Panjab University, Chandigarh- 160014

SYLLABI

OF

M. Sc. (Environment & Solid Waste Management )

(SEMESTER SYSTEM)

(3\textsuperscript{RD} & 4\textsuperscript{TH} SEMESTER)

Session 2010-2011

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## M. Sc (Environment and Solid Waste Management)

### Outlines of the Tests, Syllabus & Course of Reading  
**Session 2009-11**

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Title of the paper</th>
<th>(Paper Code)</th>
<th>Credits</th>
<th>Int. Asst.</th>
<th>Ext. Marks</th>
<th>Pract. Marks</th>
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<tr>
<td><strong>Semester I</strong></td>
<td>Dec. 2009</td>
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<td>Paper I</td>
<td>Geo-Environment and Meteorological Science.</td>
<td>(ESW 6101)</td>
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Each semester shall comprise of 4 papers, each of 150 marks, and a total of 600 marks.
SEMESTER III

Paper I: Regional and Global Environmental Issues

- Human Population and its implications, PAT Formula, Indian census, Population Regulation, Current efforts of population control, Problems of slums in urban cities (5 lectures)
- Indoor Pollution: Pollutants in the homes and work places, kitchen, living rooms (2 lectures)
- Food additives and Preservatives, Food Allergens (5 lectures)
- Public Health, Sanitation and Hygiene: Epidemiological studies – descriptive and analytical markers and indicators of pollutants in the body; Water borne, air borne, vector-borne, genetic, contagious and non-contagious diseases and their management, Sanitation measures to control infectious diseases (6 lectures)
- Environmental factors of Cancer and AIDS (2 lectures)
- Environmental ethics, environment education and awareness (2 lectures)
- Stockholm conference, Creation of UNEP and its role, World earth summits; Agenda 21, Montreal and Kyoto Protocols; UNFCCC, Convention on Biodiversity and Convention on Climate Change, CoPs, Climate Change and Global Warming; Cartagena Protocol; IPPC and its reports (a brief account) (8 lectures)
- Stratospheric Ozone depletion, Ozone hole, history, reasons and Impacts on Biota (3 lectures)
- Concept of carbon trading; carbon credits; Ecological Footprints; Carbon Footprints; Green Buildings (3 lectures)
- Impact of biodiversity decline, forest degradation, soil degradation, pollution, population explosion and poverty on the environment (4 lectures)
- Ecological and Environmental impacts of dams, with particular reference to Narmada Dam, Tehri Dam and Almetti Dam. (3 lectures)
- Global Water crisis, Rainwater harvesting, Ground water recharge (2 lectures)
- Waste recycling and Power Generation and Fly ash utilization (2 lectures)
- Eutrophication and restoration of Indian lakes; Epidemiological issues - Goiter, Fluorosis, Arsenic toxicity; New emerging diseases (a brief concept) (4 lectures)
- Bio-terrorism and Eco-terrorism (2 lectures)
Practical

1. To prepare a list of preservatives and additives used in candies, chocolates and toffees, curd, yoghurt and processed cheese available in the market.
2. To prepare a list of different types of colors used in the food stuffs.
3. To prepare a profile of smokers and analysis in terms of: Type of products like cigarettes, Bidis and Cigars, Number of persons in the family, Health effects, Number of cigarettes per person
4. Enlisting of major dams / river project in India
5. Project file on a global environmental issue and a wetland / lake
6. Model demonstration of rainwater harvesting & ground water recharge system
7. To prepare a list of various eco-terrorism and bioterrorism events
8. To calculate the carbon footprint of some anthropogenic activities
9. Enlist various green buildings in India and world

Suggested Readings

2. Webber, R. 1996. Communicable Diseases: Epidemiology and Control. 2nd ed. CABI. UK.


**Paper II: Environmental Laws**

*Environment Protection:*

Issues, and problems;
International and national efforts for protection.
Provision in constitution of India regarding Environment (Article 21, 48 A and 51 (g))

*(9 lectures)*

*Indian Efforts: laws and Rules:*

Law of Torts,
Indian Penal Code, 1860;
Code of Civil Procedure, 1908;

*(8 lectures)*

*Environmental legislation:*

Public policy strategies in pollution control.
The Environment (Protection) Act, 1986 and Rules 1986;
Wildlife Protection Act, 1972 and amended 1991;
The Water (Prevention and Control of Pollution) Act, 1974 as amended up-to 1988 and rules 1975;

*(20 lectures)*
Management and Handling Rules:
Hazardous waste (Management and Handling) Rules, 1989;
Bio-medical wastes (Management and Handling) Rules, 1998;
Recycled Plastics (Manufacture and usage) Rule, 1999;
Municipal Waste (Management and Handling) Rules, 2000. (6 lectures)

Scheme of labeling of Environmentally Friendly Products (Ecomark). (2 lectures)

Practical
1. Preparation of Project report and critical analysis on various judgements on environmental issues pronounced by the Supreme Court of India.
2. Assignments/ project work as assigned by the teacher

Suggested Readings

Paper III: Environmental Impact Assessment and Auditing, and Energy Environment

Introduction to environmental impact analysis (1 lecture)
Environmental impact statement & environmental management plan (2 lectures)
EIA guidelines 1994, notification of the Government of India, 2006; various appendices and forms for application, Procedure of Environmental clearance-Screening, Scoping, Public Consultation, Appraisal, Types of Project activities requiring Environmental Clearance (6 lectures)
Checklist for EIA (1 lecture)
Generic structure of EIA Document, Procedure of Public hearing, Composition of EAC, SEAC (2 lectures)
Coastal Regulation Zone Notification, 1991 (1 lecture)
Impact assessment Methodologies Generalized approach to impact analysis and statement

Baseline information and predictions

Guidelines for environmental audit & Introduction to environmental planning

Environmental Auditing Procedure

Matrix method and Batelle Method of auditing

Restoration and rehabilitation and reclamation ecology concept

Urban and Rural planning and land-use pattern and policy for India

Sustainable Development: The Concept and strategies of sustainable development, Economic principles, Development models, ecological economics and different methods of economic evaluation

Sun as source of energy; solar radiation and its spectral characteristics; fossil fuels – classification, composition, physico-chemical characteristics and energy content of coal, petroleum and natural gas.

Principles of generation of hydroelectric power, tidal, ocean, thermal energy conversion, wind, geothermal energy, solar collectors, photovoltaics, solar ponds, nuclear energy – fission and fusion, magnetohydrodynamic power, bio-energy – energy from biomass and biogas, anaerobic digestion, energy use pattern in different parts of the World

Environmental implication of energy use, Carbon dioxide emissions, air and thermal pollution, radioactive waste and radioactivity from nuclear reactors, impacts of large scale exploitation of solar, wind hydro and ocean energy, Conservation of energy

Practical

2. Prepare an environmental audit of hostel / institute / industrial area / city / suburbs
3. Prepare a strategy for restoration of a degraded forest ecosystem
4. Illustrate a poorly-managed and well-managed ecosystem in your area / locality.
5. Illustrate a land use pattern for a wasteland / roadsides / roundabouts.
6. Prepare a model showing sustainable development in a man-made ecosystem.
7. Collect a baseline data on vegetation in an over-grazed grassland or any disturbed ecosystem

Suggested Readings


**Paper IV: Municipal Solid Waste: Management and Techniques**

- Waste generation, Need and requirements for management and planning (2 lectures)
- Solid waste- types, generation trends, quality and quantity aspects (2 lectures)
- Integrated Solid waste Management (2 lectures)
- Solid waste characterization: ultimate and proximate analysis (2 lectures)
- Waste reduction at source- volume reduction (2 lectures)
- Collection techniques (2 lectures)
- Transport of solid waste and its optimization, transfer stations (4 lectures)
- Materials recovery/recycling: - Recycling of Aluminum, glass, plastic and, paper (4 lectures)
Treatment and disposal techniques - Burning, Open dumping, (2 lectures)
Landfill : landfilling methods and operation (4 lectures)
Landfill emissions : Leachate and Landfill gas (2 lectures)
Leachate collection & analysis (2 lectures)
Composting, Vermi-composting (3 lectures)
Incineration (3 lectures)
Energy from Waste: Pyrolysis, Gasification, Refuse derived fuels (6 lectures)
Merits and demerits of waste disposal methods (1 lecture)
Municipal Waste (Management and Handling) Rules 2000 (2 lectures)
Vadose and saturated zone monitoring of solid waste dumps (2 lectures)
Evaluation of ground water pollution, sampling and analysis, protection at disposal sites (2 lectures)

Practical
1. A visit to Composting/Vermicomposting Unit
2. Ultimate analysis of Solid waste
3. Practical knowledge and working of incinerators
4. To prepare a list of materials from municipal waste stream that can be reused /recycled
5. A visit to the RDF plant.
6. Practice exercises on computer related to handling of data
7. To determine moisture content of sample
8. To determine the pH of the given sample.

Suggested Readings


SEMESTER IV

Paper I: Statistical Applications and Modelling, and Research Methodology

**Basic Statistics:** Objectives and applications in environmental sciences; Collection, compilations and presentation of data; Basic tools of statistical analysis; Central tendency: mean (arithmetic, geometric and harmonic), median and mode; Measures of variation (standard deviation and standard error); Probability; Distribution – Normal, \( t \) and \( \chi^2 \) square, Poisson and binomial; Moments, matrices, simultaneous linear equations; Tests for comparing means of one and two-samples; Analysis of Variance (one-way); Multiple comparisons: Duncan’s multiple range test, Tukey’s test, and Dunnett’s test; Tests of hypothesis and significance (Null hypothesis); Regression Analysis; \( \chi^2 \) square test  
(25 lectures)

**Environmental system analysis:** Approaches to development of models; linear simple and multiple regression models; validation and forecasting; models of population growth and interactions - Lotka-Volterra model, Leslie’s matrix model, Point source stream pollution model, Box model, Gaussian plume model  
(15 lectures)

**Research Methodology:** Basic principles of research design; Significance of research design; Experimental set-up; Concept of research articles, research papers, reviews, scientific popular articles; Components of a Research Article (title, author-line, address, abstract, summary, hypothesis, keywords, introduction, methodology, observations, discussion, conclusion, citing relevant work of others); Reference styles; Copyright Act (in brief), Plagiarism, Cheating / academic frauds; process of reviewing; List of important journals in different fields of Environment; Concept of Impact factor; H-Index.  
(12 lectures)

**Practical**
1. Collection of data
2. Calculation of mean, mode, median, standard error, standard deviation
3. Use of statistical softwares and their usage
4. Determination of \( F \)-value, \( t \)-value, one-way analysis of variance
5. Calculation of \( r \) value
6. Application of Duncan’s multiple range test; Dunnett’s and Tukey’s test
7. Demonstration of online submission of research articles
8. Listing of various journals in environment sciences
9. Calculation of Impact factor and H-Index
Suggested Readings


Paper II: Hazardous and Biomedical Waste Management

Radioactive waste and its Management

Electronic waste, types and Management

Types and Environmental problems of hazardous wastes

Lead and Mercury poisoning

Generation, collection, segregation, treatment, transport and disposal of hazardous waste

Waste destruction, separation and Immobilization Technologies

Landfill liners: clay, Geo-membrane, HDPE, Geonet, Geotextile

Biomedical waste: Introduction: definition, Classification, types and composition, Types of solids, liquids, sharps, blood and blood tissue, radioactive material, biological and chemical material

Documentation of Biomedical waste types and guidelines
Storage of hospital waste; Types of bags and containers used for storage; Segregation of biomedical waste into different type; Handling and transport of hospital waste

(4 lectures)

Transport of medical waste: Authorization and accidental spilling reporting

(2 lectures)

Biomedical waste treatment/disposal methods: Incineration, autoclaving, microwave radiations, chemical treatments

(5 lectures)

Biomedical Waste Treatment Facility: record keeping, collection, transport and storage facilities

(5 lectures)

Hospital Effluent treatment plant: Its structure and Functioning

(2 lectures)

Practical

1. Survey of the town to make a list of various clinics / nursing homes / tertiary medical care centers / dispensaries / health care centers / multi-specialty hospitals and medical centers
2. Knowledge about the different types of wastes generated in clinics, nursing homes and hospitals in the city/town etc
3. Report about the types and amount of waste generated in a nursing home and clinic.
4. Data on the various methods of handling and transport of hospital wastes in the city
5. A visit to the Hazardous waste Generation or disposal site.
6. Visit to Industrial area especially the handling Hazardous material
7. Preparation of Project report based on a case study of one hospital

Suggested Readings


Paper III Seminar + Training

Paper IV Project /Research Undertaken

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