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 quality 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

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Paper</th>
<th>Title of the Paper</th>
<th>Exam. Duration</th>
<th>Max. Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Main Paper 1</td>
<td>Energy and Environment</td>
<td>3 hrs</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Main Paper 2</td>
<td>Environmental Pollution</td>
<td>3 hrs</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Main Paper 3</td>
<td>Environmental Toxicology</td>
<td>3 hrs</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td>Main Paper 4</td>
<td>Natural Resources and Conservation</td>
<td>3 hrs</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Main Practical I</td>
<td>8 hrs/day, two consecutive days</td>
<td>100</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>II year</td>
<td>Main Paper 5</td>
<td>Instrumentation Methods of Analysis</td>
<td>3 hrs</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>Main Paper 6</td>
<td>Environmental Engineering</td>
<td>3 hrs</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>Main Paper 7</td>
<td>Environmental Impact Assessment, Audit and Economics</td>
<td>3 hrs</td>
<td>100</td>
</tr>
<tr>
<td>7</td>
<td>Main Practical II</td>
<td>8 hrs/day, two consecutive days</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project Work</td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>1000</td>
<td></td>
</tr>
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</table>
6. Question paper model for theory and practical

<table>
<thead>
<tr>
<th>M.Sc., Environmental Sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question Paper Pattern (Non-Semester)</td>
</tr>
<tr>
<td>(Theory Paper)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part – A</th>
<th>5 x 5 = 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer all questions</td>
<td></td>
</tr>
<tr>
<td>(Two questions from each unit with internal choice)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part – B</th>
<th>5 x 15 = 75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer all questions</td>
<td></td>
</tr>
<tr>
<td>(Two questions from each unit with internal choice)</td>
<td></td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>Record 25 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project work (100 Marks)</td>
</tr>
<tr>
<td>Project Report (075 Marks)</td>
</tr>
<tr>
<td>Viva – voce (025 Marks)</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Chapter No.</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Review of Literature</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Materials and Methods</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Results</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Discussion</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Summary</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Reference</td>
<td></td>
</tr>
</tbody>
</table>
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 - 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 fussion reactions - nuclear reactors - safety measures, environmental problems related to radioactive materials - radioactive waste disposable methods.


REFERENCE BOOKS:

1. Energy principles problems alternatives : Joseph Priest
2. Environmental chemistry : John Moore et at
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 - 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 - 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, Parasuaraman, P. V. and Unnikrishnan, P., (2000). Oxford University Press,


4. Pollution Control Legislation, Volume I and II, Tamil Nadu Pollution Control Board (1999). TNPC Board, Chennai,


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 persistant pesticides. Non pesticidal organic chemicals low molecular weight hydrocarbons, aromatic hydrocarbons, PCBs, ch1 orophecols, 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 ,NOx, CO, H2S. Role of an individual in the prevention of pollution.

REFERENCE BOOKS

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
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 - IV - Introduction, principle, instrumentation and application of Naphelometry - 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 - Dougles A Skoog and Donald M. West
3. Instrumental Methods of Analysis - Willard, Merril and Dean
4. Instrumental Methods of Chemical analysis - Chatwat and Anand
7. Instrumental Methods of Analysis - B.K.Sharma
MAIN PAPER 5- NATURAL RESOURCES AND CONSERVATION


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.


REFERENCE:

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


2. Environmental Engineering, Vol. & II - G.S.Garg


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 El 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 - 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


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 SO$_2$, CO$_2$, NOx, 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:


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.