping including the inventory and safe custody of hazardous waste, Waste Avoidance and Waste minimization, Adopting the green process, Recycling the Hazardous waste in the process or elsewhere (Non ferrous waster like Brass and zinc dross), Specific studies on E waste and Biomedical waste, Mercury and Arsenic Bearing waste, Expired drugs and pesticides and insecticides, battery (acid and lithium)

4. Common Storage, Treatment and Disposal facilities. (15)

Protocol for Performance Evaluation and Monitoring of the Common Hazardous Waste Treatment Storage and Disposal Facilities including Common Hazardous Waste Incinerators as per State and Central Pollution Control Board, Rules and the guidelines applicable for development and operation of the common hazardous waste treatment, storage and disposal facilities, Criteria of Hazardous waste landfill, Specifications for liner and cover at dumping site, Monitoring methods Performance evaluation of the Incinerator and landfill. Study tour to the site near Pune

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References

1. Environmental Impact Assessment, L W. Cannter, Mc Graw Hill Publication, New York
2. Proceedings Indo-US Workshop on Environmental Impact Analysis and assessment (1980), NEERI, Nagpur
3. Environmental and Social Impact assessment, Vanclay F, Bronstein DA (1995), John Wiley and Sons, New York.
4. www.mpcb.gov.in
5. Publication of Environmental Information center, NEERI, Nagpur

6. 2nd World Congress on Engineering and Environment 1985, Institution of Engineers
7. Household Waste Management in Europe, Economics and Techniques, A Bridgestone and K Lidgren
8. Van Nosterand Company

ENV 404: Environmental law, rules and regulation 4 credits

1) **International Environmental Laws and Policies:** Evolution and development of International Environmental laws with reference to Stockholm Conference and its outcome, Nairobi Declaration, Rio Conference, Rio+5 and the Rio+10, etc.; Role of UN authorities, Multinational authorities and agreements in protection of Global Environment, future of International laws; International Agreements and Treaties: Concept of agreement and treaty, Need of international agreements and treaties, Johannesburg treaty, GAAT and Environment, CITES, Montreal Protocol. **15**

2) **Environmental Policies in India:** National Environment policy, National Committee on Environment and Planning (NCEP), Tiwari committee, Establishment of MoEF, National Forest Policy, National Water Policy and National Energy Policy, Policies Since the Mid – 1980s, Forest policies, Liberalization and Economic Approaches. 8

3) **Constitutional and legislative provision:** Constitutional Provision and the Environment: Fundamental of norms, Division of Legislative authority, The forty second Amendment Act, The directive Principles of State Policy, Article 253 and Environmental Legislation, Fedralism. 7

4) **Anti pollution acts in India:** Objectives of the Anti-pollution Acts, CPCB and SPCBs, Water Act 1974, Air Act 1981, Environment Protection Act 1986, Noise pollution Act, Mining Act 1952, The Forest (conservation) Act, 1980, The Wildlife (Protection) Act, 1972, The Biodiversity (Protection) Act, 2002, Factories Act, Motor Vehicle Act, Hazardous Waste legislation for pollution abatement, The Energy Conservation Act, 2001; Municipal Solid Waste (Management & Handling) Rules, 2000. 12

5) **Environmental Legislation related to CRZ, PIL:** Concept and need of public interest litigation, jurisdiction of High Courts and Supreme Court; Need of CRZ rules for regulation the activities in coastal zone, Statutory provisions in IPC and CRPC, common law remedies for environmental safeguard, Environment related provisions in Public Liability Insurance Act. **8**

6) Environmental Protection and Fundamental rights:: Right to wholesome environment, The rights to livelihood, The Rights to Equality, Freedom to Trade Vis-à-vis Enviromental Protection 5

7) Judicial remedies and procedures: Tort laws, Damages and Injunction; nuisance, Negligance, Strit liability and Absolute Liabilirty ;Public Noisiance;Freedom of Information and the right to know 5

EVS 405 Project **7 credits**

Dissertation based on Research Work

EVS - 406: ADVANCED TREATMENT PROCESS **4 Credits**

Advance Treatment Unit Process for waste water treatment

1. Physical Unit Process, Application, process and design parameters for 15

Activated carbon filtration for color and odor removal, Ultra filtration, Reverse osmosis Electro-dialysis for removal of colloidal and dissolved solids. Tubular and parallel plate separator, Dissolved air flotation, Chemical unit process. Precipitation with Alum, lime and ferrous sulfate for removal of Phosphates, Iron and heavy metals etc. Chemical oxidation with peroxide, and ozone for reduction in COD and color removal

Biological Process: Wetland Treatment- Root zone Cleaning System, Activated Sludge Process – Moving Bed Bioreactor, Membrane Reactor with submerged membrane, Cyclic Reactor, Nitrification and De-nitrification by aerobic and anaerobic process. Use of biological process for the removal of toxic chemicals like cyanides, phenols heavy metals etc. Recycling of Treated sewage after Tertiary Treatment Plant including flocculation, filtration

2. Advance Solid waste management 10

Sludge handling, Dewatering of sludge generated from the Industries, and waste water treatment plant by filtration (thickener, drum, belt and vacuum filtration, decanters)

Solid waste management Segregation as recyclable, biodegradable and non biodegradable solid waste, Composting (conventional and vermicomposting), Bio-mecthanization, Pyrolysis and Incineration for energy recovery, briquetting for Refused derived fuel.

3. Recycling Reuse and Recovery 20

Introduction to 3 R principle to convert waste into wealth Assimilative and supportive capacity of nature Different methods of 3 R principle to convert waste into wealth Prohibitive factors for implementing 3 R techniques Cost benefit analysis of 3 R principle, Use of waste water for irrigation (Specifications of waste water for irrigation, soil and crop selection, preventive measures and health aspects.)

Reuse of sewage in Residential complexes. Biogas recovery from high strength waste (whey, spent wash, black liquor). Soda recovery in Pulp and paper mills

Recovery of metals in electroplating, Recovery of ammonia in urea manufacturing, Recovery of plastic, paper and metal from MSW. Zero discharge technology based on 3 R principle for Pulp and paper industry. Cluster of industries based on waste products (Sugar cane processing), Case Studies. Zero discharge of solid waste from residential complex

4. Advance pollution control with respect to the followings 15

Reduction in water consumption, Discharge of pollutant from different unit operations and waste water flow, In-plant control for waste reduction, Green process as alternative route, Segregation of high strength and toxic waste water streams, Reuse of waste water, Recycling of waste water, Recovery of the pollutant as values added products.

Following specified industries are to be studied as per guidelines given above-

Sugar and molasses based alcohol Industries.Veg and chrome tannery small and medium scale. Dairy with Dairy products like butter, Ghee, Cheese, Ice-cream etc. Large scale Steel Plant, Galvanizing Textile (Cotton and Viscose), Oil refineries, Food Processing unit (Mango pulping, Soft drinks, Meat processing), Pharmaceuticals (Bulk drug manufacturing)

Reference

1. Waste Water Engineering, Met Calf and Eddy INC, Tata Mc Graw Hill
2. Liquid Waste of Industry Theory, Practice and Treatment, Nelson L. Nemerow, Adison Wesley Publishing Co.
3. Treatment of Industrial Effluent, A B Callely, D A Stafford
4. Industrial Water pollution Control, W. W. Wesley, McGraw Hill Publication
5. Industrial Pollution Control issues and technology, Nancy J Bell, Elsevier Scientific Publishing Co.
6. Industrial Waste water management, Studies in Environmental Science – 5, Elsevier Scientific Publishing Co.
7. Pollution Control in Metal Finishing
8. Studies in Environmental Science – 5, Elsevier Scientific Publishing Co
9. Industrial Effluents, N M Manivaskan, Sakthi Publication
10. Household Waste Management in Europe, Economics and Techniques, A Bridgestone and K Lidgren
11. Van Nosterand Company
12. Proceeding National Workshop on Microbial Degradation of Industrial Waste – 1981, NEERI Nagpur

13. Journals of Indian Environment Society, Indian water Works, Journal of Environmental Health.

EVS - 407: MAN AND ENVIRONMENT **4 Credits**

1. Impact of Growth on the Environment 15

Historical background to know the adverse effects of Lack of Environmental Planning, Importance of assimilative and supportive capacities of Environment for growth, Role of Environmental planning to safe guard Resources and to have balance eco-system, Importance of Baseline Environmental status (Water, Soil, Air, Natural assets, Demography, Heritage, Meteorology) , Important Concepts and parameters for planning from grass root to the National level protect the Environment Major issues of Growth e.g. socio-economic and demographic factors, Industrial and business growth Pattern, accessibility to Natural resources and exploitation pattern , Transportation and accessibility, Human resources, social behavior, economical status and aspiration for growth, Change in quality of life e.g. Rehabilitation and resettlement, waste generation treatment and disposal, restoration of the harmed ecosystem.

2. Local, Regional, National and International Issues of Planning 15

Importance of Critical review of Plan with respect to local, regional and Immediate and long term gains and Effect of Development. Need to define role of an Individual and society in the development. Involvement of local people in development plan prepared for the area. Case study of proposed Thermal Power Plants in Konkan, Comparison between exploitation and safe guard for conservation, rate of utilization and regeneration, natural and manmade growth, survival need of mankind and protection of environment. Integration of development with carrying capacity of Environment Interrelationship and Role of import of Resources and export of finish product on the growth, Conceptual thinking on Limit to Growth in the defined boundary, Case study of current issue – Development plan for Pune the current year.

3. Action Plan for Conservation and Safety 15

Listing out day to day activity and contribution of an Individual to reduce resource consumption and reduction in Waste generation, Framing Bench Mark for Resource consumption and waste generation along with incentives and penalties for less and more consumption or generation, Awareness campaign at school, college and society levels.
Role of the International Days like World Water Day, World earth Day and World Environment day, theme of the year and its implementation., Promoting the concept of Green Building and organic farming, Need and Definition of Risk Analysis, Identification of Risk due to Project activities, Cost of alleviation of risk and impact on project cost. Disasters natural and manmade reported in past and their causes, Preparation of Disaster Control Plan (any two case studies)

4. Sustainable Development and Public Participation 15

Integration of Economic, Social, and Environmental sustainability, biodiversity, and availability of natural resources in development, Critical review of drawbacks in traditional (base on economics) evaluation of development, Cost benefit analysis,

Introduction of Ecological growth factor similar to economical growth factor for sustainable development. Methodology and approach for public participation in Environmental and development decision making, Regulatory requirements for public participation, awareness amongst public participation, advantages and disadvantages of public participation, identification of participants and techniques for conflict management, incorporation of results in decision makings.

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2. Proceedings Indo-US Workshop on Environmental Impact Analysis and assessment (1980), NEERI, Nagpur
3. Environmental and Social Impact assessment, Vanclay F, Bronstein DA (1995), John Wiley and Sons, New York
4. EIA - A Biography, B D Clark, B D Bisset, P Watheam
5. 2nd World Congress on Engineering and Environment 1985, Institution of Engineers