SOLAPUR UNIVERSITY, SOLAPUR

REVISED SYLLABUS - M.Sc. II ENVIRONMENTAL SCIENCE

To be implemented from year 2011-2012

M.Sc. SEMESTER – III and IV

SCHOOL OF EARTH SCIENCES,

SOLAPUR UNIVERSITY, SOLAPUR.

SYLLABUS OT THE M. Sc . ENVIRONMENTAL SCIENCE

STRUCTURE OF THE COURSE

SCHOOL OF EARTH SCIENCES, DEPARTMENT OF ENVIRONMENTAL SCIENCE

SOLAPUR UNIVERSITY, SOLAPUR.

SYLLABUS OT THE M. Sc ENVIRONMENTAL SCIENCE

STRUCTURE OF THE COURSE

SEMESTER I

COURSE CODE	SUBJECT	Hourse/ Weaks	EXTERNAL MARKS	INTERNAL MARKS
EST 101	GEOMORPHOLOGY	4	70	30
EST 102	PHYSICAL ENVIRONMENT AND ECOLOGY	4	70	30
EST 103	ENVIRONMENTAL CHEMISTRY	4	70	30
EST 104	COMPUTER APPLICATION IN EARTH SCIENCE	4	70	30
ESP 105	PRACTICAL RELATED TO EST 101 & EST 102	6	70	30
ESP 106	PRACTICAL RELATED TO EST 103 & EST 104	6	70	30

SEMESTER II

EST 201	ANALYTICAL TECHNIQUES IN ENVIRONMENTAL SCIENCE	4	70	30
EST 202	AIR POLLUTION	4	70	30
EST 203	WATER AND SOIL POLLUTION	4	70	30
EST 204	INTRODUCTIONS TO REMOTE SENSING (RS), GEOGRAPHICAL INFORMATION SYSTEM (GIS) AND GPS.	4	70	30
ESP 205	PRACTICAL RELATED TO EST 201 & EST 202	6	70	30
ESP 206	PRACTICAL RELATED TO EST 203 & EST 204	6	70	30

SEMESTER III

EST 301	ENVIRONMENTAL TOXICOLOGY	4	70	30
EST 302	SOLID WASTE & ENVIRONMENTAL PROBLEMS ASSOCIATED WITH MAJOR PROJECTS	4	70	30
EST 303	NOISE POLLUTION, INDUSTRIAL AND OCCUPATIONAL HEALTH	4	70	30
EST 304	WASTEWATER AND GROUND WATER POLLUTION	4	70	30
ESP 305	PRACTICAL RELATED TO EST 301 & EST 302	6	70	30
ESP 306	PRACTICAL RELATED TO EST 303 & EST 304	6	70	30

SEMESTER IV

EST 401	DISASTER MANAGEMENT & ENVIRONMENTAL TECHNOLOGY	4	70	30
EST 402	ENVIRONMENTAL POLICY, ACT AND PLANNING	4	70	30
EST 403	WATERSHED MANAGEMENT	4	70	30
EST 404	DISSERTATION	4	70	30
ESP 405	PRACTICAL RELATED TO EST 401 & EST 402	6	70	30
ESP 406	PRACTICAL RELATED TO EST 403 & EST 404	6	70	30

TOTAL DURATION OF THE COURSE: 2 YEARS

Each Semester will have 1 credits (25 Marks) for- Field training for long tour / In-plant Training,/ Industrial visits or Nature visits /Field work, data acquisition related to dissertations

M.Sc. Environmental Science
PART – II Semester – III

EST 301: ENVIRONMENTAL TOXICOLOGY (70 Marks)

UNIT 1: Definition , classification, origin & general nature of toxicants in environmental factor affecting toxicity, nutritional & non-nutritional food supplements & their effects mutagenesis, teratogenesis , carcinogenesis, hellucinogens, phytotoxins, & animal toxins. Toxic response of different body system like Respiration, Gastrointestinal tract, Liver, Kidney, Immune system, Reproductive system. Effects of toxicants on ecosystem.

UNIT 3: Microorganisms and the structure of ecosystems. The types of microorganisms in Ecosystems. Microbiology of extreme environments Surfaces & Biofilms, Microbial mats. Applications of microorganism, Role of microorganisms in the production process of products medicines (Pharmaceuticals) organic acids, amino acids, Enzymes, fuels, Alcoholic beverages, Enhanced recovery of metals, petroleum products.

UNIT 4: Microorganisms and food spoilage. Microbial examinations of food. Food processing and methods of preservation . Preservation alternatives. Microbial examination of milk & dairy products. Important fermented food. Disease and foods. Microorganisms as sources of food. Control of microorganisms by physical and chemical agents.

UNIT 5: Concept & role of biotechnology in Environmental Science. Use of biotechnology in pollution control & nature protection. Genetic Engineering, tissue culture & other technology in biodegradation of hazardous waste. Biotechnology in Agro-industry & forestry. Microbial degradation of chemical pesticides, use of biopesticides. Use of biotechnology in innovative practice such as organic farming, biofertiliers, aquaculture, apiculture, sericulture.

Internal Evaluations:

Seminar + Term Paper + Test (30 MARKS)

ESP 301: Practicals on Environmental Toxicology (35 MARKS)

1. Do’s and Don’ts in micro lab.
2. Study of MPN from water samples.
3. Study of SPC.
4. Study media preparation and different techniques of inoculation
5. Morphological characteristics of microorganisms.
6. Isolation of phosphate solubilising microorganism from soil.
7. Measurement of toxicology of heavy metals in laboratory.
8. Microbial techniques – neutralization and Aseptic techniques using Autoclave.
9. Growth curve of microbial culture

Internal Evaluations:

(Viva-voice + Journal + Data Evaluation) **(15 MARKS)**

Reference Books:

1. Environmental Sciences - Jackson and Jackson
2. Environmental Sciences - Tuckeer (1990)
3. Introduction to Environmental Chemistry – A.K.De
4. The Chemistry and Microbiology of pollution – I.S. Higgins and R.G. Burns, Academic press, London 1975.
5. Statistical Methods for Environment and Agricultural Sciences – Bidgelli Hossien
6. Pollution control in process industries – S.P.Mahajan. Tata McGraw Hill pub. New Delhi.
7. Environmental Toxicology - David wright and Pamela Wellboura, Cambridge.
8. Ecotoxicology – F.Moriarty, Academic press -1998.
9. Environment and Health – Anthony I. Rowland & Paul Cooper, 3rd edition -1989.
10. Applied Eco-toxicology – Jorg Rombke & Johann F. Moltmann edition -1996.

EST 302: SOLID WASTE & ENVIRONMENTAL PROBLEMS ASSOCIATED WITH MAJOR PROJECTS (70 MARKS)

UNIT 1: Concept of solid waste, Types and classification of solid waste, effects of solid waste generation on quality of air, water and public health. Need of Solid Waste management, Technical approach for solid waste management. Disposal, recovery and recycling of organic waste. Solid waste treatment compaction, dewatering, briquette, size reduction, separation of organic and inorganic i.e. removal of metals like iron, solid waste loading, collection transport and storage. 3R Principle.

UNIT 2: Solid waste disposal methods solid waste reuse. Recycling and incineration, pyrolisis, biogas generation, solid waste as a source of raw material i.e. light weight bricks from fly ash, composting etc. Act and rules for Solid waste management. Case studies on solid wastes.

UNIT 3: Hazardous waste, types of hazardous waste and its classification. Biomedical waste, Management of hazardous wastes.

UNIT 4: Radioactive waste and pollution – concept, sources, types and possible hazardous of radioactive substances, measurement of radiation intensity. Monitoring and control of radiation pollution**.** Effects of radioactive waste pollution on environment and impact radiation on life.

Internal Evaluations:

Seminar + Term Paper + Test (30 MARKS)

ESP 302: Practicals on Solid waste & Environmental Problems Associated with major Projects. (35 MARKS)

1. Physical composition of solid waste / refuse
2. Physical characterization of solid waste / refuse.
3. Construct the composting pit.
4. Construct the pit for vermiculture.
5. EIA methods in Solid waste disposal- Leopold matrix and overlay.
6. Study of biogas plant.
7. Determination of soluble and insoluble fraction in community solid waste.

Internal Evaluations:

(Viva-voice + Journal + Data Evaluation) **(15 MARKS)**

Reference Books :

1. Environmental Management of Solid waste – Wim Salomons & S.U.Forstner.
2. The Global Ecology handbook – Walter H. Corson Beacon Press Boston -1990
3. Handbook of Environmental risk Assessment and Management- Peter Calow Blackwell Science Ltd. 1998.
4. National Disaster – David Alexander, UCL Press London, U.K. 1993.
5. Developing the Environment Problems and Management – C.J.Barrow
6. Environmental Impact Assessment and Management – Hosetti B.B. and Kumar Darya, Pub. House New Delhi- 1998.
7. Environmental Issues and Threats – S.K. Agarwal, APH Publishing Corporation 1997.

EST 303: NOISE POLLUTION, INDUSTRIAL AND OCCUPATIONAL HEALTH

(70 MARKS)

UNIT 1: Concept of Noise/ sound , characteristics & sound waves, Character & anatomy of sound. Noise measurement, theory concept, acoustic pressure, loudness, intensity.

UNIT 2: Religious festivals and noise, National & International standards of noise. Sources and effects of noise on plants, animals and human beings. Control of noise at source industrial control, prevention of public noise, community noise control.

UNIT 3: Introduction to health & environment perspectives & concern. Health hazard identification & Health risks, Health risk management, occupational health, industrial hygiene. Patterns of environmental & health status in urban & rural India.

UNIT 4: Hazards in chemical plant-Material handling hazards –classification of hazardous chemical their storage and safe keeping. Industrial safety legislation, Acts and Rules, Safety standards and codes. Safety policy-safety organization & responsibilities and authorities of different levels. Accident sequence theory, causes of accident, accident prevention & control techniques. Plant safety inspections, job safety analysis and Investigations of accidents.

UNIT 5: Industrial hygiene: Environmental stress: - Physical, chemical biological ergonomic stresses, principals of Industrial hygiene. Threshold limits value, control measures. Different physical agents & their Protective measures.

Internal Evaluations:

Seminar + Term Paper + Test (30 MARKS)

ESP 303: Practicals on Noise pollution, Industrial and Occupational Health.
(35 MARKS)

1. Measurement of Noise by Noise Level Meter.
2. Calculation of Noise levels from different locations
3. Study of safety measures in industries.
4. Estimation of polyphenol from affected plant leaves.
5. Estimation of vanadium from plant leaves.
6. Estimation of Zn, Cu, Ni, Fe, and Al.
7. Environmental Management system for environmental safety. E.g. Mines & Industries.

Internal Evaluations:

(Viva-voice + Journal + Data Evaluation) **(15 MARKS)**

Reference Books:

1. Environmental Sciences - Jackson and Jackson
2. Environmental Sciences - Tuckeer (1990)
3. Introduction to Environmental Chemistry – A.K.De
4. Environmental Problems and solution – D.K. Asthana, and Meera Asthana.
5. Environmental Pollution: Atmosphere, Land, Water and Noise – Thomas William.
6. Fundamentals of Air pollution – P.K.Goel.
7. Environment and Health – Anthony I.Rowand Paul Cooper, 3rd edition 1989.

EST 304: WASTEWATER AND GROUND WATER POLLUTION (70 MARKS)

UNIT 1: Wastewater characteristics, water system, waste water management. Collection & conveyance of sewage. Wastewater flow rate, Natural methods of wastewater disposal.

UNIT 2: Unit operations for wastewater treatment. Preliminary treatment. Sedimentation & chemical clarification. Biological treatment – I, II, & III, Treatment & Disposal of sludge. Tertiary, Advanced wastewater treatments technologies and Green technological in water treatment. Use of solar radiation in Industrial effluent treatment, solar detoxification process and micro-screening.

UNIT 3: Industrial wastewater treatment, Concept and role of ETP, STP, & CETP. Septic & imhoff Tank, House drainage & rural sanitation.

UNIT 4: Ground water pollution, sources of ground water pollution and types of pollutants. Effects on plants, animals and on human. Control measures of ground water pollution and case studies of ground water pollution. Sanitation practices & related problems. Epidemics & endemics disease causes & control

Internal Evaluations:

Seminar + Term Paper + Test (30 MARKS)

ESP 304: Practicals on Wastewater and Ground Water Pollution

(35 MARKS)

1) Determination of permanganate value / oxygen absorbed by the water sample.
2) Sludge volume Index (SVI)
3) Jar Test
4) MLSS and MLVSS.
5) Total Kljheldhal Nitrogen (TKN) in waste water
6) Estimation of volatile acid in waste water.
7) Determination of oil & grease content from the waste water sample.
8) Use of different coagulants for sludge settability
9) Detection of heavy metals by Ring oven technique.
10) Estimation of CaO from sample.
11) Estimation of Nitrates
12) Estimation of Phophates
13) Estimation of Sulphates
14) Estimation of Silica.
15) Field visit to river, lake, water and waste water, treatment plant.

Internal Evaluations:

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Reference Books:

1. Pollution control in process industries – S.P.Mahajan. Tata McGraw Hill pub. New Delhi.
2. Water and Waste water technology – M.J.Hammer, John Wiley A & sons, New York 1986.
3. Environment resources Management – Shastri
4. Wastewater Treatment for Pollution Control – Arcival S.J. Tata McGraw Hill Pub. New Delhi 1986.
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M.Sc. Environmental Science
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Internal Evaluations:

Seminar + Term Paper + Test (30 MARKS)

ESP 304: Practicals on Wastewater and Ground Water Pollution

(35 MARKS)

16) Determination of permanganate value / oxygen absorbed by the water sample.
17) Sludge volume Index (SVI)
18) Jar Test
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20) Total Kljheldhal Nitrogen (TKN) in waste water
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26) Estimation of Nitrates
27) Estimation of Phophates
28) Estimation of Sulphates
29) Estimation of Silica.
30) Field visit to river, lake, water and waste water, treatment plant.

Internal Evaluations:

(Viva-voice + Journal + Data Evaluation) **(15 MARKS)**

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8. Water and Waste water technology – M.J.Hammer, John Wiley A & sons, New York 1986.
9. Environment resources Management – Shastri
10. Wastewater Treatment for Pollution Control – Arcival S.J. Tata McGraw Hill Pub. New Delhi 1986.
11. Introduction to wastewater treatment process – R.S.Ramalho.
12. Current practices in Environmental Engineering. (Vol. I & II) Alam Singh and U.S. Sharma. International Book Traders, Delhi-1997.

*** 1 credits (25 Marks) for-**

Field training for long tour / In- plant Training,/ Industrial visits or Nature vists Field work related to dissertations.

M. Sc. Environmental Science
PART – II Semester – IV

EST 401: DISASTER MANAGEMENT & ENVIRONMENTAL TECHNOLOGY

(70 MARKS)

UNIT 1: Definition of hazard & disaster, difference between disaster & hazard, type of hazard & disaster their causes of consequences. Man made hazard, industrial accidents, causes & effect of Hazardous waste, toxic waste, and chemical waste. Oil spills, land slides, Green house effect, ozone depletion, Acid rain, changed land use practices; prevention measures, forests & industrial fires, environmental degradation due to wars.

UNIT 2: Natural disaster, earth quake, cyclone, floods, storms, Tsunami, draught, Volcanoes, epidemics. Prediction indicators of disaster planning & control of Natural disasters. National & state level planning for hazard mitigation. Disaster management, Disaster Management Plan (DMP), social & economic impact of natural disaster & man made hazards.

UNIT 3: Concept, classification and Merits or Demerits of energy resources. Present status of energy use in India & works, population and energy demand. Energy use pattern in rural & urban area, Impact of growing population on energy use, changing life style & energy use. Energy profile of oil & Natural gas Indian production & Reserves, Nuclear option, Coal, oil, Natural gas, Hydropower, Geothermal, Oceanic, wind, Biomass, Solar and Nuclear energy.

UNIT 4: Role of IREDA, MEDA in energy generation and environmental issue of there energy resources. Innovative energy technologies Magneto Hydrodynamic power generation (MHD), Fuel cells and Hydrogen gas.

Internal Evaluations:

Seminar + Term Paper + Test (30 MARKS)

ESP 401: Practicals on Disaster management and Environmental Technology

(35 MARKS)

1) Study of wood pyrolisis.
2) Study of heat of combustion of a given fuel sample.
3) Measurement of intensity of solar radiation by sunshine recorder.
4) Determination of approximate chemical formula & energy content.
5) Mathematical Calculations on Energy
6) Case study / field visit hydropower, solar, biogas, wind farm etc.

Internal Evaluations:
(Viva-voice + Journal + Data Evaluation) **(15 MARKS)**

Reference Books:

1. Environment resources Management – Shastri
2. Geomorphology in Environment Management – Cooke R.U. and J.C. Doorbkamp Clarendon press, Oxford, Tokiyo – 1974.
3. National Disaster – David Alexander, UCL Press London, U.K. 1993.
4. Developing the Environment Problems and Management – C.J.Barrow
5. Geographic Information System – Principles and Applications, Magnire D.J. Good Child M.F. and Rhind D.W. (Edu) Vol. II Longman London, 1991.

EST – 402: ENVIRONMENTAL POLICY, ACT AND PLANNING (70 MARKS)

UNIT 1: International Environmental policy, Stockholm conference (1972), Rio conference (UNCED 1992) Agenda 21.International Agreements & Treaties – Johannesburg Treaty, GAAT, CITES, Montreal protocol, Kyoto protocol.

UNIT 2: National policy on environment – (NCEP), Tiwari committee MOEF, National forest policy, National water policy, CPCB, & SPCB. Historical back ground of constitutional provision. Environmental protection Articles in IPC, writ provisions for the protection of environment.

UNIT 3: Water (Prevention & control of pollution) Act. 1974, Air (prevention & control of pollution) Act 1981. The environment protection Act. 1986, the forest (conservation) Act 1980, wild be 1972, Biodiversity 2002 their aims, objectives & major contents.

UNIT 4: Concept & need of Public Interest Litigation (PIL), Coastal Regulation Zone (CRZ), Environmental related provision in Public Liability Assurances Act 1991.

UNIT 5: Environmental planning, Urban & Rural planning, Equity Environment Versus Developments, cost benefit ratio, Intellectual Property Right (IPR), International standard organization (ISO), Environmental Audit, methods & Risk Analysis. Case studies of Environmental legislations.

UNIT 6: Concept of environmental education, history of nature education in India, It's principle, goals, needs, objectives, gains, awareness & action through environmental education. Environmental Journalism, print & electronic media. Awareness among NGO's, women's & youth through IT in environmental protection.

Internal Evaluations:
Seminar + Term Paper + Test (30 MARKS)

ESP 402: Practicals on Environmental Policy, Act and Planning. (35 MARKS)

1. Case study of environmental legislation- air, water, noise, forest and wildlife.
2. Preparation of hazard zonation maps using different types of data such as rainfall, sesmicity etc.
3. Environmental system for environmental safety.

Internal Evaluations:
(Viva-voice + Journal + Data Evaluation) **(15 MARKS)**

Reference Books:

1. Environmental Impact Assessment and Management – Hosetti B.B. and Kumar Darya, Pub. House New Delhi- 1998.
2. Environmental Law – Van Nostrand Reinhold Co. J.E.Hjeer and D.J.Hagerty 1997 New York.
3. Changing Face of the planet and Environmental Law – Chitnis V.S. and Tilak R.K. Snow white Pub. Mumbai -2001.
4. Politics, Policy and Natural Resources - Dennis L. Thompson. The free press, New York 1972.
5. The Global Ecology handbook – Walter H. Corson Beacon Press Boston -1990
6. Environmental Management – P.Khanna.
7. Environmental Policies – Sinha P.C.
8. Environmental Audit – Mhaskar A.K. Media Enviro Pune – 1998.
9. Energy Society and environment – David Elliott Routledge, London – 1997.
10. Energy and Environment in Developing countries – M.Chatterji, John Wiley and sons Chichester – 1981.
11. Introduction to energy E.S. Carredy and P.Z. Grossman, Cambridge University Press, Cambridge U.K. – 1998.
12. Non – conventional Energy sources – Rai G.D. Khanna pub. New Delhi – 2000.

EST – 403: WATERSHED MANAGEMENT (70 MARKS)

UNIT 1: Definition, Concepts, principals and classification in watershed management. Rainfall and runoff, water balance approach, water budgeting, topographic surveying, water conservation and harvesting methods – importance and techniques.

UNIT 2: Physical characteristics of watershed, Hydrological characteristics of watershed, Land-use and land-cover classification, resource appraisal. Water and soil conservation measures. (a) Drain-line treatment; (b) Area – treatment.

UNIT 3: Goals, features and watershed as unit of sustainable development, Selection of plant species for plantation, Organic farming and organic fertilizers. Agriculture and water management – participatory rural appraisal in watershed programs, community mobilization.. Social Institutions : Gram-Panchayat, Self-help Groups for Women, Farmer. Managed small-scale irrigation systems (cooperative – Lift-irrigation); Watershed Development Committees.

UNIT 4: Entry Point Activities, Concept and Application of Watershed plus Activities. Roof-top Water Harvesting and Watershed Development for Semi-urban Areas, Problems of Scaling up the Watershed Approach.

UNIT 5: Agro-forestry systems : (a) Classification; (b) Agrosilvopastoral systems; (c) Silvopastoral systems; (d) Land Agroforestry. Silviculture, (a) Role of exotics; (b) Ethnosilvicultural refugia. horticulture and pastureland development : (a) Role of grasses as fodder. Multipurpose Trees. Current Developments in the Subject.

UNIT 6: Current environmental Issues in India. Context Narmada Dam, Tehri, Almetti Dam, Soil erosion formation & reclamation & USAR. Alkaline & saline soil, waste land & their reclamation, desertification, water crises, wetland conservation.

Internal Evaluations:
Seminar + Term Paper + Test (30 MARKS)

ESP 403: Practicals on Watershed management. (35 MARKS)

1. Study of drainage patterns, slopes and slope analysis.
2. Tracing of watershed and their morphological features from toposheets.
3. Aerial photographs and satellite imageries.
4. Problems in water budgeting.
5. Designing structures for water conservation and harvesting based on field visits.

Internal Evaluations:
(Viva-voice + Journal + Data Evaluation) **(15 MARKS)**

Reference Books:

1. The Environment and Science and Technology Education - A.V. Baez, G.W. Knamiller and J.C. Smyth Pergamon Press, England 1987.
2. Socio-economic policy to better human Environment – vol.3 – Srivastava P.R.
3. Water Resources Projects and their Environment Impact – Abbasi S.A. Discovery Pub. Hous, New Delhi 2001.
4. Current practices in Environmental Engineering. (Vol. I & II) Alam Singh and U.S. Sharma. International Book Traders, Delhi-1997.
5. Developing the Environment Problems and Management – C.J.Barrow.
6. Wildlife wealth of India – Resource and Management – Indira Manjupuria and Ansari.
7. Suhas Paranjpe and K.J.Roy, Sustainable Technology: Making the Sardar Sarovar Project Viable. CEE, Ahmedabad 1995.

EST 404: DISSERTATION **(70 MARKS)**

Student will submit their independent dissertation work at the end of semester IV. Assessment of the dissertation and internship will be based on the submitted M. Sc. dissertation report, seminar and viva-voice examination.

Internal Evaluations:

Seminar + Term Paper + Test **(30 MARKS)**

ESP 404: Dissertation **(35 MARKS)**

The Internship report submitted by the student and the evaluation report by the external supervisor.

Internal Evaluations:

(Viva-voice + Journal + Data Evaluation) **(15 MARKS)**

*** 1 credits (25 Marks) for-**

Field training for long tour / In- plant Training,/ Industrial visits or Nature vists Field work related to dissertations.