

  
**KANNUR UNIVERSITY**

(Abstract)

M.Sc. Environmental Studies Programme under Choice Based Credit Semester System in the University Department- Revised Scheme, Syllabus & Model Question Papers Implemented with effect from 2015 admission- Orders issued.

**ACADEMIC 'C' SECTION**

U.O. No.Acad/C4/ 5224/2015

Civil Station P.O, Dated, 30-10-2015

- Read:
1. U.O No.Acad/C3/2049/2009 dated 11.10.2010.
  2. U.O No.Acad/C3/2049/2009 dated 05.04.2011.
  3. Meeting of the Syndicate Sub-Committee held on 16.01.2015.
  4. Meeting of the Department Council held on 09.04.2015.
  5. Meeting of the Curriculum Committee held on 10.04.2015.
  6. U.O No. Acad/C4/14536/2014 dated 29.05.2015.
  7. Letter from the Course Director, Dept. of Environmental Studies, Payyannur Campus
  8. Meeting of the Curriculum Committee held on 03.09.2015.

**ORDER**

- 1.The Regulations for Post Graduate Programmes under Choice Based Credit Semester System were implemented in the Schools/Departments of the University with effect from 2010 admission as per the paper read (1) above and certain modifications were effected to the same vide paper read (2).
2. The meeting of the Syndicate Sub-Committee recommended to revise the Scheme and Syllabus of all the Post Graduate Programmes in the University Schools/Departments under Choice Based Credit Semester System (CCSS) with effect from 2015 admission vide paper read (3) above.
3. The Department Council vide paper read (4) above has approved the Scheme, Syllabus & Model Question Papers for M.Sc. Environmental Studies Programme under Choice Based Credit Semester System(CCSS) for implementation with effect from 2015 admission.
4. As per the paper read (5) above, the meeting of the Curriculum Committee recommended certain modifications/ additions to the Regulations for Post Graduate Programmes under Choice Based Credit Semester System and the Regulations were modified in the University w.e.f. 2015 admission vide paper read (6).
5. The Course Director, Dept. of Environmental Studies vide paper read (7) above, has forwarded the Scheme, Syllabus & Model Question Papers for M.Sc. Environmental Studies Programme in line with the revised Regulations for Choice Based Credit Semester System for implementation with effect from 2015 admission.

P.T.O.

6. The meeting of the Curriculum Committee held on 03.09.2015 approved the Scheme, Syllabus & Model Question Papers for M.Sc. Environmental Studies Programme under Choice Based Credit Semester System in the Department vide paper read (8)

7. The Vice Chancellor after considering the matter in detail, and in exercise of the powers of the Academic Council conferred under section 11(1) of KU Act 1996, and all other enabling provisions read together with, has accorded sanction to implement the Scheme, Syllabus & Model Question Papers for M.Sc. Environmental Studies Programme under Choice Based Credit Semester System, offered in the University Department, w.e.f 2015 admission, subject to report to the Academic Council.

8. Orders are, therefore, issued accordingly.

9. The revised Scheme, Syllabus and Model Question Papers of M.Sc. Environmental Studies Programme effective from 2015 admission are appended.

Sd/-

**JOINT REGISTRAR (ACADEMIC)  
FOR REGISTRAR**


To

The Course Director, Department of Environmental Studies  
Payyannur Campus, Payyannur

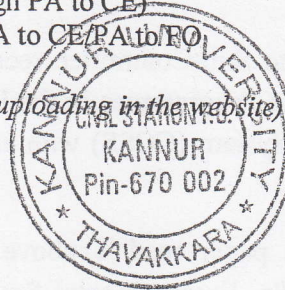
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Forwarded/By Order

  
SECTION OFFICER

B



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**KANNUR UNIVERSITY**

**DEPARTMENT OF ENVIRONMENTAL STUDIES**

**M.Sc. ENVIRONMENTAL SCIENCE**

## **SYLLABUS**

**(Under Choice Based Credit & Semester System)**

**2015 admission onwards**

**DEPARTMENT OF ENVIRONMENTAL STUDIES**

**KANNUR UNIVERSITY**

**Swami Ananthatheertha Campus  
Payyannur, Kannur**

## **P.G. Programme in Environmental Science**

The M.Sc. course in Environmental Science is a multidisciplinary post-graduate programme in the frontier area of Environmental Sciences.

**Duration** : 2 Years ( 4 semester )

**Intake** : 20 ( 17 merit + 3 payment/N.R.I quota )

### **objectives of the course:**

1. To provide an integrated knowledge of diverse disciplines and training various theoretical and applied aspects of environmental science and management leading to Masters degree.
2. To establish advance facilities and promote research and technology development to solve environmental issues and problems .
3. To undertake consultancy project in environment, disaster management, environmental impact assessment (EIA), Remote Sensing (RS), Geographical Information System ( GIS), Forest and Wild Life Management.
4. To establish good networking of academic collaboration with national and international organizations, institutions, industries and exchange of faculty and students.
5. To offer environmental information, education and communication services and offer extension activities like environmental awareness programmes for school college students and public
6. The course contents will be abreast with the latest development in the area of study. The students have to do a full time institutional or industrial training/ project work for four to five months, enabling them to have valuable hands on experience. The theory, practical, project work and training activities of this programme prepare the student to acquire knowledge , skills and expertise on specified subjects along with the integrated knowledge of all relevant disciplines.

### **Eligibilities:**

B.Sc. Degree in any of the subjects {Botany/ Zoology/ Chemistry/ Physics/ Environmental Science/ Environmental Management/ Microbiology/ Biotechnology/ Biochemistry/

Agriculture/ Horticulture/ Forestry/ any branch of Life Science/ Geology/ Geography) or an Equivalent examination or an engineering degree in Civil/ Mechanical/ Chemical/ Environmental branch with an aggregate of 55% marks in the optional.

**Admission:**

The selection of the candidate is mainly based on the marks secured in the admission test.

The admission test will cover environmental science at the undergraduate level.

**Duration of the Programme:**

The minimum duration for completion for 2 year M.Sc Environmental Science is four semesters.

**Course Details:**

A student must register for the required number of courses at the beginning of each semester. No students shall register for more than 24 credits and less than 16 credits per semester.

A total of 80 credits shall be the minimum for successful completion of the course in which a minimum of 60 credits for core course and 12 credits for electives are mandatory. Those who secure only minimum credit for core/ elective subjects has to supplement the deficiency for obtaining the minimum total credits required for successful completion of the programme from the other divisions.

**EVALUATION:**

The faculty member who teaches the course shall do evaluation of the students for each course on the basis of Continuous Evaluation and End Semester Examination shall be evaluated by External Examiners. The proportion of the distribution of marks among the continuous evaluation and end semester examination shall be 40:60.

Continuous Evaluation includes assignments, seminars, written examination and viva voce for each course. Weightage to the components of continuous evaluation shall be given for all theory papers of the course as follows:

Components of CE	Minimum Number	Weightage	Marks	Practicals	
				Weightage	Marks
Test paper	2	40	16	75	30
Assignments	1	20	08	--	--
Student Seminar	1	40	16	--	--
Record	--	--	--	25	10

**Test Paper:**

For each course there shall be at least two class tests during a semester.

**Assignments:**

Each student shall be required to do one assignment for each course.

**Seminar:**

Students are required to present a seminar on a selected topic in each paper. The evaluation of the seminar shall be done by the concerned teacher handling the course.

**Attendance:**

Minimum attendance required for each paper shall be 75% of the total number of classes conducted for that semester. Those who secured the minimum requirement of attendance only be allowed to register/appear for End Semester Examination.

Condonation of attendance to a maximum of 10 days in a semester subject to a maximum of two times during the whole period of the PG programme may be granted by the university as per university rules.

**Conduct of Examination:**

The vice chancellor will approve the panel of examiners submitted by the Head of the Department. All the teachers of the Department will be the members of the Board of examiners with Head of the Department as the Chairperson. There shall be a minimum of two external examiners. The panel approved by the Vice-Chancellor will be entrusted with the setting of question papers, conduct and evaluation of examination.

**Research Project:**

The students have to complete a minor research project during IV Semester in collaboration with any of the authorized research institutions located within or outside the state.

**Field Study:**

Students are required to go for field study in research institutions, wildlife sanctuaries, different ecosystems, polluted areas or ecotourism sites and submit a report of the same.

*In the case of any inconsistency between the implemented regulations of Choice based Credit Semester System and its application to PG Programme in Environmental Studies offered in the University Department, the former shall prevail.*

## SCHEME

### I semester

Page No	Title of Paper	Contact Hrs/week			Marks			Credits
		L	T/S	P	End sem	Internal	Total	
	Course Details/Marks							
ENS1 C01	Fundamentals of Ecology	4	1		60	40	100	4
ENS1 C02	Environmental Pollution	4	1		60	40	100	4
ENS1 C03	Environmental Chemistry	4	1		60	40	100	4
ENS1 E01 or ENS1 E02	Natural Resource and their conservation or Environment of Physical Systems	4	1		60	40	100	4
ENS1 E03 or ENS 1 E04	Biodiversity and its conservation ( or) Green Chemistry	4	1		60	40	100	3
ENS1 P01	Practical in Environmental Chemistry			5	60	40	100	2
Total					360	240	600	21

## II SEMSTER

Page No	Title of Paper	Contact Hrs/week			Marks			Credits
		L	T/S	P	End sem	Internal	Total	
	Course Details/Marks							
ENS2 C04	Environmental Engineering	4	1		60	40	100	4
ENS2 C05	Environmental Microbiology and Biotechnology	4	1		60	40	100	4
ENS2 C06	Fundamentals of Toxicology	4	1		60	40	100	3
ENS2 C07	Instrumentation and Analytical Technique	4	1		60	40	100	3
ENS2 E05 or ENS2 E06	Food adulteration and Preservation, ( or ) Hydrology and water Management	4	1		60	40	100	3
ENS2 P02	Practicals in Ecology			5	60		60	2
ENS2 P03	Field study					40	40	2
Total					360	240	600	21



### III SEMESTER

Page No	Title of Paper	Contact Hrs/week			Marks			Credits
		L	T/S	P	End sem	Internal	Total	
	Course Details/Marks							
ENS3 C08	Environmental Economics and Laws	4	1		60	40	100	4
ENS3 C09	EIA & Environmental Management	4	1		60	40	100	4
ENS3 C10	Bio statistics, Research Methods and Computer application	4	1		60	40	100	4
ENS3 C11	Natural Hazards and Disaster management	4	1		60	40	100	3
ENS3 E07 or ENS3 E08	Chemometrics and good laboratory Practices ( or ) Application of Remote sensing and GIS	4	1		60	40	100	3
ENS3 P04	Practicals in Microbiology			5	60	40	100	2
ENS3 P05	Practicals in Environmental Geology			5	60	40	100	2
Total					420	280	700	22

## IV SEMESTER

Page No	Title of Paper	Contact Hrs/week			Marks			Credits
		L	T/S	Project/ Practical	End sem	Internal	Total	
ENS4 C12	Wetlands and Mangroves	4	1		60	40	100	3
ENS4 C13	Ecotourism	4	1		60	40	100	3
ENS4 P06	Project work + viva-voce			20	60	40	100	10
Total					180	120	300	16
<b>Grand Total for all Semesters</b>					<b>1320</b>	<b>880</b>	<b>2200</b>	<b>80</b>

**Note:** - ENS - Environmental Science, C - Core paper, E - Elective Paper, L - Lecture, T - Tutorial, S - Seminar and P - Practical.

### OPEN COURSE FOR THE STUDENTS OF OTHER PROGRAMMES

Page No	Title of Paper	Contact Hrs/week			Marks			Credits
		L	T/S	Project/ Practical	End sem	Internal	Total	
ENS O C12	Fundamentals of Environmental Science	3	1		60	40	100	3

## **SEMESTER – I- CORE**

### **ENS1 C 01 -FUNDAMENTALS OF ECOLOGY**

#### **Unit-1 . Fundamentals of Environmental Science**

Definition, Scope and Importance of Environmental Science, Definition; Multidisciplinary nature of the environmental Science; Scope and importance; Need of Environmental awareness, Ecology, Interrelationship of ecology with other disciplines. Introduction to global environmental problems.

#### **Unit II. Components of the Environment:**

a).The atmosphere or the air: Layers of Atmosphere , Composition of air; importance of atmosphere, meteorological conditions and air circulation.

b).The hydrosphere or water: Importance of water, distribution of fresh water at global, national and state level.Hydrological Cycle.

c).Lithosphere or the rock and the soil: Elementary composition of rocks in the earth crust. Types of rocks; Process of soil formation: Physical weathering, Chemical and biological weathering of rocks; Role of soil in shaping the biosphere

#### **Unit III. Environmental Factors**

a) Climatic Factors - Light, Temperature of Air (atmospheric temperature), Rainfall(precipitation), Humidity of air, atmosphere(gases and wind), fire.

b) Topographic Factors: height of mountains, direction of mountains and valleys, steepness of slope and exposure of slope

c) Edaphic factors: Soil-soil formation, soil profile, soil erosion, soil conservation

d) Biotic factors: Intraspecific interactions; Interspecific interactions: Neutralism, Commensalism, Mutualism, proto co-operation, Parasitism, Predation;

#### **Unit:IV : Ecological adaptations**

Ecological adaptations of plants(Hydrophytes, mesophytes, xerophytes, and halophytes) and animals (aquatic conditions-hydrocoles; amphibious conditions or sec. hydrocoles) and Terrestrial(mesocoles and xerocoles)

## **Unit V : Ecosystem**

Definition; Components of ecosystem; Abiotic components: Light, Temperature, Pressure, Water, Wind, Soil; Biotic components: Energy flow in an ecosystem: Primary production, Secondary production; Food chain: Grazing food chain, Detritus food chain; Ecological pyramids: Pyramid of number, Pyramid of biomass, Pyramid of energy; Food web; Ecological indicators. Biogeochemical cycles : a) Gaseous cycles: Oxygen cycle, Carbon cycle and Nitrogen cycle. b) Sedimentary cycles: Phosphorus cycle, Sulphur cycle.

## **Unit VI: Population Ecology and Community Ecology:**

Population characteristics- Population growth and its dynamics; natality, mortality, growth patterns; Age distribution, Malthus theory; Community structure, Species diversity, Ecological dominance, Ecotone, Edge effect, Ecological equivalent, Succession and Climax

## **Unit VII. Major Ecosystems.**

Terrestrial Ecosystem-Forest, grass land, arid, Crop land, Wet land- Ponds, Lakes, Rivers, Oceans, Estuaries

## **Unit VIII. Applied Ecology**

Vegetation Analysis – Quadrat, Transect and Point quadrat method of saplings - Determination, of quadrat size and quadrat number ( Wiegerts's and Hendricks Methods)

Species diversity measures – Species richness – Species heterogeneity (Simpson' Indices, Shannon – Wiener Indices)

Girth class and Height class measurement.

Museology – Plants and Animals – Collection and Preservation.

Major Herbaria's and Museums.

Taxonomy and Biosystematics

Biomass and Productivity estimation techniques.

## **References**

01. Fundamentals of Ecology Eugene P. Odum, ( Natraj Publishers, Dehradun.)
02. Principles of Ecology P. S. Verma, V. K. Agarwal ( S. Chand and Co. New Delhi )

03. Environmental Biology P. D. sharma ( Rastogi Publications, Meerut )
04. Ecology and Environment P. D. sharma ( Rastogi Publications, Meerut )
05. Principles of Environmental Biology P. K. G. Nair ( Himalaya Publishing House, New Delhi)
06. Environmental Biology M. P. Arora ( Himalaya Publishing House, New Delhi )
07. Environmental Science Enger Smith, Smith, W. M. C.Brown ( Company Publishing )
08. Principles of Soil Science Watt K. E. F. ( 1973 ), ( McGraw Hill Book Company, New Delhi)
09. Introduction to Environmental Studies Turk & Turk
10. Ecology and Field Biology Robert Leo Smith ( Harper Collins college publication )
11. General Ecology H. D. Kumar ( Vikas Publishing house, New Delhi )
12. Elements of Ecology Brijgopal, N. Bharadwaj ( Vikas Publishing house, New Delhi )
13. Fundamentals of Environmental Science G. S. Dahliwal,G. S. Sangha P. K.ralhan ( Kalyani Publishers, New Delhi )
14. Environmental Ecology Bill Freedman ( Academic Press, New York )
15. Concepts of Ecology N. Arumugam ( Saras Publication, Kottar, Dist. Kanyakumari )
16. Plant Ecology P. L. Kochhar
17. A text book of Environmental Studies.D.K.Asthana,Meera Asthana (S.Chand&Co.)
- 18.Essential Environmental Studies.S.P.Misra,S.N.Pandey,(Ane Books Pvt.Ltd,Chennai)
- 19.Environmental Education – A Conceptual Analysis. P.Kelu,university of Calicut publication
- 20.Environmental Science. V.K.Ahluwalia,Sunita Malhotra(Ane Books Pvt.Ltd,Chennai)

## SEMESTER I – CORE

### ENS1 C 02 - ENVIRONMENTAL POLLUTION

**UNIT – 1** Introduction to Environment - Environmental factors - Segment of Environment - Man- Environment relationship, anthropogenic effects on the natural environment, Environmental degradation.

Environmental pollution – Definition, causes of environmental pollution – population, urbanization, industrialization, resource consumption, deforestation, agriculture and transportation.

#### **UNIT -2 Air pollution - Sources, effects and control measures.**

Definition - Air pollutants - Sources of air pollutants - Types of air pollutants - primary and secondary air pollutant- Gaseous, solid and biopollutants.

Movements and reactions of pollutants in the atmosphere.

Reactions of pollutants in the air to form smog and PAN.

Acid rain , ozone depletion, green house effect and global warming.

Factors affecting air pollutants and their mode of actions: climate, temperature, humidity and wind currents

Impacts of air pollution on

- Human being
- Animals
- Plants
- Materials, buildings and climate

Control measures of Air pollution.

#### **UNIT 3 - Water pollution - Sources, effects and control measures**

Definition and significance

Types of water pollution - Point and non point source of water pollution- surface and ground water pollution.

Sources of water pollution - Domestic, Industrial , Agricultural and Natural sources

Impact of water pollution on human being, animals, plants and environment.

Control measures of water pollution.

#### **UNIT 4 - Soil / Land pollution - Sources, effects and control measures**

Sources of soil pollution

Natural sources - Natural calamities.

Anthropogenic sources - Agricultural practices, Industrial and Municipal discharges - Municipal solid waste dumping - Land fill leachates - Plastics - Radioactive leakage - Mining activities and Electronic wastes.

Impact of soil / land pollution - Soil fertility - Soil micro organisms - Effects on plants and animals.

Control measures.

#### **UNIT 5 - Noise pollution**

Definition and concept of Noise pollution.

Sources of noise pollution - Indoor and outdoor noise pollution

Natural and Anthropogenic sources.

Impact of noise pollution - Impacts on plants and animals.

#### **UNIT 6 - Radioactive Pollution**

Definition - Scope of the study.

Types and sources of Radioactivity

Natural and manmade radioactivity

Radioactive pollution episodes

Precautions and control measures.

#### **UNIT 7 - Thermal and Marine Pollution**

Thermal and nuclear power plants as source of thermal pollution.

Impacts of thermal pollution on aquatic fauna and flora.

Controlling measures of Thermal pollution.

Marine pollution - Definition

Sources of Marine pollution - Natural and Anthropogenic sources

Control measures of marine pollution.

Pollution status of coastal and ocean waters.

Oil pollution - Sources - effects and control measures.

## References

1. **B.K Sharma – Environmental chemistry –Goel publication.**
2. A.K. De - Environmental Chemistry
3. Tyagi and Mehra - Environmental Chemistry
4. Trivedi P.R & Raj Gurdeo - Environmental water and soil Analysis, Akasdeep Pub. House, New Delhi.
5. V.K.Alhuwalia, Environmental Chemistry Ahe books, India
6. S.P. Misra and S.N. Pandey – Essential Environmental studies-Ane books Pvt. Ltd.
7. Abbasi.S.A. 1998. Environmental pollution and its control. Cogent International, Pondichery.
8. Gosh. Environmental Pollution
9. Rajvaidya. Environmental pollution control.
10. Agarwal. Water pollution.
11. Salpeker. Air Pollution.
12. Agarwal. Noise Pollution.
13. Khopkar. Environmental Pollution.
14. Pepper. Environmental and pollution science.\
15. Misra. Assessment of water pollution
16. J.N.B.Bell . Air Pollution and Plant life.
17. Daneil.A.Vallero. Environmental contamination Assessment and control
18. A.K.tripathi, S.N.Pandey, Water Pollution
19. A.K.Srivastheva, Air Pollution



## SEMESTER I - CORE

### ENS1 C 03 - ENVIRONMENTAL CHEMISTRY

#### UNIT 1.FUNDAMENTALS OF CHEMISTRY

- 1.01. Concepts and scope of environmental chemistry
- 1.02. Principles of Bio-geochemical cycle N,C, P,S, Water
- 1.03. Stoichiometry
- 1.04. Chemical Kinetics- Control of reactions, First, second and zero order reactions
- 1.05. Chemical Equilibria
- 1.06. Thermodynamics -Energy, Entropy, Enthalpy, Gibb's energy and Chemical potential
- 1.07. Acid-Base reactions
- 1.08. Solubility Products
- 1.09. Unsaturated and Saturated Hydrocarbons
- 1.10. Radio nuclides

#### UNIT 2.TRANSFORMATION OF REFRACTORY ORGANIC COMPOUNDS IN THE ENVIRONMENT

- 2.01. Synthetic detergent (Surfactant) - cationic , anionic and non- ionic detergents, Modified detergents
- 2.02. Pesticides and Fertilizers -Classification, Degradation and Analysis of pesticides, - Pollution due to pesticides , DDT, Endosulphan and its molecules, Types of synthetic fertilizers.
- 2.03 – Synthetic polymers.
- 2.04 - Petroleum products.

#### UNIT 3. CHEMISTRY OF ATMOSPHERE

- 3.1 – History and evolution of the earth's atmosphere .
- 3.2 – Structure and composition of atmosphere.
- 3.3 – Chemical composition of atmosphere.
  - 3.3.a – Classification of elements in the atmosphere.
  - 3.3. b – Water,  $\text{CO}_2$ ,  $\text{NO}_x$ ,  $\text{SO}_x$ ,  $\text{O}_2$ , Ozone, Chemical speciation, Particles, ions, and radicles in the atmosphere, Chemical processes for the formation of Inorganic and Organic Particulate matter, Thermochemical and photo chemical reactions in the atmosphere. Temperature inversion, Atmospheric lapse rate, Adiabatic lapse rate , wet and dry adiabatic lapse rate, Photochemical smog, Origin and occurrence. Oxidising and Reducing smog. Ecological effects. Oxygen and Ozone chemistry. Ozone layer. Chemistry of ozone layer. Ozone depletion Mitigation of ozone depletion. Eco friendly coolants. Chemistry of atmospheric pollutants. Acid rain and its ecological effects.

#### **UNIT 4. CHEMISTRY OF LITHOSPHERE;**

Structure and composition of lithosphere, Chemical properties of important rocks and minerals. Chemical characteristics of soil, Organic and inorganic components of soil, Soil horizon, Formation of soil, Soil forming processes, Weathering and pedogenesis, Soil pollution, Fate of chemicals in soil, Soil erosion

#### **UNIT 5. CHEMISTRY OF HYDROSPHERE**

Hydrological cycles, Composition and structure of pure water, Physico chemical properties of water and aqueous solution, Solubility of solids, liquids, and gases in water, Chemical reaction and equilibrium in water, Carbonate equilibrium, Metal ion equilibrium, Redox equilibrium  
Natural organic components in water.

#### **References:-**

1. Stanely E. Manahan, Willard grant press, boston, Massachusetts, 1978
2. Environmental chemistry B.K Sharma – Environmental chemistry –Goel publication.
3. chemistry of the Environment, R.A Bailey et al., Academic press, New York, 1993.
4. chemistry and biology of water, Air, Soil, ed. J. Tolgyessy, Elsevier, Amsterdam, 1993
5. A.K. De - Environmental Chemistry
6. Tyagi and Mehra - Environmental Chemistry
7. Trivedi P.R & Raj Gurdeo - Environmental water and soil Analysis Akasdeep Pub. House, New Delhi.
8. V.K. Alhuwalia, Environmental Chemistry Ahe books, India
9. S.P. Misra and S.N. Pandey – Essential Environmental studies – Ane books Pvt. Ltd.
10. .P.L. Soni - Physical Chemistry
11. Rangwala, Water supply and Sanitary Engineering
12. Vogel - Analytical Chemistry

## SEMESTER I - ELECTIVE

### ENS1 E 01- NATURAL RESOURCE AND THEIR CONSERVATION

#### Unit -1- Natural resource conservation:

Natural resource – Definition – Concept, classification of natural resources (Renewable and non renewable resources)

Renewable resources –

Land / Soil resources – Land as a resource, land degradation, conservation measures. Soils of India, Soil or land degradation, Causes of soil and land degradation, waste lands, desertification.

Water resources – sources of water, hydrological cycle, Use and exploitation of surface and ground water, conflict over water, water conservation strategies,

Forest resources – Importance of Forest - Ecological and Economic significance - Classification of Forest resources - Use and over exploitation, deforestation, Timber extraction, afforestation, basic causes of deforestation, management of forest resources.

Plants and animal resources – over exploitation, species extinction, control measures.

#### Unit - 2 Non renewable resources

##### Energy resources:-

Non renewable energy resources – Fossil fuels (Coal, Petroleum and natural gas), nuclear fuel.

Renewable energy resources (Biomass, Bio fuel, Hydropower, Tidal energy, wave energy, wind energy, geothermal energy, solar energy, magneto hydrodynamic power, Hydrogen energy). Energy crisis, management of energy resources.

#### Unit - 3 - Mineral resources

Classification of Minerals, Minerals of India. Uses of economic importance of minerals. Management of Mineral resource, Mineral wealth of our planet, non renewable nature of mineral deposits, the inexhaustible nature of mineral elements, use and exploitation of mineral resources, environmental effects of extracting and using mineral resources. Remedial measures.

Food resources – World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, merits of conventional agricultural system. World food supply, food security, Sustainable agriculture.

**Unit 4 : Role of an Individual in conservation of natural resources**

Definition and meaning of conservation, equitable use of resources for sustainable development.

**References:**

1. Anil Tyagi, Environmental Science, Danika publishing company, New Delhi, 2007.
2. Barrington EJW, Environmental Biology. Resource and Environmental Science series, Edward Arnold (pub) Ltd. London.
3. Purohit, S.S, Shammi, Q. Land Agarwal, A.K; A text book of Environmental science, student edition publishers, Jodhpur, 2004.
4. R.K khitoliya and K. Venkatachalam )(1997), Urban settlements and Natural hazards. Proceedings of seminar on Natural hazards in the Urban habitat. November, New Delhi.
5. Arya,A.S (1997) key note Address, Seminar on “Built Environment & Natural hazards”. Indian buildings congress. February, New Delhi

## SEMESTER I- ELECTIVE

### ENS1 E 02 - ENVIRONMENT OF PHYSICAL SYSTEMS

#### UNIT -1 : Constituents of the Nucleus

Nuclear charge – Mass and binding energy – Radioactivity – Alpha, Beta and gamma emission – successive disintegration – Radioactive series – nuclear reactions – Energy released in fission and fusion.

#### UNIT – 2 : Origin of Earth

Origin of Earth – Theories pertaining Earth's origin, internal structure of Earth's crust, mantle and core – composition, continental drift, plate tectonics.

Minerals – Rock forming and ore forming minerals. Minerals-concept of major, trace and Rare Earth Elements(REE). Classification of trace elements, Trace elements and health.

Rock and rock cycle, Structure of rocks - Rocks – Brief classification and characteristic – megascopic features of different types of rocks.

**Geomorphology:** Introduction. Soil-Weathering and pedogenesis, Factors of soil formation, soil profile, Classification of types of soil (Reference to India and Kerala), Structure of soil, Soil quality parameters and assessment

Coastal sedimentation and land forms, coastal erosion.

#### UNIT-3 : Structure and Composition of Atmosphere

Atmosphere: Structure, Composition, Stratification, Pressure gradient, Humidity, Thermodynamics of atmosphere, Lapse rate- Dry and wet adiabatic lapse rate, Temperature inversion and air pollution. Velocity, Acceleration. Vertical motion of air parcel in the atmosphere, Vertical stability of atmosphere. Horizontal motion in the atmosphere – Ferrel's Law & Coriolis's effect, Winds-formation & classification, local, winds. Clouds- formation & classification, cloud seeding, Aerosols, Artificial rain, Acid rain, Global warming, Green house effect. Ozone layer formation & depletion, Global environmental problems.

#### UNIT – 4 -: Weather & Climate

Weather & Climate: Definition & scope, classification. Climate of India, oceanic & continent influence (air-sea interaction), El nino & La nino effects.

Climate change-causes, effects. Regional scenario of climate change. Climate of India; Indian monsoon, (Onset of monsoon), Rain bearing systems, Break in change in the ecosystems. Weather & climate monitoring equipments, Meteorological data collection & analysis (Rainfall, Evaporation, Temperature, Relative humidity, Wind speed, Wind direction, Wind rose)

## **UNIT – 5 : Physical Parameters of Atmosphere**

Temperature, Heat, Heat transfer, specific heat, Energy of the atmosphere – solar energy. Absorption by the atmosphere, scattering reflection, refraction, rarefraction. Absorption by earth, Terrestrial radiation – Earth's heat balance. Nature of sound – Physiological and physical properties – speed of sound – interference of sound waves, Resonance, Doppler effect, Acoustics of auditorium, Thunder and lightning, Noise pollution and its measurement and control.

## **UNIT - 6 - Hydrology**

Hydrological Cycle- Inter-relationship of surface and groundwater. Stream flow, ground water relationships. Hydrological processes and the water budget of lakes and rivers-interaction of lake with surface and subsurface water. Influence of geology on groundwater- porosity, specific retention and specific yield. Aquifer characteristics ,springs and wells. Darcy's law. Ground water quality - physical, biological and chemical properties. Safe yield and artificial recharge.

General circulation of oceans- Winds and surface circulation, causes of ocean currents and important current systems, deep sea circulation- characteristics of convergence, upwelling & sinking of ocean water. Mean sea level - sea level changes- Sea coasts and shorelines. Introduction to coastal zone management - coastal processes beach stability, coastal erosion and protection measures.

## **Reference**

1. Arther Beiser, Applied physics, Schaum's outline series; Mc Grace Hills Book Co. New York.
2. Albert Miller, Jack C Thompson, Richard E Peterson and Donald R Haragan; Elements of Meteorology; Charles E Merrill publishing Co. Columbus.
3. Frederick K Lutgens and Edward J Tarbuck; The atmosphere; prentice Hall publications, New Jersey
4. Floyd F Sabins; Remote sensing – Principles and Interpretation; W.H freeman and Co. San Francisco.
5. Erwin Schande, Springes – Verlag; Remote sensing for environmental sciences; Berling Heidelberg, New York.
6. E.C Barrett and L.F Curtis; Introduction to Environmental Remote Sensing; Chapman and Hall, London.
7. Lutgens and Tarbuck; The Atmosphere, Prentice Hall publication, New jersey.
8. Barry and Charley; Atmosphere, Weather and Climate; The English Language Book Society, 1976.

9. A.A Ramasastry; Weather and Weather forecasting' Publication division, Ministry of Information and Broadcasting, Ministry of India, 1984.
10. Billings; Structural Geology; Tata Mc Grace Hill publication Co. New Delhi.
11. Holmes A; Principles of physical geology, Ronald, New York, 1965.
12. Berry, LG & Brian Mason; Mineralogy; Freeman publication, 1959.
13. A.V Strahles and A.H Strahles; Environmental Geo-Science; Wiley International, 1973.
14. Tyrell G.W; Principles of petrology; Methven publication, 1959.
15. Validia K.S; Environmental Geology; Tata Mc Grace Hill publishing Co. Pvt. Ltd- New Delhi, 1987.
16. R.H.green, Sampling Design and statistical methods for Environmental Biologists, 1979.
17. A.C Wardlove; Practical statistics for Experimental Biologist.
18. D.C Sancheti 7 V.K Kapoor; Statistics; Sulthan Chand & Sons, New Delhi, 1991.

## SEMESTER 1- ELECTIVE

### ENS1 – E 03 - Biodiversity and its Conservation

#### Unit-1 - Biodiversity and its Conservation:

##### 1. Introduction

Definition, Types of biodiversity such as genetic, species and ecosystem biodiversity; Biodiversity at Global, National and local levels ; The mega-diversity countries of the world ;Biogeographical classification of India.

Importance and value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values

##### 2. Measurement of Biodiversity

Species richness, species diversity, Simpson Index, Shannon Wiener Index, Alpha, Beta and Gamma Diversity

##### 3.Threats to biodiversity-

Habitat loss and degradation, poaching of wild life,introduction of exotic species,genetic pollution,climate change, man wildlife conflict;Endangered and endemic species of India; extinction of species, key stone species

##### 4 Hot spots of biodiversity.

#### Unit -2 - Biodiversity conservation

In situ conservation–protected areas-National parks,Wildlife sanctuaries,Biosphere reserves, Definition,concept and short description of and importance of major reserves; Nilgiri Biosphere Reserve ,Agasthyamalai Biosphere Reserve,Sunderban,Andaman and Nicobar,Gulf of Mannar.Project Tiger, Project Elephant , sacred groves with special reference to Kerala, Documenting traditional knowledge.Ex situ conservation-Botanical gardens,zoos,aquaria,National Bureau of Plant Genetic Resources(NBPGR), National Bureau of Animal Genetic Resources(NBAGR), Documenting traditional knowledge

#### Unit – 3 - Global strategy for conservation

Important International Conferences for Conservation (CBD, Earth Summit, Stockholm conference, Nairobi Conference, Montreal Protocol, London, Rio Declaration 1992, Berlin Mandate, Geneva Convention, Kyoto Protocol 1996, Johannesburg Conference, UNFCCC etc.)



#### **Unit – 4 - People’s movement for environmental conservation in India**

Bishnoi Movement, Chipko Movement, Narmada Bachao Andolan, Apikko movement, Silent Valley Movement, Baliyapal

#### **Recommended Books**

1. A Text Book of Environmental Sciences, S. S. Purohit, Q. J. Shammi and A. K. Agarwal, Student Edition (Agrobios), Jodhpur.
2. A Text Book of Environmental Studies, D. K. Asthana and Meera Asthana, S. Chand & Co., New Delhi.
3. Air Pollution, M.N. Rao and H.V.N. Rao, Tata McGraw Hill, New Delhi.
4. An Introduction to Air Pollution, R. K. Trivedy and P. K. Goel, B. S. Publications, Hyderabad.
5. Aerial Photography and Image Interpretation for Resource Management, Paine, D.P., John Wiley and Sons.
6. Chemical & Biological Methods for Water Pollution Studies, R.K. Trivedy and P. K. Goel, Environmental Publications, Karad.
7. Disaster Management in Hills, Dr. Satendra, Concept Publishing Co., New Delhi.
8. Ecology and Environment, P.D. Sharma, Rastogi Pub., New Delhi.
9. Environmental Science, S.C. Santara, New Central Book Agency (P) Ltd., Kolkota.
10. Ecology: Principles and Applications, J. L. Chapman and M.J. Reiss, Cambridge University Press, U.K.
11. Environment: Problems and Solutions, D.K. Asthana and Meera Asthana, S. Chand & Co., New Delhi
12. Environmental Biotechnology, M. H. Fulekar, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
13. Environmental Chemistry, A.K. Dey, New Age International Publishers, New Delhi.
14. Environmental Concerns and Strategies, T. N. Khoshoo, Ashish Publishing House, New Delhi
15. Environmental Geography, Savindra Singh, Prayag Pustak Bhavan, Allahabad.
16. Fundamentals of Ecology, E.P. Odum, W.B. Saunders Co., Philadelphia.
17. Handbook of Environmental Laws, Acts, Rules, Guidelines, Compliances and Standards, Vol. I and II, BS Publications, Hyderabad.

18. Handbook of Methods in Environmental Studies, Vol. 1 & 2, S. K. Maiti, ABD Publishers, Jaipur.
19. Law on Protection of Environment and Prevention of Pollution (Central and States), R. G. Chaturvedy and M.M. Chaturvedy, The Law Book Co. (Pvt.) Ltd., Allahabad.
20. Natural Disasters, Lee Davis, Checkmark Books, New York.
21. Practical Methods in Ecology and Environmental Science, R. K. Trivedy and P.K. Goel, EnviroMedia, Karad.
22. Standard Methods for the Examination of Water and Wastewaters, American Public Health Association, Washington, DC.
23. State of India's Environment: A Citizen's Report, Arvind Agarwal, Centre for Science and Environment, New Delhi.
24. Water Pollution: Causes, Effects and Control, P. K. Goel, New Age International Publishers, New Delhi.
25. Environmental Biology, P.S. Verma and V.K. Agarwal, S.Chand & Co., New Delhi.

**SEMESTER 1 - ELECTIVE**  
**ENS1 E - 04 - GREEN CHEMISTRY**

**Unit - 1.** Soaps, detergents and detergent builders-preparation. Difference between soap and detergents.

Cleansing action of soaps and detergents. Soaps and detergents as pollutants. Shampoo and toilet soap preparation

**Unit - 2.** Food poisoning-food poisoning caused by chemicals,poisonous plants and microorganisms, Foodhygiene in the prevention of food poisoning

**Unit -3.** Green Chemistry-Principles of Green Chemistry, Design of Green Synthesis, prevention of waste and byproducts, Atom Economy, prevention of chemical accidents, microwave assisted green synthesis, Diels Alder reaction

**Unit -4.** Water Analysis-Water quality monitoring-sampling-analysis of water-physico-chemical and biological parameters of water-water quality standards-WHO,BIS-Eutrophication (9 Hours)

**Unit – 5.** Solid wastes management-Solid wastes-Types,disposal methods-sanitary land filling,

incineration, recycling,composting-composting methods-indoor and Bangalore method, Windros method.Vermicomposting

**Unit -6. Environmental Issues-**

- a. Global warming and Green House Effect-Acid Rain-Bhopal Tragedy
- b. Environmental movements-Plachimada movement-Silent Valley-Narmada Bachao Andolan- Chipko movement

**Reference:**

Ahluwalia,V.K. Green Chemistry

Ahluwalia,V.K. and M.Kidwai. New trends in Green Chemistry

Misra,S.P.and S.N.Pandey,2009. Essential Environmental Studies, Ane Books Pvt.Ltd

Bhatia,S.C. Environmental Chemistry, CBS publications

De,A.K. Environmental Chemistry,

Bharucha,E. Text Book of Environmental Chemistry, Oxford & IBH

Ahluwalia,V.K. and Sunita Malhotra Environmental Science, Ane Books Pvt. Ltd

**ENS1 P 01 -PRACTICALS IN ENVIRONMENTAL CHEMISTRY**

**I - Determination of various Physico - chemical properties of Water, Soil and Air**

**1. Water**

1. Determination of **pH**
2. Determination of conductivity
3. Determination of D.O
4. Determination of total solids (Gravimetry)
5. Determination of total dissolved solids (Gravimetry)
6. Determination of total suspended solids (Gravimetry)
7. Determination of chlorides
8. Estimation of Copper.
9. Estimation of iron (Colourimetry)
10. Estimation of Oil & Grease
11. Estimation of residual chlorine
12. Estimation of H<sub>2</sub>S
13. Estimation of Hardness, Calcium and Magnesium
14. Chemical oxygen demand
15. Biological oxygen demand
16. Estimation of fluoride
17. Estimation of phosphate

18. Estimation of Nitrate
19. Estimation of Nitrite
20. Estimation of Total Nitrogen ( Kjeldahl method)
21. Estimation of Sodium & Potassium (Flame photometry)
22. Estimation of pesticides using TLC / paper chromatography / Colum chromatography
23. Analysis of heavy metals – As, Hg, Pb, Cd
24. Estimation of sulphate
25. Estimation Acidity and Alkalinity.

## **II. Soil Analysis**

1. Determination of soil **pH**
2. Determination of soil moisture content
3. Estimation of soil chloride
4. Determination of TOC
5. Determination of Ca<sup>2+</sup> & Mg<sup>2+</sup>
6. Analysis of soil sulphate (Gravimetry)
7. Determination Food Adulterants (Chromotographic methods)
8. Estimation of Na<sup>+</sup> & K<sup>+</sup> in soil

## **III Air Quality Analysis (Demonstration only)**

- |                       |                    |
|-----------------------|--------------------|
| 1. Particulate matter | 2. NO <sub>x</sub> |
| 3. SO <sub>x</sub>    | 4. Pollen grains.  |

## **SEMESTER – II**

### **ENS2 C 04 - ENVIRONMENTAL ENGINEERING**

#### **UNIT 1 - INTRODUCTION TO ENVIRONMENTAL ENGINEERING**

##### **WATER QUALITY STANDARDS**

Water Quality Parameters - Physical, Chemical And Biological Parameters

Water Sampling Type, Selection of Sampling Point, Equipment Used, Sample Preservation and Maintenance

Water Quality Standards - Industrial, Drinking Water

#### **UNIT 2 - WATER TREATMENT PROCESS**

Water Treatment, Mixing And Flocculation, Coagulation, Jar Test, Softening

Lime Soda And Ion Exchange Process, Filtration, Slow, Rapid And Pressure Filter,

Disinfection, Chlorination, Ozonisation and UV Application.

### **UNIT 3 - WASTE WATER TREATMENT**

Municipal Sewage and Industrial Treatment, Basic Treatment Process And Flow Sheet Water Flow Rates and Their Assessment. Unit Operation Of Pre-Treatment And Primary Treatment, Bar Rocks, Grit Chambers, Communitors, Equalization And Sedimentation, Design Concept, Secondary Treatment, Biological Unit Process, Nature And Kinetics Of Biological Growth, Aerobic Process, Activated Sludge Process And Its Modification, Oxidation Ponds , Attached Growth System, Trickling Filters, Rotating Biological Conductors, High Rate Anaerobic Reactor-CSTR, Up flow Anaerobic Filters –UAFS, UASB, Expanded, Fluidized Bed Reactors, Chemical Unit Processes, Precipitants, Coagulation, Disinfection, Tertiary/Advanced Treatment System, Filtration, Absorption, Nitrogen And Phosphorous Removal, Biological Nutrient Removal (BNR)Systems, Sewage Disposal Methods,

### **UNIT 4 - AIR QUALITY STANDARDS**

Method Of Monitoring And Standards Of Air Pollutants:

Air Quality Monitoring, Wind Roses, Air Sampling, Analysis of NO<sub>x</sub>, SO<sub>x</sub>, CO and Particulate Matter. Air Quality Standards,

### **UNIT 5 - AIR POLLUTION CONTROL**

Control of Particulate Matter: Gravitational Setting Chamber, Centrifugal Collector, Electrostatic, Fabric and Wet Collector, Scrubber.

Control of Gaseous Contaminants: Adsorption, Absorption, Combustion, Automobile Emission Control.

### **UNIT 6 - SOLID WASTE MANAGEMENT**

Municipal, Solid Waste: Types, Sources, Characteristic, Waste Collection and Transport, Techniques/Processing of Solid Waste Recovery, Reclamation, Recycle And Reuse Of Resources, Disposal Methods, Incineration, Pyrolysis, Composting, Vermi-composting, Sanitary Land Fills And Anaerobic Digestion.

Industrial and Hazardous Waste Management

### **References:-**

- i. Peavy H.S, Rwe, DR, Techobanoglous G, Environmental Engineering, McGraw-Hill Book Company, New York

- ii. Metcalf & Eddy Inc, Waste Water Engineering , Disposal and reuse ,2<sup>nd</sup> Ed.,Tata McGraw-Hill
- iii. Sawyer & McCarty, Chemistry for Environmental Engineering, McGraw-Hill
- iv. Wark K, Warner CF, Air Pollution- Its origin and Control, Harper&Row, Newyork, USA
- v. Abbasi,S.A. Environmental Pollution and its control,cogent international,Pondicherry.
- vi. Fair Geyer & Okum, Water supply & Waste Water Engineering
- vii. Earnest W. Steel, Water supply & Sewage.
- viii. S.K. Garg ,Water supply Engineering
- ix. B.K Sharma – Environmental chemistry –Goel publication.
- x. Tyagi and Mehra - Environmental Chemistry
- xi. Trivedi P.R & Raj Gurdeo - Environmental water and soil Analysis Akasdeep Pub. House, New Delhi.
- xii. V.K.Alhuwalia, Environmental Chemistry Ahe books, India
- xiii. S.P. Misra and S.N. Pandey – Essential Environmental studies – Ane books Pvt. Ltd.
- xiv. P.L. Soni - Physical Chemistry and Analytical Chemistry

## **SEMESTER II - CORE**

### **ENS2 C 05 - ENVIRONMENTAL MICROBIOLOGY AND BIOTECHNOLOGY**

#### **UNIT I : Scope and history of Environmental Microbiology**

Scope and history of Environmental Microbiology – characteristics, classification, identification and morphology of microorganism.

Microbial world – Bacteria, Archaea, Fungai, Algae, Virus, Protozoa.

Identification of microorganisms – Direct microscopic examination , cultural characteristics, biochemical and physiological and physiological properties, Antibiotic sensitivity testing, serological methods, Phage typing, protein analysis, comparison of nucleotide sequences.

#### **References**

1. Microbiology . Prescott, Harley and Klein ( Ed) 7<sup>th</sup> edition.
2. Manual of Microbiology - Tools and Techniques. Second edition. Kanika Sharma,

3. Microbiology- Michael J Pelzar, JR.E.C.S Chan and Noel.R.Krieg. 8<sup>th</sup> edition.

## **UNIT II : Genetic engineering**

Genetic engineering and tissue culture- Principles and scope of Genetic engineering. Application of genetic engineering, benefits and hazards- the ethical and social implications of genetic engineering, Tissue culture Techniques and its applications

### **References**

1. Microbiology. Prescott Harley and Klein ( Ed) 7<sup>th</sup> edition.
- 2 Microbiology- Michael J Pelzar, JR.E.C.S Chan and Noel.R.Krieg. 8<sup>th</sup> edition.
3. Biological Science. R.Soper. Cambridge University. 3<sup>rd</sup> Editon.

## **UNIT III : Environmental Microbiology**

Microbiology and segments of Environment. Microbial diversity in soil, biogeochemical role of soil microorganisms. Biodegradation of herbicides and pesticides. The aquatic micro organisms. The role and importance of microbial ecosystems, biogeochemical transformation.

### **References:**

1. Modern soil Microbiology, Elsar, Jansson and Tervors. 2dn Edition.
2. Microbiology - Michael J Pelzar, JR.E.C.S Chan and Noel.R.Krieg. 8<sup>th</sup> edition.
3. Microbiology. Prescott Harley and Klein ( Ed) 7<sup>th</sup> edition.

## **UNIT IV : Environmental Biotechnology**

Environment Biotechnology – Principles and scope, Role of biotechnology in Environmental Protection, biotechnology in industrial pollution control – Paper industries, Textile Industries, Petrochemical Industries, Leather Industries and Mining Industries

### **References**

1. Handbook of Environment Biotechnology vol 1. S.C Bhatia. Atlantic publication
2. Advances Environment Biotechnologyby S.K Agarwal
3. Environment Biotechnology, theory and application. Gareth.M.Evans and Indith C.Fuslong

## **UNIT V : Emerging trends in Environment Biotechnology**

Emerging trends in Environment Biotechnology- Bioremediation and Biosensors. Principles of Bioremediation , Techniques used in Bioremediation, Advantages and disadvantages of Bioremediation. Principles and applications of Biosensors. Concept of Bioremediation in waste water management. Waste water treatment Practices, solid waste management .

### **References**

1. Essentials of Biotechnology. R.C Sobti and Suparna S Pachauri.
2. Handbook of Environment Biotechnology. Vol 1 .S.C Bhatia, Atlantic publisher and distributions
3. Biotechnology in Environment management. Vol 2
4. Essentials of Biotechnology by Sobti.
5. Methods in Biotechnology by Hanspeter.

## **SEMESTER II - CORE**

### **ENS2 C 06 - FUNDAMENTALS OF TOXICOLOGY**

#### **UNIT- 1: Basics of Toxicology.**

Definition of toxicology, Branches of toxicology, scope and importance of toxicology, Environmental toxicology, Principles of toxicology, Toxicants and their classification. Categories of toxic effects. Factors influencing toxicity. Toxic effects due to combination of chemicals. Dose effect and dose response relationships.

#### **UNIT - 2 : Toxic Chemicals In The Environment**

Toxic chemicals in the environment – Inorganic and organic toxicants- entry in to the environment, cycles and residence time. Translocation of xenobiotics.

Toxicity of pesticides, organo chlorine, organo phosphates and carbamides, insecticides, heavy metals , radioactive substance, fluorides, chemicals, fertilizers.

#### **UNIT -3 : Toxicity**

Metabolism of toxic substance by plants and animals. Mode of action of toxicants, biotransformation of toxicants, Bioaccumulation of xenobiotics, Bioconcentration and Biomagnification. Toxicity test, In vitro and In vivo toxicity test.



Pollution by industries- types and characteristics – dispersion and circulation . Mechanism of pollutants degradable and non degradable toxic substances.

Ecosystem influence on the fate and transport of toxicants.

#### **UNIT - 4 : Occupational Health Hazards.**

Occupational health – physical, chemical, biological and physiological hazards. Control of toxic materials and protection measures. Toxicity of air , water and soil. Health and hygiene-epidemiology, epidemiological diseases ( air & water ) due to pollution problems with special reference to Kerala and India.

#### **UNIT - 5 : Ecological Risk Assessment**

Ecological risk assessment. Sanitary engineering- sewage systems, sewage treatment and disposal. Sanitary regulation.

#### **References:-**

1. A.K. De – Environmental chemistry
2. B.K.Sharma and H. Kans Environmental chemistry
3. P.D.Sharma, Environmental biology and toxicology, 1997-98.
4. P.K.gupta and D.K.Shinlee, Modern toxicology
5. g.C. Butler, Principles of Eco toxicology
6. Duffus, John H, Environmental toxicology
7. Shukla J.P and Pandey, Elements of Toxicology, Radha publishers, New Delhi.
8. Rand G.M and Perocelli S.R, Fundamental of Aquatic Toxicology, Hemisphere publishing Corporation, Washington.
9. Cockerham L.G and Shane B.S, Basic Environmental Toxicology, CRC press, Boca Raton, USA.
10. Jacob, Thankamma, Food Adulteration, MC Millan publishers Pvt. Ltd., 1976.
11. Kalia M & Sood. Food preservation and processing, Kalyani pub. Ludhiana, New Delhi.
12. Hobbs B.C & Roberts D. Food poisoning and Food Hygiene 6<sup>th</sup> Edition. Edward Arnold pub. London, 1993.
13. Kamleshwar Pandey, Shukla, J.P, Trivedi (ed)2009, fundamentals of toxicology, New central book agency (p) Ltd

## SEMESTER II - CORE

### ENS2 C 07- INSTRUMENTATION AND ANALYTICAL TECHNIQUE

#### UNIT 1: Basic Concepts Of Analytical Methods

##### 1. Gravimetry

- 1.01. Principles and applications of gravimetric methods
- 1.02. Estimation of moisture content of soil, phytomass
- 1.03. Compost and vermin compost using moisture balance.

##### 2. Volumetric methods

###### 2.01. Acidimetry and alkalimetry

-Standardisation of Reagent

###### 2.02. Permanganometry

###### 2.03. Dichrometry

###### 2.04. Iodometry and Iodimetry

###### 2.05. Argentometry

###### 2.06. Complexometry

###### 2.07. Colourimetry

###### 2.07. cerimetry(ferrous)

##### 3. Limitations of analytical methods

###### 3.01. accuracy

###### 3.02. precision

###### 3.03. error

Classification and minimization

#### UNIT II: Electro Chemical Methods

##### 2.01. pH meter

##### 2.02. glass and reference electrodes

##### 2.03. Ion selective electrodes

2.04. conductometry

Electrical conductivity measurement

2.05. Potentiometry

### **UNIT III: Photometric Methods**

3.01. Nephelometry - Turbidimetry - Sulphide determination

3.02. Spectro photometry

3.021. Beer-Lambert's law

3.022. Deviation from Beer – Lambert's law

3.023. Optical design of filter photometer

3.0232. Double beam, Electromagnetic radiation Spectrophotometry

3.0233. U.V visible Spectrophotometer, Interaction of radiation with different types of molecular energy, IR, NMR & Mass spectrophotometers,

3.024. Chemical interference

Concentration range

3.03. Flame photometry

Determination of Metals (Na, K)

3.04. Atomic absorption spectrophotometry application

3.05. Atomic emission spectrophotometry

### **UNIT IV: Techniques**

A) Dosimetry

- Geiger Muller counter,

- Scintillation counter,

B) Electrophoresis,

- Gel Electrophoresis,

- Immune electrophoresis, (ELISA, blotting technique, RFLP etc)

### **References:-**

1. D.A. Skoog and J.J. Leary, Principles of instrumental analysis,  
i. 4<sup>th</sup> ed., Saunders college Publishing, fortworth, 1992.

2. H.H. Rump, H. Krist, Laboratory Manual for the water, wastewater and soil, VCH Publishers, New York, 1988.
3. Standard methods for the Examination of water and wastewater, APHA, 21<sup>st</sup> Ed, Washington DC,
4. Lain. Marr and Malcolm S Cresser, Environmental Chemical Analysis, International textbook company...(pub), New York, 1983.
5. A.K. De - Environmental Chemistry
6. Tyagi and Mehra - Environmental Chemistry
7. Trivedi P.R & Raj Gurdeo - Environmental water and soil Analysis Akasdeep Pub. House, New Delhi.
8. V.K. Alhuwalia, Environmental Chemistry Ahe books, India
9. S.P. Misra and S.N. Pandey – Essential Environmental studies-Ane books Pvt. Ltd.
10. P.L. Soni - Physical Chemistry
11. Vogel - Analytical Chemistry
12. Khopkar, S.M. , Basic concepts of Analytical Chemistry , Wiley Eastern Ltd., New Delhi.
13. Daniel C. Harris, Quantitative Chemical Analysis, 4<sup>th</sup> Ed., W.H. Free man and Company, New York, 1995.

## SEMESTER II - ELECTIVE

### ENS2 – E 05- Food Adulteration and preservation

#### Unit – 1 – Food and its spoilage

Food – Types of food – Food spoilage and poisoning – Spoilage caused by molds, yeasts bacteria, enzymes, insects and food constituents

#### Unit – 2 - Food poisoning

Food poisoning caused by chemicals, poisonous plants and micro organisms, Food hygiene in the prevention of food poisoning, factors contributing to outbreak of food poisoning.

#### Unit – 3 - Methods and Principles of food preservation

Preservation by salting, using sugar, antibiotics, chemicals, by drying, Fermentation , cooling, concentration and heating. Preservation of milk products. Preservation of beverages.

#### Unit – 4 - Food Adulteration

Common adulterants, intentional and incidental adulteration, Methods for detection of food adulterant. Safety of food additives and preservatives. Food additive regulations, Food grades, Food standards, food laws and food regulations.

#### **Unit – 5 – Safety of Foods**

Safety of food additives and preservatives, Food additive regulations, Food grades, Food standards, Food laws and Food regulations

#### **References**

1. Jacob, Thankamma. Food Adulteration.1976. Mc Millan Pub.
2. Kalia M and Sood.1996. Food preservation and processing. Kalyani Pub. Ludhiana-  
New Delhi
3. Hobbs B.C. and Roberts D.1993. Food poisoning and Food Hygiene. 6<sup>th</sup> Edn. Edward

### **SEMESTER II - ELECTIVE**

#### **ENS2 – E 06 - Hydrology and Water Management**

- Unit - 1-** Hydrology – Definition, History of hydrology,  
Branches of hydrology – Chemical hydrology, Eco hydrology, Hydrogeology, hydro informatics, hydrometeorology, isotope hydrology, surface hydrology.
- Unit -2-** Hydrologic cycle – Different process of hydrologic cycle – precipitation,  
Canopy interception, snow melt, remelt , sub surface flow, infiltration, evaporation, transpiration, sublimation, advection, condensation.
- Unit - 3 -** Surface water hydrology – rainfall and surface runoff relationship, runoff, runoff characteristics, open channel flow,  
Statistical analysis in hydrology – Probable maximum precipitation – hydrograph, flow duration curve – Flood frequency analysis and estimation – Water balance.

**Unit - 4 -** Ground water hydrology – Ground water table, stream – aquifer interactions, base flow recession, porosity and permeability, hydraulic head and fluid potential, Darcy’s Law and hydro conductivity, Heterogeneity and anisotropy, storage properties of aquifers, Equations of ground water flow, well hydraulics, solute transport.

**Unit - 5 -** Hydrologic measurements-

- a) Quantifying surface water flow – Stage – discharge measurement .
- b) Quantifying ground water flow - Ground water pressure (Piezometer), ground water depth (aquifer test), conductivity, infiltration (infiltrometer), soil moisture (soil moisture meter, gravimetric method, capacitance probe, Time domain reflectometer, Tensiometer). Geophysical investigation – resistivity and seismic method – application of remote sensing.

c)Quantifying hydrologic exchange at the land – atmospheric boundary.

Precipitation:

- a- Precipitation characteristics
- b- Cloud properties, rain rate estimation, hail and snow detection (radar)
- c- Rain and snow fall (Rain gauge)
- d- Humidity (Sling psychrometer, thermo hydrograph)
- e- Evaporation (Evaporation pan)
- f- Transpiration

**Unit - 6 -** Water management practices

- 1) Water shed management
- 2) Wetland conservation
- 3) Rainfall pits and rain water harvesting
- 4) Contour bunding
- 5) Drip irrigation
- 6) Channel irrigation

### **Reference**

- 1) Chone, V.T. Hand book of Applied Hydrology, Mc Grace Hill publication, New Delhi.
- 2) Charlu, T.G.K and Datta, D.K. Grand water development in India, Rural electric corporation, New Delhi, 1982.
- 3) Jayaram Reddy, A Text Book of hydrology, Lakshmi publishers, New Delhi.
- 4) Ragunath, H.M, Hydrology, Villey tastem publication, New Delhi, 1985.
- 5) CWRDM Publications, CWRDM, Kamamangalam.
- 6) Linsev, Kohies Panthus; Applied Hydrology, Mc Grace Hills Publication, New Delhi.

- 7) Subramanya.K, Hydrology for Engineers, Tata Mc Grace Hills Publications, New Delhi, 1984.
- 8) IS L986 91983) Measurement of Rainfall.
- 9) IS 5973 (1976) Pan evaporimeter.
- 10) Varshney, R.S; Engineering hydrology, New chand & Bros. Publications Rorkee.
- 11) Todd.D.K. Green water hydrology; John Wileys & Sons Publications, New York.
- 12) Validia.K.S, Environmental Geology, Tata Mc Grace Hills Publishing Co. Ltd. New Delhi.
- 13) Barry and Choslay, Atmosphere, Weather and Climate, The English Language Book Society.

### **ENS2 P 02 - PRACTICALS IN ECOLOGY**

- 1.Quantitative and Qualitative analysis of Phytoplankton and Zooplanktons
- 2.Primary Productivity-Light and Dark bottle method.
- 3.Chlorophyll method
- 4.Terrestrial-Biomass
- 5.Screening Test-(Demonstration Only)
  - a. Using fish –LC 50
  - b.Macrophytes-Germination
6. Study of vegetation of local area/college campus
7. Study of fauna of local area/campus
8. To find out minimum size of the quadrat for vegetation study
9. Study of vegetation density by quadrat method
- 10 .Study of vegetation frequency by quadrat method.
11. Study of Phytoplankton.
12. Estimation of biomass.
13. Study of Zooplankton
14. Determination of water transparency by Secchi disc

15. Determination of pH and temperature of water.
16. Determination of carbon dioxide in water.
17. Field visit to terrestrial/aquatic environments.
18. Study tour (one day) ,19. Study of ecological adaptations

## **SEMESTER II**

### **ENS2 P03 – FIELD STUDY**

Students are required to go for field study in research institutions, wildlife sanctuaries, different ecosystems, polluted areas or ecotourism sites and submit a report of the same.

## **SEMESTER III - CORE**

### **ENS3 C 08 - ENVIRONMENTAL ECONOMICS AND LAWS**

#### **UNIT I : Environmental economics**

Introduction, World environmental history and economic development. Nature and scope, Principles of environmental economics. Interrelationship between economics, environment and ecology. Foundation of environmental economics

#### **UNIT II : Environmental Economics Basics and trends**

Environmental Economics Basics and trends. Environment and economy, environmental and economic growth, environmental and development.

Basic concept of sustainable development. Measures for sustainable development.

Main characteristics of environmental goods- Pure public goods, Mixed collective goods, public bads, externalities, consumption and demand, production and supply, Marginal analysis. Market and market failure. Externalities – marginal social cost, marginal private cost, marginal external growth, cost and solution to externality.

Principles of maximum social welfare - Pareto Criterion

#### **UNIT III : Resource economics**

Resource economics. Economics of natural resources. Population growth and its impact on environment.



The concept of common property resource and issues in global environmental resource sharing.

World trade and the environment – International trade, Intellectual Property rights.

Social CBA. Economic CBA, Environmental pollution- control, private cost and social cost. Application of CBA

#### **UNIT IV : Environmental Laws / Policies and agencies.**

i) History of environmental law, environmental legislation in India, Central and state boards for the prevention and control of environmental pollution, powers and functions of pollution control boards, penalties and procedure, duties and responsibilities of citizens for environment protection

ii) Wildlife Act 1972, Air and Water act, Water cess Act, Forest Act, Environmental protection Act 1986, Hazardous waste ( Management and Handling ) rules 1989, Bio medical waste

( Management and Handling ) rules 1998. Ministry of Environment and forests – notification relating to hazardous microorganisms and genetically modified organism 1999. Public liability insurance Act 1995. Noise pollution 2000. National environment tribunal Act 1995.

iii) International cooperative movements. Global Environment monitoring systems (GEMS) .Antarica convention, stockholme summit, UNCED and its four conventions- climate change, biodiversity, desertification , tropical forest, Ramsar convention.

iv) National and international agencies - Earth watch, UN organization, WCN, UNEP and others, Co operation on ozone layer, migratory species, wetlands, mangroves, oceans.

#### **UNIT V : Information, Education and Communication**

Environmental education /awareness - formal and informal education , lifestyle changes and consumerism, values and ethics.

Information networks.

ENVIS Centres - INFOTERA

Role of NGO's in the implementation of environmental policies, communication and management. Major environmental issues in India and Kerala with case studies. Green movement and Eco feminism - Chipko movement, Naarmada Bachao movement, Baliapal movement, Silent valley movement.

#### **Refereneeces:**

1. World commission on Environment and Development ; “Our common future”. Oxford University Press publications.

2. Leela Krishnan, Law and Environment.
3. Adiseshiah M.S (1987) Economics of Environment.
4. Victor P.A (1972) The Economics of Pollution, Mathau, London Publication.
5. Rogene and Buchoiz (1993) Principles of Environmental management, Prentice Hall publications.
6. Indian Institute of Ecology and Environment, New Delhi.
  1. Occasional monographs – 11,22,41,42,51,70,77,87
  2. Environment International – 42,51,71,72,75,76,84,85,86.
7. Roscheraz, Environment law and policy in India.
8. Lohithakshan (2002), 'Paristhithi Niyamangal", Kerala State Institute of Languages (Malayalam).
9. Khitolia R.K. (Ed) 2009. Environmental protection and the Law. APH publishing corporation.
10. Karpakam, M. 1991. Environmental Economics. Stuling Pub. New Delhi.

### **SEMESTER III - CORE**

#### **ENS3 C 09 - EIA & ENVIRONMENTAL MANAGEMENT**

##### **Unit I - EIA**

- i) Introduction : Definition, aim, principles and concept, scope. Origin and development of EIA. Relationship of EIA to sustainable development EIA in project planning and implementation.
- ii) Method and steps
  - a) Ad hoc Method, b) Overlay Method, c) Checklist Method, d) Network Method
  - e) Matrix Method f) Ecosystem Modeling

##### **Unit II - EIA PROCESS**

- i) Methods for preparing EIA
  - a) Socio-economic aspects, b) Making inventories, c) Sampling and data process
  - e) Baseline study
- ii) Impact prediction
  - a) Positive and negative impact, b) Primary and secondary impact
  - c) Impact on Physical Social and biotic environment
- iii) Evaluation of proposed action

- a) Risk assessment and risk management, b) Mitigation Measures
- c) Comparison of alternatives, EIS and EMP, d) Review and decision making
- d) Practices and guidelines in India

**Unit III - EIA for Different Environmental Programmes.**

- i) Industries,
- ii) Urban development
- iii) landuse
- iv) Energy projects
  - a) Hydel, b) Thermal, c) Nuclear, d) Oil gas e) solar f) wind
- v) Resource management
  - a) Agriculture, b) Irrigation
  - c) Water, d) Biodiversity, e) Costal Zone
- vi) EIA case studies

**Unit IV: Environmental Planning and Management**

- i) Principles of EPM
  - a) Principle, concepts and scope of environmental Planning
  - b) Ecological aspects of EPM
  - c) Steps in Environmental Planning
  - d) Identification and formulation of strategies of EPM
- ii) Environmental Analysis and EPM
  - a) Physical planning in relation to environment and land use classification
- iii) EPM for
  - a) Town and urban lands
  - b) Rural and agriculture land
  - c) Wastelands
  - d) Lands reclaimed
  - e) Wetlands

- f) Mining areas
- g) Industrial areas
- h) Transportation and urban planning

#### **Unit V: EPM for Environmental Hazards**

- i) Types of Environmental Hazards
  - a) Flood, draught, landslides, earth quakes, cyclones etc
- ii) Significance and characteristics of hazards in Environmental Planning and development
- iii) Opportunity and regional planning for hazard management

#### **Unit VI : Environmental Auditing**

- i) Cost benefit Analysis
- ii) Scope and types of Environmental audit
- iii) Audit Process – Pre , post audit process
- iv) International organization for standardization ( ISO)
- v) ISO 14000 standards and certification

#### **Refereneces:**

1. World commission on Environment and Development ; “Our common future”. Oxford University Press publications.
2. Leela Krishnan, Law and Environment.
3. Adiseshiah M.S (1987) Economics of Environment.
4. Victor P.A (1972) The Economics of Pollution, Mathau, London Publication.
5. Rogene and Buchoiz (1993) Principles of Environmental management, Prentice Hall publications.
6. Indian Institute of Ecology and Environment, New Delhi.
  1. Occasional monographs – 11,22,41,42,51,70,77,87
  2. Environment International – 42,51,71,72,75,76,84,85,86.
7. Roscheraz, Environment law and policy in India.

8. Lohithakshan (2002), 'Paristhithi Niyamangal", Kerala State Institute of Languages (Malayalam).

### **SEMESTER III – CORE**

#### **ENS3 C 10 - BIOSTATISTICS, RESEARCH METHODS & COMPUTER APPLICATION**

**UNIT - I** Fundamentals of Statistics (Basic concept) – Collection of Data – Classification and Tabulation – Diagrammatic Representation – Measures of Central Tendencies and Dispersion – Probability and Monte Carlo Analysis – Moments, Skewness and Kurtosis – Normal, Poission and Binomial Distributions.

**UNIT - II** Tests of Significance – Mass and alternative hypothesis – error level of significance – Equal and Unequal Sampling - t, z, x<sup>2</sup> test, Analysis of variance – One way ANOVA – Two way ANOVA – Regression and correlation - simple and multiple.

**UNIT - III** Modeling – Computer Modeling – Lotka – Volterra Model, Leslie's Matrix Model – Point Source Stream Pollution Model – Air Quality Model. Thermal Plume and Dispersion models.

**UNIT - IV** Applications of Computer in Environmental Science and Management – Data Analysis using packages (SPSS): Editing, Data Tabulation, Descriptive statistics – Correlation – Regression – Factor analysis – Cluster analysis – PCA, Graph Plotting

**UNIT - V** Scientific documentation: Methods of literature collection, design, planning and execution of investigation, Statistical methods in biological research, Preparation of scientific documents, general articles, research papers, review articles, editing of research papers, methods of citation, collection of literatures, including web based methods, bibliography and thesis writing. Presentation techniques, effective communication skill, Discussion and critic.

#### **REFERENCES**

1. Business Mathematics and Statistics, Vittal, R.R. (1986) Murgham Publications.
2. Programming with C, Byron S Gottfried (1996) Hill Publishing Co, New Delhi.
3. Statistical Methods, Gupta, S.P. (1996) Sultan Chand & Sons Publications, New Delhi.
4. Environmental Science Methods, Haynes, R (1982) Chapman & Hall, London.

5. Fundamentals of Bio-Statistics, Khan, I.A and Kanum, A., (1994) Ukaaz Publication, Hyderabad.
6. Quantitative Techniques, Kothari, C.R (1996) Vikas Publishing Housing Pvt Ltd, Hyderabad.
7. Statistics for Advanced Level, Miller, J., (1989) Cambridge University Press.
8. Statistical Methods, Snedcor, G.W. and Cochran, W.G. (1982) Academic Press.
9. Statistics in Biology. Bliss, G.I. (1970). Mc Graw Hill Book Company, Vol. I and II. New Delhi.
10. Practical Statistics for Experimental Biologists. Wardlaw, A.C. (1985), Wiley Chichester.
11. Research Methods in Social Sciences. Sharma, B.A.V., Ravindra Prasad, D. and Satyanarayana, P (1989), Sterling Publishers Pvt. Ltd.
12. Research Methodology – Methods and Techniques. Kothari, C.R., (1989), Wiley Eastern, New Delhi.
13. Introduction to Research Methodology in Agricultural and Biological Sciences, V. Venkatasubramanian (1999), New Century Book House (P) Ltd., Chennai.

## SEMESTER III – CORE

### ENS3 C 11 – NATURAL HAZARDS AND DISASTER MANAGEMENT

#### Unit – 1 - Natural hazards:

- a) Flood – causes, nature and frequency of flood. Flood hazard, Urbanization and flooding, Flood mitigation methods.
- b) Land Slides and Avalanches – Causes, prevention and correction.
- c) Coastal hazards – Tsunamis, coastal erosion, sea level changes and impact on coastal areas.
- d) Earth quakes – Causes, intensity and magnitude of earth quakes, geographical distribution of earth zones and seismic waves, nature of destruction, protection from earthquake hazards.
- e) Volcanism – Nature, extend and causes of volcanism, volcanic materials and pollution, geographical distribution of volcanoes.
- f) Lightning – Adverse affects and mitigation measures.
- g) Cyclone and Tornadoes – Causes effects and control measures.
- H) Drought - Causes, prevention and correction
- I) Fire - Causes effects and control measures.

#### Unit – 2 - Disaster Management:

Concept and scope of disaster management / emergency management.

Professional activities – Mitigation, preparedness, response, recovery, programme planning and management.

**Unit – 3 - Tools of Disaster management** – Forecasting and warning systems of disasters – Measurement of responses of disasters – Community reaction to disaster – Disaster management - Emergency Management Information Systems (EIMS) - Phases of disaster management – Pre disaster phase – Actual disaster phase – Post disaster phase – Disaster Assistance – Technological assistance – Relief camps – Camp layout – Food requirement – Water needs – Sanitation - Security –

#### **Unit - 4 - Organizations related to disaster management.**

- b) International organizations – International Association of Emergency Managers, Red cross/Red crescent, United Nations, World Bank.
- b) National Organizations – National Disaster Management of India, Emergency management and research institute (EMRI), National remote sensing institute (NIRS).

#### **References:**

- 1) Anil Tyagi, Environmental Science, Danika publishing company, New Delhi, 2007.
- 2) Barrington EJW, Environmental Biology. Resource and Environmental Science series, Edward Arnold (pub) Ltd. London.
- 3) Purohit, S.S, Shammi, Q. Land Agarwal, A.K; A text book of Environmental science, student edition publishers, Jodhpur, 2004.
- 4) R.K Khitoliya and K. Venkatachalam )(1997), Urban settlements and Natural hazards. Proceedings of seminar on Natural hazards in the Urban habitat. November, New Delhi.
- 5) Arya,A.S (1997) key note Address, Seminar on “Built Environment & Natural hazards”. Indian buildings congress. February, New Delhi.



## SEMESTER III – ELECTIVE

### ENS3 – E 07 - CHEMOMETRICS AND GOOD LABORATORY PRACTICES

1. SI Units prefixes: Chemical concentration –molarity & molality, ppm, ppb, unit conversions. Significant figures in addition, Subtraction, Multiplication and division, logarithm & anti logarithm. Types of errors: systematic and random errors. Precision and accuracy. Propagation of uncertainty- addition, Subtraction, Multiplication and division, mixed operations. The real role of significant figures

#### 2. Tools of the Trade

The laboratory-safety aspects in design and while working .Ethical handling of chemicals.Wastes –Labeling of chemicals & hazardous operations- hazard displays. Disposal of chemical wastes in the laboratory-special cases of cyanide, Cr, heavy metals\$ toxic solvents\$ chemicals. Safety practices in laboratory.

3. laboratory note book\$ recording of operations. Measuring devices-balance –care in weighing- mechanical \$ piezoelectric balances, preventing weighing errors- buoyancy correction. Burettes, pipettes, volumetric glass wares

4. basic statistics for analytical measurement. Gaussian distribution , mean value, \$ standard deviation, student's test control charts, Q test for lab data. Spred sheets- MS excel for generating graphs

#### 5. Laboratory activities

Calibration of pipette

Standard deviation of pippeting

Standard deviation of burette intervals.

Making inventory of lab chemical consumptions.

#### 6. Computing on spread sheets( MS excel) - Graph plotting

### References

1. B.K Sharma – Environmental chemistry –Goel publication.
2. A.K. De - Environmental Chemistry
3. Tyagi and Mehra - Environmental Chemistry
4. Trivedi P.R & Raj Gurdeo - Environmental water and soil Analysis Akasdeep Pub. House, New Delhi.
5. V.K.Alhuwalia, Environmental Chemistry Ahe books, India
6. S.P. Misra and S.N. Pandey – Essential Environmental studies-Ane books Pvt. Ltd.
7. P.L. Soni - Physical Chemistry Vogel - Analytical Chemistry

## SEMESTER III – ELECTIVE

### ENS3 E08 – Application of Remote Sensing and Geographic Information System

#### Unit -1 - Basics of Remote sensing

Definition

History, principle, concept and scope of remote sensing

Indian Remote Sensing Programmes

#### Unit -2- Components of Remote sensing technique

Electromagnetic energy - Electromagnetic spectrum

Interaction between light and matter

Platforms for Remote sensing techniques - Sensors - Types of sensors & resolution - Imaging by scanning techniques- across track and along track scanning - Image characteristics – Image processing – Photo interpretation and photogrammetry.

#### Unit - 3 - Source and application of remote sensing information

Aerial photography – characteristics of aerial photographs, Aerial photographs and their interpretation.

Satellite imagery - 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.

#### Unit – 4 - Geographic information system (GIS)

History and Development - Terminology and scope of GIS - Principles of GIS - Introduction to mapping and GIS - Components and Organisation of GIS. Fundamentals of computing GIS - Theory of GIS - Data concepts - Processing and visualization - Information analysis and digital data processing - Introduction to GIS Packages.

#### Unit – 5 - Application of GIS in Environmental studies

Disaster Management, Forestry, Agriculture, Water resource management, Watershed management, Coastal zone management.

## **Reference**

1. Arther Beiser, Applied physics, Schaum's outline series; Mc Grace Hills Book Co. New York.
2. Albert Miller, Jack C Thompson, Richard E Peterson and Donald R Haragan; Elements of Meteorology; Charles E Merrill publishing Co. Columbus.
3. Frederick K Lutgens and Edward J Tarbuck; The atmosphere; prentice Hall publications, New Jersey
4. Floyd F Sabins; Remote sensing – Principles and Interpretation; W.H freeman and Co. San Francisco.
5. Erwin Schande, Springes – Verlag; Remote sensing for environmental sciences; Berling Heidelberg, New York.
6. E.C Barrett and L.F Curtis; Introduction to Environmental Remote Sensing; Chapman and Hall, London.
7. Lutgens and Tarbuck; The Atmosphere, Prentice Hall publication, New jersey.
8. Barry and Charley; Atmosphere, Weather and Climate; The English Language Book Society, 1976.
9. A.A Ramasastry; Weather and Weather forecasting' Publication division, Ministry of Information and Broadcasting, Ministry of India, 1984.
10. Billings; Structural Geology; Tata Mc Grace Hill publication Co. New Delhi.
11. Holmes A; Principles of physical geology, Ronald, New York, 1965.
12. Berry, LG & Brian Mason; Mineralogy; Freeman publication, 1959.
13. A.V Strahles and A.H Strahles; Environmental Geo-Science; Wiley International, 1973.
14. Tyrell G.W; Principles of petrology; Methven publication, 1959

## SEMESTER III - PRACTICALS

### ENS3 P04 - PRACTICALS IN MICROBIOLOGY

1. General Laboratory equipments and its familiarization
2. Gram staining
3. Spore staining
4. Oxidation - Fermentation test
5. Determination of Motility
6. Catalase test
7. THB load of soil and water
8. THB load in different Environmental conditions.
9. Most Probable Number (MPN) Test.
10. Preparation of Bacterial smear
11. Preparation of Bacterial smear from nutrient agar
12. Preparation of Bacterial smear from nutrient broth
13. Simple staining of Bacteria
14. Negative staining of Bacteria
15. Media for cultivation of Micro organism
16. Preparation of Nutrient Broth
17. Preparation of Nutrient agar plates
18. Preparation of Nutrient agar slants
19. Techniques for isolation of Pure Culture
20. Pour plate method
21. Streak plate method
22. Spread plate method
23. The load of soil sample by spread plate method
24. the load of water sample by spread plate method
24. The load of soil sample by Pour plate method
25. The load of water sample by Pour plate method

## **SEMESTER III - PRACTICALS**

### **ENS3 P 05 -PRACTICALS IN ENVIRONMENTAL GEOLOGY**

1. Study of minerals - Hand Specimens
2. Study of Rocks - Hand Specimens
3. Structural geology - Interpretations of geological maps.
4. Sedimentology - Exercise - Size classification of sediments, sediment and rock fragments.
5. Sieve analysis of sediments, pipette analysis, pebble classification.
6. Drainage Basin Analysis - Generation of drainage density and drainage frequency maps.
7. Interpretation of wave climate, tide and currents for the given data.
8. Determination of Physical and Chemical properties of Soil - N, P, K, TOC, Fertility value, Soil moisture, Soil texture, Porosity, Bulk Density, Elasticity and Permeability
9. Determination of Infiltration rate.
10. Testing ground water quality.

**SEMESTER IV - CORE**  
**ENS 4 C 12 - WETLANDS AND MANGROVES**

**UNIT 1**

- Introduction to Wetlands - Wetland History, Wetland Definitions
- Wetland Classification
- Biological Adaptations to the Wetland Environment
- Biodiversity and economic importance of wetlands of Kerala
- Wetland Hydrology
- Human Impacts and Management of Wetlands

**UNIT II**

- Ramsar Convention and Ramsar sites
- Ramsar Sites in Kerala
- Wetlands of Kannur
- Wetland laws
- Wetland restoration and wise use
- Wetlands and Climate change

**UNIT III**

- Mangroves: Definition. True mangroves and Mangrove associates
- Distribution of mangroves
- Mangrove adaptations
- Significance of mangroves - Ecosystem Service Value of mangroves
- Species diversity and uses of True mangroves of Kerala
- Conservation of mangroves

**References**

- Mitsch, W.J. and J.G. Gosselink. (1986, 1993, 2000, 2007). *Wetlands*, 1st, 2nd, 3rd and 4th editions. Van Nostrand Reinhold, New York, New York and John Wiley & Sons, Inc., Hoboken, New Jersey.
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- Brinson, M. (1993) *A Hydrogeomorphic Classification of Wetlands*
- 1987 U.S. Army Corps of Engineers *Wetland delineation manual*
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- Fraser, L.H. and P.A. Keddy (eds.). 2005. *The World's Largest Wetlands: Ecology and Conservation*. Cambridge University Press, Cambridge, UK. 488 p.
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- Lucien-Brun H. 1997. Evolution of world shrimp production: Fisheries and aquaculture. *World Aquaculture*. **28**:21–33.

## SEMESTER IV

### ENS4 C13 - ECOTOURISM

**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.

**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.

### REFERENCES

01. The Encyclopedia of Ecotourism, Weaver, D. B. (2001), CABI Publishing, U.K.
02. Encyclopedia of Ecotourism, Volume I, II and III, Sinha, P.C (2003), Anmol Publications Pvt. Ltd., New Delhi.
03. Ecotourism and sustainable Development, N. Mukherjee (2008). Cybetech Publications, New Delhi.
04. Global Ecotourism, Prabhas Chandra (2003), Kaniskha Publishers, New Delhi.



**OPENCOURSE IN  
FUNDAMENTALS OF ENVIRONMENTAL SCIENCE**

**Unit 1 : Basics of environmental science**

Definition, scope and importance

**Unit 2 : Natural Resources :**

**Renewable and non-renewable resources :**

Natural resources and associated problems.

- a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.
- f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
  - Role of an individual in conservation of natural resources.
  - Equitable use of resources for sustainable lifestyles.

**Unit 3 : Ecosystems**

- Concept of an ecosystem. Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem :-
  - a. Forest ecosystem
  - b. Grassland ecosystem
  - c. Desert ecosystem
  - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Unit 4 : Biodiversity and its conservation**

- Introduction – Definition : genetic, species and ecosystem diversity.
- Biogeographical classification of India
- Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation

Hot-spots of biodiversity.

- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

### **Unit 5 : Environmental Pollution**

Definition

- Cause, effects and control measures of :-

- a. Air pollution
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

- Solid waste Management : Causes, effects and control measures of urban and industrial wastes.

- Role of an individual in prevention of pollution.

- Pollution case studies.

- Disaster management : floods, earthquake, cyclone and landslides.

### **Unit 6 : Social Issues and the Environment**

- From Unsustainable to Sustainable development

- Urban problems related to energy

- Water conservation, rain water harvesting, watershed management

- Resettlement and rehabilitation of people; its problems and concerns. Case

Studies

- Environmental ethics : Issues and possible solutions.

- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.

- Wasteland reclamation.

- Consumerism and waste products.

- Environment Protection Act.

- Air (Prevention and Control of Pollution) Act.

- Water (Prevention and control of Pollution) Act

- Wildlife Protection Act

- Forest Conservation Act

- Issues involved in enforcement of environmental legislation.

- Public awareness.

## REFERENCE

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Sd/-

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**KANNUR UNIVERSITY**  
**MODEL QUESTION PAPER**  
**I SEMESTER M.Sc. ENVIRONMENTAL STUDIES EXAMINATION,**  
**ENS1 C 01. Fundamentals of Ecology**

**Time : 3 hours**

**Max.Marks : 60**

**Section A**

**Answer any Two of the following with not more than 1000 words.**

**2X10 = 20**

1. Write an account on the global environmental issues and management measures.
2. Describe the concept of productivity in an ecosystem.
3. Write an essay on the Ecological succession.

**Section B**

**Answer any Three of the following with not more than 100 words**

**3X5 = 15**

4. Give an account on the various types of interaction among organisms of a community.
5. Describe briefly the oxygen cycle in nature.
6. What is the ecological role of biodiversity?
7. Explain the mineral cycles in the terrestrial ecosystems.
8. Give an account on the general pattern of energy flow in forest ecosystems.

**Section C**

**Answer any Five of the following with not more than 100 words**

**5X3=15**

9. Write a note on artificial ecosystems.
10. Comment on ecological niche.
11. Write notes on territoriality and home range of organisms.
12. List the biomes of the world?
13. Define population and give a detail account of population characteristics?
14. What is meant by detritus food chain?
15. What is meant by biological magnification?

**Section D**

**Answer any Five of the following**

**5X2=10**

16. What are biological clocks?
17. Comment on the scope of ecology.
18. What are stenothermal organisms?
19. What is Shannon Weiner index
20. What is EL-Nino?
21. What is quadrat sampling?
22. What is the phenology of a community?