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**SYLLABUS OF**  
**MASTER OF SCIENCE**  
**IN**  
**ENVIRONMENTAL SCIENCES**  
**TWO YEAR FULL TIME SEMESTER SYSTEM**  
**PROGRAMME**

The proposed programme shall be governed by

Department of Environmental Sciences

Faculty of Science

Dr. R. M. L. Avadh University, Faizabad-224001

(Effective from Academic Session 2011-12)

# MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCES

## TWO YEAR FULL TIME SEMESTER SYSTEM PROGRAMME

The proposed programme shall be governed by the Department of Environmental sciences, faculty of Science, Dr. R. M. L. Avadh University, Faizabad-224001  
(Effective from Academic Session 2011-12)

### PROGRAMME STRUCTURE

Part-I		Max. Marks (theory/Internal assessment*)
SEMESTER -I		
ENS-101	Fundamentals of Ecology	100 (70/30)
ENS-102	Natural Resource Conservation and Management	100 (70/30)
ENS-103	Forest and Wildlife Ecology	100 (70/30)
ENS-104	General Environmental Aspects	100 (70/30)
<b>Practical :</b>		
ENS-105	Lab course – I	100 (70/30)
ENS-106	Lab course – II	100 (70/30)
<b>Total</b>		<b>600</b>
SEMESTER -II		
ENS-201	Environmental Chemistry and Toxicology	100 (70/30)
ENS-202	Environmental Meteorology and Remote Sensing	100 (70/30)
ENS-203	Environmental Management and Impact Assessment	100 (70/30)
ENS-204	Biostatistics, Instrumentation and Computer application	100 (70/30)
<b>Practical:</b>		
ENS-205	Lab course I	100 (70/30)
ENS-206	Lab course II	100 (70/30)
<b>Total</b>		<b>600</b>
Part- II		
SEMESTER -III		
ENS-301	Environmental Microbiology and Biotechnology	100 (70/30)
ENS-302	Environmental Geoscience	100 (70/30)
ENS-303	Environmental Policies and Laws	100 (70/30)
ENS-304	Environmental Engineering	100 (70/30)
<b>Practical:</b>		
ENS-305	Lab course I	100 (70/30)
ENS-306	Lab course II	100 (70/30)
<b>Total</b>		<b>600</b>
SEMESTER -IV		
ENS- 401	Dissertation** work or Review-essay or Project Report	400
	Evaluation	
	Seminar	100
	Viva- Voce	100
<b>Total</b>		<b>600</b>
<b>Grand Total</b>		<b>2400</b>
* Internal assessment ( Test I- 10 + Test II- 10 + Attendance- 05 + Student response - 05 = 30)		
** Dissertation shall begin in Semester III (Part-II) and examined by internal as well as external examiner.		

S. Kulkarni  
22/5/11

Harshvardhan  
22/5/11

Dr. P. K. Singh  
22/5/11

## SEMESTER – I

ENS-101 FUNDAMENTALS OF ECOLOGY

M.M. 70

- Unit I** Introduction to ecology and environmental sciences: Definition, Objectives, subdivisions and scope. Basic ecological tools and techniques. Relation between ecology and environmental sciences. General concepts of level of organization, Biosphere, Autecology and Synecology.
- Unit II** Environment and abiotic components of ecosystem: Atmosphere, lithosphere and hydrosphere. Abiotic environmental factors (temperature, light, water etc. Different environmental laws and limiting factors (Liebig's law of minimum, Shelford's law of Tolerance, Combined concept of limiting Factors).
- Unit III** Biotic components of ecosystem: Biotic community (General characteristics of a community. Interdependence in a community and community metabolism) and ecological niche (concept, definition and types of niche, Gause's Principle), ecological succession and community evolution. Population ecology: Population characteristics and regulation of population size. Inter and intra specific interaction (Positive and negative interaction). Ecological genetics, Quantitative analysis of plant community, Quadrates, Frequency, Density, Important value Index (IVI).
- Unit IV** Dynamics of Ecosystems: Bio-geochemical cycle. Food chain and energy flow in ecosystems. Concepts of productivity and standing crops, ecological indicators, Ecological efficiencies, edge effect.
- Unit V** Diversity of Ecosystems: Bio geography and different ecosystems of the world (Lake, Pond, marine, estuarine and terrestrial ecosystems)

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**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

S. Mukle  
22/5/11

Trishu nar  
22/5/11

Dr. P. R. S.  
22/5/11



**ENS-102      NATURAL RESOURCE CONSERVATION AND MANAGEMENT**  
**M.M. 70**

- Unit I** Natural resources- Concept and classification and natural resources. Crisis of Water, Management of water resources – Concept and classification, Integrated water resources management. Watershed Management; Rain Water Harvesting. National lake and river conservation programme. Wetland management. Coastal zone management- Concept, scope, issues and strategies.
- Unit II** Mineral resources and Environment : Resources and reserves. Mineral and population, Ocean as new area for exploration of mineral resources. Ocean ore and recycling of resources.
- Unit III** Soil management, soil loss-soil erosion. Conservation and management strategies. Role of organic matter and its maintenance, diagnosis of nutrient deficiencies. Remedial measures and management techniques.
- Unit IV** Energy resources: 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, photovoltaic, solar ponds: nuclear energy- fusion and fission: magneto hydrodynamic power, bio-energy-energy from biomass and biogas, anaerobic digestion: energy use pattern in different parts of world.
- Unit V** Forest management : Forest- land use changes in India- future demands of forest lands, captive plantation, community forest management, Forest rehabilitation, urban forestry, Protected area management and conservation. Integrated development programme in forest area, biodiversity of India- Aquatic and terrestrial. Endangered and threatened species.

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*S. Mukherjee*  
22/5/11

*Trishu nani*  
22/5/11

*h. p. nani*  
22/5/11



- Unit-I** Forest types, Organization and productivity: Major types and composition of forests of India, structural organization of forest ecosystems, Primary production in different ecosystems and methods of measurement of primary production.  
**Social forestry:** Objectives, scope and necessity, agroforestry, Extension forestry, eucalyptus dilemma, people's participation, Roles on NGOs.
- Unit-II** **Silvicultural practices:** Silvicultural principles, different silvicultural practices, impact of deforestation and shifting cultivation on forest ecosystems.  
**Forest management:** Objectives and principles, techniques, sustainable yield relation, biodiversity and Forest.
- Unit-III** Values of wild life. Wildlife census methods (waterhole survey, point count and line transect methods, pug marks count method, King's census method), Components of wildlife habitat (Cover, Food, Water and Space), Common flora and fauna of India.
- Unit-IV** Indian wildlife (Introduction, distribution of wildlife in ecological subdivision of India), IUCN Categories, National Parks, Wildlife Sanctuaries, Biosphere Reserves and Zoos in India, Gene pool. Habit, Habitat and breeding biology of few mammals (*viz.* Elephant, Tiger) and birds (*viz.* Weaver bird, Oriental Magpie Robin).  
Wildlife protection: Ecological basis of wild life conservation and management, case studies on crocodile farming, sea turtle conservation and project tiger, wild life and range management, management of Fire, Role of NGO's in wildlife and forest conservation, Agenda-21.
- UNIT – V** Reasons for wildlife depletion (Habitat destruction, Commercial wildlife exploitation, Overgrazing etc.) Eco-tourism management, Measurement for wildlife conservation (Policies and programmes), Special projects for endangered species (Project tiger, Gir lion Sanctuary Project, Crocodile breeding project, Project Hangul), International trade of wildlife, Animal cruelty: causes and prevention.

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S. Anil K. G.  
22/5/11

Harishwar  
24/5/11

Dr. P. K. S. S.  
22/5/11

- UNIT – I** Evolution, Origin of life and Speciation, Human ecology and human settlement, Scheme of labeling of eco-friendly products (Ecomark), Environmental Education and Awareness, Environmental Management: meaning and need.
- UNIT – II** Convention on Conservation of Antarctic marine (1980) and mineral living resources, Treaty on principles governing the activities of state in the exploration and use of outer space (1967). The citizens convention on biodiversity/biological (1992), International convention on the high seas and fishing and living resources (1958) and Intervention of oil pollution casualties (1969).
- UNIT – III** Environment issues in India viz. Narmada dam, Tehri dam, *Chipko* movement, *Beej Bachao Andolan*, Green revolution, Silent valley movement, *Urja gram*, CNG implementation in Delhi. Formation and reclamation of wastelands, User, Alkaline and Saline soil, Hazardous wastes, Epidemiological issues: Goiter, Fluoriosis and Arsenic poisoning, Desertification and its control.
- UNIT – IV** Environmental priorities in India, Sustainable development: concept, objectives and principles. Challenges for sustainable development: Social, Political and Economic considerations, Role of individual and community in Sustainable development. Urban and rural planning, utilization of fly ash, waste disposal, Recycling and power generation, Resettlement and rehabilitation process.
- UNIT – V** Wetlands conservation, Water crisis and rainwater harvesting, Water conservation, Coastal management, Climate of India and Indian Monsoon, Tropical cyclones, Coral reef conservation.

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*S. Mukherjee*  
22/5/11

*1. Narayan*  
22/5/11

*h. P. S.*  
22/5/11

**M.Sc. ENVIRONMENTAL SCIENCE SYLLABUS**

**PRACTICALS**

**Semester- I**

**ENS-105: LAB COURSE – 1**

**Time: 6-8 HOURS**

**M.M. 70**

- A. To determine the following parameters of grassland vegetation** **15**  
(Two exercise to be done in examination)
1. Minimum size and number of quadrat
  2. Frequency of plant species and its comparison with Raunkiaer's standard diagram.
  3. Density of plant species
  4. Importance Value Index (IVI)
  5. Index of dominance and Diversity
- B. To calculate the following parameters** **15**  
(Two exercise to be done in examination)
1. To calculate the lambda max of the given compound by spectrophotometer.
  2. To calculate the lambda max of the given compound by Colorimeter.
  3. RF value of the given sample by Thin Layer Chromatography.
  4. RF value of the given sample by Paper Chromatography
  5. To Study the morphological and anatomical adaptation of the following.  
A- Hydrophytes B- Xerophytes
- C. Determination of Primary Productivity by following methods:** **10**  
(One exercise to be given)
1. Harvest method
  2. Chlorophyll content method.
  3. Light and dark bottle method.
- D. Comment on the following.** **10**  
(Two comments to be given)
1. Ecological pyramid
  2. Biosphere reserves
  3. Biome
  4. Ecological Models
  5. Principle of Gause
  6. Inter and intra specific Interaction
  7. Ecological Efficiency
  8. Edge Effect
  9. Standing crops
  10. Commensalisms
- E. Viva Voce** **10**
- F. Practical record/Chart/Model** **10**

**Total** **70**

*S. M. K.*  
22/5/11

*1. Arun Kumar*  
22/5/11

*Dr. P. K.*  
22/5/11



## PRACTICALS

**ENS-106: LAB COURSE – II**

**TIME: 6-8 HOURS**

M.M. 70

- |           |   |                                |
|-----------|---|--------------------------------|
| <b>A.</b> | <b>Determine the following air pollutants by HVS/Gas analyzer</b> | <b>15</b>                      |
|           | (Two exercises to be given)                                       |                                |
|           | 1-NO <sub>x</sub>   | 2- SO <sub>x</sub>             |
|           | 4- RSPM   | 5- SPM                         |
|           |   | 3- CO <sub>2</sub>             |
| <b>B.</b> | <b>Determine the following water parameters</b>                   | <b>15</b>                      |
|           | (Two exercises to be given)                                       |                                |
|           | 1-DO  | 2- BOD                         |
|           | 4- Alkalinity   | 5- TDS                         |
|           |   | 3- COD                         |
| <b>C.</b> | <b>Analysis of soil for the following parameters</b>              | <b>10 (5+5)</b>                |
|           | (Two exercise to be given)  |                                |
|           | 1- Organic matter   | 2- Nitrogen                    |
|           |   | 3- Soil water holding capacity |
|           | 4- Phosphate phosphorus   |                                |
| <b>D.</b> | <b>Comments on the following</b>                                  | <b>10 (5+5)</b>                |
|           | (Two comments to be given)  |                                |
|           | 1- Important value Index (IVI)                                    | 2- Productivity                |
|           |   | 3- Food Chain                  |
|           | 4- Autecology and Synecology                                      | 5- Liebig's law of minimum     |
|           | 6- Shelford's law of Tolerance                                    | 7. Law of Thermodynamics       |
|           | 9. Material balance   | 8. Biomes                      |
|           | 10. Energy flow   |                                |
| <b>E.</b> | <b>Viva Voce</b>  | <b>10</b>                      |
| <b>F.</b> | <b>Practical record/Chart/Model</b>                               | <b>10</b>                      |
|           | <b>Total</b>  | <b>70</b>                      |

~~S. Mukher.~~  
~~22/5/11~~

Herbman  
2/17/11

24/5/11

## SEMESTER - II

### ENS-201 ENVIRONMENTAL CHEMISTRY AND TOXICOLOGY

M.M. 70

- Unit I** Fundamentals of Environmental Chemistry: Stiochiometry, Gibb's energy, chemical potential, chemical equilibria, acid base reactions, solubility product, solubility of gases in water.  
Radioactive and Thermal pollution.
- Unit II** Air: Chemical composition of Air: Chemical speciation. Particles, ions and radicals in the atmosphere. Natural and anthropogenic sources of pollution. Primary and Secondary pollutants. Transport and diffusion of pollutants. Gas laws governing the behaviour of pollutants in the atmosphere. Oxygen and ozone chemistry. Chemistry of air pollutants Photochemical smog. Methods of monitoring and control of air pollution SO<sub>2</sub>, NO<sub>x</sub>, CO, SPM. Effects of pollutants on human beings, plants, animals, materials and on climate. Acid rain, Green house effect, Air quality Standards.
- Unit III** Water: Chemistry of water, Types, sources and consequences of water pollution, Physico-chemical and bacteriological sampling and analysis of water quality. Sewage and waste water treatment and recycling. Water quality standards. Concept of DO, BOD, COD, sedimentation, coagulation, filtration, Redox potential.  
Marine: Sources of marine pollution and control. Criteria employed for disposal of pollutants in marine system-coastal management.
- Unit IV** Soil: Soil Chemistry: Inorganic and organic components of soil. Nitrogen pathways and NPK in soils. Physico-chemical and bacteriological sampling and analysis of soil quality. Soil pollution and control.  
  
Noise: Sources of Noise pollution, measurement of noise and indices, effect of meteorological parameters on noise propagation. Noise exposure levels and standards. Noise control and abatement measures. Impact of Noise on human health.  
  
**Sources and generation of solid wastes**, their characterization, chemical composition and classification. Different methods of disposal and management of solid wastes (Hospital waste and Hazardous waste) Recycling of waste material, waste minimization technologies.
- Unit V** Bio-Chemical toxicology: Nature of toxicity (Acute and chronic) Dose and time response relationship. Teratogenecity, carcinogenicity and Mutagenecity. Toxic Chemicals in the environment.  
Biotransformation of Xenobiotics: Uptake, Distribution, Metabolism, Accumulation and excretion of xenobiotics

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*Shukla*  
22/5/11

*Prabakaran*  
22/5/11

*Ar. P. S. S.*  
22/5/11

- Unit I** Earths as a planet- Motion of the earth, seasons, law of Black body radiation solar constant, Albedo. Mean heat balance of the earth atmosphere system. General Circulation.
- Unit II** Atmospheric structure and composition, Temperature and pressure, humidity. Dry adiabatic and saturated adiabatic lapse rates. Stability of the atmosphere. Inversions. Local winds. Clouds- Their formation and classification. Artificial modification of Clouds.
- Unit III** Climatology - Climatic control. Elements and factors of climate and their interaction. Oceanic and Continental influence, Influence on environment. Climatic Change.
- Unit IV** Basic Concepts of Remote Sensing, Physics of Remote Sensing; electromagnetic spectrum, terminologies, Principles of Radiation: radiation Transfer. Spectral reflectance of vegetation, soil and water. Interpretation principles and techniques.
- Unit V** Thermal and microwave sensing: basic concepts, Profiles: SAR, SLAR-operation, Characteristics of RADAR signals, earth surface characteristics influencing RADAR returns. Interpretation of microwave Data. Application of remote sensing, G.P.S. and G.I.S.

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S. M. K. S.  
22/5/11

Trishan Gnan  
24/5/11

Debabrata  
22/5/11



**Unit I** Environmental Management, Concept of Environmental management, Aspects & approaches to Environmental Management, Ecological Basis of Environmental Management, Agro-climatic Regional Planning, Risk Assessment : Basic components of a hazard control system, Techniques of risk assessment, Emergency control & disaster planning

**Unit II** Environmental Impact Assessment: Introduction, concept and aims, impact statement, methods and processes, mitigation measures. Prediction and assessment of impacts on air, water and noise. EIA Guidelines 1994, notification of Govt. of India.

**Unit III** Public participation in Environmental decision making. Environmental Economics, Economics of pollution control, Cost Benefit Analysis. Economics and Environment

Economic growth, Gross National product and the quality of life: Sustainable-earth economy, Discount factor

Environmental Ethics: Ethics and moral, Throw-away society ethics, Sustainable-Earth Society ethics, Ethical guidelines.

**Unit IV** Prediction and assessment of impacts on the biological, cultural and socio-economic environments, Introduction and basic concepts.. Environmental Impact Assessment of major developmental projects – industries, mining, thermal power plants, atomic power stations, transport (rail, road highway), tourism (including hotels, beach, resorts)

**Unit V** Environmental Audit – introduction, concepts, steps, methodology. EIA of different xenobiotics (chemical, fertilizer, heavy metals)

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*S. N. K. G.*  
22/5/11

*T. Subramanian*  
22/5/11

*J. S. S. S.*  
22/5/11

- Unit I** Basic elements and tools of statistical analysis: Probability, Sampling, Measurement and distribution of attributes; Distribution – Normal, Poisson and Binomial; Arithmetic, Geometric and Harmonic Means; moments; tests of hypothesis and significance, t and  $\chi^2$  tests.
- Unit II** Models of population growth and interactions- Lotka-Volterra model, Leslie's matrix model, point source stream pollution model, box model, Gaussian plume model.
- Unit III** Principal of analytical methods: Titrimetry, Gravimetry, Colourimetry, Spectrophotometry (atomic absorption spectrophotometry, X-ray fluorescence, X-ray diffraction, flame photometry, NMR and ESR spectroscopy) Chromatography, Gas chromatography, , GLC, HPLC, Electrophoresis, Gel filtration.
- Unit IV** Bio-sensors: Radioactive techniques and scintillation counter, Microscopy (Compound, Phase contrast, fluorescent, electron microscope). pH meter, refractometer, Nephelometer , biochips, Smoke meter. Samplers- types methods of sample preservation.
- Unit V** Introduction and history of Computer. Computer Basics, Communication technology and Information superhighway. IT tools, MS Windows and MS Office (MS word, MS Power point and MS Excel) Application of Computer in Environmental Modeling and forecasting.

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*Shukla*  
22/5/11

*Tarben ma*  
24/5/11

*Shukla*  
22/5/11

## SEMESTER – III

### ENS-301 ENVIRONMENTAL MICROBIOLOGY AND BIOTECHNOLOGY

M.M. 70

**Unit I** Microbial diversity. General classification. Microbial colonization. Effect of environmental determinants (Temperature, radiation, salinity etc.) Algal Blooms. Biological interactions of microbes with plants and animals.

**Unit II** Microbiology of air, water, and soil. Biogas generation. Alternative sources of energy like hydrogen.

Utilization of treated effluent water.

**Unit III** Principles of immunology – resistance, antigen immunity, antigen, antibody, binding and reaction mechanism. Immunological response to infectious diseases. Inflammation and complement systems. Hypersensitivity (Allergy). AIDS and Cancer. Bioremediation: Bioreactors for Bioremediation, Types of bioremediation (Natural ,solid phase ,slurry phase and bioventing) ,application of bioremediation ,biodegradation of xenobiotics and pollutants , Biodgradation of pesticides ,Enzyme catalyzed pesticide degradation reactions Biosorption: Use of bacteria ,fungi and algae in biosorption , Biomineralization and bioleaching.

**Unit IV** Recombinant DNA technology and its application. Bio-pesticides, biodegradation of Pesticides, hydrocarbon plastic etc. Role of genetically engineered microbes in the environment, guidelines and ethics of their release.

Microbial management of Hazardous waste and wastelands. Biotechnological approaches and steps involved in conventional and advance treatment technology. Biofertilizer technology: Rhizom culture, Blue-green algae culture, *Azolla* culture and *Micorrihizae* culture. Benefits and significance of biofertilizers in agriculture.

**Unit V** Industrial use of bacteria, lactic acid, vinegar and amino-acid production, alcoholic fermentation, penicillin production, vitamins and enzymes. Food microbiology – contamination and spoilage of fresh food . Preservation of food . Fermentated food, food poisoning. Microbiology of milk, milk products – sources and types of micro-organisms, pasteurization.

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*Shukla*  
22/5/11

*Prasanna*  
22/5/11

*Aradhya*  
22/5/11



## PRACTICALS Sem-II

ENS-205: LAB COURSE – III

TIME: 6-8 HOURS

M.M. 70

<b>A. Analysis of the following parameters:</b> (Two exercises to be given)	<b>20</b>
1. Hardness	
2. Transparency	
3. Turbidity	
4. Chloride ion/salinity	
5. Total dissolved solids	
6. Conductivity	
7. Composition of solid waste	
8. Chlorophyll content estimation in road side plants	
<b>B. Statistical analysis</b>	<b>20</b>
1. To calculate the student "t" test by recorded data.	
2. To evaluate heterogeneity of Given population. ( $\chi^2$ test).	
3. To test for interspecific association.	
4. To test for independence.	
5. To calculate the mean value of observed data.	
<b>C. Comments on the following:</b> (Two exercises to be given for comments)	<b>10</b>
1. pH meter	2. DO meter
3. Conductivity meter	4. Jackson turbidity meter
5. Nephelometer	6. Spectrophotometer
7. Flame Photometer	8. Lux meter
9. Anemometer	10. Sound meter
<b>D. Viva Voce:</b>	<b>10</b>
<b>E. Practical record/Chart/Model</b>	<b>10</b>
<b>Total</b>	<b>70</b>

*Sanku*  
22/5/11

*Harbender*  
22/5/11

*Lucy*  
22/5/11

## PRACTICALS

ENS-206: LAB COURSE – IV

TIME: 6-8 HOURS

M.M. 70

- A. **Analysis of Heavy metals in given samples by Atomic Absorption Spectrophotometer.** 20  
(Two experiment to be given)  
1. Ag 2. Al 3. Ca 4. Cd 5. CO 6. Cr 7. Cu 8. Fe 9. Hg 10. Mg  
11. Mn 12. Ni 13. Pb
- B. **Hypothetical EIA of following:** 20  
(One exercise to be given)  
1. Urbanization  
2. Dam construction  
3. Hydroelectric power generation  
4. Tourism  
5. Sugar mills
- C. **HPLC Practical** 10  
(One exercise to be given)  
1. To determine the concentration of metals by HPLC.  
2. Identify the metals by HPLC
- D. **Comments on the following**  
(Two comments to be given)  
1. Teratogenesisity 2. Redox Potential 3. Physics of Remote Sensing  
4. GIS 5. Environmental Ethics 6. IT Tools  
7. Electrophoresis 8. Biochips 9. COD  
10. Albedo
- E. **Viva Voce:** 10
- F. **Practical record/Chart/Model:** 10

Total 70

*S. Mukherjee*  
22/5/11

*P. Subramanian*  
22/5/11

*J. Lakshmi*  
22/5/11

## SEMESTER – III

### ENS-301 ENVIRONMENTAL MICROBIOLOGY AND BIOTECHNOLOGY

M.M. 70

- Unit I** Microbial diversity. General classification. Microbial colonization. Effect of environmental determinants (Temperature, radiation, salinity etc.) Algal Blooms. Biological interactions of microbes with plants and animals.
- Unit II** Microbiology of air, water, and soil. Biogas generation. Alternative sources of energy like hydrogen.  
Utilization of treated effluent water.
- Unit III** Principles of immunology – resistance, antigen immunity, antigen, antibody, binding and reaction mechanism. Immunological response to infectious diseases. Inflammation and complement systems. Hypersensitivity (Allergy). AIDS and Cancer. Bioremediation: Bioreactors for Bioremediation, Types of bioremediation (Natural ,solid phase ,slurry phase and bioventing) ,application of bioremediation ,biodegradation of xenobiotics and pollutants , Biodgradation of pesticides ,Enzyme catalyzed pesticide degradation reactions Biosorption: Use of bacteria ,fungi and algae in biosorption , Biomineralization and bioleaching.
- Unit IV** Recombinant DNA technology and its application. Bio-pesticides, biodegradation of Pesticides, hydrocarbon plastic etc. Role of genetically engineered microbes in the environment, guidelines and ethics of their release.  
Microbial management of Hazardous waste and wastelands. Biotechnological approaches and steps involved in conventional and advance treatment technology. Biofertilizer technology: Rhizom culture, Blue-green algae culture, *Azolla* culture and *Micorrihizae* culture. Benefits and significance of biofertilizers in agriculture.
- Unit V** Industrial use of bacteria, lactic acid, vinegar and amino-acid production, alcoholic fermentation, penicillin production, vitamins and enzymes. Food microbiology – contamination and spoilage of fresh food . Preservation of food . Fermentated food, food poisoning. Microbiology of milk, milk products – sources and types of micro-organisms, pasteurization.

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Schulka  
22/5/11

1. Subramanian  
22/5/11

Dr. P. S. S. S.  
22/5/11



**Unit I** Environmental Geosciences- Fundamental concepts.

The earth systems and biosphere: Conservation of matter in various geospheres- lithosphere, hydrosphere, atmosphere and biosphere. Energy budget of the earth. Earth's thermal environment and seasons. General relationship between landscape, biome and climate. Climates in India, Indian Monsoon, El Nino, Droughts, tropical cyclones and western disturbances.

**Unit II** Earth's processes and geological hazards: earth processes: Concept of residence, times and rates of natural cycles. Catastrophic geological hazards. study of floods, landslides, earthquakes. Volcanism and avalanche. Prediction and perception of the hazards and adjustments to hazardous activities.**Unit III** Introduction : Composition of ocean water. Horizontal and vertical distribution of temperature in ocean, source of organic salinity in oceans and its controlling factors. Sources and types of marine deposits, their classification and distribution.**Unit IV** Land use planning: The land use plan. Soil surveys in relation to land use planning. Methods of site selection and evolution.**Unit V** Environmental Geochemistry: Concepts of Major, Trace and rare earth elements (REE). Classification of trace elements, mobility of trace elements: Trace elements and health. Possible effects of imbalance of some trace elements. Diseases induced by human use of land.

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**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

S. Anurag  
22/8/14

I. Anurag  
22/8/14

J. Anurag  
22/8/14

**Unit I** Environment protection- Issues and Problems, International and national efforts for environment protection. National Environmental Policy of India. (PSAP,1992; NCSPSED,1992 ). Provision of Constitution of India regarding Environment (Article 48, 51A and 253).

**Unit II** The Water ( Preventions and Control of Pollution ) Act, 1974; The Water Rules,1975; Air (Prevention and Control of Pollution) Act, 1981; The Air Rules,1982 ; Environmental Protection Act, 1986; Forest Conservation Act,1980; Indian Forest Act (revised), 1982; Wildlife (Protection) Act, 1972 and their amendments; Noise Pollution Rules,2000; Motor Vehicle Act, 1988.

**Unit III** Regulation for management of Hazardous Substances

Hazardous Waste ( management and Handling) Rules, 1989; Manufacture, Use, Import, Export & Storage of Hazardous Microorganisms & Genetically Engineered cells Rules, 1989; Hazardous Chemicals (Manufacture, storage & Import) Rules, 1989; Public Liability Insurance Act, 1991; National Environmental Tribunal Act, 1995; Biomedical Waste Rules, 1998.

**Unit IV** Public Interest Litigations (Cases filed & Movement in India) Scheme of labeling of Environment friendly products (Eco-Mark). National and International Organizations dealing with environmental issues. Famous Environmental Conventions

**UNIT – V** Case studies to be taken up: M.C. Mehta Vs Union of India: Ganga pollution case of Tanneries, AIR-1988 SC 1037 (1987), M.C. Mehta Vs Union of India, Ganga Pollution (Municipalities), AIR 1988 SC 1115 (1988), R.L. and E. Kendra Dehradun Vs State of U.P. (Dehradun quarrying case, AIR 1985 SC 652 and Banwari Sewa Ashram Vs State of U.P. AIR, 1987, SC 374.

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**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

*S. Mukherjee*  
22/5/14

*Trishna*  
22/5/14

*Dr. P. K. Mishra*  
22/5/14

- Unit I.** General principals and application of chemical engineering- Heat transfer – Different methods- Heat exchangers-Evaporators – Basic principles of radiation – handling of toxic and hazardous materials.
- Unit II.** Mass transfer: Ideal mixtures, Rault and henry's laws, X-Y diagrams- the distillation columns, reflux ratio, ideal plate, estimation of the number of ideal plates by Mc cabe Thiels method.
- Unit III.** The packed column, various types of packing, Requisite properties of packing, Channeling and flooding- Introduction of liquid-liquid extraction.  
Solid- liquid separation: filtration, Filtration equipments (details) Centrifuges, Sedimentation continuous thickener solid- gas separation- Cyclone, electrostatic precipitators, bag filters and scrubbers.
- Unit VI.** Introduction to chemical process industries, Concepts of Unit operations and unit processes. the flow chart , Simplified flow chart with description for the following. Sulphuric acid, caustic soda, metal refining, Insecticides, petroleum refining, paper and pulp organics with emphasis on local plants and sources of pollutants.
- Unit V.** Elements of Hydraulics- principles of fluids- basic equation for flow through pipes and open channels- Discharge and velocity equation.  
Water purification process in natural and engineered systems. Water supply – design and layout of water distribution systems.  
Process analysis, design and layout of industrial and municipal waste water systems.

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**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

S. Chukla  
22/5/11

Harben  
22/5/11

Dr. Parker  
22/5/11



## PRACTICALS

**ENS-305: LAB COURSE – V**  
**TIME 6-8 HOURS**

**M.M. 70**

- A. To record the following parameters by weather monitoring station 15**  
(Two exercise to be given)  
1. Atmospheric Pressure    2. Rain fall    3. Out door, Indoor Temperature  
4. Wind Speed and Direction    5. Wind Chill and Temperature  
6. Humidity and Dew point
- B. Microbial studies: 15**  
(Two slides to be given)  
1. Bacteria, Fungi and Protozoa studies- identification and comments.  
2. To Study the pollen grains in the given area.
- C. Experiments to perform: 10**  
(Two exercise to be given)  
1. Preparation of nutrient broth/Glucose broth  
2. Inoculation of inoculum (Any polluted water)  
3. Preparation of Nutrient Agar Medium (NAM)  
4. Preparation of Potato Agar Medium (PAM)  
5. Demonstration of pouring and streaking techniques  
6. Grams staining of *Lacto bacilli*  
7. Faecal colliform  
8. SPC
- D. Comments on the following 10**  
(Two comments to be given)  
1. Algal Blooms    2. Hyper Sensitivity    3. Bioremediation  
4. Pasteurization    5. El-Nino    6. Energy Budget of the earth  
7. Trace Elements    8. Food Poisoning    9. Bioleaching  
10. Xenobiotics
- F. Viva Voce: 10**
- G. Practical record/Chart/Model: 10**

**Total**

**70**

*S. Mukh.*  
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*S. C. Pathy*  
22/5/11

## PRACTICALS

ENS-306: LAB COURSE – VI

TIME: 6-8 HOURS

M.M.70

<b>A. Environmental Engineering Practical</b>	<b>20</b>
(Two Exercise to be given)	
1. To determine the Flow of liquid by Laminar Flow Bench	
2. Separation of Oil and grease from the given samples	
3. To determine the SO <sub>x</sub> , NO <sub>x</sub> , RSPM, SPM TPM through Stack Assembly.	
4. To determine the DO Saturation in given water sample.	
<b>B. Experiments on Remote Sensing:</b>	<b>20</b>
(One exercise to be given)	
1. Study of toposheets, satellite imageries and interpretations of images.	
2. Study of 3-D vision test cards with the help of pocket stereoscope.	
<b>C. Comments on the following</b>	<b>10</b>
(Two comments to be given)	
1. Environmental Polices	2. Eco Mark
4. Heat Transfer	5. Reflux Ratio
7. Electrostatic Precipitators	8. Principals of fluids
9. Rault's and Henry Law	10. Land use plan
3. Evaporators	6. cyclones
<b>D. Viva voce:</b>	<b>10</b>
<b>E. Practical record/Chart/Model:</b>	<b>10</b>
<b>Total</b>	<b>70</b>

*S. Mukherjee*  
22/5/11

*Prabakaran*  
22/5/11

*Dr. Parth*  
22/5/11

**SYLLABUS OF THE COURSE OF**  
**INNOVATIVE PROGRAMME OF UGC**

**[Pollution Abatement through Environmental Management (PATEM)]**

**PREPARED**

**BY**

**DEPARTMENT OF ENVIRONMENTAL SCIENCES**

**DR. R. M. L. AVADH UNIVERSITY,**  
**FAIZABAD-224001**



# Syllabus of the Course of Innovative programme of UGC

## Pollution Abatement through Environmental Management (PATEM)

SEMESTER -I		
Course No	Title of the Course	Marks
PATEM 301	Concept of Environment, Ecology and Resources	100
PATEM 302	Water and Soil Pollution and Control	100
PATEM 303	Air and Solid Waste pollution and Control	100
PATEM 304	Biostatistics, Instrumental Techniques and Computer Application	100
PATEM 305	Laboratory Practical on Environmental Analysis	100
	<b>Total</b>	<b>500</b>
SEMESTER -II		
Course No	Title of the Course	
PATEM 401	Environmental Impact Assessment and Environmental Management Systems (EIA & EMS)	100
PATEM 402	Natural Disaster Management	100
PATEM 403	Green Technology and Sustainable Development	100
PATEM 404	Indian Environmental law and Society	100
PATEM 405	Seminar / Project / Dissertation, Field studies	100
	<b>Total</b>	<b>500</b>
	<b>Grand Total</b>	<b>1000</b>

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## SEMESTER I

PATEM 301

Concepts of Environment, Ecology and Resources M. M.-100

**Unit-1: Ecology and Ecosystems:** Scope of Ecology, Subdivisions in Ecology, system concept in Ecology, component parts of an ecosystem, Classification of ecosystems, Ecological factors; temperature, Light, water.

**Bio-geochemical cycles:** Carbon cycle, nitrogen cycle, sulphur cycle, phosphorous cycle,

**Organism and Environmental Complex:** Type of interactions between different components, concept of stress and strain and Biological stress and strain, concept of limiting factor, Responses to change in Environmental complex, Law of minimum.

**Functional attributes of an Ecosystem:** Biological Diversity and stability.

**Food chain, Trophic levels & Ecological pyramid concept:** Types of food chain & Significance of food chains, method for studying food chains, pyramid of number, biomass & energy.

**UNIT II: Primary Production:** Concept of Primary Production, Factors affecting primary production, method for measuring primary production, Relationship between GNP, NPP and atmospheric respiration, primary productivity of different world sites.

**Secondary Production:** Concept of secondary production and secondary productivity, maintenance cost, production-assimilation efficiency and secondary productivity. Relationship of secondary production to net primary production.

**Energy flow in Ecosystems:** Concept of Energy, Energy source in Ecosystem, Laws governing energy transformation, concept of free energy, Enthalpy and Entropy, Energy flow in producers and consumers, Lindeman's Trophic-Dynamic concept, Ecological efficiencies, Energy flow models.

**Unit-III: Energy Resources:** Environmental Impact of Fossil Fuel use.

**Geothermal Energy:** Source, Principle of harnessing energy and its operation.

**Nuclear Energy:** Source, fission and fusion reactions.

**Solar Energy:** their advantages and drawbacks.

**Perpetual and Renewable Energy source:** Wind mills and applications, aero-generators, their advantages and disadvantages,

**Water Energy:** Hydroelectricity, wave and tidal energy, tidal power plant.

**Energy from Biomass:** Biomass as fuel, Biogas plants and generation, uses of biogas.

**Unit IV: Forest Resources:** Major types and composition of forests with references to India, Structural organization of forest ecosystems, Primary production in different Forest ecosystems & methods of measurement.

**Importance of Forests:** With reference to major and minor produce, climate, soil erosion, pollution control and water management, Concept of Biosphere Reserve, Biodiversity and forest. Forest Loss and management, Loss of forest cover with reference to world and Indian Context Impact of deforestation and shifting cultivation on forest ecosystems, Objective, Principle and techniques of forest Management. Management of forests involving different silvicultural principles and practices. Sustainable yield relation.

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**Unit-I:** Water resources and hydrological cycle, Importance and uses of water, structure and properties of water, history of major water pollution episodes, classification and types of water pollution, pollution of lakes, reservoirs, rivers, estuaries, coastal waters and ground water.

**Unit-II:** Water pollutants and their effects- nature, sources and degradation of organic matter, effects of organic pollution, type, persistence, kinetics, mode of action and toxicity of pesticides; source and accumulation of heavy metals, toxicity of heavy metals in organisms; source, characteristics, composition, fate of oil on organism, waterborne pathogens and their diseases; effect and control of thermal discharges; source, distribution, fate and biological effect of radioactive substances; eutrophication process, effects and control of eutrophication.

**Unit-III:** Soil pollution through fertilizers, pesticide and Irrigation water: Sources of soil pollution: agricultural practices and soil pollution,; type, rate application and fate of fertilizer, effect of nitrate, phosphate and potash fertilizers; type, demand, production and consumption of pesticides, persistence, fate and degradation of pesticides in soil, toxicity and effect of pesticides on soil organisms and plants biological control of pests, integrated pest management, evaluation of water quality, changes in soil by irrigation water.

**Unit-IV:** Soil Pollution through heavy metal, soil erosion and run off mining and solid waste: Source, translocation, distribution and uptake of heavy metals, toxic and ecological effect; factors responsible for soil erosion, siltation and soil sediments, environmental impact of mining on socio-economic condition, land degradation, air, water, flora and fauna; source, nature and generation of solid waste, their characteristic and classification, environmental and health impact of solid waste pollution.

### **PATEM 303    Air and Solid Waste pollution and Control    M. M. 100**

**Unit-1: Definition, history and meteorology of air pollution:** The earth's atmosphere, definition and classification of air pollution / pollutants, air quality in world and India, effects of meteorological parameters (wind velocity and turbulence, temperature lapse rates and stability, plume behavior), transport and diffusion of air pollution.

**Emission source of air pollution:** Natural sources, major Industrial sources (thermal Power generation plants, food and few industry, pulp and paper, inorganic and organic chemicals, Automobile exhaust, cigarette smoking, and occupational exposures, chemical weapons.

**Unit-II: Primary and secondary air pollutants and their atmospheric reactions:** oxides of carbon, sulphur and nitrogen, ammonia, hydrogen sulphide, hydrogen chloride, fluoride, chlorine, phosphorus, heavy metals, hydrocarbons, aldehydes, organic carcinogens, particulates, pesticides, radioactive substances, primary

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photochemical reactions in atmosphere, formation of ozone, PAN, free radicals and aldehydes in the air, reactions involving oxides of sulphur and nitrogen, smog, acid rain, ozone depletion. **Effects of air pollution:** Effects of air pollution plants and microorganisms and lichens, effects of air pollution on man and animals, effects of air pollution on physical structure and materials, effect of air pollution on climate change.

**Unit-III: Solid waste disposal and management:** Sources and generation of solid wastes, their characterization, chemical composition and classification. Different methods of disposal and management of solid wastes (Hospital waste and Hazardous waste) Recycling of waste material, waste minimization technologies.

**Unit-IV: Bioremediation:** Types of bioremediation application, biodegradation of pesticides and hazardous wastes, degradation of oil spills, biosorption, uses of bacteria in biosorption, use of fungi in biosorption, biomineralization and bioleaching, microorganisms involved in bioleaching of ores, mechanism of bioleaching, bioleaching and metal recovery.

#### **PATEM 304 Biostatistics, Instrumental Techniques and Computer Applications M. M. 100**

**Unit I: Basic elements and tools of statistical analysis:** Probability, Sampling, Measurement and distribution of attributes; Distribution - Normal, Poisson and Binomial; Arithmetic, Geometric and Harmonic Means; moments; tests of hypothesis and significance, t and  $\chi^2$  tests.

**Unit-II: Spectroscopic methods:** The principle, instrumentation (basic lay-out) and application of the ultraviolet and visible spectrometry, Fluorescence Photometry, Infra-red-spectroscopy, Nuclear Magnetic Resonance Spectrometry.

**Atomic Absorption Spectroscopy:** The principle, differences, instrumentation and application of Flame emission spectroscopy and Absorption spectroscopy. **Bomb Colorimetry:** Principle, experimental arrangement and its application.

**Unit-III: Chromatography Techniques:** The principle, experimental techniques, qualitative and quantitative analysis, applications of Adsorption Chromatography, Ion exchange chromatography, Paper chromatography, Thin layer chromatography, Gas liquid chromatography (Instrumentation), High performance liquid chromatography.

**Unit V: Introduction and History of Computer.** Computer Basics, Communication technology and Information superhighway. IT tools, MS Windows and MS Office (MS word, MS Power point and MS Excel) Application of Computer in Environmental Modeling and forecasting.

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## SEMESTER II

### **PATEM 401 Environmental Impact Assessment and Environmental Management Systems (EIA & EMS) M. M. -100**

- Unit I:** Introduction background, Nexus between Development and Environment, comparison between economic and Ecological criteria, concept of externalities, shared resources, Global commons & carrying capacities. Origin and Development of EIA. Relationship of EIA to sustainable & Development. EIA in Project planning & Implementation, EIA process: Evaluation of proposed action: Scoping EIA methodologies. Role of GIS in EIA baseline studies. Risk Assessment and Risk Management: Mitigation measures, comparison of alternatives, Reviews and decision making, compensatory actions, Green belts: Review of Procedure. Practices and guidelines in India.
- Unit II:** Case Studies on EIA of (a). River Valley Projects (b). Thermal Power Plants (c). Mining Projects (d). Oil Refineries and Petrochemicals (e). Tourism (f). Coastal zone development.
- Unit III:** Environmental Management System: ISO 9000 & ISO 14000 guidelines. Standards & Certification procedures, Risk assessment and emergency Preparedness. Environmental audit: Introduction & Scope, advantages of environmental audit, Types of audit (Compliance audit, Surveillance audit and EMS audit).
- Unit IV:** General approach of Environmental Audit: Audit team, guidelines for preparation of audit report, Pre-audit activities, activities at the site, Post-audit activities, Problems encountered during the audit- SWOT Analysis (Strength, weakness, Opportunities and through analysis) identified from Environmental. Audit Assessing Economic & Environmental benefits direct from Environmental Audit, Some case studies on Environmental audit

### **PATEM 402**

### **Natural Disaster Management**

**M. M. -100**

- Unit I:** Natural Hazards: Their Zoning and Risk Assessment, Environmental Security and Hazards Zoning, hazard zoning maps & preparedness plan. Risk Assessment Analysis: Hazards vs. Risk, Evaluation of Risk, Strategies for Hazard Mitigation: Priorities, Prediction, warning & Public information, Minimizing the probability of hazards, Public policy for hazard management.
- Unit II:** Earthquakes & Flood: Earthquakes and seismic hazards: origin & severity, effects, stability of structure & Risk Assessment, coping with seismic hazards, Earthquake prediction & control. Floods and flood management, causes excess flows, reduced carrying capacity of rivers, Runoff versus infiltration, sediment load & changing course of rivers management of floods (Strategy, treatment of water sheds, Reservoir & Detention basis, water spreading, ground water recharge, stream channelization, flood embankments), hazards zoning and land use regulation, Flood forecasting & warning.

S. Anurag  
22/5/11

Subash  
22/5/11

Pranav



**Unit III:** Cyclones, Tsunamis and Volcanic hazards: Cyclones & their genesis, Tsunamis and its impact, coastal hazards mitigation measure, Nature of volcanic hazards, Prediction of volcanic eruptions, mitigation of volcanic hazards.

**Unit IV:** Remote Sensing and Application: Introduction to remote sensing, Advantages of remote sensing over conventional methods of resource survey, components of remote sensing system- Electromagnetic radiation (EMR), platform, sensors, geography information system (GIS), methods and types of aerial photography, principles of satellite sensing, data acquisition, transmission and interpretation. Application of remote sensing in flood management, watershed management, soil mapping, urban management and land use, ground water management, mining impact assessment, coastal problems and preventing natural disasters.

### **PATEM 403 Green Technology and Sustainable Development**

**M. M. -100**

**Unit I:** Introduction: Emergence of new 20<sup>th</sup> century Technology, Technology transfer, The North to South issue, Technology: a double edge sword: A boon or a bane. Technology for sustainable development some valuable gifts of Science & Technology to mankind (Energy to sustain civilization, Food for all, Health for all, Biotechnology, Human genome Project, Space Technology, Communication Technology, the dawn of Nanotechnology), Negative legacy of Science & Technology, Technology for sustainable developments. Birth of Environmental Technology. Planning for sustainable development.

**Unit II:** Appropriate Technology for air Pollution Control. Removal of Sulphur from autofuel, Removal of SO<sub>2</sub> from waste gases of Smelters processing sulphide ores, Removal of SO<sub>2</sub> from Coal Power Plants by Flue-gas desulphurization, clean coal technology, Fluidized (Lime stone) Bed Combustion of coal to reduce SO<sub>2</sub> emission. Coal gasification Technology to convert high sulphur coal to low-sulphur coal gas control Technology of NO<sub>x</sub> (Modifying combustion technology, Recirculation of flue gas in to burners & dilution of flame, use of reducing agents to convert oxidizing NO<sub>x</sub> in to nitrogen) Control technologies for VOCs Control of green house gases.

**Unit III:** Bioengineering for Waste removal- Micro remediation Technology, Bioabsorption, Bioremediation etc.(using Fungi & bacteria), Phytoremediation Technology, plant species involved in phytoremediation, Mechanism of Phytoremediation. Vetiver Grass Technology (VGT) with case studies, use of water hyacinth & duck weed in water pollution control. Composting Technology: Environmental. Factors controlling composting. Composting methods (Microbial slurry- windrows Technology, Vermitechnology) Composting of hazardous wastes & their Significance.

**Unit IV:** Environmental Biotechnology for Sustainable Agriculture. High tech agriculture in India, concept of Sustainable agriculture, Agriculture biotechnology, the gene revolution, Biofertilizer technology (Rhizobium, Azospirillum, Mycorrhizal, Blue green algae, Azobacter, Azolla- BGA Symbiotic Biofertilizer, Biomanure technology, vermiculture biotechnology), Biotechnology for Pest & disease control. Technologies for alternative methods of Food production (Hydroponics, Saline agriculture, green house farming etc.

*S. Mukherjee*  
22/5/11  
*Dr. P. K. Saha*  
22/5/11  
*Dr. R. K. Saha*  
22/5/11



**Unit-I: Water Act 1974 and Air Act 1981:** Constitution of Central and State Pollution Control Boards, Power, Function and responsibility of Central and State Boards (Objectives, Area of jurisdiction, responsibility of an industry, power and function of state and central Government, Cognizance of offence, Penalties and Punishment), **Forest conservation Act, 1980:** Objective and Jurisdiction, Responsibility of Industry. Wildlife Protection Act 1972 Authorities under the Act. Wild life Advisory Boards and their functions, Detection and prevention of offences. Cognizance of offences, The wildlife (protection) Amendment Act. 1991.

**Unit II: The Environment Protection Act 1986.** Necessity and Scope of the Act. Powers of the Central Government, Parallel Provisions with the water and the Air act. Important rules & notification under the Environment Protection Act 1986 : Public Hearing notification 1997, Biomedical waste (Handling and Disposal) rules 1998. Recycled plastic manufacture and usage rules 1999, Municipal Solid Waste (Management and Handling) Rules 2000, The Noise Pollution (Regulation and Control) Rules 2000.

**Unit-III:** Human impact on the Earth, Hunting and Gathering Society, Agriculture Society, Industrial Society, **Sustainable -Earth Society:** Concept of throw-away and sustainable -Earth Society, our future society; a prediction. Environmental movement and peoples participation with special references to Gandhamardan, and Narmada Bachao Andolan. Women and Environmental protection.

**Unit-IV: Economics, Environment and Environmental Ethics:** Economic growth, Gross National product and the quality of life: Sustainable-earth economy, Economics and Pollution control, Discount factor, Cost-benefit and cost effectiveness analysis, **Environmental Ethics:** Ethics and moral, Throw-away society ethics, Sustainable-Earth Society ethics, Ethical guidelines.

*S. Mukherjee.*  
22/5/11

*Dr. Arun Kumar*  
24/5/11



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V.C. 246223, 246330 (O)

V.C. 246224, 245209 (R)

फैक्स/Fax, V.C. 246330 (O), 245209 (R)

Registrar 245957 (O), 246042 (R)

F.O. 246386 (O), 225958 (R)

**डॉ० राम मनोहर लोहिया अवध विश्वविद्यालय, फैजाबाद (उ० प्र०)**  
**Dr. RAM MANOHAR LOHIA AVADH UNIVERSITY, FAIZABAD (U.P.)**

आंक/Ref. :

Date : 02.06.10

To,

The Joint Secretary (ASIST)  
University Grants Commission,  
Bahadur Shah Zafar Marg,  
New Delhi-110002

**Subject:** Submission of proposal entitled "Pollution Abatement through Environmental Management (PATEM)" under Teaching and Research in Interdisciplinary Innovative and Emerging Areas.

Sir,

With reference to your DO. No. F.1-5/2007 (INNO/ASIST) dated 30 April, 2010. I am sending the proposal (Three copies) from the Department of Environmental Sciences "Pollution Abatement through Environmental Management (PATEM)" after screening the proposal through Committee recommended as per guidelines for an appropriate action at your end.

With regards,

Encl. A. Minutes of Screening Committee

(Registrar)

Registrar

Dr. R. M. L. Avadh University  
Faizabad

S. Mukherjee  
22/5/11

Dr. R. M. L. Avadh University  
Faizabad





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फैक्स / Fa., V.C. 246330 (O), 245209 (R)

Registrar 245957 (O), 246042 (R)

F.O. 246386 (O), 225958 (R)

# राम मनोहर लोहिया अवध विश्वविद्यालय, फैजाबाद (उ० प्र०) RAM MANOHAR LOHIA AVADH UNIVERSITY, FAIZABAD (U.P.)

Ref. :

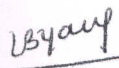
दिनांक / Date : 02.06.10

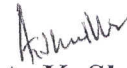
Minutes of the meeting of the Screening Committee for the "Teaching and Research in Interdisciplinary and Emerging Areas" proposal under innovative programme of UGC (F.1-5/2007 (INNO/ASIST) held on 02.06.10 at 11.00 am at the Dr. R. M. L. Avadh University, Faizabad-224001 (U.P.)


- The proposal Pollution Abatement through Environmental Management (PATEM) is in multidisciplinary area and is not of a routine nature.
- It seems to be a useful innovative course and address prominent issue of protection of environment at National and Global level.
- The department of Environmental Sciences has necessary core staff to run the programme and expertise of related areas is available at University campus.
- The Department is viable and vibrant to run the programme.

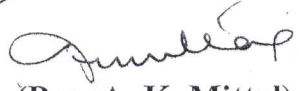
## Recommendation

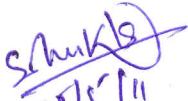
The Screening Committee unanimously recommended the proposal of Department of Environmental Sciences for consideration and necessary action.

  
2.6.2010  
Prof. V. B. Upadhyay  
(Member Expert)  
of Zoology, DDU Gorakhpur  
University, Gorakhpur

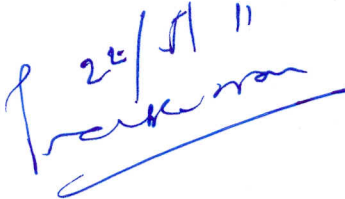
  
(Dr. A. K. Shukla)  
Coordinator, UGC

  
(Registrar)  
Secretary  
Dr. R. M. L. Avadh University  
Faizabad

  
(Pro. A. K. Mittal)  
V.C.  
Prof. A. K. Mittal  
Vice Chancellor  
Dr. R.M.L. Avadh University  
FAIZABAD (U.P.)

  
24/5/11

  
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Registrar 245957 (O); 246042 (R)  
F.O. 246386 (O); 225958 (R)

डॉ० राम मनोहर लोहिया अवध विश्वविद्यालय, फैजाबाद (उ०प्र०)  
Dr. RAM MANOHAR LOHIA AVADH UNIVERSITY, FAIZABAD (U.P.)

क्रमांक /Ref. :

दिनांक/Date : 14/11/09

Encl.-C

This is to be certify that the University is approved under Section 12 (B) of the UGC Act and is fit to receive grants from the UGC.

General physical facilities, such as furniture / space etc., are available in the Department and University will provide required infrastructure facilities for the innovative programme.

I/we shall agree and abide by the rules governing the scheme in case assistance is provided to us from the UGC for the P. G. Diploma in Pollution Control and Environmental Management.

I/we shall complete the proposal within the stipulated period. If I/we fail to do so and if the UGC is not satisfied with the progress of the proposal, the Commission may terminate the proposal immediately and ask for the refund of the amount received by me/us.

The above proposal is not funded by any other agency.

Schukla  
22/5/11

22/5/11

22/5/11

Registrar  
Registrar

Dr. R. M. L. Avadh University  
Faizabad