BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024.

M.Sc. Environmental Sciences - Course Structure under CBCS

(applicable to the candidates admitted from the academic year 2008-2009 onwards)

Semester	Course	Course Title	Ins. Hrs / Week	Credit	Exam Hrs	Marks		Total
						Int.	Extn.	
I	Core Course – I (CC)	Environmental Chemistry	6	4	3	25	75	100
	Core Course – II (CC)	Statistical Application on Environmental Sciences	6	4	3	25	75	100
	Core Course – III (CC)	Computer Application in Environmental Sciences	6	4	3	25	75	100
	Core Course – IV (CC)	Principles of Environmental Sciences	6	5	3	25	75	100
	Core Course – V (CC)	Practical – I – Environmental Chemistry	6	4	3	40	60	100
		Total	**30**	**21**				**500**
II	Core Course – VI (CC)	Environmental Biology & Geology	6	4	3	25	75	100
	Core Course – VII (CC)	Environmental Microbiology, Biotechnology & Bio-Chemistry	6	4	3	25	75	100
	Core Course – VIII (CC)	Environment & Health	6	5	3	25	75	100
	Core Course – IX (CC)	Forest Resource Management	6	4	3	40	60	100
	Elective – I	Practical II – Environmental Microbiology, Biotechnology & Biochemistry	6	4	3	40	60	100
		Total	**30**	**21**				**500**
III	Core Course – X (CC)	Environmental Legislation & Justice	5	4	3	25	75	100
	Core Course – XI (CC)	Environmental Impact & Assesment	5	5	3	40	60	100
	Core Course – XII (CC)	Environmental Pollution & Degradation	5	4	3	25	75	100
	Core Course – XIII (CC)	Practical III – Environmental Pollution & Degradation	5	4	3	40	60	100
	Elective - II	Renewable Energy Technology	5	4	3	25	75	100
	Elective – III	Industrial Pollution Control	5	4	3	25	75	100
		Total	**30**	**25**				**600**

IV	Core Course – XIV (CC)	Climate Change	6	4	3	25	75	100
	Core Course – XIV (CC)	Environmental Engineering, Conservation & Management	6	4	3	25	75	100
	Project Work	Dissertation 80 Marks [2 reviews– 20+20 = 40marks Report Valuation = 40 marks] Viva 20 Marks	6	7	-	-	-	100
	Elective - IV	Forest Ecology & Wild Life Management	6	4	3	25	75	100
	Elective - V	Remote Sensing & GIS	6	4	3	25	75	100
		Total	**30**	**23**				**500**
		Grand Total	**1`20**	**90**				**2100**

Note:

Core Courses include Theory, Practicals & Project

No. of Courses	14 - 17
Credit per Course	4 - 5
Total Credits	70

Elective Courses

(Major based / Non Major / Internship)

No. of Courses	4 – 5
Credit per Course	4 – 6
Total Credits	20

	Internal	External
Theory	25	75
Practicals	40	60

Project

Dissertation	80 Marks	[2 reviews – 20+20	=	40 marks
		Report Valuation	=	40 marks]
Viva	20 Marks			20 marks

Passing Minimum in a Subject

CIA	40%	Aggregate 50%
UE	40%	

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CORE COURSE - I (CC): ENVIRONMENTAL CHEMISTRY

UNIT 1 **- Fundamentals of Environmental Chemistry** : Stoichiometry, Gibb's energy, chemical potential, chemical equilibria, acid-base reactions, solubility product, solubility of gases in water , the carbonate system, unsaturated and saturated hydrocarbons, radionuclides.

UNIT 2 - **Chemical composition of Air**: classification of elements, chemical speciation. Particles, ions and radicals in the atmosphere. Chemical processes for formation of inorganic and organic particulate matter. Thermochemical and photochemical reactions in the atmosphere. Oxygen and ozone chemistry. Chemistry of air pollutants. photochemical smog.

UNIT 3 - **Water Chemistry**: Physico-Chemical parameters of water, concept of DO, BOD, COD, sedimentation, coagulation, filtration, Redox potential, water cycle, types of
water, sampling techniques.

UNIT 4 - **Chemistry of the soil**: Structure of lithosphere, Nature of soil - physical properties of soil - soil water - soil air - soil temperature - mechanical composition- structure and texture. Chemical properties of soil: Minerals of soil - colloids in soil; ion exchange reactions in soil. Soil fertility and evaluation - organic matter in soil and their transformation - soil pH and its effect on fertility.

UNIT 5 - **Toxic Chemicals in the environment**-Xenobiotics- in Air, Water and soil. Biochemical aspects of Arsenic, Cadmium, Lead, Mercury, Carbon Monoxide, O_3 and PAN, Pesticides, Insecticides, MIC, carcinogens. **Principles and Applications**: Titrimetry, Gravimetry, Colourimetry, Spectrophotometry, Atomic Absorption Spectrophotometry,Flame photometry, Electrophoresis. X-ray fluorescence, X-ray diffraction, Chromatography-GC, GLC and HPLC,.

REFERENCES

1. Banerji,S.K, 2002. Environmental chemistry. Prentice-Hall of India, New Delhi.
2. Bhatia,S.C, 2002. Environmental chemistry. CBS publishers and Distributors, New Delhi.

3. Chatwal,A. .1999. Instrumental methods of chemical analysis. Himalaya publishing House, Mumbai.
4. Cunningham.P, Cooper.H, Eville.G, and M.T. Hepworth.1999. Environmental Encyclopedia.Jaico Publishing House, Mumbai.
5. De A.K. 1990. Environmental Chemistry. Wiley Eastern Ltd., New Delhi.
6. Gilreath, E.S. Fundamentals of Inorganic Chemistry.
7. Glasstone, S and Lewis. Essentials of Physical Chemistry.
8. Johnson, D.O. Netteville, J.T. Wood, J.C. and James M. 1973. Chemistry and the Environment W.B. Saunders Co., Philadelphia.
9. Sharma, B.K. and Kaur, H.1994 .Environmental Chemistry. Goel Publishing House, Meerut.
10. Sindhu, P.S, 2002. Environmental chemistry. New age international publishers, New Delhi.
11. Sodhi,C.S .2000. Fundamental concepts of environmental chemistry. Narosa Publishing house,New Delhi.
12. Warme,R.P. 1985. Chemistry of Atmospheres. Clarendon Press, Oxford.
13. Weigbery, Instrumentation manual. McGraw Hill, NewYork.
14. Williamson,S.J. 1971. Fundamentals of air pollution. Wesley publishing company.

CORE COURSE - II (CC): STATISTICAL APPLICATIONS ON ENVIRONMENTAL SCIENCES

UNIT1:

Graphical representation of statistical data - Bar diagram, pie diagram, histogram, frequency polygon, frequency curve, O gives –less than and greater than. Measures of central tendency - mean, median and mode - measures of dispersion - range, quartile, mean deviation, standard deviation.

UNIT 2:

Measures of skewness and kurtosis and coefficient of variation - simple problems only - correlation (Karl Pearson's coefficient of correlation - simple problems), regression.

UNIT 3:

Probability theory - definition of probability - events - rules of probability (addition and multiplication rules only) - compound probability - baye;s theorem - theoretical distributions - binomial poisson and normal (statements only) - with simple application problems.

UNIT 4

Sampling theory – types of sampling –Data collection – primary and secondary- testing of hypothesis using normal and student - t distributions.

UNIT 5:

Chi-square test and ANOVA - Application to environmental studies. Simple problems only

References:

1. Amble V.N. 1975.Statistical methods in Animal Sciences. Indian Society of Agricultural Statistics, New Delhi.
2. Bailey, N.T.J. Statistical methods in Biology, The English Universities Press Ltd., U.K.
3. Fisher R.A. and Yates E. 1963, Statistical table for Biological Agricultural and Medical Research, Oliver and Boyd, London.
4. Gupta. Statistical Analysis
5. Kandasamy,P, K. Thilagavathi and K. Gnanavathi,Engineering Mathematics. Chand and Co Ltd., New Delhi.
6. Krebs, C. 1989. Ecological methodology .Academic press, London.
7. Ludwig, J.A. & Reynolds, J.F. 1988. Statistical Ecology – A primer on methods and computing. John-Wiley & sons. New York.
8. Miller, J. 1996. Statistics for advanced level. 2nd Edition. Cambridge University Press (Low price edition). Pp. 442.
9. Naveedam. Teach your self Statistics
10. Sivadhanupillai. Statistical Analysis
11. Venkatraman,M.K. Engineering Mathematics Vol. I & II. The National Publishing Co.

CORE COURSE - III (CC): COMPUTER APPLICATIONS IN ENVIRONMENTAL SCIENCES

UNIT 1:

Introduction to computers: Computer system - Hardware components - CPU, Memory, I/O devices, information storage media; software components; Computer Programmes - Stored programme concept, operating systems - DOS and its use; Algorithm - flow charts and pseudo - code.

UNIT 2:

Functions and sub programmes: Statements of functions - function subprogramme - subroutine subprogram - common statements - Equivalence statements.

File Management: I/O statement for sequential access file. I/O statements for direct access file. Auxiliary I/O statements, file positioning I/O statements namelist statements.

UNIT 3:

Study of scientific packages such as Fox pro, Microsoft office - MS Excel - spreadsheets/worksheets & graphing features to model simple systems and their graphical presentations-Applications.

UNIT 4:

MS word – formating documents – insert objects-creating tables-labels-and envelopes using mail merge. MS Powerpoint –slide show – formatting presentation – Inserting clipart. MS Access.

UNIT 5:

Programming exercise to handle problems of statistical types by using statistical package. Statistical techniques: Probability, discrete and continuous series, estimation of parameters(mean,median,mode) hypothesis testing (t- test); ANOVA; regression and correlation. Forecasting and simulation for simple environmental modeling.

REFERENCES

1. Balagurusamy, Computer application.
2. E.V. Krishnamurthy and S.K. Sen .Computer - Based Numerical Algorithm. East West Press, 1984.

3. K.S. Trivedi.Probability and Statistics with Reliability, queuing and Computer Science Applications. Prentice Hall, India.
4. Krebs, C. 1989. Ecological methodology .Academic press, London
5. Ludwig, J.A. and. J.F Reynolds. 1988. Statistical Ecology – A primer on methods and computing. John-Wiley and sons. New York.
6. Manuals of work processor, dBase and Lotus.
7. S.C. Gupta and V.U. Kapoor. Fundamentals of Mathematics Statistics.

CORE COURSE IV
PRINCIPLES OF ENVIRONMENTAL SCIENCES

Unit I

Basic components of an ecosystms – structure and functional aspects of an ECO system, Tropic structure – Ecological Niche – Ecological dominances – Stability Diversity rule, Energy flow in ecosystems – Laws of Thermodynamics, Productivity – Biomass production, primary productivity and net productivity

Unit II

Food Chain – Types of food chain, with examples, Foodweb, Ecological pyramid of biomass – Number and energy – inverted ecological pyramids

Unit III

Aquatic Ecosystem – Physics – Chemical nature of lentic and lotic ecosystems, Types of aquatic ecosystem – structure and organization with examples of fresh water Ecosystem, Marine water ecosystem, estuarine water Ecosystem – Mangroves

Unit IV

Population dynamics, models for single and interacting population, stable points, stable cycles, chaos competition, prey perdation etc. Ecological succession, primary and secondary processes in succession, models of successions, climax community and types of climax

Unit V

Biogeochemical Cycles – Availability and rate of cycling of nutrients – gaseous and Sedimentay cycle

References:

1. Fundamental and Environmental Ecology, III Edition, (1971) Odum, E.P. Prentice Hall
2. Anjaneyulu, Y. 2004, Introduction to Environmental Science, B.S. Publications
3. D. Daniel Chiras, 2001, Environmental Science, 6th Ed., Jones and Bartlett Publishers.
4. Mukherji Shormila, 2004, Fragile environment, Manak Publication Pvt. Ltd.
5. Subramanian. V. 2002, A text book in Environmental Science, Narosa Publishing House, New Delhi.

CORE COURSE - V (CC) - PRACTICAL I: ENVIRONMENTAL CHEMISTRY

1. Volumetric analysis by EDTA titrations.
2. Conductometric experiments:
   a. Equivalent conductivity of strong electrolyte at infinite dilution
   b. Acid-base titration
      (i) Strong acid Vs strong base -HCl Vs NaOH
      (ii) Weak acid Vs Strong base-CH_3COOH Vs NaOH
      (iii) Mixture of acids Vs Strong base-HCl + CH_3COOH Vs NaOH
3. Potentiometric experiments:
   Redox titrations
      (i) FAS Vs $KMnO_4$
      (ii) KI Vs $KMnO_4$
   b. Determination of solubility of AgCl
   c. Determination of pH

4. Colorimetric experiments:
   Determination of cation concentrations of:

   a) Fe^{3+} b) Cr^{6+} c) Ni^{2+}

SEMESTER – II - CORE COURSE – VI (CC):
ENVIRONMENTAL BIOLOGY AND GEOLOGY

UNIT 1:

Components of Environment - biotic and abiotic factors. Principles and concepts of ecosystem: producers, consumers decomposers. Primary productivity and secondary productivity, Food chains, Food webs, Energy flow, Trophic structure and Ecological pyramids. Biogeochemical cycles - oxygen cycle, carbon cycle, nitrogen cycle, sulphur cycle and phosphorous cycle.

UNIT 2:

Ecosystem types - Aquatic– Freshwater- Pond, River. Marine-Estuary, Mangroves, Seagrasses,
Corals, Deep sea.

UNIT 3:

Population: Definition, characteristics of population density, natality, mortality, age distribution, growth patterns, population fluctuation, population equilibrium, biotic potentials, population dispersion ,Regulation of population.

Community: Definition, characteristics of community, Community dominance, Community structure, Community stratification, Community periodicity. Fluctuations within the community, Communal interdependence, Ecotone, Edge effect, Ecological niche, Ecological equivalents, Ecological succession, types, process, climax and significance of succession.

UNIT 4:

Environmental Geology: Structure and composition of atmosphere –Energy budget of the earth. First and second law of thermodynamics. Atmospheric mass transfer and weather-Movement of air masses- global weather changes. Atmospheric stability, Inversion.

UNIT 5:

Climates of India, Indian monsoon, EI Nino, Drought, Tropical cyclones , Western disturbances, and catastrophic geological hazards. Study of floods, landslides, earthquakes, volcanism and avalanche. Mineral resources-ores of Al and Fe.

REFERENCES

1. Agarwal,1996.Environmental Biology.Agro Botanical publishers,India.
2. Bhatia,S.C,2002.Environmental chemistry, CBS publishers and Distributors, New Delhi.
3. Chapman, J.L. and Reiss, M.J. 1995. Ecology-Principles and applications. Cambridge University Press (Low price edition). Pp. 294.
4. Clarke A.C. Elements of Ecology John Wiley, London.
5. Das gupta.A, and Kapoor.A.N, 1999. Principle of physical geography. Chand and company limited, New Delhi.
6. Mishra P.C. and Trivedy R.K. 1994. Ecology and Pollution of Indian Lakes and reservoirs. Enviromedia, Karad.
7. Odum E.P. 1971.Fundamentals of Ecology, W.B. Saunders Co. Philadelphia and London.
8. Sharma P.D. 2003.Ecology and Environment .Rastogi Publication, Meerut.
9. Shukla and Chandel, 1998 .Plant Ecology and Soil science. Chand and company limited, NewDelhi.

CORE COURSE - VII (CC): ENVIRONMENTAL MICROBIOLOGY, BIOTECHNOLOGY AND BIOCHEMISTRY

UNIT1:

Introduction: Scope of microbiology, structure and reproduction in general - Algae, Fungi, Bacteria, Viruses and Actinomycetes- Sterilization , preparation and maintenance of culture media-Isolation and identification of common Algae, Fungi, Bacteria.

UNIT 2:

Soil microorganisms - Microorganisms in water, algalbloom. Microorganisms in air, origin distribution and estimation. Microorganisms in food and milk, Food poisoning and food preservation. Production of organic compound by microbial fermentation ethanol, citric acid, production of antibiotics by microorganisms-penicillin, Enzyme - Zymase. Disease producing microorganisms - Tikka disease, Red rot of sugar cane, White rust, TMV, cholera, typhoid, dysentery, Jaundice.

UNIT 3:

Importance of biotechnology-Techniques in cells and tissues culture. Applications of cells and tissue culture, regeneration of plants from tissue culture, protoplast isolation and fusion, somatic hybridization.

UNIT 4:

Sewage treatment using microbial systems,-Bioremediation of waste water-eg.,Heavy metal. Energy and fuel using microorganisms - hydrogen production using hydrogenase and nitrogenase, hydrocarbon production. Use of mycorrhizae in reforestation,biofertilizers.Use of microbes for improving soil fertility, current levels of biodiversity. Steps to preserve biodiversity, insitu and exsitu conservation, Gene banks, and species conservation.

UNIT 5:

Structure and functions of carbohydrates, proteins and lipids. Metabolism - Glycolysis, Citric acid cycle, Electron transport, Oxidative phosphorylation and regulation of ATP production. Oxidation of fatty acids and amino acids, Urea cycle. Biosynthesis of Carbohydrates, lipids and aminoacids in animal tissues.

REFERENCES

1. Agarwal.K.C.1998,Biodiversity, Agro Botanica,New Delhi.
2. Ambika Shanmugam.1998.Fundamentals of Biochemistry for medical students. Kartik offset printers,Chennai.
3. Atlas R.M. 1984. Microbiology, Fundamentals and applications .Macmillan Publishing Co., New York.
4. Gupta P.K.1994. Elements of biotechnology .Rastogi Company .Meerut.
5. Ignacimuthu.S, 1998. Basic Biotechnology . Tata McGraw-Hill Co limited ,NewDelhi.
6. Keshar ,T .1990. Biotechnology, Wiley eastern Ltd., New Delhi.
7. Kumerasan V. 1994. Biotechnology .Saras publication .Kanyakumari.
8. Lehninger A.L. 1982. Principles of Biochemistry .CBS Publishers and Distributors.Delhi.
9. Pelczer,M.J,Chan.E.C.S and N.R.Krieg.2001.Microbiology.Tata McGraw-Hill Publishing company limited,NewDelhi .
10. Purohit ,M. 1990. Fundamentals of biotechnology .Agro botanical publishers, Bikaner.
11. Ranganatha Rao. Text Book of Biochemistry, Prentice Hall, India.
12. Ross F.C. 1986.Introductory microbiology .Charles E. Mermill publishing company.
13. Schlegal N.G. 1986. General Microbiology.Cambridge University Press, U.K.

CORE COURSE VIII - ENVIRONMENT AND HEALTH

Scope: The objective of this paper is to acquaint students who have little knowledge about environmental issues, their impact on health and how clean environment per se will pave the way for personal health.

Unit 1.

Man and environment – Ecosystems and natural balance – resources: biodiversity and its importance and threats – renewable and non renewable energy sources and types – rural energy problem – future energy options – solar energy – biogas – biodiesel- Sustainable development- limits to growth (Forester and Meadows) – EIA and its need.

Unit 2.

Pollution and health: Classification and effects of air and water effects of pollutants on human health – acid rain, automobile pollution: effects of oxides of carbon, sulphur and nitrogen on plants, animals, man and environment – effect pof fertilizers, pesticides and heavy metals on human health – biomagnification – eutproication: algal blooms, red tide – sewage and solid waste problem and disposal – treatment.

Unit 3.

Environment and disease: Global warming and ozone hole – CFC- effect on climate, health and agriculture – Water and air borne diseases: TB, cholera, amoebiasis, helminthiasis, Dehydration: ORT – social exonomic and health impacts of AIDS.

Unit 4.

Personal health: WHO definition – psychosomatic diseases – stress management – obesity and cholesterol management – body mind relationship – Yoga: aims, astanga yoga, basics about meditation.

Unit 5.

Population and health: Population explosion and the constraints in service sector- growth trends in developing and developed countries – urbanisation and its impacts – Occupational health hazards: asbestosis, silicosis, black lung disease; Food contamination and additives – biopesticdes, organic farming, and GM foods.

Reference

1. Turk and Turk (1995) Environmental science, Saunders company, USA
2. Park and Park (1985) Social and preventive medicine, East west puhlications, New Delhi
3. Publications of world health organization on health and diseases
4. Light on Yoga, BKS Iyengar.

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CORE COURSE IX – FOREST RESOURCE MANAGEMENT

Unit I

Forest – Forest ecology-biotic and abiotic factors – forest types and classification: State of World's forest. Functions of Forest. Threats to forest ecosystem and forest resources; Impacts of Deforestation on quality of the Environment Forestry; Introduction – objects – branches

Unit II

Forest management and management system: objectives and principles; Introduction to Silviculture, silvicultural systems and techniques; stand structure and dynamics, sustained yield relation; growing stock; regulation of yield; management of commercial forests, forest cover monitoring

Unit III

Social forestry: different dimensions of social forestry – scope of social forestry, village woodlot – strip plantations – farm forestry-agro forestry; backyard planting-urban forestry – Multipurpose forestry: Approaches to afforestation of barren lands. Joint forest participatory management

Unit IV

Bio diversity; Levels and types of biodiversity; Biodiversity hot spots. Threats to biodiversity predator control, exotic introductions, parasites and diseases. Protection and conservation of flora and fauna. Preservation of wet lands; protection measures taken at global level

Unit V

Forest surveying and engineering-different methods of surveying maps and reading, Forest laws their role in nature conservation; planning and evaluation – tools and approaches for integrated planning; Forest laws: Multipurpose development of forest resources and forest industries development.

References:

1. Khanna, L.S. and Chaturvedi, 2000 Handbook of Forestry, Khanna Bandhu Publication, Delhi
2. Negi, S.S. 1997, Forest law and policy, International book distributor
3. Dwivedi A.P. 1993, Forestry in India, Surya Publications, Dehra Dun
4. Lal. J.B. 1992, Deforestation; Causes and control in : Status of Indian Forestry: Problems and perspectives, P.K. Khosla (ed.) Indian society of tree Scientists, solan, p 33-49.

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ELECTIVE I - PRACTICAL II: ENVIRONMENTAL MICROBIOLOGY, BIOTECHNOLOGY AND BIOCHEMISTRY

1. Significance of oxygen, pH, temperature, light .Adaptations of plants and animals in

I. Fresh water habitat
II. Terrestrial habitat
III. Marine habitat - Rocky, Sandy and Deep sea. Common examples of plants and animal in the above habitats.

2. Effect of temperature on DO of fresh water; Oxygen consumption of an aquatic animal and a terrestrial animal. Salt loss and salt absorption of fish in experimental media of two different concentrations.

3. Observation of compound microscope, micrometry, Photomicrography. Microscopic preparation of diseased leaves. Sterilization procedures - Autoclave, Hot air oven, Preparation of media staining procedure gram stain. MPN technique; Methylene blue test for determining the microbial quality of milk..

4. Toxicity studies: Application of LC_{50}in fishes and the significance of dose response curves. Estimation of proteins, Sugars and lipids in fishes; Estimation of chlorophyll content and total phenols in plants (experimental fishes/plants are to be treated already with pesticides or heavy metals, industrial waste water or sewage for the above practicals). Separation of free amino acids by paper chromatography.

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SEMESTER – III
CORE COURSE X – ENVIRONMENTAL LEGISLATION AND JUSTICE

Unit I

Ethics – Concepts – Ethical theories – consequential theory – deontological theory – virtue ethics – situation ethics – feminist ethics – Illustration cases – DPGs – Biopiracy – GMO – Stem cell research. Environment and constitution of India – Environmental legislature Machinery – Constitutional Status of Environment – Duty to Protect Environment

Unit II

Laws on Water Pollution control – Powers of Central and State Pollution Control Boards - Prevention and Control of Water Pollution – Closure or Stoppage of water and Electricity Supply – Citizen suit provision – Power of Central Government to Supersede the Central Board – Power of State Government to Supersede the State Board.

Unit III

Laws on Air Pollution Control – Powers and Functions of Boards – Air Pollution control Areas – Indoor Air Pollution – Prohibition of Emission of Air Pollutants

Unit IV

Environment (Protection) Act 1986 – Powers of Central Government – Legal Regulation of Hazardous Substance – Hazardous Wastes (Management and Handing) Rules 1989 the Natural environment Tribunal Act 1995 – Legal Measures to control Noise Pollution – Solid waste management and handling rules – 2000

Unit V

International environmental conventions – Montreal Protocol – Earth Summit – Agenda 21 – Biodiversity Convention – Kyoto Protocol – Millennium development Goals – Based convention.

Reference:

1. Gurdip Singh, (2005), 'Environmental Law in India', Macmillan India Ltd., New Delhi- 110 002
2. Bala Krishnamoorthy, (2005) Environmental Management, Prentice Hall of India private Limited, New /delhi
3. Agarwal S.K. (1997), Environmental Issues and Themes, APH Publishing Corporation, New Delhi
4. John O Neil. R. Kerry Turner and Ian J. Batemaned ed. (2001), Environmental Ethics and Philosophy, An Elgar Reference collection, USA

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CORE COURSE – XI (CC): ENVIRONMENTAL IMPACT & ASSESSMENT

UNIT 1

Introduction to environmental impact analysis, Environmental impact Statement and Environmental management plan. EIA guidelines 1994, notification of Government of India.

UNIT 2

Impact Assessment Methodologies ,Generalized approach to impact analysis, Guidelines for Environmental Audit.

UNIT 3

Base line information and prediction (land, water, atmosphere, energy, biological, cultural and socio-economic) Restoration and rehabilitation technologies, Landuse pattern ,Urban Planning and Rural planning Concept and strategies of sustainable development ,Environmental priorities in India and sustainable development. Cost benefit analysis. Environmental ethics and ecomark.

UNIT 4

Overview of risk assessment. Major accident in industries - causes and effects and risk to workers- risk of genetically modified organisms. Eco - epidemiology. Application of risk assessment in policy and legislation in India. Psychology of risk, economics of risk, risk financing and compensation.

UNIT 5

Need for Environmental Education, Levels of environmental education, school children, students, rural and urban public industrial workers. Role of NGOs in environmental awareness. Introduction to GIS and Remote Sensing. .Application of GIS and Remote Sensing in environmental sciences.

REFERENCES:

1. Canter L.W. 1977. Environmental impact assessment .McGraw Hill Book co., New York.
2. Cutter,L.1999. Environment risks and hazards.Prentice Hall of India Private Limited, New Delhi.
3. Dalua.A.K.1993. Environmental impact of large reservoir projects on human settlement. Efficient offset printers. Delhi.
4. Erickson ,P.A. 1977. Environmental Impact Assessment principles and Application.
5. Gopal,L,J.1997. Rural Development. Mangal deep publications,Jaipur.
6. Masters G.M. 1991 Introduction Environmental Engineering and Science .Prentice-Hall of India Pvt. Ltd., New Delhi.
7. Munn ,R.E. 1982 Environmental Impact Assessment . McGraw Hill Book Co., New York.
8. Purushotham Reddy.K and Narasimha Reddy.D.2002. Neelkamal publications Private Ltd., Hyderabad.
9. Rau, J.G. and Wooten, D.C. 1980. Environmental impact analysis handbook. McGraw Hill Book Co., New York.
10. TNPCB,1999.Pollution control legislations -Tamilnadu pollution control board . Vol-I and II, Chennai.
11. Trivedy ,R.K. and M.P Sinha. 1995. impact of Mining an Environment. Enviro media, Karad.
12. Turner, R.K. Pearce D and Bateman, I .1993. Environmental Economics – An Elementary Introduction .The John Hopkins University Press .Baltimore.
13. WHO, 1982. Rapid Assessment of Sources of Air, Water and Land Pollution. World health organization, Geneva.

CORE COURSE - XII (CC):
ENVIRONMENTAL POLLUTION AND DEGRADATION

UNIT 1

Air Pollution: Structure of the atmosphere, Types of air pollutants, primary and secondary particulate and gaseous contaminants, their sources and impact on vegetation, animals and human beings. Photochemical smog, Bhopal gas disaster. Acid rain formation its effects on environment. Green house effect-Global Warming - stratospheric ozone depletion. Community air pollution survey. Meteorological factors in air pollution survey. Meteorological factors in air pollution, wind, Atmospheric stability, plume behaviour. Air pollution monitoring, principles of sampling and analysis of particulate and gaseous contaminants.

UNIT 2

Water Pollution: Sources and types of water pollution. Classification of water pollutants - Oxygen demanding wastes, pathogens, plant nutrients, synthetic organic compounds, inorganic chemicals and mineral substances. Thermal pollution - sources and effects, an episode of thermal pollution. Sewage - nature of sewage.

UNIT 3

Land Pollution: Sources, types and nature of solid wastes, effects of solid wastes, solid industrial wastes, defecation and its effects, fertilizer pollution, types of fertilizers field run off-effects. Pesticides pollution, history, types - effects of biocides, Other forms of environmental degradation, monoculture and its impacts, Dam water development projects and its impacts. Soil erosion - types and factors, Desertification.

UNIT 4

Radioactive Pollution: Radiation - types and units-sources natural and man-made. Effects of radioactive pollution atomic explosions an radioactive pollution and an episode. Noise pollution: Sources, types, characteristics of sound, noise, intensity annoyance, impacts of noise pollution. Noise levels in different cities of the World and in India.

UNIT 5

Marine pollution: Sources of marine pollution and control. Criteria employed for disposal of pollutants in marine system. Impact of marine pollution. Oil pollution - sources and effects, an episode of oil pollution. - coastal management

REFERENCES

1. Abbasi.S.A.1998. Environmental pollution and its control, Cogent international, Pondicherry.
2. Asthana.K and Asthana,M .2003.Environment. Chand and Co. Ltd., New Delhi.
3. Bhatia.H.S.1998.Environmental pollution and its control ,Golgotia publications (P) Limited, Delhi.
4. Dara.S.S.2002.A text book of environmental chemistry and pollution control,Chand and Co. Ltd., New Delhi .
5. De, A.K 1987. Environmental Chemistry. Wiley Eastern Ltd., New Delhi.
6. Kannan K, 1991 Fundamentals of Environmental Pollution S. Chand and Co., Delhi.
7. Kudesia,V.P. 1997. Air pollution. Pragati publications,Meerut.
8. Kumaraswamy,K, Alagappamoses,A, and Vasanthy.2004. EnvironmentalStudies. National offset printers,Tanjavur.
9. Mishra P.C. and Trivedy R.K. 1994. Ecology and Pollution of Indian lakes and reservoirs. Enviromedia ,Karad.
10. Murty J.V.S. 1994. Watershed Management in India. Wiley Eastern Ltd., New Delhi.
11. Rao M.N. and H.V.N. Rao, 1989. Air Pollution .Tata McGraw Hill Publishing Co. Ltd., New Delhi.
12. Sharma B.K and H.Kaur. 1994. Water Pollution.- Goel Publishing House, Meerut.
13. Sharma B.K. and H.Kaur. 1994. Air Pollution .Goel Publishing House, Meerut.
14. Sharma B.K. and H.Kaur. 1994. Soil and Noise Pollution . Goel Publishing House. Meerut.
15. Sharma B.K. and H.Kaur. 1995. Environmental Chemistry. Goel Publishin. House, Meerut.
16. Timmy katyal and Satake.M.1998. Environmental pollution,Anmol Publications (P) Ltd., New Delhi.
17. Trivedy R.K. 1995. River Pollution in India .Enviromedia, Karad.
18. Trivedy R.K. and P.K Goel. 1995 .An introduction to air pollution. Enviromedia, Karad.

CORE COURSE - XIII (CC)
PRACTICAL III: ENVIRONMENTAL POLLUTION & DEGRADATION

1. Water and effluent analysis:

   a) Physical parameters: pH, temperature, electrical conductivity, turbidity.
   b) Chemical parameter: Total solids, total dissolved solids, Total suspended solids, alkalinity, acidity, total hardness, calcium, magnesium, chloride, Fluoride, Dissolved oxygen, BOD & COD.
   c) Nutrient parameters: Kjeldahl nitrogen, nitrates, nitrites, phosphates, sodium, potassium, silicates, sulphates (one water sample and one available effluent sample are to be analyzed).
   d) Estimation of Phytoplankton, Zooplankton, algae, protozoa, Biotic indices - Shannon – Weaver index.

2. Soil Analysis : pH, Electrical conductivity, alkalinity, Total organic matter, Total phosphorous, Total nitrogen, sodium potassium,.Spot tests: Nitrate, ammonia and carbonate.

3. Air analysis: SPM, SO_2, H_2O, H_2S, NO_x (Using High Volume Air Sampler)

ELECTIVE II (EC):RENEWABLE ENERGY TECHNOLOGY

UNIT 1:

Sun as source of energy: solar radiation and its spectral characteristics; Fossil fuels-classification, composition, physico-chemical characteristics and energy content of coal, petroleum and natural gas,energy use pattern in different parts of the world.

UNIT 2:

Solar Energy: Introduction, Need for alternative energy Sources. Estimation of solar radiation.
Solar energy collectors: Flat plate collectors - solar air Heaters - concentrating collectors – Focussing. Type - non-focussing type. Applications of solar Energy-solar energy water heating, space heating - space cooling- solar distillation - Solar furnace - solar thermal electric power conversion Solar photovoltaics - solar cell - solar pumping - solar energy storage systems - solar ponds - solar hydrogen.

UNIT 3:

Wind Energy: Introduction, Basic principles of wind energy conversion - wind data and energy estimation - site selection considerations - Basic components of a wind energy conversion systems (WEC). Classification of WEC systems, Types of wind machines - Applications of wind energy - Environmental aspects. Energy from the Ocean: Ocean thermal energy conversion (OTEC) - Energy from tides - Energy from ocean waves - micro-hydal power.

UNIT 4:

Energy from Biomass: Introduction - Biomass conversion technologies - Biogas generation - classification and types of biogas plants - construction : and Design considerations - Community biogas plants - Materials used for biogas generation - Different wastes and weeds - utilization and biogas; Thermal gasification of biomass, Classification of gasifiers, Gasification process.
Applications .energy plantation.

UNIT 5

Bio-energy resources:Petroplants – Biodiesel from *Jatropha sp*.. Fuel cell , Principles, -Hydrogen fuel cell-Alcohol fuel cell-advantages and disadvantages. Briquetting of solid wastes. Pyrolysis. Improved chulhas, smokeless chulhas. Pedal power devices. Low cost house - construction.
Integrated approach for biovillages, IREP, Urjagrams.

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9. Johnson,G.L. Wind energy system. Prentice - Hall Inc., New Delhi.
10. Maheswar ,D. Renewable Energy Environmental and development. Konark publishers pvt ltd.,
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12. Rai ,G.D.2001. Non-conventional energy sources. Khanna publishers,New Delhi.
13. Sukhatme, S.P.1996. Solar Energy . Tata Mc Graw Hill publishing company Ltd., New Delhi.
14. Trivedi.P.R,and K.N.Sudarshan.1994.Environment and natural resources conservation. Common wealth publishers, New Delhi.
15. Tyagi .Fuels from weeds and wastes.
16. Weber ,C.I. Biological field and laboratory methods of measuring the quality of surface water and effulent. EPA6704 93001 -Ohio.
17. Weigbery, Instrumentation manual .McGraw Hill, NewYork.

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ELECTIVE III (EC): INDUSTRIAL POLLUTION AND CONTROL

UNIT 1:

Importance of industries - Indian scene - Availability of the Raw materials and their transportation, solid, liquid and gaseous raw materials. Principles of purification and handling. Energy for industry and energy conservation concepts.

UNIT 2:

Tanneries: Production of leather, vegetable tanning and chrome tanning processes. Sources and characteristics of wastes. Effect of tannery effluent and other wastes on receiving bodies and treatment methods of the wastes. Sugar mills and Distilleries - their manufacturing processes, sources and characteristics of their wastes. On receiving bodies, Treatment of their wastes and disposal.

UNIT 3:

Paper and pulp mills manufacturing processes, sources and characteristics of wastes. Effect of wastes. Treatment processes of the wastes. Textile mills - manufacturing processes, sources and characteristics of wastes. Effects of the wastes on receiving bodies. Treatment of the wastes.

UNIT 4:

Cement industries - manufacturing process, sources of pollution and wastes. Effect of wastes. Control technique of pollution. Oil refineries and thermal power plants-processes involved. Sources of pollution characteristics of pollutants and their effects. Pollution control techniques.

UNIT 5:

Fertilizer industries: manufacturing processes, sources and characteristics of wastes and their effects. Treatment processes pharmaceutical plants: manufacturing processes sources and characteristics of wastes and their effects. Treatment of wastes.

REFERENCES

1. Austin ,G.T. 1977 Shreves' Chemical processes in industries. McGraw Hill Book Co., New York.
2. Khudesia ,V.P. 1986. Industrial pollution control.Pragati Prakasham,Meerut.
3. Mahajan S.P. 1986. Pollution Control in process industries. Tata McGraw Hill Co. Ltd., New Delhi.
4. Rao M.N. and Datta .1982 .Wastewater treatment. Oxford and IBH, New Delhi.
5. Sharma, B.K. 1991. Industrial Chemistry. Krishna Prakashan Mandir,Meerut.
6. Trivedy, B.K. 1991. Pollution control in industries. Enviro media publishing Co., Karad.

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CORE COURSE XIV - CLIMATE CHANGE

Unit 1

Atmospherer, Hydrospher, Lithosphere, Biosphere and theirlinkage. Earth's geological history and development and ecvolution of the atmosphere; Gaina Hypothesis. Elements of climate, climatic controls. Earth and sun relations; Rotation and Revolution. Spatial and temporal patterns of climate parameters.

Unit 2

Meteorology fundamentals – Pressure, temperature, wind, humanity, radiation, atmospheric ssstability adiabatic diagrams, turbulence and diffusion. Scales of meteorology. Applications of micrometeorology to vegetated surfaces, urban areas, human beings, animals. Application of Meteorological principles to transport and diffusion of pollutants. Scavenging processes. Effects of meteorological parameters on pollutants and vice versa. Wind roses. Topographic effects. Pollution climatology.

Unit 3

Atmosphere and climate. Basic atmospheric properties, climatic controls. Climatic classifications and variability. Movement in the atmosphere: global scale, regional scale, local scale. Oceans: General circulation patterns. Air – Sea interaction.

Unit 4

Global Energy balance: Source, transfer, distribution. Energy balance of the atmosphere. Wind, stability and turbulence; Amonsoons; El Nino, Southern Oscillations, cyclones. Natural climate changes: Records of climate change (glacial cycles, ocean sediments, corals, tree rings)

Unit 5

Human Impacts on climate – Causes and consequences of Global warming – Greenhouse effect; Global and regional trends in greenhouse gas emissions – Sea level rise; role of oceans and forests as carbon sinks, Ozone depletion – stratospheric ozone shield; Ozone hole. Impacts of Climate change: Effects on organisms including humans; effects on ecosystems and productivity; species distribution ragnes; spread of diseases; Extinction risk for temperature – sensitive species; UV effects Climate change and Policy: Montreal Protocol; Kyoto Protocol; Carbon trading; clean development mechanisms.

Reference

1. Barry, R.G., 2003. Atmosphere, weather and climate. Routledge Press, UK
2. Critchfield, Howard J., 1998, General climatology, Prentice Hall India Pvt. Ltd., New Delhi.

3. Firor, J., and J.E.Jacobsen, 2002. The crowded greenhouse: population, climate change and creating a sustainable world. Yale Universtiy Press.
4. Harvey D., 2000, Climate and Global Climate Change, Premtioce Hall.

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CORE COURSE - XV (CC): ENVIRONMENTAL ENGINEERING, CONSERVATION MANAGEMENT

UNIT 1:

Water quality standards (ISI). Water purification processes in natural and Engineered Systems. Water Supply _ Design and layout of water distribution systems. Ground water recharge, Watershed: Concept, characteristics and types, Land development, water investigation and watershed management.

UNIT 2:

Wastewater Treatment - Primary, Secondary and advanced treatment: Classification and application of physical Unit processes with principles and process analysis, Design and layout of Industrial and Municipal wastewater treatment systems, Wastewater Disposal and Reuse.

UNIT 3:

Air Pollution control - control by dilution, its limitations, control by process changes, control by engineered systems for fixed sources. Control of particulate emissions - settling chambers, centrifugal collectors, wet collectors, fabric filters and Electrostatic precipitators, their principles, techniques and devices. Control of gaseous contaminants - Adsorption and Absorption techniques. Condensation and combustion techniques. Control of Automobile emissions. Noise pollution control-control at source, along sound transmission path and at receiver.

UNIT 4:

Principles and methods of solid waste collection, treatment and disposal - Land filling, composting and incineration techniques. Recovery and recycling of useful solid wastes control measures for soil erosion and land reclamation. Causes of flood and its control. Fertilizer management: Chemical and Biofertilizers, benefits of biofertilizers. Pest management, Chemical control methods, rational use of biocides, and biological and integrated control.

UNIT 5:

Forest types - Tropical evergreen and semi-evergreen forests in India, Dry deciduous and dry evergreen forests, grassland, vegetation survey, optimum exploitation, deforestation and its impact. Afforestration - Social and agroforestry schemes. Forest fire-prevention, control and suppression, Wildlife in India - Animals and birds, endangered species, conservation of wildlife, Sanctuaries and National parks. Environmental law; legislative measure for the control of environmental pollution and conservation of Biodiversity.

REFERENCES:

1. Arakevi ,H.R. and R .Donahue .1984. Principles of Soil, Conservation and Water Management. Oxford and IBH publishing Pvt. Ltd., New Delhi.
2. Duggal,K.N.1998.Elements of Environmental Engg..Chand and company Ltd.,New Delhi.
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5. Masters ,G.M. 1991.Introduction Environmental Engineering and Science. Prentice-Hall of India Pvt. Ltd., New Delhi.
6. Metcalf and Eddy.Waster water Engineering. McGraw Hill Publishing Co., New York.
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8. Pollution control legislations.Vol I and II Tamil nadu pollution control Board, Chennai.
9. Rangwala,S.C, K.S.Rangwala and P.S.Rangwala. 1997. Water supply and sanitary engineering, Charotar publicating house, Anand.
10. Rao ,C.S. 1991. Environmental Pollution Control Engineering .Wiley Eastern Ltd., New Delhi.
11. Trivedy, R.K. 1994. Pollution Management in industries . Enviromedia, Karad.

ELECTIVE IV (EC)
FOREST ECOLOGY AND WILDLIFE MANAGEMENT

UNIT 1:

Concepts of forest ecology: analysis of forest ecology present - day forests and silviculture. Forest Tree Variability and diversity: Components of phenotypic variation, the ecotype concept, Niche. Life and structure-Reproduction and tree farm.
The forest environment - solar radiation Temperature, Atmospheric moisture and other factors, climate, soil, nutrient cycle, the soil - plant water cycle, Fire and forest productivity.

UNIT 2:

The Ecosystem: Site, community and Ecosystem analysis. Animals and their roles in forest ecosystem. Macroevolution and reciprocal adaptations. Competition and survival, forest succession - stages of succession natural succession, climax forest fire and control, wind throw. Logging, climatic changes spatial variation in the forest - Forest community. Spatial continuity of the forest community, discrete forest communities. Merging forest communities. Spatial continuity of the forest community, discrete forest communities. Merging forest communities. Analysis of forest ecosystem. Ecosystems and system analysis. Systems model, productivity examples of ecosystem analysis. Systems model, productivity examples of ecosystem analysis.

UNIT 3:

Forest resources and forest types, Tropical wet evergreen, tropical semi evergreen, dry evergreen, tropical moist deciduous, sub-tropical wet deciduous, Sub-tropical pine, sub-tropical dry, Dry deciduous, tropical thorn, moist temperate, dry temperate, alpine and grassland. Ecological significance of these forests, forest management practices and preservation of forests.

UNIT 4:

Importance and value of biodiversity; Losses in biodiversity, benefits and functions of biodiversity, exploitation, evaluation and assessment. Ecological basic for evaluation, rarity of species, Bio-indicators, medicinal

plants - different systems of practice; Ayurveda, Siddha, Unani and Homeopathy, Traditional plants. Medicinal plants of India - marketing, tribal medicines. Conservation of medicinal plants and their genetic resources. Mapping, surveying techniques, methods of valuing nature and the environment - national monetary values, valuing economic benefits, energy-based evaluation, Replacement value. Conservation and protection ecological evaluation of biotic communities, protection of various habitats, planning and development.

UNIT 5:

Wild life resources and conservation wild animals Endangered mammals, reptiles, Birds and other animals and plant life. Wild life management and protection- Wild life projects in India. Role of governmental and nongovernmental organisations inWild life protection. Role of IUCN, WWF and other international agencies in Wild life management.

REFERENCES

1. Agarwala V.P.1985 Forests in India - Environmental and production frontiers. Oxford and IBH publishing Co., New Delhi.
2. Balakrishnan M., Borgstorm R., and S.W.Bie. 1994. Tropical ecosystems.A Synthesis of Tropical ecology and conservation. Oxford and IBH publishing company and Pvt Ltd., New Delhi.
3. Puri G.S., Gupta R.K., Meher-Homji V.M., and Puris .1989. Forest Ecology. Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
4. Sharia V.B. 1982. Wildlife in India.Nataraj Publishers, Dehra Dun.
5. Spurr S.H. and B.V. Barnes.1980. Forest Ecology. John Wiley and Sons, NewYork.
6. Whitmore. T.C. 1993. An Introduction to Tropical Rainforests. ELBS-Oxford University Press. Oxford.

ELECTIVE V (EC): REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM (GIS)

UNIT 1

Remote sensing data acquisition - optical, mechanical scanning, charge - coupled device (CCD) digitization, video digitization, RS data already in a digital format: Landsat MSS and TM sensor systems, SPOT sensor systems. Aircraft multiple spectral scanners, Digital image data formats.

UNIT 2

Satellite image preprocessing and Enhancement; Statistical extraction and histogram computation RS data; Radio data, Image reduction and magnification - contrast enhancement, rationing, spatial filtering edge enhancement - PCA - vegetation indices texture transformation.

UNIT 3

Thematic Information extraction and change detection; supervised, unsupervised classification, combining ancillary and contextual data in the classification - land use classification, accuracy, site specific classification accuracy - Nature of change detection and change detection algorithms.

UNIT 4

Interface of remote sensing and geographical Information systems; Fundamentals of GIS concepts - data encoding, data management, data manipulation, data output.

UNIT 5

Remote sensing in floods and droughts, reservoir sedimentation, forest cover and mineral mapping, mangroves, wildlife habitat, biosphere and biomass estimation.

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- Chowengredt, R.A. 1983. Techniques for image processing and classification in Remote sensing. Academic press Inc. New York.
- Jenson, J.R. Introductory Digital Image processing: Remote sensing perspective. Prentice Hall, Engelwood cliffs. NJ.
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