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**KOLHAN UNIVERSITY**

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**SYLLABUS FOR  
B. Sc ENVIRONMENT AND WATER  
MANAGEMENT  
(HONOURS)**



**Under Choice Based Credit System (CBCS)**

**2017**

Semester	Paper Code	Courses	Credit	Examination	Full Marks	Pass marks	Total Marks
<b>Semester - I</b>	BEWMC1	Environment and Ecology	4	Semester End	70	28	350
			2	Internal assessment	30	12	
	BEWMC2	Environmental Pollution I	4	Semester End	70	28	
			2	Internal assessment	30	12	
	GE -1	Botany/Chemistry/ Maths/Physics	4	Semester End	70	28	
			2	Internal assessment	30	12	
AECC-I	(English Communication / MIL Communication)	2	Semester End	50	20		
<b>Semester - II</b>	BEWMC3	Environmental Pollution II	4	Semester End	70	28	350
			2	Internal assessment	30	12	
	BEWMC4	Environmental Chemistry	4	Semester End	70	28	
			2	Internal assessment	30	12	
	GE -2	Botany/Chemistry/ Maths/Physics	4	Semester End	70	28	
			2	Internal assessment	30	12	
AECC-II	Environmental Science	2	Semester End	50	20		
<b>Semester - III</b>	BEWMC5	Fluid Mechanics	4	Semester End	70	28	

			2	Internal assessment	30	12	450
	BEWMC6	Environmental Pollution II	4	Semester End	70	28	
			2	Internal assessment	30	12	
	BEWMC7	Water Treatment	4	Semester End	70	28	
			2	Internal assessment	30	12	
	GE -3	Botany/Chemistry/ Maths/Physics	4	Semester End	70	28	450
			2	Internal assessment	30	12	
	SEC-I	General Knowledge & Current affairs	2	Semester End	50	20	
<b>Semester - IV</b>	BEWMC8	Hydrology I	4	Semester End	70	28	450
			2	Internal assessment	30	12	
	BEWMC9	Energy Resources and Biodiversity	4	Semester End	70	28	
			2	Internal assessment	30	12	
	BEWMC10	Waste Water Treatment	4	Semester End	70	28	
			2	Internal Assessment	30	12	
	GE -3	Botany/Chemistry/ Maths/Physics	4	Semester End	70	28	
			2	Internal Assessment	30	12	
	SEC-I	Personality Development	2	Semester End	50	20	
<b>Semester - V</b>	BEWMC11	Hydrology II	4	Semester End	70	28	450
			2	Internal Assessment	30	12	
	BEWMC12	Environmental Management I	4	Semester End		28	

					70		400
			2	Internal assessment	30	12	
	*DSE 1& 2	Disaster Management	4	Semester End	70	28	
			2	Internal Assessment	30	12	
		Computer application and biostatistics in environmental science	4	Semester End	70	28	
			2	Internal assessment	30	12	
		Environmental Economics	4	Semester End	70	28	
			2	Internal assessment	30	12	
<b>Semester - VI</b>	BEWMC13	Environment Management II	4	Semester End	70	28	400
			2	Internal assessment	30	12	
	BEWMC14	Environment Management III	4	Semester End	70	28	
			2	Internal assessment	30	12	
	**DSE 3	Entrepreneurship Development	4	Semester End	70	28	
			2	Internal assessment	30	12	
		Remote Sensing and GIS	4	Semester End	70	28	
			2	Internal assessment	30	12	
	DSE 4	Project / job training	6	Project	100	40	
	<b>TOTAL</b>						

**Note:**

\* In semester V candidates shall choose any two of the following as Discipline Specific Elective - 1 & 2

1. Disaster Management

2. Computer application and biostatistics in environmental science
3. Environmental Economics

**\*\*In semester VI candidates shall choose any one of the following as Discipline Specific Elective - 3**

1. Entrepreneurship Development
2. Remote Sensing and GIS

**SEMESTER - I**

**Paper code - BEWMC1**

**Paper name – Environment & Ecology**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Environment</b>	Introduction, History and Scope of environmental science, Environmental priorities of India, Environment Organizations and agencies.	
2	<b>Components of Environment</b>	<p><b>Atmosphere:</b> Introduction, composition and structure of Atmosphere.</p> <p><b>Hydrosphere:</b> Introduction, Water resources, Hydrological cycle.</p> <p><b>Lithosphere:</b> Introduction, Layers of earth section, Landforms, Rocks (types and cycle), Soil profile.</p> <p><b>Biosphere:</b> Introduction, Animal Association (interactions).</p> <p><b>Introduction of ecology:</b> Definitions of ecology, species, population, community, ecotone, habitat, environment and ecosystem.</p>	
3	<b>Ecology</b>	<p><b>Ecosystem:</b> Ecosystem structure, Ecological pyramids, Ecosystem function, Productivity of the ecosystem, food chains, food web, energy flow in ecosystems. Biogeochemical cycles (carbon cycle, nitrogen cycle, phosphorous cycle, oxygen cycle, Sulphur cycle).</p> <p><b>Kinds of Ecosystem:</b> Forest ecosystem, grassland ecosystem, aquatic ecosystem, cropland ecosystem.</p>	
			70
	<b>Practicals</b>	<ul style="list-style-type: none"> <li>➤ Determination of frequency, density and abundance of different plant community by quadrat method.</li> <li>➤ Determination of abiotic components (pH, turbidity, temperature) of a pond ecosystem.</li> </ul>	15
			85

**References:**

1. Ecology and Environment, P.D.Sharma (Rastogi Publication)
2. Fundamentals of Ecology, E. P. Odum,
3. Concepts of Ecology, Edward J. Kormondy (Pearlson Prentice Hall)
4. Fundamental of Ecology, M.C.Das (Tata McGraee Hill)
5. Essentials of Ecology and Environmental Science, S.V.S Rana (PHI Learning Private Limited)

Paper code - BEWMC2

Paper name – Environmental pollution 1

Module	Topics	Details	Marks
1	<b>Environmental Pollution</b>	Introduction, definition, pollution and contamination	
2	<b>Air Pollution</b>	Definition, Air quality standards, emission standards. Sources of air pollution, Classification of air pollution.	
3	<b>Air pollutants</b>	Sources, sinks, effects and control of Carbon dioxide, Carbon monoxides, NO <sub>x</sub> , SO <sub>x</sub> , particulate matter, hydrocarbons.	
4	<b>Global environment problems</b>	<b>Smog:</b> Introduction, reducing smog, photochemical smog and PAN formation mechanism, effects and control. A great smog of London: A case study. <b>Climate Change:</b> Introduction, climate and weather, causes and effects. <b>Global warming:</b> Introduction, green house gases, process, effects and control. <b>Ozone layer depletion:</b> Introduction, responsible gases, mechanism, effects and control. Ozone Hole Over Antarctica: A Case Study. <b>Acid rain:</b> Introduction, responsible gases, mechanism, effects and control. The Taj Mahal: A Case Study.	
			70
	<b>Practical</b>	<ul style="list-style-type: none"><li>➤ Estimation of solid particulate matter,</li><li>➤ Estimation of NO<sub>x</sub> and SO<sub>x</sub>.</li><li>➤ Report on global environmental problems.</li><li>➤ Literature review on global environmental problems.</li></ul>	15
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**References:**

1. Environmental Chemistry, H. Kaur (PragatiPrakashan)
2. Environmental Chemistry, A.K.Dey (New Age International Publication)
3. A Basic Course in Environmental Studies, S.Deswal/A.Deswal (Educational and Technical Publication)
4. Air Pollution, M.N.Rao (Tata McGraee Hill)

## SEMESTER - II

Paper code - BEWMC3

Paper name – Environmental pollution II

Module	Topics	Details	Marks
1	<b>Water Pollution</b>	Definition, Sources of water pollution.	
2	<b>Water pollutants</b>	Sources and effects of Inorganic pollutants, Organic pollutants, Sewage and Domestic wastes, Pesticides, Detergents, Biological pollutants.	
3	<b>Control of water pollution</b>	Minimizing water pollution, recycling of waste water.	
4	<b>Global Environment problems</b>	<b>Eutrophication:</b> Introduction, Types, Effects, Control. <b>Surface water pollution:</b> Introduction, sources, effects and control. <b>Ground water pollution:</b> Introduction, sources, effects and control. <b>Thermal pollution:</b> Introduction, sources, effects and control.	
5	<b>Solid Waste</b>	Introduction, types, causes, effects, methods of disposal and management.	
6	<b>Hazardous wastes</b>	Introduction, sources, disposal and management.	
			70
	<b>Practicals</b>	<ul style="list-style-type: none"><li>➤ Determination of heavy metals in waste water sample.</li><li>➤ Determination of DO.</li><li>➤ Effect of water pollution on flora.</li><li>➤ Visit to a waste management plant and make a report.</li></ul>	15
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### References:

1. Environmental Chemistry, H. Kaur (PragatiPrakashan)
2. Environmental Chemistry, A.K.Dey (New Age International Publication)
3. A Basic Course in Environmental Studies, S.Deswal/A.Deswal (Educational and Technical Publication)
4. Water Pollution, Sharma and Kaur (Goel Publishing House)
5. Solid Waste Management, K,Shashi Kumar (P.H.I Learning Private Limited)

Paper code - BEWMC4

Paper name – Environmental chemistry

Module	Topics	Details	Marks
1	<b>Water Chemistry</b>	Acid base equilibrium. Buffer in water systems.	
2	<b>Water quality parameters</b>	Physical: turbidity, colour, pH. Chemical: Total solids, conductivity, alkalinity, acidity, hardness, chlorides, fluorides, carbonates in water, Total nitrogen by Kjeldahl method, nitrates, nitrites, phosphates, DO, BOD and COD.	
3	<b>Green Chemistry</b>	Principles of green chemistry, Emerging green technologies.	
4	<b>Instrumentation</b>	Basic principle of Instrumentation and application of spectrophotometer, application of pH, conductivity meter and turbidity meter.	
5	<b>Environmental Toxicology</b>	Introduction, various toxicants [pesticides, fertilizers, heavy metals (cadmium, mercury, lead, chromium, zinc), radioactive substance], bioaccumulation and bio magnifications. Impacts on human, animals & Plants. Monitoring.	
			70
	<b>Practicals</b>	<ul style="list-style-type: none"><li>➤ Determination of physical parameters of water-turbidity, colour, pH.</li><li>➤ Determination of chemical parameters of water-total solids, conductivity, alkalinity, acidity, chlorides, fluorides, hardness, carbonates in water, Total nitrogen by Kjeldahl method, nitrates and phosphates.</li></ul>	15
			85

**References:**

1. Environmental Chemistry, H. Kaur (PragatiPrakashan)
2. Environmental Chemistry, A.K.Dey (New Age International Publication)
3. A Basic Course in Environmental Studies, S.Deswal/A.Deswal (Educational and Technical Publication)
4. Air Pollution, M.N.Rao (Tata McGraee Hill)

**SEMESTER - III**

**Paper code - BEWMC5**

**Paper name – Fluid Mechanics**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Introduction to Fluid Mechanics</b>	Properties of Fluid: Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Surface tension and Capillarity, fluid pressure, measurement of pressure, manometers.	
2	<b>Kinematics of Flow</b>	Types of Fluid Flow: Steady and Unsteady flow, Uniform and non uniform flow, Laminar and turbulent flow, Compressible and Incompressible flow, Rotational and irrotational flow, One , two and three dimensional flow. Rate of flow of Discharge, Continuity Equation.	
3	<b>Open Channel Flow</b>	Classification of flow in open channel, Discharge through open channel by Chezy’s formula, flow through notches and weirs, Economical sections.	
4	<b>Pipes Flow</b>	Introduction, Bernoulli’s Equation, Limitation of Bernoulli’s Equation, Application of Bernoulli’s Equation (Venturimeter, Orifice meter, Pitot tube) Loss of Head in Pipes, Darcy’s Formula for loss of Head in Pipes, Chezy’s Formula for loss of Head in Pipes.	
5	<b>Pumps</b>	Introduction, Centrifugal pump, Reciprocating pump, Maintenance of pumps.	
			70
	<b>Practicals</b>	<ul style="list-style-type: none"> <li>➤ Determination of surface tension by capillary rise method.</li> <li>➤ Determination of Viscosity of water by capillary flow method.</li> <li>➤ Measurement of discharge in an open laboratory channel by area-velocity method with rectangular notch using a pitot tube.</li> <li>➤ Measurement of discharge in an open laboratory channel by area velocity method with v- notch using a current meter.</li> <li>➤ Measurement of discharge in a pipe using orifice meter, venturimeter.</li> <li>➤ Determination of resistance coefficient of a uniform channel flow and in a pipe flow.</li> </ul>	15
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**References:**

1. A text of Fluid Mechanics and Hydraulic Machines, R.K.Bansal (Laxmi Publication)
2. Fluid Mechanics and Hydraulic Machines, Dr. R.K.Mandal (Laxmi Publication)
3. Water Supply Engineering, S. K. Garg (Khanna Publishers)

**Paper code - BEWMC6****Paper name – Environmental pollution III**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Noise pollution</b>	Definition, Sources, standards, measurement, types, effects and control.	
2	<b>Land degradation</b>	Definition, sources, types, effects and control.	
3	<b>Solid Waste</b>	Introduction, types, causes, effects, methods of disposal and management.	
4	<b>Hazardous wastes</b>	Introduction, sources, disposal and management.	
5	<b>Radioactive pollution</b>	Definition, types (ionic and non-ionic radiation), sources, effects and control.	
6	<b>E waste</b>	Definition, types, sources, environmental impacts and management.	
7	<b>Plastic pollution</b>	Introduction, its decomposition and persistence, environmental impacts and management.	
8	<b>Offshore oil pollution:</b>	Introduction, sources, effects and control.	
			70
	<b>Practicals</b>	<ul style="list-style-type: none"><li>➤ Estimation of Soil pH.</li><li>➤ Estimation of Soil moisture.</li><li>➤ Measurement of noise level.</li><li>➤ Report on global environmental problems.</li><li>➤ Literature survey on global environmental problems.</li></ul>	15
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**References:**

1. Environmental Chemistry, H. Kaur (PragatiPrakashan)
2. Environmental Chemistry, A.K.Dey (New Age International Publication)
3. A Basic Course in Environmental Studies, S.Deswal/A.Deswal (Educational and Technical Publication)
4. Water Pollution, Sharma and Kaur (Goel Publishing House)

**Paper code - BEWMC7**

**Paper name – Water Treatment**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Water Quality Standard</b>	Drinking water standard, Industrial standards, Irrigation standard, Stream standard, Effluent standard.	
2	<b>Sampling</b>	Introduction, location, frequency, methods of collection, types of samples (grab and composite), Storage of microbial and physiochemical samples.	
3	<b>Water Treatment</b>	<b>Screening:</b> Course and fine screen <b>Plain Sedimentation:</b> Theory of Sedimentation, Sedimentation Tanks. <b>Sedimentation aided with Coagulation:</b> Chemicals used for Coagulation, Constituents of coagulation sedimentation plant. <b>Filtration:</b> Theory of filtration, Types of filters and their classification. <b>Disinfection:</b> Methods of Disinfection, Chlorination <b>Water Softening:</b> Methods of removing Temporary Hardness, Methods of removing Permanent Hardness.	
4	<b>Specific Water Treatment</b>	Removal of Colour, Odour and Taste from water, Removal of Iron and Manganese Defluoridation of water, Desalination of Brackish Water: Necessity of Desalination, Methods of Desalination	
			70
	<b>Practical</b>	<ul style="list-style-type: none"><li>➤ Determination of Ca and Mg hardness.</li><li>➤ Determination of optimum coagulation dose through jar testing.</li><li>➤ Determination of Chlorine demand for disinfection of water.</li><li>➤ Visit to water treatment plant and make a report.</li></ul>	15
			85

**References:**

1. Hydrology and Water Resource Engineering, S.K. Garg (Khanna Publishers)
2. Hydrology and Water Resource Engineering, K.C. Patra (Narosa Publishing House)

**SEMESTER - IV**

**Paper code - BEWMC8**

**Paper name – Hydrology I**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Water as a resource</b>	Irrigation water (relation between delta & duty of water, Kor water demand), domestic, industrial, hydro-power generation, navigation.	
2	<b>Hydrology</b>	Introduction, hydrological cycle, Hydrological budget.	
3	<b>Precipitation</b>	Types, forms, characteristics of precipitation falling in India, measurement of precipitation- non recording and recording type gauge (tipping bucket, weighing type and float recording gauges).	
4	<b>Water losses from precipitation</b>	Interception, evaporation, transpiration.	
5	<b>Evaporation</b>	Losses from water surfaces, Dalton's Law, factors effecting evaporation losses, measurement of evaporation by pan measurement, evaporation losses from land surface.	
6	<b>Transpiration</b>	Losses and its measurement by phytometer method, evapotranspiration and its measurement by lysimeter.	
			70

**References:**

1. Hydrology and Water Resource Engineering, S.K. Garg (Khanna Publishers)
2. Hydrology and Water Resource Engineering, K.C. Patra (Narosa Publishing House)
3. Hydrology , H.M.Raghunath (New Age International Publication)
4. Engineering Hydrology , K. Subramanya (McGraee Hill Company)

**Paper code - BEWMC9****Paper name – Energy Resources and Biodiversity**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Energy resources</b>	Energy Scenario, Energy Resources	
2	<b>Nonrenewable energy resources</b>	Fossil fuels and their impact on environment.	
3	<b>Renewable energy resources</b>	Hydel Energy, Solar Energy, Wind Energy, Bio Energy, Geothermal Energy, Ocean Energy, Tidal Energy, Nuclear Energy. Advantages of renewable energy sources over non- renewable energy resources.	
4	<b>Biodiversity</b>	Introduction, importance of biodiversity, causes of decline in biodiversity. Concept of IUCN, Red data book, Extinct, Endangered, Threatened, Vulnerable and Rare species. Hot spots and mega diversities, India as a mega diversity. Biodiversity conservation: In situ and ex situ conservation. Protected areas: National Parks, sanctuaries and biosphere reserves.	
			70
	<b>Practical</b>	Develop a working model on the use of renewable energy.	15
			85

**References:**

1. Ecology and Environment, P.D. Sharma, Rastogi Pub., New Delhi.
2. Bharucha, E. Text book of Environmental Studies, Orient Longman

**Paper code - BEWMC10**

**Paper name – Waste Water Treatment**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Waste water / Sewage Quality and characteristics of Sewage</b>	Introduction, Physical characteristics of sewage, Chemical characteristics of Sewage, Bacteriological characteristics of sewage.	
2	<b>Treatment of Sewage</b>	Classification of treatment processes <b>Preliminary Treatment:</b> Screening, Grit removal, Oil and grease removal. <b>Primary Treatment-</b> Sedimentation, its importance and tanks. Sedimentation aided with Coagulation-Chemical precipitation and coagulation, Merits and demerits of coagulation.	
3	<b>Secondary Treatment</b>	<b>Sewage Filtration-</b> Contact beds, Intermittent sand filters, Trickling filter, Construction and Operation, Merits and demerits <b>Activated Sludge Process:</b> Definition, Construction, Operation of Activated sludge process, Merits and demerits. <b>Oxidation ponds and Aerated Lagoons:</b> Oxidation ponds, Oxidation ditches. <b>Anaerobic Stabilisation Units:</b> Anaerobic Stabilisation Ponds, Septic Tank, Imhoff Tank.	
4	<b>Advanced Water Treatment</b>	Nitrogen removal, Phosphorous removal.	
5	<b>Treatment and Disposal of Sludge</b>	Introduction, treatment and disposal of sludge.	
6	<b>Disposal of Waste water</b>	Methods of disposal of waste water.	
			70
	<b>Practical</b>	<ul style="list-style-type: none"><li>➤ Determination of nitrite in waste water.</li><li>➤ Determination of phosphate in waste water.</li><li>➤ Determination of ammonia in waste water.</li><li>➤ Determination of BOD and COD.</li><li>➤ Visit to waste water/ sewage treatment plant and make a report.</li></ul>	15
			85

**References:**

1. Hydrology and Water Resource Engineering, S.K. Garg (Khanna Publishers)
2. Hydrology and Water Resource Engineering, K.C. Patra (Narosa Publishing House)
3. Sewage Disposal and Air Pollution Engineering ,S.K.Garg (Khanna Publishers).

**SEMESTER - V**

**Paper code - BEWMC11**

**Paper name – Hydrology II**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Surface water hydrology</b>	Sources of water, Intakes for collecting surface water and its types, Types of Conduits for transporting water	
2	<b>Distribution system</b>	Introduction, layouts, methods, reservoirs- function and types, storage capacity, leakage detection, its prevention and rectification.	
3	<b>Ground water hydrology</b>	Introduction, occurrence, zones, velocity and movement, aquifers and its types, concept of groundwater yield, specific yield and specific retention. <b>Forms of underground sources:</b> infiltration galleries, infiltration wells, springs, Wells- Open and tube wells. <b>Tubewells-</b> Introduction, types, boring of tubewells, its failure and maintenance.	
4	<b>Water resource management</b>	Inter basin transfer of water, waste water reuse, desalination, Rain water harvesting	
			70
	<b>Practicals</b>	<ul style="list-style-type: none"><li>➤ Demonstration of layout of distribution system.</li><li>➤ Detection of leakage in pipeline by pressure meter/ flow meter.</li></ul>	15
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**References:**

1. Hydrology and Water Resource Engineering, S.K. Garg (Khanna Publishers)
2. Water Supply Engineering. S.K. Garg (Khanna Publishers)
3. Hydrology and Water Resource Engineering, K.C. Patra (Narosa Publishing House)
4. Engineering Hydrology , K. Subramanya (McGraw Hill Company)
5. Water Supply, Waster Disposal and Environment Engineering, A.K.Chatterjee (Khanna Publishers)

**Paper code - BEWMC12**

**Paper name – Environment Management I**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Meteorology</b>	Meteorological parameters, atmospheric stability, Temperature inversion, mixing height. Lapse rate <b>Methods of measurement:</b> Wind direction and speed, temperature, solar radiation. Plume behavior, wind rose diagram, Dispersion of pollutants. Human activity and meteorology.	
2	<b>Global atmospheric changes</b>	Introduction, Global temperature, Simple global temperature models, Regional effects of temperature change.	
3	<b>Management of Land</b>	Soil conservation practices for restoration of eroded soils, biological reclamation.	
4	<b>Environment management</b>	Self-purification of natural rivers, zones of pollution in a river stream. Role of bacteria, algae, fungi and protozoa in environment management, role of microbes in pollution abatement, bioremediation. Case studies and latest updates in environment.	
			70
	<b>Practicals</b>	<ul style="list-style-type: none"><li>➤ Determination of meteorological parameters (temperature, wind speed and direction).</li><li>➤ Determination of different parameters of soil.</li><li>➤ Visit to/ training in a microbiology laboratory.</li></ul>	15
			85

**References:**

1. Air Pollution. M.N.Rao (Tata McGraee Hill)
2. A Basic Course in Environmental Studies, S.Deswal/A.Deswal
3. Environment Management, BalaKrishnamoorthy, PHI learning pvt.Lmt.

**Discipline Specific Elective**  
**Paper name – Disaster Management**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Flood</b>	Causes, nature and frequency of flood. Flood hazard, Urbanization and flooding, Flood mitigation.	
2	<b>Earth quakes</b>	Causes, intensity and magnitude of earth quakes, geographical distribution of earth zones and seismic waves, nature of destruction, protection from earthquake hazards.	
3	<b>Volcanism</b>	Nature, extend and causes of volcanism, volcanic materials and pollution, geographical distribution of volcanoes. Adverse effects, mitigation measures.	
4	<b>Disaster Management</b>	Concept and scope of disaster management / emergency management. Phases and professional activities – Mitigation, preparedness, response, recovery.	
5	<b>Tools of Disaster management</b>	Emergency Management Information Systems (EIMS) organizations related to disaster management.  International organizations – International Association of Emergency Managers, Red cross/Red crescent, United Nations, World Bank. National Organizations – National Disaster Management of India, Emergency management and research institute (EMRI), National remote sensing institute (NIRS).	
			70

**References:**

1. Environment: Problems and Solutions, D.K. Asthana and Meera Asthana, S. Chand & Co., New Delhi
2. Environmental Hazards, Smith, K.Routledge, London.
3. Geological Hazards, Bell, F.G. Routledge, London.
4. Natural Hazards, Bryant, E. (1985) Cambridge University Press. London

**Discipline Specific Elective****Paper name – Computer application and biostatistics in environmental science**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Data</b>	Methods of Collection. Primary and secondary data collection.	
2	<b>Tabulation</b>	Types of tables. Diagrammatic and graphical representation. Construction of frequency curve, Bar diagram, Histogram and Pie diagram [use suitable classified data/tables]	
3	<b>Biostatistics</b>	Measures of central tendency-Calculation of Mean, Median and Mode, Measures of dispersion- range and deviations, Mean deviation, Standard deviation and standard error, Probability and correlation. Designing and methodology of an experiment or a study, demography and vital statistics.	
4	<b>Computer application</b>	Introduction and basic concepts of computer. Computer operating systems – WINDOWS - MS Word, Excel/ Spreadsheet (data entry, generation of charts and graphs), Surfer (Generate contour from a text file). Web resources (Search, Save, copy, image, text,etc.), Photoshop (Processing images) Internet, World Wide Web, Search Engines, E-Mail. Computer applications in the design of water resources systems (flood forecasting, system concept and global hydrologic system, collection and utilization of data in the model).	
			70
	<b>Practical</b>	<ul style="list-style-type: none"> <li>➤ Computation of mean, mode, median, standard deviation. (Using softwares – Excel/SYSTAT)</li> <li>➤ Creation of e mail accounts.</li> <li>➤ MS office.</li> </ul>	15
			85

**References:**

1. Computer Fundamental, B.Ram (New Age International Publication.
2. HTML 5 in Simple Steps, Kogent Solution Inc. (Dreamtech Press)
3. Microsoft Office 2007, John Walkenbach (Wiley India)
4. Fundamental of Mathematical Statistics, Gupta & Gupta

**Discipline Specific Elective**  
**Paper name – Environmental Economics**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Basics of Economics of Environment</b>	Fundamental concepts in Environmental economics, Economy-environment interaction: Resource Economics, Environment Cost benefit analysis, Circular flow model and Material Balance Model, Environmental Kuznets Curve, Modeling the market process, market equilibrium, consumer surplus and producer surplus.	
2	<b>Renewable Resources and Common Property Resources</b>	Optimal use of exhaustible and renewable resources, Optimal provision of public goods-Lindahl's equilibrium; Energy and Environment – Resource Scarcity, Pricing of Resources, common property resources	
3	<b>Market Failure and Externalities</b>	Modelling a public good, relationship between public goods and externalities, Absence of property rights: the Coase theorem.	
4	<b>Valuation of Non-marketable goods</b>	Environmental valuation; Environmental damages/benefits, social cost benefit Analysis, Integrated environmental and Economic accounting and the measurement of environmentally corrected GDP, Use values, option values and non-use values -total economic value, Valuation techniques; production based, contingent valuation, hedonic-pricing, travel cost ,method, risk assessment	
			70

**References:**

1. Environmental Economics, Thomas and Callan. Cengage Learning, India Edition
2. Environmental Economics, Kolstad, C.D. Oxford University Press, New Delhi
3. Environmental Science: Earth as a Living Planet, Botkin, Daniel B. John Wiley and Sons, New Delhi.
4. Environmental Accounting and Sustainability, Markandya, A. Edward Elgar Publishing Ltd. U.K.
5. Natural Resource Accounting and Economic Development: Theory and Practice, Charles, P. and J.R. Vincent. Edward Elgar Publishing Ltd. U.K.

**SEMESTER - VI****Paper code - BEWMC13****Paper name – Environment Management II**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Sustainable Development</b>	Concept of Sustainable Development, Need for Sustainable Development, Objectives, Strategies of Sustainable Development.	
2	<b>Environment and safety</b>	Occupational health hazards and its management.	
3	<b>Environmental Impact Assessment</b>	Concept, Objective and Role of EIA, Various Components of EIA, Methodology of EIA Study.	
4	<b>Environmental Auditing</b>	Concept of Environmental Auditing, Objective, Audit Procedure.	
5	<b>Environmental Acts and Legislation</b>	Environmental (Protection) Act, 1986, Air (Prevention and Control of Pollution) Act, 1981, Water (Prevention and Control of Pollution) Act, 1974, Wild life Protection Act, Forest (Conservation) Act, 1980, Issues involved in enforcement of Environmental Legislation, Public Awareness	
			70
	<b>Practicals</b>	<ul style="list-style-type: none"><li>➤ An EIA study of industrial/ water resource development projects or</li><li>➤ Project on occupational safety.</li></ul>	15

**References:**

1. A Basic Course of Environmental Studies, S.Deshwal/A.Deshwal (Educational and Technical Publication)
2. Industrial Safety, Health and Environment Management System, P.K. Jain (Khanna Publishers)
3. Environment Management, BalaKrishnamoorthy, PHI learning pvt.Lmt.

**Paper code - BEWMC14**

**Paper name – Environment Management III**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Important International Conventions / Conference</b>	Stockholm Conference – 1973. Rio summit – 1992 Montreal protocol – 1987. Kyoto protocol – 1997 Ramsar convention - 1971 Stockholm Conference – 1973 Rio summit – 1992 Montreal protocol – 1987 Kyoto protocol – 1997 Ramsar convention – 1971 Agenda 21	
2	<b>Environmental protection in India</b>	Natural laws – The articles of Human Rights Declaration related to environment – Article-3 – Right to life, Article-7- Equality before law, Article-17- Right to property, Article-23- Work Environment.	
3	<b>National and international organisations</b>	Regulating Agencies in India - Ministry of Environment and Forest, Central and State Pollution Control Boards. International Agencies -CITES, EPA, IUCN, UNEP, WCED, MAB	
			70

**References:**

1. World commission on Environment and Development “Our common future”. Oxford University Press publications.
2. The Economics of Pollution, Victor P.A ,Mathau, London Publication.
3. Principles of Environmental management, Rogene and Buchoiz, Prentice Hall publications.

**Discipline Specific Elective**  
**Paper name – Entrepreneurship Development**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Introduction to Entrepreneurship</b>	Definition and concept of Entrepreneurship, classification and type of entrepreneurs, Nature and importance of Entrepreneurs. Entrepreneurship & small Business problems of entrepreneurship	
2	<b>Entrepreneurship Developments</b>	Entrepreneurial environment, Institutions in and of entrepreneur, Role of EDI's, NIESBUD, NSIC, DIC'S in promoting entrepreneurs.	
3	<b>Entrepreneurship &amp; innovation</b>	Entrepreneurship & innovation	
4	<b>Project Identification</b>	Over view of project identification, search of a business idea, identification of project, identification of business opportunities	
5	<b>Project formulation</b>	Project formulation, preparation of Project Report, Project appraisal	
6	<b>Source of Finance</b>	Sources of finance for small Business, Management of working capital	
7	<b>Small Scale Industry</b>	Setting up of a small industry-an overview of steps involved. Sickness in small scale industries - Reason & remedies	
			70

**References:**

1. B. K. Mehta: Entrepreneurship, SBPD, Agra.
2. Tandon B.C.: Environment and Entrepreneur; Chugh Publications, Allahabad.
3. Sin era David: Entrepreneurial Megabucks; John Wiley and Song, New York.
4. SrivastavS.B. A Practical Guide to Industrial Entrepreneurs; Sultan Chand and Songs, New Delhi.
5. Prasanna Chandra: Project Preparation, Appraisal & Implementation, Tata McGraw Hill, New Delhi.

**Discipline Specific Elective**  
**Paper name – Remote Sensing and GIS**

<b>Module</b>	<b>Topics</b>	<b>Details</b>	<b>Marks</b>
1	<b>Remote Sensing</b>	Definition, principle and concept of remote sensing, components of Remote sensing technique, Electro magnetic energy, Electro magnetic spectrum, Interaction between light and matter, Image characteristics, source of remote sensing information – Aerial photography – characteristics of aerial photographs, landsat imagery, Application of remote sensing into ground water exploration, mining of mineral resources, Landslides, subsidence and earthquake mitigation, waste land mappings, wet land conservation.	5  10  15
2	<b>Geographic information system (GIS)</b>	Introduction, terminology and scope of GIS, principles of GIS, Application of GIS in Environmental studies – Disaster Management, Forestry, Agriculture, Water resource management, Watershed management, Coastal zone management.	20
			70

**References:**

1. Essential Environmental Studies, Misra, S.P and Pandey, Ane Book Pvt. Ltd., Chennai
2. Concept of Ecology, Kormondy, E.J, Prentice Hall of India
3. Text book of Environmental Studies, Bharucha E, Orient Longman