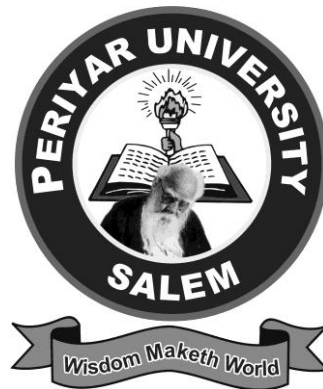


PERIYAR UNIVERSITY

SALEM – 636 011.



PERIYAR INSTITUTE OF DISTANCE EDUCATION

[PRIDE]

M.Sc., ENVIRONMENTAL SCIENCE

SYLLABUS & REGULATION

NON - SEMESTER

[Candidates admitted from 2007-2008 onwards]

M.Sc., ENVIRONMENTAL SCIENCES

REGULATIONS

1. Condition for Admission

A candidates who has passed a Bachelor degree in Science with **Environmental Sciences / Botany! Zoology! Biotechnology/Biochemistry/ Chemistry/ Home Sciences/ Nutrition and Dietetics! B.Sc., MLT/ Genetics/ Bio-informatics/ Marine Biology or a Bachelor degree in Agriculture / Animal Science/ Medicine or Veterinary Sciences / Pharmacy and including Indians Farms of Medicines and Homeopathy degree** of this university or any of the above degree of any other university accepted by the Syndicate as equivalent thereto, subject to such condition as may be prescribed thereto shall be permitted to appear and qualify for the M. Sc., Environmental Sciences degree examination of this University after a course of study of two academic years.

2. Duration of the Course

The course for the degree of Master of Environmental Sciences shall consist of two academic years.

3. Course of Study

The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.

I-Year

Main Paper 1	-	Energy and Environment
Main Paper 2	-	Environmental Pollution
Main Paper 3	-	Environmental Toxicology
Main Paper 4	-	Instrumentation Methods of Analysis

Main Practical I

II - Year

- Main Paper 5 - Natural Resources and Conservation
- Main Paper 6 - Environmental Engineering
- Main Paper 7 - Environmental Impact Assessment, Audit and Economics

Main Practical II

Project Work

4. Examinations

The theory examination shall be three hours duration to each paper at the end of the each year. The candidates failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examinations. The practical examinations for PG course should be conducted at the end of the year.

At the end of the second year viva-voce will be conducted on the basis of the Dissertation / Project work submitted by the student. The viva - voce will be conducted by one internal and one external examiner jointly.

5. Scheme of Examinations

S. No.	Paper	Title of the Paper	Exam. Duration	Max. Mark
1 Year				
1	Main Paper 1	Energy and Environment	3 hrs	100
2	Main Paper 2	Environmental Pollution	3 hrs	100
3	Main Paper 3	Environmental Toxicology	3 hrs	100
4	Main Paper 4	Natural Resources and Conservation	3 hrs	100

		Main Practical I	8 hrs/day, two consecutive days	100
II year				
5	Main Paper 5	Instrumentation Methods of Analysis	3 hrs	100
6	Main Paper 6	Environmental Engineering	3 hrs	100
7	Main Paper 7	Environmental Impact Assessment, Audit and Economics	3 hrs	100
		Main Practical II	8 hrs/day, two consecutive days	100
		Project Work		100
			Total	1000

6. Question paper model for theory and practical

M.Sc., Environmental Sciences

Question Paper Pattern (Non-Semester)

(Theory Paper)

Part – A

5 x 5 = 25

Answer all questions

(Two questions from each unit with internal choice)

Part – B

5 x 15 = 75

Answer all questions

(Two questions from each unit with internal choice)

QUESTION MODEL FOR PRACTICALS

(Non – Semester Pattern)

Time 6 Hours

Max. Marks : 100

3 Major questions, each carry 25 marks (3 x25 = 75 marks)

For both year

Record 25 marks

Project work

(100 Marks)

Project Report

(075 Marks)

Viva – voce

(025 Marks)

7. Format to be followed in dissertation

The formats/certificate for dissertation to be submitted by the students are given below.

Format for the preparation of project work

- a) Title page
- b) Bonafide certificate
- c) Acknowledgement
- d) Table of Contents

Chapter No.	Title	Page No.
1	Introduction	
2	Review of Literature	
3	Materials and Methods	
4	Results	
5	Discussion	
6	Summary	
7	Reference	

CERTIFICATE

This is certify that the dissertation entitle (title of the dissertation) submitted in part fulfillment of the requirement of the degree of Master of Science in Environmental Science to the Periyar University, Salem is a record of bonafide research work carried out by (name of the candidate) Under my supervision and guidance and that no part of the dissertation has been submitted for the award of any degree, diploma, fellowship or other similar titles or prizes and that the work has not been published in part of full in any scientific or popular journals or magazines.

Signature of the Co-ordinator

Signature of the Examiners(s)

1.

2.

8. Passing Maximum

The candidate shall be declared to have passed the examination if the candidate secures not less than 50 marks in the University examination in each theory paper.

For the Practical paper, a minimum of 50 marks out of 100 marks in the University examination and the record notebook taken together. There is no passing minimum for the record -notebook. However submission of a record notebook is a must.

For the project work and viva-voce the candidates should secure 50% of the marks for pass. The candidates should compulsorily attend viva-voce examination to secure pass in the paper. Candidate who does not obtain the required minimum marks for a pass in a paper/project report shall be required to appear and pass the same at a subsequent appearance.

9. Classification or successful candidates

Candidates who secure not less than 60% of the aggregate marks in the whole examination and have passed all papers in single attempt shall be declared to have passed the examination in **First Class**.

All other successful candidates shall be declared to have passed in the **Second Class**.

Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed the examination in **First Class with Distinction** provided they pass all the examinations prescribed of the course at the first appearance.

Candidates who pass all the examinations prescribed for the course in the first instance and within a period of three academic years from the year of admission to the course only are eligible for **University Ranking**.

10. Maximum duration for the completion of the PG programme

The maximum duration for completion of the PG programme shall not exceed four years. Thereafter, candidate will be permitted to appear for the examination only under the regulations then in force.

11. Commencement of the Regulation

The above regulations shall take effect from the academic year 2009 - 2010 i.e for students who are to be admitted to the first year of the course during the academic year 2009 -2010 and thereafter.

MAIN PAPER I - ENERGY AND ENVIRONMENT

UNIT - I - First law of thermodynamics - Enthalpy - second law of thermodynamics - Carnot theorem - Carnot cycle - Converting heat to work reversible process - concept of entropy - entropy pollution - free energy - Gibbs and Helmholtz free energy. Energy conservation.

UNIT - II - Sources and classification - solar energy- conversion to heat conversion to electricity -solar cells - geothermal energy -wind energy - tidal energy-ocean energy.

UNIT - III - Fossil 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 - petroleum refining - environmental problems associated with petroleum products.

UNIT - IV - Nuclear Energy - fission, and fusion reactions - nuclear reactors - safety measures, environmental problems related to radioactive materials - radioactive waste disposal methods.

UNIT - V - Biomass energy - Sources, classification characterization of biomass - energy production from biomass - methane fermentation - alcoholic fermentation - hydrogen gas production, biofuel cell and Biodiesel. Gasohol.

REFERENCE BOOKS:

1. Energy principles problems alternatives : Joseph Priest
2. Environmental chemistry : John Moore et al
3. Basic Environmental technology : Jeny A.Nathansan
4. Physical chemistry : Pun and Sharma
5. Environmental Biotechnology : Jogdamd
6. Living Environment : Reavan

MAIN PAPER 2- ENVIRONMENTAL POLLUTION

UNIT - I - Structure of the atmosphere, Global and Microclimates, Sources and Classification of Air Pollutants. Transport and Diffusion of Pollutants. Plume behavior and stack dispersion, Reactions of hydroxyl radical with O₂, N₂, CO₂ and Oxides of Nitrogen, Sulphur and Carbon, Global Emission of Major Air pollutants, Sinks of Air pollutants - Acid rain: Ozone depletion - Montreal protocol; global warming - Kyoto protocol; Gaseous pollution control measures; photo chemical smog; Automobile pollution in India; Zero emission standards; Noise pollution - Sensing, Measurement, Abatement measures. Air Protection Act. Noise Protection Act.

UNIT - II - Properties of water - Characteristics of water bodies; Heavy metals, Speciation and Complexation, water quality. Ground water pollution, Effluent standard, DO, BOD, COD, acidity, alkalinity, salinity, hardness; drinking water quality standards; Water pollution: Eutrophication, sources and sinks and classification of water pollution, Global discharge of heavy metals into water bodies, Purification of water by adsorption, flocculation ion exchange and reverse osmosis methods. Alternative of end of pipe treatments - Green Science, Radioactive pollution, Thermal pollution, Water Protection Act.

UNIT - III - Soil pollution; Sources, sinks and broad classification, movement and sorption mechanisms of inorganic contaminants and their impacts on physico-chemical and biological properties of soil and plants, Sediment pollution - Black carbon - formation and fate, Adsorption for organics, Global discharge of heavy metals into soil, Soil pollution control measures. Environmental Protection Act.

UNIT - IV - Hazardous Solid Wastes - Sources, Transport, Disposal, Hospital Wastes, Socioeconomic Impact in Third World Country - Basel Convention of Hazardous Wastes. Anthropology Effects – Population – Explosion – Environmental Laws.

UNIT - V - Industrial disaster and pollution - Case studies-chemical Industries - Pesticide Industries - Bhopal Disaster , Chernobyl accident, Love canal Disaster, Exxon Oil Disaster, Impact and Remedial Measures - Labeling - Laws and Regulations - Pollution Control Board.

REFERENCES:

1. India Disaster Report: Towards a Policy and Initiative, Parasuraman, S and Unnikrishnan, P, V, (2000). Oxford University Press,
2. Disaster Management, (1994). Indu Prakash Rashtra Prahari Prakashan, Gaziabad.
3. Environmental Law and policy in India, II Edition, Divan, S. and Rosencranz, A. (2001). Oxford University Press.
4. Pollution Control Legislation, Volume I and II, Tamil Nadu Pollution Control Board (1999). TNPC Board, Chennai,
5. Limnology, Charles Goldman and Alexander J. Home (1983) Mc Graw Hill,
6. An Introduction to Soil and Plant Growth, 5th Ed, Roy I Donalua, Raymond W Miller and John C Shiekluna (1987) Prentice Hall of India.
7. Textbook of Soil Science, 4th Ed., Biswar, T. D. and Mukherjee, S. K (1987) Mc Graw Hill.
8. Encyclopedia of Environmental Pollution and Control, Trivedy, R. K. (1994) Environmental Publications, Karad.

MAIN PAPER 3- ENVIRONMENTAL TOXICOLOGY

UNIT - I - Principles of toxicology Introduction; Classification of toxic agents; Characteristics of exposure; Spectrum of undesired effects; Interaction of chemicals; dose response; Variation in toxic responses; descriptive animal toxicity tests. Mechanism of toxicity- Introduction; Delivery; Reaction of toxicant with the target molecule; Repair or disrepair.

UNIT - II - Factors influencing toxicity – abiotic and biotic factors, interaction of chemicals. bioactivation, bioaccumulation, biomagnification. Analysis of toxicants in environmental samples.

UNIT - III - Risk assessment - Introduction; Definitions; Risk perception; Hazard identification; Exposure assessment; Risk characterization; Medium specific exposure assessment; Multimedium risk characterization.

UNIT - IV - Sources, transport, mobility, disposition and effect of pesticides - Op and Oc pesticides- herbicides and non persistent pesticides. Non pesticidal organic chemicals low molecular weight hydrocarbons, aromatic hydrocarbons, PCBs, chl orophenols, dioxins, phthalate, esters p1 astisizers, PAHs.

UNIT - V - Sources, transport, mobility, disposition and effect of heavy metals - As, Hg, Cd, Cr, Pb, Se, Inorganic ions - nitrates, phosphates, fluorides, asbestos, SO₂, NO_x, CO, H₂S. Role of an individual in the prevention of pollution.

REFERENCE BOOKS

1. Environmental management. Vol III. Ed.B.Nath. L.Hem, D.Deevuyst, UUB Press Brussels, Belgium.
2. Principles of ecotoxicology. G.C. Butler.
3. Toxicology. Casarett and Doull.
4. Essential of toxicology. T.A. Loomis,
5. Modern toxicology P.K Gupta:et at,
6. Ecotoxicology- M.Moriarity
7. Toxicology-The basic science of poisons.Ed.Cwl is D Klaassen.
8. Toxicology and Risk Assessment - Ed.Anna M Fau and Louis
9. Principles, methods and applications. W. Chang.

MAIN PAPER 4- 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, X² 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.LPalanisamy
6. Standard Method for the Examination of Water and Waste water - APHA
7. Instrumental Methods of Analysis - B.K.Sharma

MAIN PAPER 5- 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. Ecosystem – types, Structure and components. Forest, Grassland, Desert, Aquatic (Pond, Lake, Stream, river, estuarine, marine) Ecosystem. Energy transfer – food chain – Food web.

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

MAIN PAPER 6- 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 I.s.Birdie, Phanpat Ral Publishing Co, New Delhi, 1998.
2. Environmental Engineering, Vol. & 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

MAIN PAPER 7- ENVIRONMENTAL IMPACT ASSESSMENT, AUDIT AND ECONOMICS

UNIT - I - Environmental Impact Assessment: Definition - Purpose of ETA - Regulatory frame work in India - Base line data generation - Requiring and planning of field survey - Review of information required on development/industrial project - procedure for reviewing EI analysis and statement - EIA guidelines 1994 - Notification of Govt., of India Identification of environmental risks due to developmental project activities Preparation of on- site and off-site disaster management plans.

UNIT - II - Assessment Methodologies: Physical Environment Assessment - Flora Assessment Plant Survey - Animal population size - Aquatic Assessment - Necessity of public participation in environmental decision making - Prediction and assessment of visual impacts of socio-economic environment,

Ecoplaning: Definition and concept - Land use policy for India - Urban and rural planning for India - Land use pattern - Cost benefit Analysis - Limits to Growth theory.

UNIT - III - Environmental Audit: Objectives - Scope - Coverage - Policy development - Defining boundaries - Goals - Policy compliance - Organization and staffing of Audit team - Resources - Approach to Audit; (a) Pre-visit Activity (b) on-site activities - Understanding Management Systems - Assessing strengths and weaknesses - Audit evidence gathering and evaluation (c) Post Audit Activities - Audit principles - Benefits to Industry

UNIT - IV - Environmental Economics: Concepts of Economics and Scope of Environmental Economics - Economics of Pollution Control- Cost-Benefit Analysis and Evaluating Alternatives - Environmental Accounting - General Framework of Environmental Accounts.

UNIT - V - Case studies Water related projects, Air related projects, soil and solid waste related 'projects Environmental quality - Public and socio economic welfare 0 New ways towards environmental management - Active - Protective approach - Changing concept of environmental management - Cleaner production - Environmental Management System.

REFERENCES

1. Canter L. W", Environmental Impact Assessment, McGraw Hill Book Co, New York (1996).
2. Bregman J.L., Environmental Impact Statements, Lewis Publishers, Londo(1999).
3. Singleton R, Castle P and Sort D, Environmental Assessment, Thomas Telford Publishing, London (1999).
4. Eccleston C.H.. Environmental Impact Assessment - A comprehensive guide to project and strategic planning, John Wiley and Sons (2000).
5. Murthi S. Economic Growth and Environment, RSBA Publishers (1998).

PRACTICAL I

AIR, WATER AND SOIL ANALYSIS

1. Air Analysis: I. 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.
3. 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 (identification)

PRACTICAL -2 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.