

Annexure No.	33 B
SCAA Dated	29.02.2008

BHARATHIAR UNIVERSITY: COIMBATORE 46
SCHOOL OF DISTANCE EDUCATION
M.Sc., ENVIRONMENTAL SCIENCE – SCHEME OF EXAMINATIONS
(With effect from 2007-2008 and onwards)

P A P E R	P A P E R C O D E	T I T L E O F P A P E R	E X A M D U R A T I O N	M A X I M U M M A R K S
Year I				
Paper 01	07ESDC01	Water Pollution and Management	3	100
Paper 02	07ESDC02	Air Pollution and Management	3	100
Paper 03	07ESDC03	Soil Pollution and Solid Waste Management	3	100
Paper 04	07ESDC04	Instrumentation Methods of Analysis	3	100
Practical I	07ESDP01	Air, Water and Soil analysis	6	100
Year II				
Paper 05	07ESDC05	Management of Energy Resources	3	100
Paper 06	07ESDC06	Natural Resources and Conservation	3	100
Paper 07	07ESDC07	Environmental Engineering	3	100
Paper 08	07ESDC08	Environmental Impact Assessment	3	100
Practical II	07ESDP02	Waste Water Treatment	6	100
Total Marks				1000

PAPER 01: 07ESDC01

WATER POLLUTION AND MANAGEMENT

UNIT I:

Sources of water - hydrological cycle - physico-chemical properties of water, softening of water - water quality standard for potability - Pollution parameters, BOD, COD, Coliform bacteria - Water borne diseases. Effects of water pollution on aquatic system. Health effects of water pollution.

UNIT II:

Treatment of water for potable purpose (mixing, sedimentation, coagulation, filtration and disinfection) - Water pollution - Domestic, industrial and agricultural waters. Primary and secondary treatment. Sludge disposal. Biological treatment: Kinetics of Biological growth - activated sludge treatment - trickling filters - anaerobic digestion, combined aerobic and anaerobic treatment process, aerobic process.

UNIT III:

Advanced waste water treatment - removal of dissolved organics and inorganic - precipitation, iron exchange, reverse osmosis, electro dialysis, adsorption and oxidation. Removal of nutrients. Removal of heavy metals - overall waste water treatment for sewage water. Water pollution treatment using constructed wetlands

UNIT IV:

Watershed management. Concept and frame work - water harvesting and recycling, water planning and management - case studies in Tamilnadu.

UNIT V:

Water Prevention and Control of Pollution Act 1974 as amended up to 1988 and Rules 1975. Water Cess Act 1977 and Rule 1978.

REFERENCE:

1. Waste Water Engineering - Metcalf and Eddy
2. Environmental Engineering - Howard S. Peavy et al
3. Environmental Chemistry - Stanley E. Manahan
4. Environmental Chemistry - Anil Kumar, DEE
5. Introduction to environmental Engineering and Science - Gilbert M Masters
6. Industrial Chemistry - B.K. Sharma
7. Industrial Pollution Handbook - H.E. Lund
8. Pollution Control Legislation (Vol I and II) - Tamilnadu Pollution Control Board.
9. Water Supply and Sanitary Engineering - G.S. Birdies and J.S. Birdie
10. Watershed Management - V.V. Dhruva Narayana, G Sastry, U.S. Patnaik

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PAPER 02: 07ESDC02**AIR POLLUTION AND MANAGEMENT****UNIT I:**

Importance of atmosphere - composition: structure - elemental properties of atmosphere - chemical and photochemical reaction in the atmosphere, meteorology - weather, humidity, pressure, wind pattern. Atmospheric dispersion - temperature plume behavior, stack height and maximum mixing depth, Gaussian plume model and co-efficient. Windrose diagram.

UNIT II:

History of air pollution: sources and classification; particulates and gaseous pollutants in the atmosphere. Effects of air pollutants on human health, animals, vegetation, materials and structures. Economic effects of air pollution. Global effects of air pollution - green house effect, acid rain, photochemical smog - CFC.

UNIT III:

Air pollution monitoring - methods, air quality standards; ISI, EPA sampling and measurement of particulate matters - gaseous pollutants, CO₂, CO, NO_x, SO₂, H₂S, oxidants, ozone and hydrogen fluoride. Control of gaseous emission: adsorption by liquids, adsorption by solids, combustion and condensation. Control of SO₂, NO_x, CO, CO₂ and hydrocarbons.

UNIT IV:

Radiation pollution - Types, sources and its effects -Noise pollution - sound waves - source and effects. Nature of noise and introduction - Effects of noise on People - Sources of noise - Assessment and measurement of sound - Basic principles of noise control.

UNIT V:

Air pollution and Control of Pollution Act 1981 as amended by Amendment Act 1987 and Rules 1982. Motor vehicle Act 1988.

REFERENCE:

1. Environment Chemistry -Stanly E. Manahan.
2. Air Pollution- C. S. Rao
3. Introduction to Air Pollution -Stern
4. Instruction to Environmental Engineering and Science- Gilbert M. Masters
5. Environmental Engineering - Howard S.Peavy et al.
6. Environmental Chemistry - Banerji.
7. Air Pollution - M.N. Rao and C.S.Rao
8. Air Pollution -Raju
9. Pollution Control Legislation - Vol. I & II, Tamilnadu Pollution Control Board
10. Water Supply and Sanitary Engineering - G.S.Birdie and I.S. Birdie
11. Biotechnology and Alternative Technology - A.Charavathy
- 1 2. Noise Pollution - Vandana Pandey
13. Noise Pollution and its control- V.P.Kudesia and T.N.Tiwari

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PAPER 03: 07ESDC03

SOIL POLLUTION AND SOLID WASTE MANAGEMENT

UNIT I:

Nature of the soil - water and air in the soil - acid, base and ion exchange in the soil
macro and micro nutrients in the soil- soil erosion.

UNIT II:

Soil pollution - agricultural chemicals, fertilizers, pesticides, insecticides, fungicides,
herbicides and metals.

UNIT III:

Hazardous wastes compounds, formulations and classes of substances, chemical
classification of hazardous waste, industrial and hospital hazardous waste, hazardous
waste management, segregation and recovery of hazardous waste components. Treatment
process for unsegregated waste, fixation of hazardous solid waste prior to disposal,
hazardous waste in land fill.

UNIT IV:

Municipal solid wastes - quantities and characteristics, waste collection and transports,
waste processing and resources recovery and recycling, incineration, pyrolysis,
composting - vermicomposting and sanitary land fills and anaerobic digestion.

UNIT V:

Hazardous waste (Management and Handling) Rules 1989 - the Manufacture Storage
and Import of Hazardous Chemicals Rules 1989 - Biomedical Waste (Management and
Handling) Rules 1998 - Plastic Act 1999.

REFERENCE:

1. The text Book of Soil Science - Dhaji
2. The nature and properties of soil - Harry O Buckman
3. Soil Physics -Helmut Kohuke
4. Environmental Engineering - Peavy et al
5. Soil Pollution and Soil Organisms - PC Mishra
6. Environmental Agricultural Pollution - P.R.Trivedi
7. Soil Chemistry and its Application - Malcom Cresser
8. Basic Environmental Technology - Nathensan
9. Environmental Chemistry - Stanly Manahan
10. Pollution Control Legislation Vol. 1 & 11- Tamilnadu Pollution control Board.

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PAPER 04: 07ESDC04

INSTRUMENTAL METHODS OF ANALYSIS

UNIT I:

Basic principles, instrumentation and application of solvent extraction, ion exchange, electrophoresis, paper chromatography, TLC, GC, HPLC.

UNIT II:

Limitations of analytical methods accuracy and precision, classification and minimization of errors. Electromagnetic radiation spectrophotometry - interaction of radiation with different types of molecular energy, basic principles, instrumentation and applications of UV and Visible spectrophotometer, IR and NMR.

UNIT III:

Introduction, principle, instrumentation and environmental applications of flame photometer - AAS. Atomization flame atomization graphite furnace atomizers, application of AAS. Atomic Emission Spectroscopy- Instrumentation - quantitative analysis - direct reading spectrometers. Plasma excitation - flame excitation - laser excitation - chemical interferences - concentration range - Mass spectrophotometer.

UNIT IV:

Introduction, principle, instrumentation and application of Nephelometry - Turbidometry - Conductometry - Potentiometry - Ion Selective Electrodes.

UNIT V:

Rules for construction of diagram and graphs - types of diagrams and graphs - measure of centre value and dispersion - correlation - regression, test of significance t , X^2 and ANOVA.

REFERENCE:

1. Principles of Instrumental Analysis - Douglas A Skoog and Donald M. West
2. Voges Text Book of Quantitative Inorganic Analysis and Elementary Instrumental Analysis - Eiassett. R.C. Denney, G.H. Jeffery, J Mendham
3. Instrumental Methods of Analysis - Willard, Merrill and Dean
4. Instrumental Methods of Chemical analysis - Chatwat and Anand
5. Bio-statistics - S.P.L.Palanisamy
6. Standard Method for the Examination of Water and Waste water - APHA
7. Instrumental Methods of Analysis - B.K.Sharma

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PAPER 05: 07ESDC05

MANAGEMENT OF ENERGY RESOURCES

UNIT I:

First law of thermodynamics - Enthalpy - second law of thermodynamics - Carnot theorem (arnot cycle) - converting heat to work reversible process - concept of entropy - entropy pollution free energy - Gibbs and Helmolts free energy.

Unit II:

Sources and classification - Solar energy - conversion to heat - conversion to electricity – solar cells - efficiency - geothermal energy - wind energy - Kayatar- Muppanthal, Sulthanpet - tidal energy.

Unit III:

Forest fuels - origin and development of coals - ranking and analysis of coal, liquefied coal - cleaner coal combustion - coal gasification - origin and resources of petroleum and natural gas - composition and classification of petroleum - petroleum refining - environmental problems associated with petroleum products. Atomic Energy nuclear reactors, safety measures. Environmental problems related to radioactive materials - radioactive waste disposable methods - gas hydrates.

Unit IV:

Sources, classification and characterization of biomass and other solid wastes, combustion or biomass- pyrolysis of biomass, gasification of biomass-Biodiesel.

Unit V:

Biochemical and chemical methods of energy production from biomass - methane fermentation / anaerobic bio gasification of biomass, alcoholic fermentation, bioenergy from wastes, hydrogen gas production, biofuel cells.

REFERENCE:

1. Energy Principles Problems Alternatives - Joseph Priest
2. Problem of our Physical Environment - Priest
3. Environmental. Chemistry - John Moore et al
4. Basic Environmental Technology - Jerry Anathansan
5. Physical Chemistry - Puri and Sharma
6. Environmental Pollution - Laure
7. Environmental Biotechnology - Jogdamd

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PAPER 06: 07ESDC06

NATURAL RESOURCES AND CONSERVATION

UNIT I:

Natural resources - Classification. Air resources; chemistry of the atmosphere, effects in the biosphere, sinks of atmospheric constituents, oceans, vegetation, renewable energy and conservation - Direct solar energy - Indirect solar energy - other renewable energy sources, conservation and efficiency.

UNIT II:

Water - A fragile resource; Importance of water - properties of water - our water supply and its renewal - water conservation - Innovative approaches to water resource management - a case study in water management (the Columbia River).

UNIT III:

Soil and land resources: Soil resources - distribution of soil resource - soil problems - soil conservation and regeneration. Land resources - Importance of Natural areas - Wilderness - Parks and wildlife refuges - Forests - Rangelands - Freshwater rangelands - Coastline and Estuaries - Agricultural lands - land use - Conservation of land resources. Western and eastern ghats, Hotspots.

UNIT IV:

Minerals: A non renewable resources, Use of minerals - minerals distribution and abundance -mineral formation and extraction - Environmental implications - mineral resources - increasing our mineral supplies - Expanding our supplies through substitution and conservation. Terrestrial and marine mineral resources.

UNIT V:

Wild life: Our plant and animal resources. Importance of wild life - Endangered and extinct species - Human causes of endangered species and Extinction - Wildlife conservation - Wildlife management - Introduction of genetic resources - biological species - diversity – conservation - restriction to release. Germ plasm - gene bank – Database.

REFERENCE:

1. Global Diversity - Word Conservation, Brain Groombridge
2. The Environment - Raven
3. Resources Ecology - S.K.Agarwal

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PAPER 07: 07ESDC07

ENVIRONMENTAL ENGINEERING

UNIT I:

Design facilities for water treatment plant: Principles and Design of plain sedimentation tank, sedimentation with coagulation, slow and rapid and filtration - pressure filters water softening by zeolite and ion exchange process - Reverse osmosis- Disinfection of water.

UNIT II:

Design of pre and primary waste water treatment plant: Principle and design of screen, Equalization tank, grit chambers, rectangular and circular sedimentation tank.

UNIT III:

Design facilities for aerobic treatment of waste water: Principles of biological treatment. Design of trickling filters. Activated sludge process and oxidation ditch.

UNIT IV:

Design facilities for anaerobic treatment of waste water and sludge; sludge digestion and thickening - sludge drying beds, design of anaerobic digesters and septic tank.

UNIT V:

Design of air pollution control equipment: Principle and design of minimum stack height, settling chamber, cyclone collector, fabric filter and ESP.

REFERENCE:

1. Water Supply and Sanitary Engineering - G.S.Birdies and J.s.Birdie, Phanpat Ral Publishing Co, New Delhi, 1998 .
2. Environmental Engineering, Vol. I & II - G.S.Garg
3. Wastewater Engineering - treatment, disposal and reuse - Metcalf and Eddy.Inc.
4. Industrial Waste Water Pollution Control- W.Wesley Eohenfeldes Jr.
5. Environmental Engineering - Howard S.Peavy: Dolad R Rove; George Techbanoglories

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PAPER 08: 07ESDC08

ENVIRONMENTAL IMPACT ASSESSMENT

UNIT I:

Environmental Impact Assessment: General Introduction - Environmental Inventory - Environmental Assessment - EIS - Historical perspective - environmental Assessment Process - Goals of ETA - Organization responsible for EIA - contents of EIA - EIA of India.

UNIT II:

Guidelines for EIA: Industries and Environmental Guidelines - Industrials Areas-ecologically sensitive areas, citing criteria. EIA - EMP, management planning cell. Criteria for water related projects - Environmental setting, environmental indicators of water quality - Biological factors, ecological indicators an laboratory studies. Field survey - data collection - recent approach in EIA studies carrying capacity.

UNIT III:

Impact assessment methodology - various steps EIA, ecological survey methods, assessment of surface and sub surface hydrology, soil flora and fauna macro and micro climate, special and unques habitats, use of resources. Environmental quality, analytic and integrative approach, overlay check list matrices and network methodologies, environmental valuation techniques, cost - benefit analysis.

UNIT IV:

Case studies - hydroelectric projects, mines, refineries, power plants, tanneries, textiles and dyeing industries, roads, airports - concept of welfare economics - economics externalities - environmental quality as a public welfare social functions, cost and benefit analysis. Pollution as an economical problem optimum level of pollution, control of pollution, control methods, Cleaner Production Technologies.

UNIT V:

Coastal Regulation Zone Notification 1991 - The Environmental Impact Assessment Notification - 1994 and Amendment - constitution of panel for public hearing in districts.

REFERENCE:

1. Environmental Impact Assessment: Principles of Procedure - R.E.Munn (score 5)
2. A practical guide to EIA - P.A Erikson
3. EIA Principles and Applications - P.AErikson
4. EIA analysis: hand book - Rao & U.S.Wotten, MC.Graw Hill, USA, 1980
5. Environmental Assessment and Statements - Van Nostr and Renhold, J.E Heer and DJ. Hagerty, 1977
6. EIA for developing countries – A.K. Biswar & S.B.S Agarwal
7. Perspectives in Environmental Management -R.Buckley
8. Environment Assessment Source book - World Bank Technical Paper Series
9. Integrated Regional Risk Assessment, Vol I & II - AY. Gheorghe and M.Nicolet, Moniver Kluver Academic Publication 1995
10. Cost Benefit Analysis and the Environment ~ N.Hanely and C.L Spach, Edward Elgar Publication, UK, 1993.
11. Environmental Economics, S.Shankaran, 1994

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PRACTICAL I: 07ECDP01

AIR, WATER AND SOIL ANALYSIS

Air Analysis:

1. Measurement of particulate matters (SPM) – by high volume of air sampler – Estimation of metals in SPM.
2. Analysis of SO₂, CO₂, NO_x, CO and Ammonia.

Water, waste water and soil analysis:

pH, Conductivity, Total hardness, turbidity, acidity, alkalinity, chloride, sulphate, nitrate, nitrite, total nitrogen, potassium, calcium, magnesium, DO, BOD, TOC, CEC in soil.

Metals: Cr, Cd, Pb, Cu and Fe

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PRACTICAL II: 07ECDP02

WASTE WATER TREATMENT

Waste water treatment:

1. Chemical treatment: Faster technique - determination of optimum pH, turbidity, sludge volume, COD, phosphate, Nitrate before and after treatment with alum.
2. Biological treatment: Activated sludge treatment – with mixed culture – determination of pH, Sludge volume, COD, Phosphate, ammonia and nitrate before and after treatment.
3. Disinfection – chlorine break point – residual chlorine - microbial population count by MPN.
4. Solid waste management – biomethanization of solid and liquid waste – total gas measurement, methane, pH, TOC and NPK.

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M.Sc. Environmental Science – SDE

MODEL QUESTION PAPERS

PAPER 01: 07ESDC01

WATER POLLUTION AND MANAGEMENT

Time : 3 Hours

Total Marks : 100

Answer any Five questions

(5X20)

All questions carry equal marks

1. Give an account on the physico-chemical properties of water and water quality standards for potable water?
2. Describe methods of treatment of potable water?
3. Write briefly on the role of constructed wetlands for water pollution treatment?
4. Explain water shed management? Describe a suitable example?
5. Discuss the importance of Water Prevention and Control of Pollution Act 1974 and Water Cess Act 1977 in water resource management?
6. Describe various methods to remove dissolved organics from water?
7. Write an account sludge disposal methods?
8. Write the effects of water pollution on aquatic ecosystem?

PAPER 02: 07ESDC02

AIR POLLUTION AND MANAGEMENT

Time : 3 Hours

Total Marks : 100

Answer any Five questions

(5X20)

All questions carry equal marks

1. Write a note on Atmospheric dispersion and plume behavior?
2. Give a brief account on the sources, classification and effects of air pollution on human health, animals, vegetation, materials and structures?
3. Explain various control measures to reduce gaseous emissions?
4. Define noise? Discuss sources and effects of noise on people?
5. Write briefly on Motor Vehicle Act and Air Pollution Control Act of 1981?
6. Describe various sources and effects of radiation pollution?
7. Write on acid rain, photochemical smog, and CFC?
8. Describe various sampling procedure for collection of particulate matter?

PAPER 03: 07ESDC03
SOIL POLLUTION AND SOLID WASTE MANAGEMENT

Time : 3 Hours

Total Marks : 100

Answer any Five questions (5X20)
All questions carry equal marks

1. Describe various types of soil erosion?
2. Write briefly on the various sources and effects of soil pollution?
3. Define hazardous waste? Describe disposal techniques?
4. Discuss the importance of MSW recycling?
5. Write on the Hazardous Waste Rules 1989, Biomedical Waste Rules 1998 and Plastic Act 1999.
6. Explain the process of composting in MSW management?
7. Describe the nature and various components of soil?
8. Describe methods of disposal and management of hazardous hospital waste?

APER 04: 07ESDC04
INSTRUMENTAL METHODS OF ANALYSIS

Time : 3 Hours

Total Marks : 100

Answer any Five questions (5X20)
All questions carry equal marks

1. Describe the principle and applications of HPLC?
2. Briefly explain the applications of
 - I. NMR
 - II. Spectrophotometer
3. Write the environmental applications of graphite furnace atomizers, AAS?
4. Write on flame excitation and laser excitation mass spectrophotometer?
5. Describe ANOVA, regression?
6. Describe the principle and applications of GC?
7. Write the principle and applications of turbidometry and potentiometry?
8. Write on different types of diagrams and graphs?

**PAPER 05: 07ESDC05
MANAGEMENT OF ENERGY RESOURCES**

Time : 3 Hours

Total Marks : 100

**Answer any Five questions (5X20)
All questions carry equal marks**

1. Describe Gibbs and Helmholtz free energy?
2. Give a brief note on geothermal energy and its advantages?
3. Write on petroleum and petroleum products and its importance as an energy sources?
4. Discuss on biodiesel?
5. Describe the methods of energy production from biomass?
6. Describe the process of methane fermentation?
7. Explain the Composition and classification of petroleum?
8. Write on the various developmental process of coal?

**PAPER 06: 07ESDC06
NATURAL RESOURCES AND CONSERVATION**

Time : 3 Hours

Total Marks : 100

**Answer any Five questions (5X20)
All questions carry equal marks**

1. Describe various renewable energy resources?
2. Write on the importance of water resource conservation?
3. Explain hotspots and natural resource conservation?
4. Write notes on land resources?
5. Discuss the marine mineral resources?
6. Briefly describe the importance of gene bank in biodiversity conservation?
7. Explain wildlife and its management?
8. Write on the environmental implications of mineral extraction?

**PAPER 07: 07ESDC07
ENVIRONMENTAL ENGINEERING**

Time : 3 Hours

Total Marks : 100

**Answer any Five questions (5X20)
All questions carry equal marks**

1. Explain the water softening techniques?
2. Write on the principle and design of sedimentation tank?
3. Explain the biological treatment of wastewater?
4. Describe the sludge treatment techniques?
5. Explain the design and application of cyclone collector?
6. Describe the principle and application of trickling filter?
7. Explain the water disinfect ion methods?
8. Write the process of reverse osmosis?

**PAPER 08: 07ESDC08
ENVIRONMENTAL IMPACT ASSESSMENT**

Time : 3 Hours

Total Marks : 100

**Answer any Five questions (5X20)
All questions carry equal marks**

1. Define EIA; explain the various steps in EIA process?
2. Write about the environmental indicators of water pollution?
3. Explain the various EIA methodologies?
4. Describe the EIA case study for refineries, tanneries?
5. Write short notes on Costal Regulation Zone Notification 1991. EIA Notification 1994?
6. Write briefly on cost benefit analysis?
7. Explain cleaner production technologies?
8. Write on the EIA case study for hydroelectric projects?