

SYLLABUS

**MASTER OF TECHNOLOGY
(ENVIRONMENTAL ENGINEERING)**

M. Tech.

**M. Tech., First Year Examination, 2015
M. Tech., Second Year Examination, 2016**



**JODHPUR NATIONAL UNIVERSITY
JODHPUR**

Jodhpur National University

M.Tech. Programme, CIVIL (Environmental Engineering)

TEACHING/EXAMINATION SCHEME & SYLLABUS

I SEMESTER

Subject Code	Subject	Hrs. / Week				Marks Exam			Exam Hrs
		L	T	P	Total	Theory Exam/ Viva voce	Internal Assessment	Total	
MCE 111	Strategic Management	4	2	-	6	100	50	150	3
MCE 112	Environmental Chemistry	4	2	-	6	100	50	150	3
MCE 113	Environmental Management, Legislation and Policy	4	2	-	6	100	50	150	3
MCE 114	Air and Noise Pollution	4	2	-	6	100	50	150	3
MCE 115	Env (Lab) I			6	6	50	50	100	3
	Total	16	8	6	30	450	250	700	15

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TEACHING/EXAMINATION SCHEME & SYLLABUS

II SEMESTER

Subject Code	Subject	Hrs. / Week				Marks			Exam Hrs
		L	T	P	Total	Theory Exam/ Viva voce	Internal Assessment	Total	
MCE 211	Design of Environmental Structures	4	2	-	6	100	50	150	3
MCE 212	Environmental Impact Assessment of Civil Engg. Projects	4	2	-	6	100	50	150	3
	(Any one from 03 and 04 each)								
MCE 213.1	Industrial Water & Waste Water Engineering.	4	2	-	6	100	50	150	3
MCE 213.2	Atmospheric Environmental Pollution & Control								
MCE 213.3	Global Warming & Climatic Change								
MCE214.1	Hydraulics of Water & Waste water system	4	2	-	6	100	50	150	3
MCE 214.2	Energy & Environment								
MCE 214.3	Environmental Health and Safety								
MCE 215	ENV (LAB) II	-	-	6	6	50	50	100	3
	Total	16	8	6	30	450	250	700	15

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III SEMESTER

Subject Code	Subject	Hrs. / Week				Marks			Exam Hrs
		L	T	P	Total	Theory/ practical Exam	Internal Assess- ment	Total	
MCE 311	Solid Waste Engineering and Management	4	2	-	6	100	50	150	3
MCE 312.1	Advanced Water Treatment	4	2	-	6	100	50	150	3
MCE 312.2	Pollution Control and Waste Management								
MCE 312.3									
MCE 312.4	Watershed Management. Environment Management Legislation & Policy								
MCE 313	Seminar	-	-	6	6	100	-	100	3
	Total	8	4	6	18	300	100	400	9

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IV SEMESTER: -

Subject Code	Subject	Hrs. / Week				Marks		
		L	T	P	Total	Theory\ Practical Exam	Internal Assessment	Total
MCE 411	Dissertation	-	-	-	-	200	-	200
	Total	-	-	-	-	200	-	200

Total Marks: 700 + 700 + 400 + 200 = 2000

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TEACHING/EXAMINATION SCHEME & SYLLABUS

I SEMESTER

MCE 111 STRATEGIC MANAGEMENT

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Basic of Management: Scientific management: Fredrick Winslow Taylor; Henry foyal's administrative Management; Managerial Roles; Managerial skills.

Managing Change: Need for change; Paradigm shifts; Organization inertia; Leadership committed to change; Strategy of managing change; case studies highlighting steps needed for managing change successfully.

Crisis Management: Contingencies; contingency planning; visualizing possible majors problems for the organization in the foreseeable future; preparing an organization and its staff to deal with such problems; case studies.

Innovation and Creativity: Encouraging creativity at all levels; Innovation; Key for future leadership; Innovation for product; process or the organization itself; Increment improvement v/s quantum jump.

Entrepreneurship: Need of the hour: Entrepreneurship; Developing qualities for entrepreneurship; Calculated Risk: Entrepreneurship within an organization.

Work study and Re-engineering: Productivity; Methods of improving productivity by changes in the manufacturing process as well as by better utilization of assets; Re-engineering the product process as well as the organizational set up.

Managing Intangibles: Management at different levels in an organization; Organizational culture; Leadership effective leadership for overall success; Motivation; Developing a diverse workforce; Negotiations within the organization; Attitudes and Behavior.

Communication Skills: Communication Basic: Written and Verbal communication, Presentation skill, Meetings and their effective; organization; Dealing/Interacting with customers.

Quality and Customer Care: Quality Management; Reliability of product; Defect and Defect Analysis; Total Quality; Economics of Quality; Quality Standards and ISO-9000; Customer care and important outcome of quality and quality relationship.

Safety and Ergonomics: Safety its practice at all levels; Safety training; Importance of Safety; Cost of neglecting safety; Environment and need to maintain a clean and healthy environment; Ergonomics-a new term combining nature and its inhabitants.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 112 Environmental Chemistry

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Fundamentals of Environmental Chemistry: Concept and scope of environmental chemistry, stoichiometry, Gibb's redox potential chemical potential, chemical equilibria, acid-base reaction, solubility of gases in water, definition of environmental terms.

Atmospheric Chemistry: Atmosphere-composition, structure, heat balance, chemical composition of air (classification of elements, chemical speciation, particles, ions and radicals in atmosphere), chemical processes for formation of inorganic and organic particulate matter, thermo chemical and photochemical reactions in the atmosphere, oxygen and ozone chemistry.

Soil Chemistry: Lithosphere-formation of the earth, zonal structure of the earth and its composition, composition of the earth as a whole, differentiation of elements. Soil and agricultural nature and composition of soil, acid-base and ion-exchange reaction in soil, macronutrients in soil, NPK in soil, micronutrients in soil.

Chemistry of water and aquatic system: Hydrosphere-characteristic, characteristic and structure of the ocean, snow and ice, fresh water system. Properties of water and their significance, characteristic of water bodies, alkalinity, calcium and other metals in water, sedimentation, coagulation, organic pollutants in sewage, soaps, oil and detergents pesticides in water, their classification, radio-nuclide in water.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 113 Environmental Management, Legislation and Policy

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Preparation of Environmental Management Plans (EMS): Environmental management overview. Environmental Management Issues and considerations. Environmental management systems (EMS) principles and elements and the ISO 14001 – Environmental management systems – standard.

International Environmental Laws: Evolution and development of international Environmental laws with reference to Stockholm Conference, Nairobi Declaration, Rio Conference, Rio+5 and the Rio+10, etc.

Global environmental issues and International laws: To control Global warming, Ozone depletion, Acid rains, hazardous waste, CITES etc. Role of UN authorities in protection of Global Environment, Multinational authorities and agreements, future of International laws.

Environmental Laws in India: Environmental policy and laws. Constitutional and statutory laws in India : Doctrine Principles of State Policy, Fundamental Duties and Fundamental Rights and panchayat Raj System.

Statutory protection of the Human Environment: Such as Indian Penal Code, Factories Act, Motor Vehicle Act, Hazardous Waste legislation for pollution abatement.

National Environmental policy and Implementation.

Current Developments in the Subject.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 114 Air and Noise Pollution

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Source of air pollution; classification of aerosols, Gases vapors, natural pollutants; properties of air pollutants; Meteorological factors influencing dispersion of air pollutants; Gaussian plume model for dispersion of air pollutants and its applications; Effects on man material, vegetation, art treasure;

Air pollution disasters; Economic Effects of air pollution; Global Effects of Air pollution; Air pollution due to automobiles and emission control; General concept of transport planning for prevention of air pollution; Control technology for particulate and gaseous pollutants.

Basics of noise pollution; Measurement of noise; permissible noise levels in different zones; Effects of noise.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 115 Environmental LAB. I

(0-0-6)
Exam Hrs:-3
M.M.:-100

1. Study on morality, normally and buffers.
2. Determination of organic matter by Walkley and Black method from soil.
3. To study principles, component & working operation of flame photometer.
4. To study principles, components & working operation of colorimeter/Spectro Photometer.
5. To compare chemical characteristics of soil by rapid tests.
6. Demonstration of HPLC for pesticides analysis.
7. Demonstration of potentio-galvano stat for heavy metal analysis.
8. To determine NO₃.
9. to determine COD
10. to determine BOD
11. to determine VVS
12. color Measurement and Removal by O₃.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

II SEMESTER

MCE 211 Design of Environmental Structures

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Conduit: Stresses in pipes strength of conduits, design of concrete and steel pipe for internal and external loads, anchor blocks.

Tanks: Underground tanks, retaining wall and floor junction Rectangular and circular tanks in R.C.C. and steel intz tanks. Steel and concrete staging.

Treatment Units: Clarifiers flocculator, Filter house, Hopper bottom tanks, Digesters.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 212 Projects Environmental Impact Assessment of Civil Engineering.

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Environmental Impact Assessment- Definition, Objectives, Types- Rapid and Comprehensive EIA, EIS, FONSI. Step-by Step procedure for conducting EIA and Limitations of EIA, Prevention of Significant deterioration (PSD) Programme.

Frame Work of Impacts Assessment: Scope and contents of EIA, methodologies and techniques of EIA.

Attributes, Standards and Value Functions: Public participation in EIA. Environmental Management Plan (EMP) and Disaster Management Plan (DMP)

ELA Case Studies: Thermal Power Plant, Mining, Fertilizer, Construction Projects, Air port, Water and Wastewater Treatment Plants.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 213.1 Rural Water supply and Sanitation

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Importance of Village Community in India, conditions of Indian villages with special regard to economic, social and health aspect. Quality of water needed for village community. Sources of water for village water supplies. Types of wells of sanitary aspects in well construction, Disinfection of wells. Different types of pumps, used for village wells. Treatment of water. Communicable Diseases-Disease and immunity, communicable disease source, Mode of transfer, control of communicable disease.

Fly and mosquito control: Life cycles of flies and mosquitoes, various methods for flies and mosquito control.

Milk and food sanitation: Essentials of dairy farm and cattle shed sanitation. Tests for milk and dairy products, food epidemics, food poisoning, botulism.

Rural Sanitation: Village Latrines, septic tanks Aqua privies, Storm water and sullage problems. Sanitation of cattle farms and dairy. Animal waste, collection and disposal of refuse.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 213.2 Atmospheric Environmental Pollution and Control

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Introduction – Sources, effects on – ecosystem, characterization of atmospheric pollutants, air pollution episodes of environmental importance.

Meteorology – Composition and structure of the atmosphere, wind circulation, solar radiation, Lapse rates atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature inversions, Windrose diagram.

General characteristic of stack emissions, plume behavior, heat island effect.

Pollutants dispersion Models – Description and application of point, line and areal sources.

Air Pollution Control Equipment for particulate matter & gaseous pollutants – Gravity settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostatic precipitator(ESP) – Adsorption, absorption, scrubbers, condensation and combustion.

Indoor Air Pollution – Sources, effects and control.

Noise – Sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and, prediction equations, control measures, Legal aspects of noise.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 213.3 Global Warming and Climate Change

(4-2-0)
Exam Hrs:-3
M.M.:-100+50 =150

Energy Issues and Climate change: Alternate Energy Sources

Green – House Effect as a Natural Phenomenon, Green House Gases (GHG_s) and their Emission Sources Quantification of CO₂ Emission Global Warming Potential (GWP) of GHG_s

Modeling Climate change, Ozone layer depletion and its control.

Impacts of climate change – Global and India, Temperature Rise, Seal Level rise, Coastal Erosion and landslides, Coastal Flooding, Wetlands and Estuaries loss.

Kyoto Protocol – Importance, Significance and its role in Climate Change.

Carbon Trading – Mechanisms, Various Models (European, India) Global and Indian Scenario

Cleaner Development Mechanisms – Various Projects related to CO₂ Emission Reduction

Alternatives of Carbon Sequestration – Conventional and non-conventional techniques, Role of Countries and Citizens in Containing Global Warming.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 214.1 Hydraulics of Water and Wastewater Systems

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Water Supply System – Introduction – types of systems, population forecasting methods, water demand, pressure, design period, pipe materials and roughness coefficient.

Storage Reservoirs – Need, Different types, capacity determination and evaluation of pumping systems.

Pipe Networks - Peak Factors for intermittent and continuous distribution system. Branch and Grid Iron systems. Nodal Demand, Design Layouts of distribution systems, Evaluation of distribution system- Computer Analysis of Pipe Networks for different options. Economic Analysis of Pipelines and Networks.

Leak detection – Prediction, Prevention and Control.

Water Quality in Distribution System – Factors affecting water Quality, Predictive tools and intermediate disinfection.

Wastewater Collection System – Separate and Combined Sewer, relevant equations for flow conditions, pipe materials and roughness coefficient, design guidelines and examples. Sewer Appurtenances.

Sewer Network – Estimation of Nodal Flows, Pumping Stations, Evaluation of Different Network Options.

Storm Sewers – Flooding and water problems, run-off calculations, storm water inlets, open drains and sewer pipes and design for different layouts.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 214.2 Energy and Environment

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Sun as **source of energy**, nature of its radiation, heat budget of the earth, earth's temperature and atmosphere. Photosynthesis, food-chain. Energy resources and their exploitation. Conventional and non-conventional **energy sources**: Fossil fuels-coal, oil and nature gas: hydroelectric power: Tidal, wind, geothermal energy: biomass: solar collectors, photovoltaics, solar ponds: nuclear-fission and fusion magnetodynamic power(MHD). **Resources of energy** use pattern in different parts' of the world and its **impact on the environment**. CO₂ emission in atmosphere, air thermal pollution, radioactivity form nuclear reactors, fuel processing and radioactive waste, hazards related to hydropower.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 214.3 Environmental Health and Safety

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Safety Health and Environment: Perspectives and concerns, interrelationship and interactive approach, development projects and related aspects of safety and health, environment as the ultimate beneficiary/losers.

Safety and Health Hazards: Identification of potential safety and healthy hazards in industrial and development projects, reduction strategies, policies and legislation international and legislation, international and national perspective, safety standards and management systems, ISO 18000. Industrial health safeguards and implementation mechanisms.

Health and Safety Risk Management: Risk identification, allocation and authority, potential of health risks in industrial and development processes, local and national policies, public awareness and participation in prevention procedures Industrial environmental conditions, emissions and noise abatement.

Toxicology: Basic concepts, toxicity and its impacts, industrial toxicants and hazardous materials toxic and hazardous waste management, measurement of toxicity, TLM and lethality studies physiological and metabolic effects on flora and fauna. Evaluation of toxicity, methods, used to assess toxicity classification of toxic materials. Physiological and metabolic effects of toxicants, such as VOC and organic solvents, used in industry heavy metals such as Mg CL, Cu pb Al, AS, Zn Mutagenic and carcinogenic compound. Anti cancer drugs.

Water and airborne Diseases: Potential and widespread effects water and airborne bacteria and viruses, human immune- system and its vulnerability to these bacteria and viruses, preventive and curative measures, epidemics and their containment, biological warfare and protective measures. Safeguarding water sources and ambient air quality, disaster management.

Effects of Global Warming: Concepts and considerations atmospheric gases and their impacts on ionosphere, meteorology and dispersion and atmospheric gases, greenhouse effect, Polar ice caps and snow melts due to temperature fluctuations, health and hygiene considerations.

Human Environment and Health Status in Urban and Rural India: Water and sanitation situation in urban and rural context, historical perspective, WHO and other bodies and their role in public health projects development eradication programs and their efficacy development impacts in urban and rural sectors, psychological impacts, public awareness of sanitation and hygiene issues and role of NGOs

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 215 Environmental Lab II

(0-0-6)

Exam Hrs:-3

M.M.:-100

Air Quality: Air for SPM, RSPM, NO₂ & SO₂ using High volume sampler, NO_x, CO, SO₂, using continuous analysers. Noise measurement using SLM

Use of Softwares Like LOOP, SEWER, CALINE etc.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

III SEMESTER

MCE 311 Solid Waste Engineering and Management

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Land pollution and control- Land Pollution sources and their impacts, general control measures.

Solid Waste- Sources and Engineering Classification, Characterization, generation and quantification.

Transport- Collection system, collection equipment, transfer stations, collection route optimization.

Treatment Methods- Various methods of refuse processing, refuse processing, recovery, recycle and reuse, composting-aerobic and anaerobic, incineration, pyrolysis and energy recovery.

Disposal Methods. Impacts of open dumping, site selection sanitary land filling – design criteria and design examples, leachate and gas collection systems, leachate treatment.

Recent Developments in Solid Wastes Reuse and Disposal- Power Generation, Blending with construction materials and best management practices (BMP)

Role of various organizations in Solid Waste Management- Governmental, Non-Governmental, Citizen Forums.

Biomedical Waste Management- Sources, treatment and disposal.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 312.1 Advanced Water Treatment

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

General History of water supply and sewerage in India. Development in different five year plans, Future scope.

Population studies and Demand of water: Period of design population data, population growth methods of estimating population reliability of estimates. Water uses, factors affecting consumption. Variations in demand. Fire requirements.

Sources: Surface and underground sources. Construction and maintenance of wells and filtration galleries. Capacity of reservoirs Intakes: River, canal and impounding reservoir and intakes and their design.

Transmission of Water: Types and materials of conduits, Hydraulic characteristics, Water hammer appurtenance. Pumping of water type design and selection. Economics of pump and rising main.

Distribution of Water: Pressure and capacity requirement of systems. Field and office analysis of distribution network, Service reservoir. Maintenance of distribution system. Emergency disinfection of mains.

Sewerage Systems: Patterns of sewerage systems, kinds of sewer. Types of sewage.

Design of sewerage systems: Hydraulics of sewers. Flow at sewer Estimates of sewage flow, Storm water runoff. Design and layout of sanitary and combined sewerage systems. Maintenance.

Sewer Appurtenance: Manholes, flushing tanks. Inverted siphons, Regulators.

Pumping of Sewage: Necessity. Types and characteristics of pumps. Capacity of wet well. Pumping station.

Plumbing Requirements of tall buildings. Financing of water supply and drainage schemes. Capitalised cost. Present worth. Annual expenses. Depreciation. Sinkfund and amortization. Factors affecting determination of rates.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 312.2 Pollution Control and Waste Management

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Primary Wastewater Treatment: Introduction to wastewater treatment, Volume and strength reduction of waste water, Flow diagram of wastewater treatment, Preliminary treatment – flow measurement screen and shredder. Grit chamber, skimming tank. Primary treatments- sedimentation, primary clarifier final clarifier.

Secondary Wastewater Treatment: Trickling filter, activated sludge process, biological tower, combined filtration and aeration process, tapered, step and extended aerations. Low cost treatments sand filter, contact bed, rotating biological contactor, septic tank, stabilization pond and lagoons.

Tertiary Wastewater treatment: Chemical precipitation, Membrane filtration, Reverse osmosis, Ion exchange, Electro-dialysis and Effluent disinfections, Design aspects of effluent treatment plant (ETP). Concept, operation and maintenance of common effluent treatment plant (CETP). Wastewater treatment for major industries such as fertilizer, sugar, petroleum refining, pesticides, pulp and paper, textile and power generation.

Sludge treatment: Organic and inorganic sludges, Primary and secondary sludges, Compressible and noncompressible sludges. Thickening, Conditioning, Dewatering Filtration, Digestion and Drying of sludges. Sludge disposal strategies.

Solid Waste Management: Land filling, Incineration, Pyrolysis, Composting, Biogas generation and recycling; Hazardous waste management; generation, Classification collection. Storage transportation and disposal.

Air and noise Pollution control: Control of particulate matters; Gravity settling chamber, Cyclone separator, Bag filter and Electrostatic precipitator; Control of gaseous pollutants-scrubbing adsorption, combustion and dispersal. Noise pollution control; at source, during transmission and at receptor.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 312.3 Watershed Management

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Introduction to watershed, concept and significance. Physical characteristics of watershed. Hydrological characteristics of watershed. Land-use and land – cover classification, resource appraisal. Water and soil **conservation measures**.

(a) Drain – line treatment: (b) Area – Treatment

Goals, features and watershed as unit of sustainable development. Selection of plant species for plantation. Organic farming and organic fertilizers. Social Institutions: Gram – panchayat, Self-help Groups for Women, Farmer, Managed small – scale irrigation system (cooperative – Lift – irrigation); Water-shed **Development committees**. Entry point Activities. Concept and Application of watershed plus Activities. Roof- top Water Harvesting and Watershed Development for Semi-urban Areas. **Problems of Scaling** up the watershed Approach. Agro-forestry systems: (a) Classification: (b) Agrosilvopastoral systems; (c) Silvopastoral Systems (d) Land Agroforestry. Silviculture. (a) Role of exotics; (b) Ethnosilvicultural refugia, horticulture and pastureland development : (a) Role of grasses as fodder. Multipurpose Trees. Current Developments in the Subject.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 312.4 Environmental Management Legislation and Policy

(4-2-0)

Exam Hrs:-3

M.M.:-100+50 =150

Preparation of Environmental Management Plans (EMS): Environmental management overview. Environmental Management Issues and considerations. Environmental management systems(EMS) principles and elements and The ISO 14001 – Environmental management systems – standard.

International Environmental Laws: Evolution and development of international Environmental laws with reference to Stockholm Conference, Nairobi Declaration, Rio Conference, Rio+5 and the Rio+10, etc.

Global environmental issues and International laws : to control Global warming, Ozone depletion, Acid rains, hazardous waste, CTIES etc. Role of UN authorities in protection of Global Environment, Multinational authorities and agreements, future of International laws.

Environmental laws in India: Environmental policy and laws. Constitutional and statutory laws in India : Doctrine Principles of State policy, Fundamental Duties and Fundamental Rights and panchayat Raj System.

Statutory protection of the Human Environment : such as Indian Penal Code, Factories Act, Motor Vehicle Act, Hazardous Waste legislation for pollution abatement.

National Environmental policy and Implementation.

Current Developments in the Subject.

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TEACHING/EXAMINATION SCHEME & SYLLABUS

MCE 313

Seminar

(0-0-6)
M.M.:- 100

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TEACHING/EXAMINATION SCHEME & SYLLABUS

IV SEMESTER

MCE 411 Dissertation

M.M.:- 200