BHARATHIAR UNIVERSITY, COIMBATORE
M.Sc. ENVIRONMENTAL SCIENCES (UD)
From the Academic year 2016-17 onwards
SCHEME OF EXAMINATION (CBCS PATTERN)

			Durn.	Int.	Ext.	Total	Credit
Semester I							
CORE 1	15ENVA13A	Basics in Chemistry and Biology for Environmental Sciences	3	25	75	100	4
CORE 2	16ENVA13B	Environmental Pollution	3	25	75	100	4
CORE 3	15ENVA13C	Statistics and Research Methods in Environmental Management	3	25	75	100	4
CORE 4	16ENVA13D	Instrumental Methods of Analysis	3	25	75	100	4
ELECTIVE 1	15ENVA1EA/ 14ENVA1EA	Environmental Toxicology (or) Occupational Health and Industrial Safety	3	25	75	100	4
SUPPORTIVE 1			2	12	38	50	2
Practical I	11ENVA13P1	Practical I	6	25	75	100	4
SEMESTER II							
CORE 5	16ENVA23A	Environmental Impact Assessment	3	25	75	100	4
CORE 6	16ENVA23B	Waste Management and Bioremediation	3	25	75	100	4
CORE 7	16ENVA23C	Biodiversity and Conservation	3	25	75	100	4
CORE 8	14ENVA23D	Green Products	3	25	75	100	4
ELECTIVE II	14ENVA2EB/ 15ENVA2EB	Concepts of Industrial Ecology (or) Natural Hazards Disaster Management	3	25	75	100	4
SUPPORTIVE II			2	12	38	50	2
Practical II	16ENVA23P1	Practical II	6	25	75	100	4
SEMESTER III							
CORE 9	14ENVA33A	Remote Sensing and GIS	3	25	75	100	4
CORE 10	14ENVA33B	Environmental Engineering	3	25	75	100	4
CORE 11	16ENVA33C	Environmental Laws and	3	25	75	100	4

		Policy					
CORE 12	14ENVA33D	Natural Resources Management	3	25	75	100	4
ELECTIVE III	14ENVA3EC	Environmental Biotechnology (Or) Environmental Management and Sustainable Development	3	25	75	100	4
SUPPORTIVE III			2	12	38	50	2
PRACTICAL III	14ENVA33P1	PRACTICAL III	6	25	75	100	4
SEMESTER IV							
	Project work and viva-voce examination					150	6
	Self – study paper : Social Issues and Environment (or) Climate Change					50	2
	Industrial visit and Viva-voce examination					50	2
	Summer project					50	2
		TOTAL				**2250**	**90**

SUPPORTIVE PAPERS OFFERED FOR OTHER DEPARTMENT STUDENTS:

Semester	Subject Code	Title of the Paper	Durn	Int.	Ext.	Total	Credit
I	16ENVGS01	Ecotourism	**2**	12	38	50	2
II	14ENVGS02	Natural Disaster Management	**2**	12	38	50	2
III	14ENVGS03	Environmental Education and Awareness	**2**	12	38	50	2

Note :

1. Practical paper is offered as one single paper with a common code, encompassing all core papers for a given semester, for the University examination with 4 credits.
2. Equal number of experiments to be fixed for all papers.

Note: The revised syllabus for the following papers core/practical furnished below be followed and there is no change in the existing syllabi of remaining papers. A Self study paper for 50 marks with 2 credits is being introduced. Two optional papers are being given out of which the candidate can choose any one of following paper (1) Climate Change (2) Social Issues and Environment

CORE 2: ENVIRONMENTAL POLLUTION

Objectives: To educate the students on pollution of water, air and soil, impacts of pollution and control measures.

UNIT- I

Structure of the atmosphere, Sources and Classification of Air Pollutants. Transport and Diffusion of Pollutants. Plume behavior and stack dispersion, Reactions of hydroxyl radical with O2, N2, CO2 and Oxides of Nitrogen, Sulphur and Carbon. Sinks of Air pollutants – Acid rain: Ozone depletion – Montreal protocol; Global warming – Kyoto protocol; Gaseous pollution control measures; photo chemical smog; Automobile pollution in India; Zero emission standards; Particulate matter pollution – PM 10 and PM 2.5 – Cleaner technologies – online monitoring of pollution

UNIT - II

Properties of water – water quality. DO, BOD, COD, acidity, alkalinity, salinity, hardness; drinking water quality standards; Water pollution; Classification of water pollutants, Ground water pollution, Sources and sinks, Eutrophication. Purification of water by adsorption, flocculation, ion exchange and reverse osmosis methods. Alternatives of end of pipe treatments, Online monitoring of industrial effluents - Radioactive pollution and control measures

UNIT - III

Soil pollution; Sources, sinks and broad classification, movement and sorption mechanisms of organic and inorganic contaminants and their impacts on physio-chemical and biological properties of soil and plants, Sediment Pollution – Black carbon – Soil pollution control measures – Physico-chemical and Biological methods.

UNIT – IV

Hazardous Solid Wastes – Hospital Wastes, Radioactive Wastes - Sources, Transport, Disposal. Municipal solid wastes - hazards, disposal and energy production- Case studies; Light pollution and control measures; and Thermal pollution and control measures. Noise pollution – Sensing, Measurement, Abatement measures.

UNIT V

Industrial Disasters and Pollution - remedial measures – Case studies-Chemical Industries – Pesticide Industries, Bhopal Disaster, Chernobyl accident, Love canal Disaster, Oil Disasters – Exxon, British Petroleum- Gulf of Mexico; e-wastes, Impact and Remedial Measures.

REFERENCES

1. Chemistry for Environmental Engineering and Science, Sawyer C.N., Mc Carty P.L., and Parkin,G.F (2003), Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. A text book of environmental chemistry and pollution control, Dara S S,.(1998), S. Chand & Company Ltd, New Delhi
3. An Introduction to Soils and Plant Growth, 5th Ed, Roy I Donalue, Raymond W Miller and John C Shiekluna (1987) Prentice Hall of India.
4. Environmental Engineering, Howard S Peavy (2003), Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
5. Environmental Chemistry, A.K. De (2001), New Age International Publishers, New Delhi.
6. Environmental Chemistry, S. E. Manahan (2000), CRC Press, USA.

CORE 4 INSTRUMENTAL METHODS OF ANALYSIS

Objectives: To impart understanding on principles, instrumentation and applications of various instrumental methods in the analysis of chemicals responsible for the pollution of the environment

UNIT - I

Spectroscopic Techniques: Properties of EMR – Basic Principles, Instrumentation and applications of: Ultraviolet – visible (UV-VIS) Spectroscopy, Infrared spectroscopy, FT-IR, Flame Spectrometry; Atomic Absorption spectroscopy (AAS) – Inductively Coupled Plasma Emission Mass Spectroscopy (ICP-MS), Mass spectrometry, Nuclear magnetic resonance spectroscopy (NMR), Electron paramagnetic resonance (EPR), Flourimetry – Chemiluminescence's Detector System, X-Ray Fluorescence, Microscopy, SEM, TEM, Online analyzers.

UNIT - II

Chromatographic Techniques: Basic principles, Instrumentation and applications of Chromatography – paper, thin layer chromatography (TLC), Gel permeation chromatography, Ion exchange chromatography – High performance liquid chromatography (HPLC) and Gas Chromatography (GC)-Electrophoresis-SDS-PAGE, Agarose gel electrophoresis, 2D-Electrophoresis, PCR, Types of Centrifuge-high speed refrigerated centrifuge.

UNIT – III

Radiochemical analysis: Types of radiation – radioactive decay; Carbon dating; Radioactive labeling – Isotope dilution, Radiation detectors – Geiger Muller Counter, Scintillation counters; Application of isotopes in biological and environmental studies, Neutron activation analysis.

UNIT - IV

Electrochemical Techniques: Introduction to Techniques – Basic principles, Instrumentation and applications of Conductometry, Potentiometry – Ion selective meter – Voltammetry – Polarography; Coulometry.

UNIT - V

Turbidimetry and Nephelometry, Elemental analyzer, TOC analyzer, Portable Gas Analysis – H_2S, CO_2, SO_2, O_3, HC, Particulate analysis, Stack monitoring, Meteorological equipments.

REFERENCES

1. Principles of Instrumental Analysis, Skoog, D. A., Holler, F. J. and Crouch, S. R. (2007). Thomson Brooks/Cole, Belmont, CA.
2. Vogel's Text Book of Quantitative Inorganic Analysis, Barnes, J.D. J., Denney, R.C., Jeffery, G.H and Mendham, J. (1999) 6th Edition, Pearson Education Ltd., U.K.
3. Fundamentals of Analytical Chemistry, Skoog, D.A and D.M.West, (2004) Thomson Asia Pvt Ltd, Singapore.
4. Instrumental Methods of Chemical Analysis, Ewing G.W, (1985) 5th Edition McGraw Hill, U.K.
5. Instrumental Methods of Chemical Analysis, B.K. Sharma, (2001) Goal Publishing House, Meerut., India.
6. Standard Methods for the Examination of Water and Wastewater, (1998) 20th (Ed.) APHA, Washington, D.C.
7. Environmental Monitoring and Instrumentation, Bucholtz, F., (1997) Optical Society of America, Washington D.C.
8. Environmental Sampling Analysis: A Practical Guide, Xeith, L.H., Boca Raton, F.L. (1991), Lewis Publication.

CORE 5

ENVIRONMENTAL IMPACT ASSESSMENT

Objectives: To expose the students to the recent methods, programmes and projects, preparation of EA and EIA reports and institutional requirements of assessment of environmental impacts of policies and plans.

UNIT - I

Objectives – Basis for Environment Impact Assessment, Screening of Projects – Environmental Assessment Procedures – Writing the Environmental Assessment and Checklists, Concept and Significant Impact – Case Studies - Project Alternatives.

UNIT - II

EIA Methodologies – Adhoc Method – Checklist Methods – Matrix Methods – Network Methods The Environmental Impact Statement Process. – Preparing EIS – Environmental Management Plan (EMP).

UNIT - III

Prediction and Assessment of Impacts on natural Resources – Biota, Surface Waters, Ground Water, Air, Noise, Hazards, Historic and Cultural Resources, Transportation, Socio-economic relationships. Interlinking of rivers and River Basin Management.

UNIT - IV

Notification – 1994, 2006, 2012 – Public Participation, Regional and Sectoral Impact Assessment, Major limitations of Environmental Impact Assessment.

UNIT - V

Case studies - Land Clearing Projects – Dam sites – EIA for Aquaculture, Steel, Mines, Hydel, Thermal, Nuclear, Oil and Gas based Power Plants – Highways projects – Industrial Projects.

REFERENCES

1. Environmental Impact Assessment, Canter, L.W., (1996) Mc Graw Hill, New York.
2. Environmental Impact Statements, Bregman, J. I., (1999) Lewis Publishers, London.
3. Environmental Assessment, Singleton R, Castle, P and Sort, D (1999), Thomas Telford Publishing, London.
4. Effective Environmental Assessment, Eccleston, C. H., (2000) Lewis Publishers, London.
5. Environmental Impact Assessment- A Comprehensive Guide to Project and Strategic Planning, Eccleston, C.H., (2000) John Wiley and Sons.
6. A guide book for Integrated Ecological Assessments, M. E. Jensen and P. S. Bourgeron (2001) Springer-Verlag, New York, Inc.

CORE 6

WASTE MANAGEMENT AND BIOREMEDIATION

Objectives: To impart knowledge on the management of solid and liquid wastes from municipal and industrial sources and principles of remedial measures of recycling, reuse and recover from the wastes.

UNIT - I

Wastes– Classification and Quantification – Solid Waste Management and Disposal: Sources and Generation of Solid Waste – characterization, composition and classification. Hazardous Waste Management: Cyanides, Dioxins, Detergents, Plastics, Nylon and Paper. Waste Minimization approaches – Monitoring and Management strategies. Radioactive Waste: Sources, half life of radioactive elements, modes of decay. Effects on Plants, Animal and Man. Low and High-level Radioactive Waste Management – Waste Minimization and Treatment, Radiation standards.

UNIT - II

Recycling of Wastes – Types – sources – composition of waste – recycling of waste for Industrial, Agricultural and Domestic Purposes; Recycling of Metals, Reuse, recovery and reduction of paper and plastics; Recycling in Food Manufacturing, Beverages, Apparel, Leather, Paper, Pulp, Chemical and other industries; Fly Ash utilization. Waste Disposal Methods – incineration, pyrolysis, medical waste disposal strategies. Strategies for conversion of biodegradable waste into organic fertilizers and fuels. Composting, Vermicomposting and biomethanization.

UNIT - III

Microbial Activity in Soil and Ground Water, Lithosphere as Microbial habitat, Microorganisms in rock and minerals, Mineral soil and Organic soil. Physiological groups of prokaryotes, Geomicrobial transformations – Biodegradation of carbonates – Biomobilization of silicon, phosphate, nitrogen. Geomicrobiology of fossil fuel, methane, peat, coal and petroleum.

UNIT – IV

Principles of Bioremediation – Rapid growth and Metabolism- Genetic plasticity – Metabolic pathways for the degradation of xenobiotics, hydrocarbons – Microbial site characterization – Biodegradation potential – Bioprocess design, optimization – Microbial removal rates – inherent problems associated with biotreatment studies. Microbiological methodologies – Standard biotreatability protocols – Quantification of biodegradation; Biocleaning -Chernobyl radioactive contaminated area - Phytoremediation.

UNIT - V

Aerobic Bioremediation: Bioremediation of Surface Soils: Fate and transport of contaminants in the Vadose zone – Biodegradation in soil ecosystems – Types of soil treatment systems –

Bioreactors. Subsurface Aerobic Bioremedidation: *in situ* Bioremediation – *in situ* Bioventing – *in situ* treatments of Harbour Sediments and Lagoons. Bioremediation in fresh water and marine systems: Bench and Pilot Scale studies – *in situ* Bioreactor treatment of sediments – *in situ* treatment in marine ecosystem. Anoxic/Anaerobic Bioremediation: Anoxic/Anaerobic Processes –Fermentation, Degradation of xenobiotics – Anoxic/Anaerobic bioremediation of hydrocarbons, Phenols, Chlorophenolic compounds, Polycyclic Aromatic Hydrocarbons (PAH), Heterocyclic Compounds, Cyanide, dyes, Radioactive wastes.

REFERENCES

1. Microbial Ecology, IV Ed., Atlast, R.M and Bartha, R., (2000) Addison Wesley Longman Inc.
2. Bioremediation, Baker, K.H. and Herson, D.S., (1994) Mc Graw–Hill Inc, New York.
3. Biology of Microorganisms, VII Ed., Brock,T.D., Madigan,M.T. Martinko,J.M. and Parker, J (1994) Prentice Hall, New Jercy.
4. Geomicrobiology, Ehrlich,H.L (1996) Marcel Dekker Inc., New York.
5. Bioremediation – Principles, Eweis, J.B., Ergas, S.J, Change, D.P.Y and Schroeder, E.D (1998). Mc Graw-Hill Inc.
6. Environmental Engineering, Kiely, G (1998) Irwin/Mc Graw Hill International, U.K.
7. Hazardous Waste Management, II Ed, LaGrega,M.D., Buckingham, P.L., and Evans, J.C (2001) Mc Graw Hill Inc.
8. Microbial Degradation of Xenobiotics and Recalcitrant Compounds, Leisinger, T, Cook, A.M., Hutter, R and Nuesch, J (1981) Academic Press, London.
9. Hazardous Wastes and Solid Wastes, Liu, D.H.F and Liptak,B.G (2000), Lewis Publishers, New York.
10. Microbiology, Pelezar, M.J.Jr., Chan, E.C.S and Kreig, N.R (1993) Tata Mc Graw Hill, Delhi.
11. Remediation of Petroleum Contaminated Soils – Biological, Physical and Chemical processes, Riser-Roberts, E., (1998) Lewis Publisher, New York.
12. Vadose-Zone and Ground Water Contamination – Assessment, Prevention and Remediation, Russel Boulding, J (1995), Lewis Publishers, Tokyo.
13. Recycling of Crop, Animal and Human Waste in Agriculture, Tandon (1995), Mc Graw Hill Publishing Co.
14. Biodegradation and Bioremediation, Martin Alexander (1999), Academic Press

CORE 7
SEMESTER II
BIODIVERSITY AND CONSERVATION

Objectives: To impart understanding on the occurrence and distribution of various flora and fauna, their existence and conservation

UNIT - I
Biological Diversity: Species – Origin of new species, Community and ecosystem diversity, Genetic diversity, Systematics in Diversity – Environment and Genetic Variations – Biological Classification – Phylogenetic Relationship – Ecological Biodiversity –Species Concept – Biological and Phylogenic Concepts; Species Inventory – Biodiversity hot spots. IUCN categories– Red data book.

UNIT II
Species Diversity – Global Distribution of Species - Tropical species diversity – Diversity in terrestrial, marine and freshwater –Micro-organisms-lower and higher plants – lower and higher invertebrates and vertebrates; Species extinction and Endangered species; Monitoring indicator species and habitats; Threats to biodiversity: Extinction – Past rate of Extinction – Human Caused Extinctions – Endemic species - Extinction rates - Man and animal conflicts.

UNIT III
Habitats and Ecosystem – Classification – Ecosystem mapping, tropical forests, grasslands, wetlands, coral reefs, mangroves; Habitat lass: Habitat destruction – Fragmentation and degradation – desertification, Habitat restoration, Economics of Ecosystem, Green Revolution, Food Plants, medicinal and ornamental plants, animal uses – livestock and fisheries.

UNIT - IV
Conservation and Management –National and International Protected Areas – Current Practices in Conservation - in *situ* Conservation and *ex situ* Conservation of Threatened Species – Species Diversity – Case Studies – Deciduous Forests - Desert Lizard communities – Coral Reef - Fish Communities -Island species – Environmental ethics – Biodiversity – a Socio – Political Perspective – Western and Eastern Ghats - Himalayas.

UNIT V:
National Legislation – Protection of Wild flora and Fauna -Protection of National Habitats - Biodiversity Economics, Intellectual Property Rights (IPR):Land Conversion, Invasions, Causes, Values and Policies for managing Agro-biodiversity. Biodiversity legislation and Conventions– International laws and Policies for biodiversity conservation, CBD conventions and targets, TRIPS, CITES, Ramsar, IITA and IATO, Environmental and Forest Acts. WTO, GATT, UPOV: Plant Breeders Rights, Patent offices in India, PPV and FRA. Biodiversity Bill 2002 – Patent Act – Agenda 21 – Multilateral Treaties

REFERENCES
1. Global Biodiversity – Status of the Earths Living Resources, Brian Groombridge (1992) Chapman & Hall, London.

2. Ecology of Natural Resources, FerancoisRamade (1991), John Wiley.
3. Global Biodiversity and Strategy, IUCN (1992).
4. Biodiversity, Science and Development, Francesco di castri (1996), Backhuys Publishers, The Netherlands.
5. The Biology of Biodiversity, Kato, M (1999), Springer Verlag, Tokyo.
6. Biodiversity Conservation – In Managed forest and Protected areas, Kotwal, P.C. and S. Banerjee (2002). Agrobios, India.
7. Global Biodiversity, Sinha, R. K(1997), INA Shree Publishers, Jaipur.
8. Mega diversity Conservation, flora, Fauna and Medicinal Plants of India's hot spots, Chaudhuri, A. B. and D. D. Sarkar (2003), Daya Publishing House, Delhi.
9. Conservation of Biodiversity and Natural Resources. Singh, M.P., B.S. Singh and Soma S. Dey (2004), Daya Publishing House, Delhi.
10. Biodiversity –Strategies for Conservation, Dadhich L. K. and A.P. Sharma (2002), APH Publishing Corporation, New Delhi.
11. Global Biodiversity – Conservation Measure, Khan, T. I and Dhari N Al Ajmi (1999), Pointer Publishers, Jaipur.
12. An Advanced Textbook on Biodiversity – Principles and Practice, Krishnamurthy, K.V (2003). Oxford and IBH Publishing, New Delhi.
13. T.B.1: Krishnamurthy, KV., 2003, An advanced Text book on biodiversity, Oxford and IBH Book. Co., New Delhi.
14. T.B.2: Hall, BK. and Hallgrimsson, B., 2014. Evolution, 5th Edition, Johnes and Bartlett India Pvt. Ltd. New Delhi.
15. Ridley, M., Evolution, 3rd Edition, Blackwell Science Ltd a Blackwell Publishing company, USA, 2004.
16. Curry, G.B. and C.J. Humphries (ed), 2007. Biodiversity Databases Techniques, Politics, and Applications Edited by, CRC Press, Taylor & Francis Group. Frankel,
17. Otto, H., Anthony, H.D., Brown and Burdon JJ. 1995. The conservation of Plant Biodiversity, 1st edition, Cambridge University Press
18. Levin, SA (ed), Encyclopedia of Biodiversity Volume 1 –Academic Press
19. Manual of patent Practice and procedure Patent office, India, 2005.
20. Evolution Understanding Evolution http:// evolution. berkeley.edu /evolibrary/ article/ evo_01 accessed on 28.12.2014.
21. Geologic Time and Earth's Biological History ftp://ftpdata.dnr.sc.gov
22. /geology/Education/PDF /Geologic%20Time.pdf
23. Hall, BK. and Hallgrimsson, B., 2014. Evolution, 5th Edition, Johnes and Bartlett India Pvt. Ltd. New Delhi.
24. Center of origin - Wikipedia, the free encyclopedia en.wikipedia.org/wiki/Centeroforigin accessed on 28.12.2014
25. Biodiversity Hotspots - http://en.wikipedia.org/wiki/Biodiversity_hotspot accessed on 28.12.2014.
26. Plant Genetic Resources : Otto, H., Anthony, H.D., Brown and Burdon JJ. 1995. The
27. conservation of Plant Biodiversity, 1st edition, Cambridge University Press
28. General account on Biodiversity Krishnamurthy, K.V. An advanced Text on Biodiversity : Principles and Practice. Oxford & IBH publiching Co. Pvt. Ltd. New Delhi 2014.
29. Megadiverse Countries; http:// geography. about.com/od/ physicalgeography /a/Megadiverse - Countries. htm accessed on 28.12.2014 UNIT:

30. Geodatabase Standards: www.data. gov.bc.ca/local/dbc /docs/geo/services/ standards
31. procedures/ file_geobase_standards.pdf accessed on 31.12.2014.
32. Geodata standards http://www.tdwg.org/proceedings/article/view/48 accessed on 31.12.2014
33. Barcode Standards : barcoding.si.edu/pdf/dwg_data_standards-final.pdf accessed on 31.12.2014.
34. UNESCO http://en.wikipedia.org/wiki/Biosphere_reserves_of_India accessed on
35. 31.12.2014
36. Curry, G.B. and C.J. Humphries (ed), 2007. Biodiversity Databases Techniques, Politics, and Applications Edited by, CRC Press, Taylor & Francis Group. Frankel,
37. UNIT V: Biodiversity Economics, Legislation and Intellectual Property Rights (IPR):
38. Environmental and Forest acts, TRIPS, UPCOV, Suigeneris systems, plant Breeders
39. Conservation, Management and use of Agrobiodiversity naasindia.org/Policy% 20Papers /pp4.pdf
40. PPV & FRA http://www.plantauthority.in/ accessed on 31.12.2014
41. Patent office of India http://www.ipindia.nic.in/ accessed on 31.12.2014

CORE 11: ENVIRONMENTAL LAW AND POLICY

Objectives: To impart knowledge about environmental laws, regulations and policies of India and international environmental laws

UNIT I

Environmental policy in Ancient India, Medieval India, British India, during post independent era, the seventies, eighties and nineties. International environmental policy – environmental problems and their impact on international system, the instruments of international environmental policy – international law, soft law, scientific cooperation - fund support, sanction, dispute settlement procedures, non state actors and international environmental policy - Transnational environmental policies – the Indus river basin, the Ganga – Brahmaputra river basin system

UNIT II

Environmental planning, trends in planning, concepts and approaches and strategic environmental planning and management. International Environmental laws - hazardous wastes-Basal convention – Necessity for International Environmental Court. United Nations Environment Programme [UNEP] role on international environment laws. Case studies for International environmental disputes.

UNIT III

Constitutional and legislative provisions : constitutional provisions and the environment, environmental protection and fundamental rights, judicial remedies and procedures – Tort law, public nuisance, the writ jurisdiction, statutory remedies, public interest litigation, class action, freedom of information and the right to know.

UNIT IV

Indian legislation to protect the environment: The water act of 1974, The Water Cess act of 1977, The wildlife Act of 1972, the air act of 1981, The public Liability insurance act of 1991, the natural environmental tribunal act of 1995, the national environment appellate authority act of 1997, the mines and minerals act of 1957. Case studies one each in the protection of forests, rivers and wild life.

UNIT V

The Indian forest act of 1927, the forest (conservation) act of 1968, The atomic energy act of 1962, The factories act of 1948. The environmental protection act of 1986, The national environment appellate authority act of 1997. The forest conservation act 1980, The wildlife protection act 1972 (2002 amendment), - Plastics Waste management Rules 2015.

REFERENCES

1. Environmental law in India – Gurudeep Singh (2005) Mc Millan, New Delhi.
2. Environmental law and policy in India, Shyam Diwan and Armin Rosencrany, 2001, Oxford University Press, New Delhi.
3. Pollution Control Legislations, Vol. I and II, 1999, Tamilnadu Pollution Control Board, Chennai.
4. Environmental Management in Practice, Vol I, Nath B., Hens, L., Compton, P and D. Devuyst (1998), Routledge, London and New York.
5. The ISO 14000 Handbook: Joseph Cascio. ISO 14004 – Environmental management systems: General guidelines on principles, systems and supporting techniques (ISO 14004: 1996 (E).
6. ISO 14001: Environmental management systems: Specification with guidance for use (ISO 14001: 1996b (E)). (International organization for standardization – Switzerland).

SUPPORTIVE PAPER I
ECOTOURISM

Objectives: To teach the students the importance of tourism and ecotourism activities

UNIT - I

Concepts of Tourism - Classification – Religious Tourism – Cultural Tourism – Heritage Tourism – Monumental Tourism – Adventure Tourism – Mass Tourism – Sustainable Tourism – Consumptive and Non-Consumptive Tourism. Principles of Ecotourism – Types of Ecotourism – Concepts of Ecotourism – Origin of Ecotourism – Objectives of Ecotourism – Benefits of Ecotourism – Trends affecting Ecotourism.

UNIT - II

Places of interests of Ecotourism – Ecocircuit of the Western Ghats – Infrastructural Facilities for Ecotourism – Maintenance of Ecological Centers – Important Biosphere Reserves. Target group of Ecotourism – Ecotourism and Conservation – Study of different Ecosystem – Rain forest Ecotourism – Mountain Ecotourism – Polar, Islands and Coasts Ecotourism – Wilderness – Marine Ecosystem- Sanctuaries and National Parks - TQM of Ecotourism Resorts, Knowledge, skills, attitude and commitment of ecotourism service providers.

UNIT - III

Impact of Ecotourism – Economic Impacts (Fiscal Impacts, Concept and Methods) – Types and Degree of Impacts from Ecotourism activities – Socio-cultural Impacts – Ecotourism related organization – Ecotourism Research-Disasters and Ecotourism-Role of ethics in ecotourism - Advantages and Disadvantages of Ecotourism- Eco-branding and Eco-labeling of Ecotourism

Products - Marketing of Ecotourism, Ecotourism and Sustainable Development - Management Issues in Ecotourism, Ecotourism-based/related employment: Scope and areas of employment.

REFERENCES

1. The Encyclopedia of Ecotourism, Weaver, D. B. (2001), CABI Publishing, U.K.
2. Encyclopedia of Ecotourism, Volume I, II and III, Sinha, P.C (2003), Anmol Publications Pvt. Ltd., New Delhi.
3. Ecotourism and sustainable Development, N. Mukherjee (2008). Cybetech Publications, New Delhi.
4. Global Ecotourism, Prabhas Chandra (2003), Kaniskha Publishers, New Delhi.
5. Ecotourism. An Introduction, Fennell A David. (2003), Routledge, London and New York,
6. Ecotourism Impacts, Potentials and Possibilities, Wearing and Neil (2000), Oxford: Butterworth & Heinemann.
7. Case studies in ecotourism, Buckley, R. (2003), Cambridge: CABI.
8. Environmental impacts of ecotourism, Buckley, R. ed. (2004), Oxfordshire: CABI.
9. Facing the wild: ecotourism, conservation, and animal encounters, Bulbeck, C. (2005), London: Earthscan.
10. Tourism, ecotourism, and protected areas. Ceballos-Lascurain, H. (1996), Gland: IUCN
11. Ecotourism: Management and Assessment, Diamantis, D. (2004), London: Thomson.
12. Ecotourism: a guide for planners and managers, Lindberg, K. and D.E. Hawkins. (eds). (1993), North Benninton: The Ecotourism Society.
13. Ecotourism, Page, S.J. and R.K. Dowling. (2002). New York: Prentice Hall.
14. Ecotourism, Weaver, D. (2001). Milton: John Wiley & Sons.

PRACTICALS

SEMESTER II

M.Sc. Environmental Sciences

PRACTICAL II

Green Products

1. Flower waste into manure by windrow composting method
2. Leaf waste into manure by windrow composting method
3. Paper waste into manure by windrow composting method
4. Kitchen waste into manure by windrow composting method
5. Flower waste into manure by vermi-composting method
6. Leaf waste into manure by vermi-composting method
7. Paper waste into manure by vermi-composting method
8. Kitchen waste into manure by vermi-composting method

BIODIVERSITY AND CONSERVATION

Biodiversity assessment

1. Plankton community study: Phytoplankton and Zooplankton: Species identification - Diversity – density – abundance – distribution– Primary productivity

2. Aquatic insect community study: Species identification - Diversity – density – abundance – distribution

3. Fish community study: Species identification - Diversity – density – abundance – distribution

4. Amphibians community study: Species identification - Diversity – density – abundance – distribution

5. Reptiles community study: Species identification - Diversity – density – abundance – distribution

6. Bird community study: Species identification - Diversity – density – abundance – distribution

7. Mammals community study: Species identification - Diversity – density – abundance – distribution

8. Vegetation studies: Line, quadrates and belt transect methods– Species identification - Diversity – density – abundance – distribution

9. Grassland community study: Species identification - Diversity – density – abundance – distribution

10. Taxonomic identification of plants and animals using morphological and molecular techniques.

Self Study Paper

CLIMATE CHANGE

Unit I

Climate change – concept of climate change - Human Impacts on climate- greenhouse gas emissions, sea level rise - Global warming, greenhouse effect, global and regional trends in green house gas emissions - role of oceans and forests as carbon sinks, ozone depletion- stratospheric ozone shield and Ozone hole – Impact of Climate Change on weather and climatic patterns, ice caps, glaciers, agriculture, vegetation, biodiversity, sea level, tourism and their implications.

Unit II

Climate change - Adaptation and Mitigation strategies - renewable energy, green building, energy efficiency and reducing consumption - low carbon economy - international adaptation initiatives and programs - Integrated mitigation for development and planning through low emission development strategies - Climate Change and sustainable development

Unit III

International agreements and protocols. The role of UN Collaborative Programme on Reducing Emissions from vehicles - United Nation Framework Convention on climate change (UNFCCC) – Key provisions of the UNFCCC, its structure, and different party groups under the convention -Annex I, Annex II and Non-Annex I countries. The Kyoto protocol and its associated bodies. Overview of Conference of Parties (CoP). Main climate change negotiations evolved over the past years and highlights of some key issues relevant to future climate change regime.

References:

1. Climate Change and Biodiversity: Perspectives and Mitigation Strategies - Prabha Shastri Ranade, ICFAI University press (2008).

2. Botkin, Daniel B. and Keller, Edward A. Environmental Science: Earth as a Living Planet.6th ed. John Wiley & Sons,USA. 2007. Burroughs, W.J. Climate Change: A Multidisciplinary Approach. 2nd ed. Cambridge University Press. 2007.
3. Chasek, P. S. The Global Environment in the Twenty-First Century -Prospects for Internation al Co-operation. Indian Reprint by Manas Publications, New Delhi. 2004.
4. Claussen, E. ed. Climate Change: Scenario, Strategies and Solutions. Arlington VA. 2001.
5. Dash, S. K. Climate Change-An Indian Perspective. Centre for Environment Education and Cambridge University Press Pvt. Ltd., New Delhi. 2007.
6. Dodds, F. (ed.). Earth Summit. 2002. A New Deal. Earthscan Publications Ltd., UK. 2002.
7. Enger, E.D. and Smith, B. F. Environmental Science: A Study of Interrelationships. 11th ed. McGraw Hill Inc., USA. 2006.
8. Hardy, John T. Climate Change: Causes, Effects, Solutions. Wiley & Sons, USA. 2003.
9. Harris, F. Global Environmental Issues. Wiley & Sons, Inc., USA. 2004.
10. Harvey L. D. D. Global Warming: The Hard Science.NY: Prentice-Hall.2000.IPCC, Emission Scenarios, Inter Governmental Panel on Climate Change, Cambridge University Press, 2000.
11. Silver C. S. and De Fries, R. S. One Earth one Future: -Our Changing Global Environment. East-West Press Edition, 1991.

12. Speth, J. C. Global Environmental Challenges –Transitions to a Sustainable World. Orient Longman Pvt. Ltd., New Delhi. 2004. UNEP.

Social Issues and Environment

Unit I:

Human Population and the Environment - Population growth, variation among nations.

Population explosion and environmental quality – Family Welfare Programme - Environment and human health - Human Rights to a clean environment - Role of Information Technology in Environment and human health - Case Studies

Unit II

From Unsustainable to Sustainable development - Urban problems related to energy – existing conventional energy sources – rate of depletion – alternate energy sources and its sustainable use – India's clean energy goals 2012-2022 – significance of energy audit – recent initiatives of renewable energy by Govt. of India. Water scarcity and importance of water - water conservation - rain water harvesting - watershed management – causes and effects of water crisis – World Water Council & UNDP initiatives.

Unit III

Consumerism and waste products - e-pollution and their management – plastic and biomedical waste - management – Impacts of plastic and biomedical waste on environment –public awareness – Urbanisation and pollution – challenging issues - vehicular, solid waste, water, noise pollution – Issues involved in enforcement of environmental legislation

Suggested Readings:

1. Botkin, Daniel B. (2011) Environmental Science: Earth as a Living Planet, John Wiley and Sons, New Delhi.

2. Markandya, A. (2006) Environmental Accounting and Sustainability, Edward Elgar Publishing Ltd. U.K.

3. Charles, P. and J.R. Vincent (2003) Natural Resource Accounting and Economic Development: Theory and Practice, Edward Elgar Publishing Ltd. U.K.

4. Haab, T. and Mc Connell K.E. (2003) Valuing Environmental and Natural Resources, Edward Elgar Publishing Ltd. U.K.

5. Harper, C. (1996) Environment and Society, Prentice Hall, Washington D.C.

6. Barry, J. (1999) Environmental and Social theory, Routledge, London.

7. Riley, E. Michelson, W.C. (Ed.) (1998) Hand Book of Environmental Sociology, Westport Greenwood Press, USA.

8. Adame, M.E. (1987) Agricultural Extension in Developing Countries, Longman, London.
9. Sen Sarma, P.K. and Jha, L.K. (2008) A manual of Forestry Extension education, APH Pub. Corp., New Delhi.

10. Massimo Livi-Bacci (2012). A Concise History of World Population (V Ed.), Wiley-Blackwell

11. Yaukey, D., Anderton, D.L. and Landquist, J. H.(2007) Demography: The Study of Human Population,Wavelength Pres Inc. IL. USA

12. Miller Katherine (2004) Communication Theories: Perspectives, Processes, and Contexts, McGraw Hill, New York.

13. Stephen W. Littlejohn and Karen A. Foss (2007) Theories of Human Communication, Cengage Learning, New Delhi.

14. King, Leslie and Deborah McCarthy (2009) Environmental Sociology: From Analysis to Action, (II Ed.), Rowman and Littlefield, USA.

15. Mayerfeld Michael Bell (2012) An Invitation to Environmental Sociology, (IV Ed.), Pine Forge Press, SAGE, London.

ANNEXURE V

QUESTION PAPER PATTERN (revised)

CORE PAPERS

PART A

Time : 3.00 Hrs. **Marks: 75**

Answer all questions **(10 x 1 =10)**

Ten Multiple choice questions each carrying one mark

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

PART B

Answer any FIVE **(5 x 2 = 10)**

Seven questions out of which FIVE have to be answered

11.
12.
13.
14.
15.
16.
17.

PART C

Answer all Questions **(5 x 5 = 25)**

Five questions with Internal Choice

18. a or b
19. a or b
20. a or b
21. a or b
22. a or b

PART D

Answer any THREE **(3 x 10 = 30)**

Five questions out of which THREE have to be answered

23.

24.

25.

26.

27.

(Unit wise distribution of questions should be followed)

QUESTION PAPER PATTERN (revised)

SUPPORTIVE PAPER AND SELF STUDY PAPER

PART A

Answer all questions **(6 x 1 =6)**

Six Multiple choice questions each carrying one mark

1.
2.
3.
4.
5.
6.

PART B

Answer any THREE **(3 x 2 = 6)**

Five questions out of which THREE have to be answered

7.
8.
9.
10
11.

PART C

Answer all Questions **(2 x 5 = 10)**

TWO questions with Internal Choice

12. a or b
13. a or b

PART D

Answer any TWO **(2 x 8 = 16)**

Three questions out of which TWO have to be answered

14.
15.
16.

(Unit wise distribution of questions should be followed)