

SEMESTER COURSES FOR
MASTER'S DEGREE PROGRAMME IN ENVIRONMENTAL SCIENCES

Post Graduate Course in Environmental Sciences will be of Four Semesters (2 Yrs.) based on 96 Credits (24 in each Semester), out of which, 64 Credits would be of Theory while 32 Credits would be of Practical (including 8 Credits of Dissertation). In each Semester i.e. I, II & III , there would be Two Laboratory Courses of Four Credits each, while the IV Semester would have Dissertation of 8 Credits based on Research work. In Semester III & IV there would be one optional course of Four Credits each that would be offered to the students other than the students of Environmental Sciences. Similarly, students of Environmental Sciences of III & IV Semester have to opt Four Credits course in each Semester from the optional courses offered by other departments.

Evaluation of Course work:

The students would be continuously evaluated during the conduct of courses on the basis of their performances in Minor Test-I (upto 20% of syllabus), Minor Test-II (21% to 40 of syllabus) & Major Test III (41% to 100% of syllabus).

Each Minor Test would be of 1hrs. duration and carries 20% weightage of marks while Major Test would be of 2½ hrs. duration and carries 60% weightage of marks.

For 4 Credit Courses : Major test will have Seven Questions , out of which One is compulsory. Out of remaining Six Questions , candidate will have to attempt 3. Each question would be of 15 marks.

For 2 Credit Courses : Major test will have Four Questions , out of which One is compulsory. Out of remaining Three Questions , candidate will have to attempt 2. Each question would be of 10 marks.

For Lab. Courses: Daily evaluation of Practical records/Assignments/Viva-voce etc. would carry 50% weightage. Final Practical performance + Viva-voce with 100% syllabus covered would carry 50% weightage.

The following courses of study are prescribed for the Ist, 2nd, 3rd & 4th Semesters of Master's Degree Programme in Environmental Sciences :-

SEMESTER- I

Examinations to be held in
Dec.,2014 ; Dec. 2015, and Dec. 2016

Course No.	Title	Credit	Contact hours per week L – T - P
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THEORY COURSES:-

PSESTC101	Principles of Ecology	4	4 – 0 - 0
PSESTC102	Aquatic Environments	4	4 – 0 - 0
PSESTC103	Remote Sensing	4	4 – 0 - 0
PSESTC104	Environmental Chemistry	2	2 – 0 - 0
PSESTC105	Basics of Earth Sciences	2	2 – 0 - 0

LABORATORY COURSES:-

PSESPC101	Lab Course-I	4	0 – 0 - 6
PSESPC102	Lab Course-II	4	0 – 0 - 6

SEMESTER- II

Examinations to be held in
June,2015 ; June2016, and June 2017

Course No.	Title	Credit	Contact hours per week L – T - P
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THEORY COURSES :-

PSESTC201	Environmental Microbiology	4	4 – 0 - 0
PSESTC202	Principles of Climatology	4	4 – 0 - 0
PSESTC203	Biological Statistics	2	2 – 0 - 0
PSESTC204	Computer Applications	2	2 – 0 - 0
PSESTC205	Natural Resources : Conservation & Management	4	4 – 0 - 0

LABORATORY COURSES :-

PSESPC201	Lab Course-I	4	0 – 0 - 6
PSESPC202	Lab Course-II	4	0 – 0 - 6

SEMESTER-III

Examinations to be held in
Dec.,2014 ; Dec., 2015 and Dec. 2016

Course No.	Title	Credit	Contact hours per week L – T - P
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THEORY COURSES:-

PSESTC301	Environmental Impact Assessment & Management	4	4 – 0 - 0
PSESTC302	Environmental Pollution	4	4 – 0 - 0
PSESTC303	Environmental Analysis & Instrumentation	2	2 – 0 - 0
PSESTC304	Ecotoxicology	2	2 – 0 - 0
*PSESTC305	Climate Change: Issues and Policies	4	4 – 0 - 0

LABORATORY COURSES :-

PSESPC301	Lab Course-I	4	0 – 0 - 6
PSESPC302	Lab Course-II	4	0 – 0 - 6

SEMESTER-IV

Examinations to be held in
June,2015 ; June2016, and June 2017

Course No.	Title	Credit	Contact hours per week L – T - P
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THEORY COURSES :-

PSESTC401	Environmental Law	4	4 – 0 - 0
PSESTC402	Disaster Management	4	4 – 0 - 0
PSESTC403	Basic course in Environmental Economics	2	2 -0 -0
PSESTC404	Environmental Biotechnology	2	2 -0 -0
*PSESTC405	Man and Environment: Issues and Policies	4	4 -0 -0

DISSERTATION :-

PSESDC401	Dissertation	8	0 -0 -12
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* Optional Course offered to the students from other Departments

Detailed Syllabus Semester - I

Course No. : PSESTC101

Title : Principles of Ecology

Credits : 4

Syllabus for the examinations to be held in Dec.,2014 ; Dec. 2015, and Dec. 2016

OBJECTIVES :

The purpose of the course is to make the students to understand various ecological principles and factors that determine the size and number of population that can co-exist within a specific area. This knowledge is crucial for better development and management of natural resources and global environment.

UNIT - I : INTRODUCTION TO ECOLOGY AND ECOSYSTEM

- 1.1 Ecology- its subdivisions, scope and relation with other life sciences.
- 1.2 Ecological factors- physical factors (water, light, temperature).
- 1.3. Ecological factors - Edaphic (Soil) and topographic factors.
- 1.4. Ecosystem - Concept, components and characteristics.
- 1.5. Ecosystem development and concept of climax.

UNIT -II : ECOSYSTEM STUDY

- 2.1. Laws of Thermodynamic and generalized model of energy flow through an ecosystem.
- 2.2. Primary productivity and methods of its measurements.
- 2.3. Secondary productivity (concept), Law of minimum and Law of tolerance
- 2.4. Food chain, foodweb & ecological pyramids
- 2.5. Ecological indicators of environmental factors.

UNIT -III : BIOTIC COMMUNITY - PRINCIPLES AND CONCEPTS

- 3.1. Concept of biotic community.
- 3.2. Intra community - classification & the phenomenon of ecological dominance.
- 3.3. Community Analysis.
- 3.4. Species diversity within community.
- 3.5. Patterns in communities.

UNIT - IV : POPULATION CHARACTERISTICS & DYNAMICS

- 4.1. Group properties (Intra specific interactions).
- 4.2. Attributes of population - density, natality and mortality.
- 4.3. Age distribution.
- 4.4. Population growth vis-a-vis the concept of carrying capacity.
- 4.5. Density as a factor in regulating population - density independent and density dependent factors.

UNIT-V : POPULATION REGULATION STRUCTURE AND INTERACTION

- 5.1. Population dispersal.
- 5.2. Population structure.
 - (a) Internal Distribution Patterns.
 - (b) Aggregation and Allee's principle.
 - (c) Isolation and territoriality.
- 5.3. Interaction within population.
 - (a) Negative Interactions - Interspecific competition, predation, parasitism, amensalism.
 - (b) Positive Interactions - Commensalism, Co-operation, mutualism.
- 5.4. Population Behaviour.
 - (a) Basic behaviour patterns.
 - (b) Regulatory and compensatory behaviours.
 - (c) Social behaviour.
- 5.5. Character Displacement - Sympatry and allopatry.

LITERATURE RECOMMENDED:

1. Benton, A.H. and Werner, W.E. (1976).Field Biology and Ecology. Tata Mc. Graw Hill Publishing Company Ltd. New Delhi.
2. Chapman, J.L. and Reiss, M.J. (1995).Ecology-Principles and applications.
3. Claude Fauric; C.Ferra; Medori, P. & Devaux, J. (2001). Ecology. Sciences & Practice. Oxford & IBH Pub. Co. Pvt. Ltd. (N. Delhi).
4. Dash, M.C. (1993).Fundamentals of Ecology. Tata Mc.Graw Hill Publishing Company Ltd. New Delhi.
5. Kormondy, E.J. (1986).Concept of Ecology.Prentice Hall of India, New Delhi.
6. Odum, E.P. (1996).Fundamentals of Ecology. Natraj Publishers, Dehradun.
7. Southwick, H.C. (1972). Ecology & Quality of our Env.. Van No. Strand Reinhold Company, New York.

Detailed Syllabus
Semester - I

Course No.: PSESTC102

Title: Aquatic Environment

Credits : 4

Syllabus for the examinations to be held in
Dec.,2014 ; Dec. 2015, and Dec. 2016

OBJECTIVES :

The present course has been designed to provide information on various aspects of aquatic environment, changing physico-chemical profile, biotic characteristics and applicability of the information for the exploitation of such water resources and also for their better management and conservation.

UNIT-I: AQUATIC ENVIRONMENT, HYDROLOGY AND HYDRAULICS

- 1.1 Indian water resources and their status.
- 1.2 Hydrological cycle and Global Water Balance
- 1.3 Runoff: factors affecting runoff.
- 1.4 Measurement of runoff, stream gauging, stream hydrograph.
- 1.5 Properties of fluids: introduction: hydraulics, properties (density, specific weight, specific volume, specific gravity and compressibility), types of fluids.

UNIT-II: WETLANDS AND RAMSAR CONSERVATION

- 3.1 Ramsar's role in water resource management.
- 3.2 Integrated framework for wetland inventory, assessment and monitoring.
- 3.3 Ramsar framework for wetland inventory: core data fields for inventory of biophysical and management features of wetlands.
- 3.4 Wetland Assessment.
- 3.5 Wetland Monitoring.

UNIT-III: LOTIC AND LENTIC ENVIRONMENT

- 2.1 Lakes: Origin and Classification.
- 2.2 Stratification: thermal and chemical
- 2.3 Springs: origin, importance and classification
- 2.4 Physical characteristics of Lakes, rivers and springs
- 2.5 Chemical characteristics of Lakes, Rivers and Springs.

UNIT-IV: AQUATIC ORGANISMS.

- 4.1 Ecological classification of fresh water organisms.
- 4.2 Plankton: importance and management.
- 4.3 Macrophytes: importance, classification and management.
- 4.4 Aquatic organisms- Fishes, importance, causes of their depletion & conservation.
- 4.5 Aquatic birds: Importance and causes of their depletion.

UNIT-V: CONSERVATION AND MANAGEMENT

- 5.1 National Water Policy
- 5.2 Causes for dwindling of fresh water resources.
- 5.3 Water conservation.
- 5.4 Ramsar framework for wetland management.
- 5.5 Development of National Wetland Policy (as per Ramsar convention).

LITERATURE RECOMMENDED

1. Wetzel, R. G. (2002). Limnology Lakes and River Ecosystem. Academic Press, London.
2. Schwoerbel, J. (1991). Handbook of limnology. Scientific publ. Jodhpur.
3. Goldman, C. R. and Horne, A. J. (1994). Limnology. Mc. Graw Hill Int. Book Co., New Delhi.
4. Hutchinson, G. E. (2004). Treatise on Limnology. Vol. I, part-2, Vol. II. John Willey and Sons, New York.
5. Jhingran, V. G. (1992). Fish and Fishes of India. Hindustan Publishing Corporation, India.
6. Aggarwal, S. C. (1999). Limnology. APH Publ. Corp., New Delhi.
7. Garg, S. K. (1998). Hydrology and water resources engineering. Khanna Publishers, Delhi.
8. Bal, A.S (2005). An Introduction to Environment Management. Himalaya Publishing House, Mumbai.
9. India's Wetlands Mangroves and Coral Reefs (1992). WWF India.
10. Dugan, P. (1993). A Mitchell Beazley World Conservation Atlas. Wetlands in Danger. Mitchell Beazley, London.
11. Abbasi, S. A. (1997). Wetlands of India. Discovery Publishing House. New Delhi.
12. Sinha, P. C. and Mohanty, R. (2002). Wetland Management Policy and Law. Kanishka Publishers, Distributors, New Delhi.

Detailed Syllabus **Semester - I**

Course No.: PSESTC103

Title: Remote Sensing

Credits : 4

Syllabus for the examinations to be held in **Dec.,2014 ; Dec. 2015, and Dec. 2016**

OBJECTIVES :

Remote Sensing Technology has developed remarkably as an important tool for scientific management of resources & environment. The technology improves our understanding of both global & local environments & to map & monitor changes in these environment. Remote Sensing application for natural/physical resources assessment, is helpful to improve our ability to achieve the goal of optimum land use planning & in turn sustainable resource management & development. This course has been designed with the objectives to acquaint the students with basic remote sensing principles, concepts & their applications in various fields.

UNIT -1 : INTRODUCTION TO REMOTE SENSING AND REMOTE SENSING SYSTEMS

- 1.1 Remote sensing: Definition, Concept of Electromagnetic radiation (EMR); Electromagnetic Spectrum; Radiation principles, Scope of remote sensing
- 1.2 EMR interaction with Atmosphere & Terrain
- 1.3. Platforms and Sensors: Classification of Platforms, Basic Characteristics of Sensors and Spatial, Spectral, Temporal, Radiometric resolutions
- 1.4 Remote sensing systems: Framing and Scanning Systems
- 1.5 Introduction to IRS, LANDSAT - 5, 7 and SPOT - 4, 5, IKONOS, NOAA, INSAT, satellites and sensors

UNIT -2 : AERIAL PHOTOGRAPHY AND PHOTOGRAMMETRY

- 2.1 Aerial Photography-I: Definition, Basic information, Specifications for Planning and execution of aerial photography.
- 2.2. Aerial Photography- II: Types of aerial photographs & information recorded on aerial photographs.
- 2.3. Brief information about Tilt, Swing, overlap of aerial photographs.
- 2.4. Fundamentals of photogrammetry I: Taking measurements from aerial photographs i.e. Scale of aerial photographs, distance, area.
- 2.5 Fundamentals of photogrammetry II: Stereovision, Stereoscopes, Measurement of height of objects by Parallax method.

UNIT -3 : MICROWAVE AND THERMAL REMOTE SENSING, GIS

- 3.1 Microwave Remote Sensing I : Introduction, advantages, Active remote sensing components, Radar Operating Principles, Spatial resolution in RADAR, SLAR, SAR, Space borne RADAR
- 3.2 Microwave Remote Sensing II: RADAR return, image Characteristics & interpretation of radar images
- 3.3 Thermal Remote Sensing: Concept, Thermal Infrared Radiation properties, application of Thermal infrared remote sensing
- 3.4 Geographical Information System (GIS)-I: Definition, Components of GIS, Geographical data & database structures.
- 3.5 Geographical Information System (GIS)-II:, Spatial data models viz. raster and vector, Data input & output in GIS.

UNIT -4: IMAGE ITERPRETATION

- 4.1 Visual Interpretation of aerial photographs & Satellite images
- 4.2 Digital Image Processing: Digital Image & image structure, hardware and software requirements for digital image processing.
- 4.3 Image restoration: Radiometric and geometric errors and their corrections
- 4.4 Image enhancement: Contrast, Contrast enhancements- linear and non linear, edge enhancement.
- 4.5 Information Extraction: Principal component analysis, Image classification- unsupervised and supervised, change detection.

UNIT -5: REMOTE SENSING & GIS APPLICATIONS

- 5.1 Remote sensing & GIS application in Forestry
- 5.2 Remote sensing & GIS application in Ecology & Environment.
- 5.3 Remote sensing & GIS application in Agriculture, Soil survey and soil mapping
- 5.4 Remote sensing & GIS application in Land use/ land Cover & land evaluation.
- 5.5 Remote sensing & GIS application in Disaster Management.

LITERATURE RECOMMENDED:

1. Burrough, P.A. (1986). Principles of Geographical Information System for Land Resource Assessment.Oxford Univ. Press.
2. Curran, P.J. (1988).Principles of Remote Sensing, ELBS, Longman Inc.
3. Jensen, J.R. (1986).Digital Image Processing. Prentice Hall, New York.
4. Jensen,J.R.(2003).Remote Sensing of the Environment, Pearson Education, Singapore.
5. Lillesand T.M. & Kiefer R.W. (1987).Remote Sensing & Image Interpretation. Second Ed. John Wiley & Sons, NewYork.
6. Rao,U.R.(1996).Space Tech. for Sustaniable development, Tata McGraw Hills Co., N. Delhi.

Detailed Syllabus Semester - I

Course No.: PSESTC104

Title: Environmental Chemistry

Credits : 2

Syllabus for the examinations to be held in Dec.,2014 ; Dec. 2015, and Dec. 2016

OBJECTIVES :

This course has been designed to acquaint students with natural chemical constituents of the environment, the interactions between them and manner in which changes are brought about due to human interference, particular pollution.

UNIT-I:

- 1.1 Concept and scope of Environmental Chemistry - Pollutant, Contaminant, Receptor, Sink, Pathways of a pollutant, Speciation, Threshold limit value, Stoichiometry, Gibb's energy.
- 1.2 Composition of atmosphere and atmosphere structure.
- 1.3 Cycling of primary gaseous pollutants and chemistry of methane cycle.
- 1.4 Chemical and photochemical reactions in atmosphere.
- 1.5 Chemistry of ozone and alternatives for CFC's.

UNIT-II:

- 2.1 Water: Physical properties, Auto-ionization of water, Acid base equilibria, pH of water
- 2.2 Buffer Solutions: Concept of Buffering capacity, Importance of natural buffers, Oxidation –reduction redox potential
- 2.3 Concept of DO, BOD and COD. Principles of coagulation, flocculation, sedimentation and filtration.
- 2.4 Introduction to Soil : composition & its components.
- 2.5 Acidic and basic soils, Soil buffering, Cation exchange capacity of soil.

UNIT-III:

- 3.1 Toxic chemicals in the Environment.
- 3.2 Enzyme inhibition.
- 3.3 Microorganisms-the catalyst of aquatic reaction.
- 3.4 Chemistry of chloro organic compounds such as DDT, Lindane, Polychlorinated derivative of cyclo pentadiens and Polychlorinated biphenyls.
- 3.5 Long term effects of chloro-organic compounds.

LITERATURE RECOMMENDED

1. Baird, C (2000). Environmental Chemistry. W. H. Freeman and Company, USA.
2. De, A. K. (2003). Environmental Chemistry. New Age International Ltd., New Delhi.
3. Eisenbund, M. and Gesell, T. (1997). Environmental Radioactivity-from natural, industrial and military sources. Acad. Press, USA.
4. Mido, Y. and Satake, M. (1995). Chemicals in the environment. Discovery Pub. House, New Delhi.
5. Harrison, R. M. and Mora, S. J. De. (1996). Introductory chemistry for the Environmental Chemistry. Cambridge University, Press.
6. Girard, J. E. (2005). Principals of Environmental Chemistry. Jones and Bartlett Publishers, Inc.
7. Sodhi, G. S. (2006). Fundamental concepts of environmental chemistry. Narosa Publishing House, New Delhi.
8. Sharma, B. K. (2001). Environmental Chemistry. Krishna Prakashan Media Pvt. Ltd. Meerut.

Detailed Syllabus **Semester - I**

Course No.: PSESTC105

Title: Basics of Earth Sciences

Credits: 2

Syllabus for the examinations to be held in **Dec.,2014 ; Dec. 2015, and Dec. 2016**

OBJECTIVES:

This course is designed to fulfill the needs of students of environmental sciences in understanding the internal structure of Earth and various geomorphological processes as well as systems responsible for the formation and modification of landforms on the Earth. This would also serve as a base for different applied aspects of environmental science e.g. GIS & remote sensing, disaster management and environmental impact assessment and management.

UNIT - I : INTERIOR OF EARTH

- 1.1 Types of seismic waves and their role in the study of Earth's interior.
- 1.2 Different zones in the Earth's interior and their composition.
- 1.3 The Earth's Magnetic Field - Magnetic reversal and magnetic anomaly.
- 1.4 Continental Drift Theory.
- 1.5 Theory of isostasy and global isostatic adjustment.

UNIT-II : GEOMORPHOLOGICAL PROCESSES

- 2.1 Types of sedimentary and igneous rocks.
- 2.2 Metamorphic rocks and their types; Rock cycle
- 2.3 Folds and faults, major types of folds and faults
- 2.4 Physical weathering, chemical weathering and their types.
- 2.5 Volcanism - Components and types of volcanoes, volcanic materials, process and effects of volcanism

UNIT-III : GEOMORPHOLOGICAL SYSTEMS

- 3.1 Factors affecting landform development.
- 3.2 Fluvial system - Factors affecting stream erosion and deposition, erosional and depositional landforms.
- 3.3 Underground water system - Water table, landforms formed by ground water action.
- 3.4 Aeolian system - Mechanism of wind erosion, erosional and depositional landforms.
- 3.5 Glacial system - Mechanism of glacial erosion, erosional and depositional landforms

LITERATURE RECOMMENDED:

(A) Books :-

1. Cooke, R.U. and Doornkamp, J.C. (1974). Geomorphology in Environmental Management- An Introduction, Clarendon Press, Oxford, U.K.
2. Easterbrooke, D.J. (1969). Principles of Geomorphology. McGraw Hill, New York.
3. Keller, E.A. (1999). Introduction to Environmental Geology. Prentice Hall, New Jersey.
4. Press, F. and Siever, R. (1994). Understanding Earth. W.H. Freeman & Co., U.S.A.
5. Ritter, D.F.; Kochel, R.C. and Miller, J.R. (1995). Process Geomorphology. Wm. C. Brown Publishers, U.S.A.
6. Singh, S. (2000). Physical Geography. Prayag Pustak Bhawan, Allahabad.
7. Smithson, P.; Addison, K. and Atkinson, K. (2002). Fundamentals of the Physical Environment. Routledge Publishers, London.
8. Strahler, A.H. and Strahler, A.N. (1992). Modern Physical Geography. John Wiley & Sons, New York.
9. Wild, R. (1993). The Earth Care Annual. National Wildlife Federation, Rodale Press, Pennsylvania.

(B) Web Sites :-

1. <http://www.pbs.org/wnet/savageearth/>
2. <http://www.usgs.gov/network/science/earth/earth.html/>

PSESPC101 : Lab Course-I (Based on PSESTC101; PSESTC103; PSESTC105)

1. To determine minimum size of quadrat to be laid down for study of plant community.
2. To determine minimum no. of quadrat to be laid down for study of plant community.
3. Find out abundance of different plant species in given plot of vegetation.
4. Find out density of different plant species in given plot of vegetation.
5. Find out frequency of different plant species in given plot of vegetation.
6. Determine the cover area of different plant species.
7. Determine the Basal area of different plant species.
8. Calculate I.V.I. of different plant species in given plot of vegetation. Arrange different species in descending order of IVI. Draw Polygraph of Ist Five species in order of IVI.
9. Determine type of dispersion of different plant species in given plot of vegetation.
10. Cut V.S. of Mesophyte leaf to study ecological adaptation.
11. Cut V.S. of Xerophyte leaf to study ecological adaptation.
12. Cut V.S. of Hydrophyte leaf to study ecological adaptation.
13. Determine the number of seeds in given seed mixture by Capture-Recapture method.
14. Qualitative as well as quantitative count of different phytoplankton in given water sample.
15. Draw Ombrothermic curve from given data of Temp. and Precipitation.
16. Above and below ground biomass in given plot of vegetation.
17. Texture of different types of soils.
18. To determine the Bulk density and porosity of the soil.
19. To estimate the temperature & moisture contents of the different soil at different profile-(surface, 10cm., 20cm., 30cm).
20. To measure the leaf area, length & breadth values of different species (monocots & dicots) and to compute the Kemp's Constant for each species.
21. Study of satellite images and aerial photographs, information recorded on the Remote Sensing data sets.
22. Study of toposheets and information recorded on them.
23. Calculation of distance, area and scale from satellite images and photographs.
24. Introduction to image interpretation using various photo elements.
25. Acquaintance with digital remote sensing data.
26. Introduction to image processing software and its use.
27. Introduction to basics of GIS using GIS software.

PSESPC102 : Lab Course-II (Based on PSESTC102; PSESTC104)

1. To find out the amount of CO_2 in water sample by Titration method.
2. To find out the amount of DO from water sample by Alsterberg's alkaline sodium azide method.
3. To find out the amount of Cl^- in water sample by Titration method.
4. To find out the amount of CO_3 and HCO_3 from given water sample by Titration method.
5. To find out the amount of Ca^{++} from given water sample by Titration method.
6. To find out the amount of Ca^{++} and Mg^{++} from given water sample by Titration method.
7. To find out pH of given water sample by potentiometric method.
8. To study the temperature variations in lotic and lentic water bodies at different depths.
9. To find out the transparency of water by Secchi Disc method.
10. To analyze the water sample for amount of TDS.
11. To analyze the water sample for amount of TSS.
12. To analyze the water sample for amount of TS.
13. To identify the given specimen of macrophytes and write their morphological characteristics.
14. To find out the electrical conductivity of given water sample.

Detailed Syllabus Semester - II

Course No. : PSESTC201

Title: Environmental Microbiology

Credits : 4

Syllabus for the examinations to be held in June,2015 ; June2016, and June 2017

OBJECTIVES :

The main objective of this course is to make the students familiar with micro organisms without which human could not survive as these microbes occur in large number in most natural environment and bring about many desirable and undesirable changes. Beside their role in evolution of life on this planet, the microbial activity is linked directly with processing and removal of dead bodies and sewage. Thus , their role as scavengers is encouragable. The study of this course will help the students to develop the sustainable environment.

UNIT -I : INTRODUCTION AND HISTORY OF MICROBIOLOGY

- 1.1 History and scope of microbiology
- 1.2 Branches of microbiology
- 1.3 Preparation of Media for Isolation and culture of Microorganisms
- 1.4 Sterilization techniques used in Microbiology
- 1.5 Staining techniques for light microscopy

UNIT -II : MICROBIAL ENVIRONMENT

- 2.1 Nature and function of micro-organisms in soil
- 2.2 Nature and function of micro-organisms in air
- 2.3 Microbes and Biogeochemical cycles - Carbon cycle, Sulphur cycle, Nitrogen cycle, Phosphorus cycle and iron cycle
- 2.4 Aquatic Microbiology - Microbes of marine , fresh water & polluted environment
- 2.5 Potability of water - Microbial assessment of water quality

UNIT - III : FOOD MICROBIOLOGY

- 3.1 Initial contamination and microbial spoilage of food
- 3.2 Sources and types of microbes in milk
- 3.3 Pasteurization of milk
- 3.4 Preservation and dehydration of food
- 3.5 Fermented foods : Vegetables and dairy products

UNIT - IV : INDUSTRIAL MICROBIOLOGY

- 4.1 Types of fermentation process
- 4.2 Alcoholic fermentation
- 4.3 Production of vinegar, lactic acid and citric acid
- 4.4 Production of antibiotics, amino-acids, vitamins, vaccines, steroid transformation
- 4.5 Microorganisms in Bioassays

UNIT - V : DEVELOPMENTS IN ENVIRONMENTAL MICROBIOLOGY

- 5.1 White - rot fungal (WRF) technology for treatment of hazardous wastes.
- 5.2 Bioremediation - concept, types, advantages and disadvantages.
- 5.3 In-situ bioremediation
- 5.4 Bioventing and Air sparging
- 5.5 Alternate electron acceptors technology and Bioaugmentation

LITERATURE RECOMMENDED :

1. Agarwal, I.K. and I.K. Nene (1985). Seed borne diseases of field crops and their control. Publication and information Division, I.C.A.R.
2. Agries, G.N. (1988). Plant Pathology, Acad Press, Inc.
3. Alexander, M. (1983). Soil Microbiology, Wiley Eastern Limited.
4. Frazier, W.C. and D.C. Westheff (1978). Food Microbiology, TATA McGraw Hill Pub. Co. Ltd.
5. Frobisher, M.R.D., Hinsdill, K.T. Crabtree, C.R. Goodheart (1974). Fundamentals of microbiology W.B. Saunders Company.
6. Hincee, R.E. and Olfenbuttel, R.F. (1991). *In Situ* Bioreclamation : Applications and Investigations for Hydrocarbons and Contaminated Site Remediation. Butterworth – Heinemann, U.S.A.
7. Meyers, R.A. (1999). Encyclopedia of Environmental Pollution and Cleanup. Vol.2. John Wiley & Sons, U.S.A
8. Pelzcar, M.J.; Reid, R.D. & E.C.S. Chan (1977). Microbiology. MCGRAW Hill, New York.
9. Schlegel, H.G. (1985). General Microbiology, Cambridge University Press
10. Shukla, S.B. and Shantharam (2000). General Microbiology. Oxford & IBH Publishing Co. Ltd. N. Delhi.
11. Stainer, R.Y.; J.L. Ingraham; M.L. Wheels and P.R. Painter (1995). General Microbiology. McMillan Press Hong Kong.
12. Subha Rao, N.S. (1986). Soil Micro-Organisms and Plant growth. Oxford and IBH Pub. Co.
13. Tortora, G.J.; Funke, B.R. & Case, C.L. (1995). Microbiology-An Introduction. Benjamin / Cummings Pub. Co., USA.

Detailed Syllabus Semester -II

Course No. : PSESTC202

Title: Principles of Climatology

Credits : 4

Syllabus for examinations to be held in June,2015 ; June2016, and June 2017

OBJECTIVES :

Climatology describes the long-term pattern of weather in a particular area. Climates often undergo cyclic changes over decades, centuries and millennia. Determining where we are in these cycles and predicting what may happen in the future is an important, but difficult process. As foolproof predictions of environmental futures may be an unattainable goal, but by a better understanding of environmental processes and systems, we shall be better prepared to manage the physical environment sympathetically and to respond to foreseen and unforeseen environmental changes. In this context, the present course describes the basic concepts of climatology and their applications in weather forecasting and immediate human environments.

- UNIT - I :**
- 1.1 Definition, sub-divisions and scope of climatology.
 - 1.2 Composition and structure of the atmosphere.
 - 1.3 Insolation; Factors governing insolation.
 - 1.4 Heat budget of the Earth.
 - 1.5 Factors determining horizontal distribution of temperature.
- UNIT - II :**
- 2.1 Factors controlling pressure, horizontal distribution of pressure.
 - 2.2 Factors controlling wind .
 - 2.3 Wind system; Types of planetary winds.
 - 2.4 Local winds and types.
 - 2.5 Measurement of wind, air temperature and insolation.
- UNIT - III :**
- 3.1 Air masses and air fronts.
 - 3.2 Climatic classification- Basis of classification; Koeppen's classification.
 - 3.3 Thornthwait's classification- 1931 scheme
 - 3.4 Thornthwait's classification- 1948 scheme
 - 3.5 Tools in weather forecasting, weather forecasting in India.
- UNIT - IV :** Climate of the world : Describing the climatic features and native vegetation of the following :
- 4.1 Equatorial
 - 4.2 Savanna
 - 4.3 Hot Desert
 - 4.4 Mediterranean
 - 4.5 Steppe

- UNIT - V :**
- 5.1 Hazards - Fog and thunderstorm.
 - 5.2 Effect of climate on vegetation.
 - 5.3 Bioclimatology- Climate and Human Health
 - 5.4 Climate and House types.
 - 5.5 Climatic change-Indicators of past climate, Carbon dioxide theory, Volcanic dust theory.

LITERATURE RECOMMENDED :

(A) Books :

1. Cunningham,W.P. and Saigo,B.W.(1999). Environmental Science - A Global Concern WCB McGraw- Hill, U.S.A.
2. Emiliani,C. (1992). Planet Earth.Cambridge University Press,U.K.
3. Fellmann,J.;Getis,A. and Getis,J.(1996).Human Geography-Landscapes of Human activities. WCB McGraw- Hill, USA.
4. Houghton, J. (1997).Global Warming - The complete Briefing.Cambridge Univ. Press, U.K.
5. Lean,G. & Hinrichsen,D.(1994). Atlas of the Environment. Harper Perennial Pub., New York.
6. Lundgren, L. (1986). Environmental Geology.Prentice Hall, New Jersey.
7. Lunine, J.I. (1999).Earth-Evolution of a Habitable World.Cambridge Univ. Press, U.K.
- 8.McKnight, T.L. (1993).Physical Geography-A Landscape Appreciation.Prentice Hall, New Jersey.
9. Pearce,F. (1989). Climate and Man - From the Ice Ages to the Global Greenhouse. Ivison Books, London.
10. Rogers, J.J.W. and Feiss,P.G. (1998). People and the Earth - Basic Issues in the Sustainability of Resources and Environment. Cambridge University. Press, U.K.
11. Smithson, P.; Addison,K. and Atkinson,K. (2002). Fundamentals of the Physical Environment. Routledge Publishers, London.
12. Wellburn,A.(1996).Air Pollution and Climate Change-The Biological Impact. Longman Publishers, Singapore.

(B) Web Sites :

1. <http://ecosys.drdr.virginia.EDU:80/atm.html/>
2. <http://www.islandnet.com/~skies/>

Detailed Syllabus Semester – II

Course No. : PSESTC203

Title : Biological Statistics

Credits : 2

Syllabus for the examinations to be held in June,2015 ; June2016, and June2017

OBJECTIVES :

Biometrics helps the biologists to understand the nature of variability and to assess and represent it quantitatively. The course is designed to help the students to make statistical calculations to present the result in more meaningful manner.

- UNIT - I :**
- 1.1 Importance and scope of biometry.
 - 1.2 Sampling of data - random and non-random sampling.
 - 1.3 Diagrammatic (Line, bar, pie diagram) and Graphic (Histogram, frequency polygon, frequency curve, cumulative frequency curve) representation of data.
 - 1.4 Measures of central tendency - Mean(AM,GM &HM), Mode & Median.
 - 1.5 Measures of dispersion; skewness & kurtosis
- UNIT -II :**
- 2.1 Probability distribution - Binomial distribution.
 - 2.2 Poison distribution.
 - 2.3 Normal distribution.
 - 2.4 Test of hypothesis, two types of errors.
 - 2.5 T-Test for assumed population mean and comparison of two samples.
- UNIT -III:**
- 3.1 Chi square test and its application.
 - 3.2 Co-relation and regression.
 - 3.3 Principles of design of experiments. Examples of CRD and RBD.
 - 3.4 One way analysis of variance.
 - 3.5 Two way analysis of variance

LITERATURE RECOMMENDED :

1. Gupta, S.C. (1999). Fundamentals of Statistics. Himalayan Pub. House Delhi.
2. Hoshmand, A.R.(1988).Statistical methods for Env.& Agr. Science. CRS Press, New York
3. Khan,I.A. & Khanum,A. (1994). Biostatistics. Ukaaz Publications, Hyderabad.
4. Rao,P.S.S. & Richard, J.(1996). An Introduction to Biostatistics. Prentice Hall, New Delhi.
5. Sukhatma, P.Iii. and Amble,Iii.N. (1976). Statistical methods for Agricultural workers : ICAR, New Delhi.

Detailed Syllabus Semester – II

Course No. : PSESTC204

Title : Computer Applications

Credits : 2

Syllabus for the examinations to be held in June,2015 ; June2016, and June2017

OBJECTIVES :

The Present course has been designed with the objective to provide the basic knowledge about the computer and performing various statistical calculations easily to present the result in a more meaningful manner.

- UNIT -I :**
- 1.1 Computer components & its types.
 - 1.2 Computer terms & Number system (Binary to decimal & vice-versa).
 - 1.3 Computer memory & its types.
 - 1.4 Secondary storage device FD/HD.
 - 1.5 Algorithms & Flowcharts.
- UNIT -II :**
- 2.1 UNIX Operating system & its features, Windows.
 - 2.2 Internal & External commands of DOS & its functions.
 - 2.3 Language types & features.
 - 2.4 Types of Networks, data transmission methods, communication protocols
 - 2.5 Internet, World Wide Web.
- UNIT III :**
- 3.1 Features of C, datatypes, constants, variables.
 - 3.2 Operators, Library functions.
 - 3.3 Conditional & Control statements.
 - 3.4 I/O statements, arrays (One dimensional).
 - 3.5 Functions , String functions.

LITERATURE RECOMMENDED :

1. Balagurusamy, E. (1995). Programming with C. Tata McGraw Hil Pub., New Delhi.
2. Jain, P.K. (1995). Fundamentals of Computers . BPB Pub., New Delhi.
3. Kanetkar, Y. (1998). Exploring in C. BPB Pub., New Delhi.
4. Rajaraman, Iii. (1989). Fundamentals of Computers . PHI Pub., New Delhi.
- 5 Schaum Series (1992). Programming in C : Tata McGraw Hil Pub., New Delhi.
6. Sharma, A.K. (1996). Computer Science. Dhanpat Rai & Sons, New Delhi.
7. Sinha, P.K. (1995). Computer Fundamentals. BPB Pub., New Delhi
8. Jamwal, S.S. (2009) Executing C - a practical approach , Saksham Books International .

Detailed Syllabus Semester - II

Course No. PSESTC205

Title : Natural Resources : Conservation &
Management

Credits : 4

Syllabus for the examinations to be held in June,2015 ; June2016, and June 2017

OBJECTIVES :

The Natural resources of ecosphere are being wastefully consumed at an increasing rate under the combined effect of population explosion & industrialization. The current rate of usage takes absolutely no account of real size of available reserves of natural resources. The needs of future are greatly ignored. In addition to this, malnutrition is fast spreading in most countries of the world, including India. Even advanced countries will no longer be protected from shortages of Natural resources. The course is designed to provide information to the students about the natural resource of this planet, the causes of their depletion & their conservation & management for future use.

UNIT -I : NATURAL RESOURCES - PLANTS

- 1.1 Natural resources: introduction, characteristics & classification.
- 1.2 Concept of endemic, extinct and threatened species (endangered, rare, vulnerable & interminate species).
- 1.3 Plants as a natural resource: a general account with reference to timber, food & medicines.
- 1.4 Degradation of plant resources: Causes & Consequences.
- 1.5 Priorities for Conservation of plant resources: wild relatives of crop plants, land races, advanced cultivars, medicinal plants & wild plants of potential utility.

UNIT -II : NATURAL RESOURCES - WILDLIFE

- 2.1 Definition, concepts & importance of wildlife.
- 2.2 Depletion of wildlife: Causes & Consequences. Man & wildlife conflict.
- 2.3 Wildlife Census methods
- 2.4 Important National Parks, Wildlife Sanctuaries & Biosphere Reserves in India with their characteristic wildlife.
- 2.5 Endangered wildlife species (Birds & Mammals) of India. Important Wildlife species of J&K State.

UNIT -III : NATURAL RESOURCES - SOIL & MINERALS

- 3.1 Soil as a natural resource: a general account with reference to nutrients & soil biota
- 3.2 Role of agricultural practices in soil degradation.
- 3.3 Role of wind & water erosion in soil degradation.
- 3.4.1 Origin, distribution & uses of economic minerals.
- 3.4.2 Exploitation of mineral resources from oceans with special reference to India.

- 3.5.1 Impact of exploitation of economic minerals on environment.
- 3.5.2 Methods of conserving the economic mineral resources.

UNIT -IV : NATURAL RESOURCES - ENERGY

- 4.1 Energy : scenario in India
- 4.2 Coal, oil & natural gas
- 4.3 Hydro energy, wind energy , tidal energy.
- 4.4 Solar energy , Nuclear energy
- 4.5 Biogas, fire wood ,Petroplants, Dendro thermal energy

UNIT -V : NATURAL RESOURCES- CONSERVATION STRATEGIES & MANAGEMENT

- 5.1 Ex-situ conservation of Plants & Animals
- 5.2 In-situ conservation of Plants & Animals
- 5.3 Soil conservation measures
- 5.4 Conservation & Management of Water Resources
- 5.5 Conservation & Management of Energy resources

LITERATURE RECOMMENDED :

1. Bandhu, Desh (1987). Env. Education for conservation & Development. Indian Environment Society New Delhi.
2. Brady, N.C. (1974). The nature & properties of soil McMillan & Co.
3. Chaturvedi, A.N. (1994). Management of India's forest resources. Khanna Bandhu, Dehradun.
4. Dar, G.H.; Bhagat, R.C.; Khan, M.A. (2002). Biodiversity of the Kashmir Himalaya. Anmol Publication, Pvt. Ltd. New Delhi.
5. Dasmann, R.F. (1981). Wildlife Biology. 2nd edition. John Wiley & Sons. New York
6. Frankle, O.H. & Hawkel, J.G. (1975). Plant genetic resources. International Biological Programme-2, Cambridge Univ. Press London.
7. Gautam, A. & Rastogi, S. (2003). Resource Geography. International Publishing House, Meerut
8. Gupta, K.C. (2002). Energy & Environment in India - A study of Energy Management. Gyan Publishing House, New Delhi.
9. Heywood, V.H. (1995). Global Biodiversity Assessment. Cambridge University Press, UK
10. Jadhav, H.V. (1997) Energy & Environment. Himalaya Publishing House. Delhi.
11. Jairajpuri, M.S. (1991). Animal Resources of India - Protozoa to mammalia - State of the Art. Zoological survey of India. XI-XXVII.
12. Kathiresan, S.B. (1986). Essentials of forest management. Natraj Publishers Dehradun.
13. Kumar, H.D. (1995). Modern concepts of Ecology. Vikas Pub. House, Pvt. Ltd. New Delhi.
14. MaDicken, K.G. & Vergora, N.T. (1990). Agroforestry : classification & Management, John Wiley & sons, New York.
15. Nautiyal, S. & Kaul, A.K. (1999). Forest Biodiversity & its Conservation Practices in India. Oriental Enterprises, Dehradun, India.
16. Negi, S.S. (1992). Himalayan Wildlife, Habitat & Conservation. Indus Publishing Company, New Delhi.
17. Owen, O.S. & Chiras, D.D. (1995). Natural Resources Conservation. Prentice Hall India
18. Singh, M.P. (2004). Natural Resources & renewable Energy. Daya Publishing House, Delhi.
19. Tiwari, P.C. (1995). Natural Resources & sustainable development in Himalaya. Shree Almora Book Depot., India.

PSESPC201 : Lab Course-I (Based on PSESTC201; PSESTC202; PSESTC205)

1. To study the principle, construction and working of Autoclave.
2. To study the principle, construction and working of electric oven.
3. To study the principle, construction and working of Incubator.
4. To study the principle, construction and working of Laminar Air Flow.
5. To prepare Gram stain for the study of bacteria.
6. To study the type of bacteria in curd by Gram staining technique.
7. To calculate the number of bacteria in given sample of milk by DMC method.
8. To calculate the number of bacteria per ml. in a given sewage sample by DMC method.
9. To measure the size of bacteria in a given sample.
10. To study the bacteria of throat using sterile swab by Gram staining technique.
11. Prepare nutrient agar medium, sterilize the medium and prepare slants and plates of the medium for culture and study of microbes.
12. Prepare potato dextrose agar medium, sterilize and prepare plates of the medium for culture and study of microbes.
13. To study the growth /colonies of different microbes present in the Petri plate.
14. To find out the drinking water quality by MPN method.
15. Prepare MacConkey's agar medium, sterilize and prepare plates of medium.
16. To study the different colonies present in the Petri plate of medium for differentiation of Lactose fermentor and non-lactose fermentor bacteria.
17. To prepare a list of trees available in the Campus.
18. To identify and describe the given minerals.
19. To standardize Ocular meter using standard stage meter.
20. Study bacteria present nodules of legume plants using Gram's Staining technique.
21. Measurement of air temp. and related calculations.
22. Measurement of wind speed and direction.
23. Decoding of synoptic elements plotted on a weather map.

PSESPC202 : Lab Course-II (Based on PSESTC203 , PSESTC204)

1. Classification of the provided data and preparation of frequency distribution table.
2. Diagrammatic (Line, bar, pie diagram) and graphic (Histogram, frequency polygon, frequency curve) representation of the data.
3. Determination of Mean, Mode & Median in different data (individual, discrete & continuous data).
4. Determination of Standard Deviation, CV in different data (individual, discrete & continuous data).
5. Exercise based on addition and multiplication rule of Probability.
6. Exercise based on Binomial, Poisson & Normal distribution.
7. Testing the significance of the Mean of a assumed population, Mean of two samples (independent & dependent).
8. To test the goodness of fit of the data (Chi Square test).
9. Exercise based on Correlation & Regression analysis.
10. Exercise based on One way & Two way ANOVA.
11. Write a Program in C to print “HELLO M.Sc. E.V.S.”
12. Rewrite the Program
 - (a) to print 1000 times and
 - (b) take the string at runtime
13. Write a Program in C to convert given temperature in Celsius scale to Fahrenheit scale by using formula : $F=1.8*C+32$.
14. Write a Program in C to print area of Rectangle.
15. Write a Program in C to print given Integer value “I”.
16. Write a Program in C to copy input to output, one character at a time.
17. Write a Program in C to print some float values & add them.
18. Write a Program in C to calculate the area of a circle.
19. Write a Program in C to calculate the circumference of a circle.
20. Write a Program in C to generate even numbers from 2-50.
21. Write a Program in C to generate odd numbers from 1-1000.
22. Write a Program in C to generate even numbers from 1000-1.
23. Write a Program in C to generate a sequence of natural numbers.

24. Write a Program in C to generate average of 1st ten natural numbers.
25. Write a Program in C to generate sum of ten natural numbers.
26. Write a Program in C to check whether the given number is even or odd.
27. Write a Program in C to print the average of “n” numbers, if “n” is non-zero.
28. Write a Program in C. Given the marks of the students in three subjects, grade is calculated by adding marks in three subjects as M1, M2, M3. Print “PASS”, if grade>50, otherwise “FAIL”
29. Write a Program to add the contents of array A [10] and array B[10] and store the result in array C[10].
30. Perform the following actions on arrays :
 - (a) incrementing each element by 10.
 - (b) Find the length of a given array.
31. Demonstrate recursive functions in C. Call in main program.
32. Design a function to compute the factorial of a number. Call in main program to generate results.
33. Design a function to generate Fibonacci series upto n. Call in main program.

Detailed Syllabus Semester – III

Course No. PSESTC301

Title : Environmental Impact
Assessment & Management

Credits : 4

Syllabus for examination to be held in Dec. 2014 ;Dec. 2015 & Dec. 2016

OBJECTIVES :

The environment Impact Assessment is among the tools which in recent years have been employed widely to determine the impacts of various activities on the environment with a view to avoid or mitigate such impacts. Deterioration in environmental quality increased with the increase in human activities. The objective of environmental impact assessment is to make available, information on the environmental repercussions of impacts of a project or other developmental activities. The main purpose of this course is to apprise the students of various principles & methodologies of Env. Impact Assessment, consequences of developmental projects & other activities of man which in turn will enhance their decision making ability.

- UNIT - I :**
- 1.1 Environmental Impact Assessment (EIA) : Concepts, objectives, origin & generalized approach to EIA.
 - 1.2 Methodologies of EIA and EIA guidelines (GOI Notification of 1994, 2006)
 - 1.3 Environmental Impacts, their types & important impacts to be considered in EIA .
 - 1.4. Environmental Impact Statement & Environmental Management Plan.
 - 1.5 Environmental Auditing : Concept & guidelines.

UNIT - II : EIA OF :

- 2.1 River valley Projects.
- 2.2 Mining Projects.
- 2.3. Oil refinery
- 2.4. Thermal Power Project
- 2.5 Cement Industries

UNIT - III : PREDICTION & ASSESSMENT OF IMPACTS ON :

- 3.1 Water Environment
- 3.2 Air Environment
- 3.3 Noise Environment
- 3.4 Socio-Economic & Cultural Environment
- 3.5 Biological Environment

- UNIT - IV :**
- 4.1. Impact of tourism on Environment
 - 4.2 Biotic impact on flora & fauna in Himalaya
 - 4.3. An Introduction to Watershed & its management
 - 4.4 Wastelands & their reclamation.
 - 4.5 Environmental Education: formal & informal education & their role in environmental Awareness.

- UNIT - V :**
- 5.1 Environmental priorities in India & sustainable development
 - 5.2 Ecotourism & Environment
 - 5.3 Rain Water Harvesting : an overview
 - 5.4 Land use planning: concept, elements to be considered an integrated approach
 - 5.5 Landuse capability and suitability classification for sustainable landuse.

LITERATURE RECOMMENDED :

1. Baldwin, J.H. 1985. Environmental Planning & Management. International Book Distributors. Dehradun, India.
2. Bandhu, D., Bongartz, H., Ghazuwani, A.C. & Gopal B. 1994. Environmental Education for sustainable development. Indian Environmental Society, New Delhi.
3. Cantar, L.W. (1977). Environmental Impact Assessment. Mc.Graw Hill, Pub., New York.
4. Rajora, R. (2002). Integrated Watershed Management. Rawat Publications, Jaipur & New Delhi.
5. Sapru, R.K. 1987. Env. Management in India, Ashish Publishing House, New Delhi.
6. Singh, S.S., 1989. Impact of tourism on mountain env.. Research India Publication, Meerut
7. Trivedi, P.R. & Raj, C., 1992. Env. Problems Impact Assessment. Akashdeep Pub. House, New Delhi
8. Trivedi, P.R. & Raj, C., 1992. Env. Biology, Akashdeep Pub. House, New Delhi
9. UNEP (United Nations: Env. Programme) 1980. Industry & Env. Series, Vol. 1.
10. United Nations 1994. Trends in Environmental Impact Assessment of Energy Projects.

Detailed Syllabus Semester - III

Course No. : PSESTC302

Title : Environmental Pollution

Credits : 4

Syllabus for the examinations to be held in Dec. 2014 ;Dec. 2015 & Dec. 2016

OBJECTIVES :

This course has been designed to introduce the students with various causes, problems and control of pollution. Pollution of this earth started with the development of intelligence in mankind. But in the modern times, due to population explosion and simultaneous urbanization and industrialization, new problems have plagued the humanity. Consequently, soil pollution, air pollution, noise pollution, radiation pollution, water pollution etc. have become very important.

UNIT- I : AIR POLLUTION

- 1.1. Sources and kinds of air pollution.
- 1.2. Air quality standards
- 1.3. Odour pollution
- 1.4. Indoor air pollution
- 1.5. Vehicular pollution & its control

UNIT- II : AIR AND NOISE POLLUTION

- 2.1 Common effects of air pollution on materials , human beings, animals & vegetation
- 2.2. Gaseous pollutants and their control
- 2.3. Particulate pollutants and their control
- 2.4. Air pollution & climate change : Acid rain, Ozone depletion & Global warming
- 2.5. Noise pollution : sources , effects and control

UNIT -III : LAND POLLUTION

- 3.1. Sources and control of Soil pollution
- 3.2. Sources and management of municipal solid waste
- 3.3. Sources and management of Biomedical waste
- 3.4. Sources and management of Hazardous waste
- 3.5. Sources and management of Industrial waste.

UNIT -IV : WATER POLLUTION I

- 4.1. Sources and kinds of water pollution.
- 4.2. Water quality standards
- 4.3. Effects of water pollutants on physico-chemical characteristics of water
- 4.4. Effects of water pollutants on plants : phytoplankton and macrophytes
- 4.5. Effects of water pollutants animals : zooplankton, macrobenthic invertebrates & fish

UNIT -V : WATER POLLUTION II

- 5.1 Sources and kinds of marine pollution
- 5.2. Effects and control of marine pollution
- 5.3. Sources, effects and control of thermal pollution
- 5.4. Eutrophication and restoration of lakes
- 5.5. Groundwater contamination and control

LITERATURE RECOMMENDED :

1. Bretsehnedder, B. & Kurfurst, J.(1987). Air Pollution. Elsevier Scientific Pub. Co. Amsterdam , Oxford, New York.
2. Bridgman, H. (1992). Global Air Pollution. CBS Pub. New Delhi.
3. Bush, M.B. (1997). Ecology of a changing planet. Prentice Hall, USA.
4. Dassber, H.S. & Bortitz, S. (1988). Air pollution & its influence on vegetation. Dr.W.Junk Pub. Dor drencht- Bostan Lancaster.
5. Davis, M.L. & Cornwell,D.A. (1991). Intro. Oto Environmental Engg. McGraw Hill International Edition.
6. Dhaliwal,G.S.; Sawgha,G.S.& Ralhan, P.K. (1996). Fundamentals of Environmental Science. Kalyani Pub., Ludhiana.
7. Edward,C.A.(1976).Environmental Poll. by Pestacades.Plenum Press,London &New York.
8. Kamboj, N.S. (1999). Control of Noise Pollution. Deep & Deep Pub. Pvt. Ltd., New Delhi.
- 9.Kudesia, V.P. (1990). Air pollution.Pragati Prakashan, Meerut - 250001.
10. Misra, S.C. And Mani, D. (1994). Agricultural Pollution.(Vol. I). Ashish Publishing House 8/81, Punjabi Bagh, N. Delhi - 110026.
11. Naji,G.K.;Dhillon, M.K.; Dhaliwal,G.S.(1999). Noise Poll..Commonwealth Pub., N.Delhi.
12. Odum,E.P. (1996). Fundamentals of Ecology. Natraj Pub. Dehradun.
13. Patrick, R. Dugan (1972). The Water pollution problems (Part-I). Plenium Pub. Corp. 227, West. 17th Street, New York - 110011.
14. Prasad, O & Choudhary, M.C. (1992). Environmental Pollution Radiation, Venus Publishing House 11/298 press Colony, Maya Puri, N. Delhi.
15. Rana, S.V.S. (2003). Essentials of Ecology & Environmental Sciences.Prentice Hall of India, New Delhi.
16. Rao, M.N. & Rao, H.U. (1998). Air Pollution. Tata McGraw Hill Pub. Company, New Delhi.

Detailed Syllabus Semester - III

Course No.: PSESTC303

Title : Environmental Analysis &
Instrumentation

Credits : 2

Syllabus for examination to be held in Dec. 2014 ;Dec. 2015 & Dec. 2016

OBJECTIVES :

The main object of this course is to acquaint student with number of instruments & related analytical methods that can be used for characterization of pollutants in the environment & quantification of observation.

UNIT - I AIR AND WATER ANALYSIS :

- 1.1. Sampling & Analysis of physico-chemical parameters of Air : SPM, NO₂, SO₂ & Relative humidity
- 1.2. Biological Parameters of Air : Bacteria & fungi (Standard plate Count).
- 1.3. Sampling & Analysis of physical parameters of water : movement, colour, temperature, annual heat budget, transparency, turbidity
- 1.4. Analysis of Chemical Parameters of water : COD, BOD, Total dissolved solid, Total suspended solid
- 1.5. Analysis of Chemical Parameters of water : Na, K, P, NO₃

NIT - II PHOTOMETRY : PRINCIPLE, OPERATION & APPLICATION OF

- 2.1. UV-VIS Spectrophotometer.
- 2.2. Infrared Spectrophotometer
- 2.3. Flame Photometer
- 2.4. Atomic Absorption Spectrophotometer.
- 2.5. Inductively Coupled Plasma Atomic Emission Spectrophotometer

UNIT -III CHROMATOGRAPHY :

- 3.1. Paper Chromatography- Principle, experimental procedures & application.
- 3.2. Thin Layer Chromatography- Principle, experimental procedures & application
- 3.3. High Pressure liquid Chromatography - Principle, instrumentation & application
- 3.4. Ion Chromatography – Principle, applications & experimental procedures
- 3.5. Gas Chromatography – Principle, Components & Applications

LITERATURE RECOMMENDED :

- Rajvaidya, N. & Markenday, D.K. : Environmental Analysis & Instrumentation (Vol.2)
A.P.H. Pub.Co.5, Ansari Road, DaryaGanj, N. Delhi.
- A.P.H.A. : Standard Methods for the examination of water &
wastewater, 20th ed.. Am. Pub. Hlth. Asso., Washington

Detailed Syllabus **Semester - III**

Course No. : PSESTC304

Title : Ecotoxicology

Credits : 2

Syllabus for examination to be held in **Dec. 2014 ;Dec. 2015 & Dec. 2016**

OBJECTIVES :

The aim of the present course is to acquaint the students with various aspects of environmental toxicology from molecular to ecosystem level so as to equip students to evolve best ways of dealing chemical pollution.

UNIT -I : CONCEPT, HISTORICAL BACKGROUND AND DEFINITIONS

- 1.1 Basic Concepts of Toxicology
- 1.2 Development of environmental toxicology - Historical and evolutionary perspective.
- 1.3 Toxicants and Toxicity - factors that effect toxicity.
- 1.4 Toxicity of chemical mixtures
- 1.5 Dose effect and response ; Dose-response relationships.

UNIT -II : ROUTES AND KINETICS OF TOXICANT UPTAKE

- 2.1 Toxicity testing - Testing for acute toxicity and chronic toxicity.
- 2.2 Toxicokinetics - Absorption, Distribution and elimination of toxicants.
- 2.3 Route of toxicant uptake - skin, lungs, GIT, gills, toxicant uptake in plants.
- 2.4 Biochemical effects of Mercury, Lead, Chromium, Cadmium, Arsenic and their relation to toxicity.
- 2.5 Biotransformation and bioaccumulation

UNIT -III :COMPLEX ISSUES

- 3.1. Antidotal procedure in toxicology.
- 3.2. Environmental Toxicology of metal mining and smelting
- 3.3. Biological indicator of toxicants.
- 3.4. Methodology of ecological reassessment and risk management.
- 3.5. Environmental toxicology of fertilizers.

LITERATURE RECOMMENDED :

1. Wright, D.A. & P.Welbwin (2002)-Environmental Toxicology, Cambridge Univ. Press, U.K.
- 2.Banerjee, S.K. (2010). Environmental Chemistry 2001. Prentice Hall of India Pvt. Ltd., New Delhi.
- 3.Satake, M.Y. Mido ; H. Ysuhisa, S.; Taguchi, M.S.; Sethi, S.A., Iqbal (1997). Environmental Toxicology, Discovery Pub. House, New Delhi.
- 4.De,A.K. (2003) Environmental Chemistry, New Age Int. Lts. N. Delhi.
- 5.Sood, A.(1999). Toxicology, Sampand Songs, N. Delhi.

Detailed Syllabus
Semester – III

Course No. : * PSESTE305

Title : Climate Change: Issues & Policies

Credits : 4

Syllabus for examination to be held in
Dec. 2014 ;Dec. 2015 & Dec. 2016

UNIT – I : UNDERSTANDING CLIMATE CHANGE

- 1.1 Introduction to the Climate System
- 1.2 Drivers of Climate system
- 1.3 Climate Change and Natural Variability
- 1.4 The Human Effects on Climate: Changes in Atmospheric Constituents and Radiative Forcing.
- 1.5 Learning from the Past.

UNIT – II CLIMATE CHANGE: VULNERABILITIES AND IMPACTS

- 2.1 Climate change impacts – reasons for concern
- 2.2 Global warming, Glaciers & sea levels, Extreme events, ozone hole, atmospheric brown clouds, biodiversity loss.
- 2.3 Vulnerabilities and impacts (Agriculture and forestry; water resources)
- 2.4 Climate Impacts on Society (Displacement and migration, Human settlement and Health)
- 2.5 Impact of climate change on marginalized sections.

UNIT – III RESPONSES TO CLIMATE CHANGE: ADAPTATION AND MITIGATION

- 3.1 Limiting climate change: Adaptation and Mitigation
- 3.2 Adaptation concepts and strategies
- 3.3 Renewable Energy Sources and Climate Change Mitigation
- 3.4 Costs and benefits of adaptation
- 3.5 Projections of future climate change

UNIT - IV POLICY FRAMEWORK ON ASPECTS OF CLIMATE CHANGE:

- 4.1 Governmental and Intergovernmental Actions to Combat Climate Change.
- 4.2 The Role of the IPCC on Climate Change
- 4.3 United Nations Framework Convention on Climate Change
- 4.4 The Kyoto Protocol to the Framework Convention.

- 4.5 The global carbon market (CDM, JI, IET). Ecological Footprints and Carbon Footprints.

UNIT – V CLIMATE CHANGE AND INDIA’S CONCERNS

- 5.1 Climate Change Impacts on Natural Resources.
5.2 Vulnerability of Coastal Belt in India towards climate Change.
5.3 Climate Change, Rural Livelihoods and Food Security in India.
5.4 India's Position on International Climate Negotiations.
5.5 India's National Action Plan on Climate Change.

LITERATURE RECOMMENDED :

- 1. The Politics of Climate Change and the Global Crisis: Mortgaging Our Future :**
Author: Praful Bidwai, Publisher: Orient BlackSwan.
- 2. Climate Change: Biological and Human Aspects:** Author: COWIE, Publisher: Cambridge University Press
- 3. Climate Change:** Author: Shelley Tanaka, Publisher: Greenwood Books
- 4. Climate Change:** By: K.R. Gupta (Author) | Publisher: Atlantic
- 6. Climate Change and Agriculture in India:** By: K. Palanisami (Author) , C. R. Ranganathan (Author) , Udaya Sekhar Nagothu (Author) , Krishna Reddy Kakumanu (Author) | Publisher: Routledge India
- 7. Global Climate Change and Sustainable Energy Development:** By: A.N. Sarkar (Author) , Anand Bhushan (Author) | Publisher: Pentagon Press
- 8. Climate Change:** By: Jonathan Cowie (Author) | Publisher: Cambridge Univ Pr |
- 9. Climate Change:** By: Oxford University Press (Author) , Barnaby Newbolt (Author) | Publisher: Oxford University Press, USA
- 10. Climate Change Effect in the Sundarbans:** By: Wagner Sven (Author) , Halder Nirmol Kumar (Author) | Publisher: Lap Lambert Academic Publishing
- 11. Climate change : the science, impacts and solutions / A. Barrie Pittock. Publisher: CSIRO PUBLISHING**

PSESPC302 Lab Course-II (Based on PSESTC303; PSESTC304)

1. To study the principle, construction and working of HPLC
2. To study the principle, construction and working of Ion Chromatograph
3. To study the principle, construction and working of AAS
4. To study the principle, construction and working of Flame Photometer.
5. To study the principle, construction and working of Single Beam Spectrophotometer
6. To study the principle, construction and working of Double Beam Spectrophotometer.
7. To study the principle, construction and working of high volume air sampler.
8. To determine the suspended particulate matter load in the ambient air.
9. To determine the indoor particulate matter using handy air sampler.
10. To analyse the amount of phosphate from given water sample.
11. To measure the SO₂ concentration in air.
12. To measure the NO₂ concentration in air.
13. Find out the minimum and maximum sound pressure level and Leq₁₀ in your classroom using sound level meter.
14. Study of various meteorological parameters (Air temp., humidity, rainfall, wind direction & speed)
15. Latitude, Longitude and Altitude of a Point
16. Preparation of analytical standard solutions using serial dilution method.
17. To determine major ion concentration in a given water sample using Ion Chromatograph.
18. Study the effect of penicillin on bacterial growth.
19. Study the effect of different concentrations of salt solution on Osmotic stress in onion.
20. From given data of %age mortality and calculate Leq₅₀.
21. From given toxicity data of chemical A & B calculate the Leq₅₀ of mixture to conclude additional or antagonistic effect.

PSESPC301 Lab Course-II (Based on PSESTC301; PSESTC302)

1. Calculate the stomatal index on the upper and lower surface of given leaf material.
2. Calculate the stomatal frequency on the upper and lower surface of given leaf material.
3. A field visit for the preliminary assessment of environmental impact of different developmental project.
4. Prepare a questionnaire to study the social impacts of developmental projects.
5. A field visit to assess various types of environmental hazards to workers working in different industrial units.
6. Different methods for the collection of municipal solid waste and its disposal in your community.
7. Determine the BOD of a water sample from a given water body.
8. To analyse the amount of sulphates from given water sample.
9. To analyse the amount of nitrates from given water sample.
10. To measure water transparency in a given water body using Secchi Disc.
11. Find out the total suspended solids (TSS) present in given water sample
12. Find out the total dissolved solids (TDS) present in given water sample
13. To find out the COD of the water sample by open reflux method.
14. To analyse the amount of silicates from given water sample.
15. To analyse the amount of phosphates from given water sample.

Detailed Syllabus Semester - IV

Course No. PSESTC401

Title: Environmental Law

Credits : 4

Syllabus for the examinations to be held in June,2015 ; June2016, and June 2017

OBJECTIVES :

The main objective of this course is to acquaint the students with elementary principles of environmental Laws to enable them to make proper & effective use of their professional abilities. Because the scientific gains can be put into use within the parameters of a legal system & the science & Law must be subservient to the needs of the society.

UNIT - I: INTRODUCTION TO ENVIRONMENTAL LAWS

- 1.1 Environmental Protection : Issues & Problems
- 1.2 Key International Efforts for Environmental protection
- 1.3 Sustainable Development : Essential features and Legal Implications
- 1.4 UN Framework Convention on Climate Change, 1992
- 1.5 Kyoto Protocol, 1997

UNIT - II : ENVIRONMENTAL PROTECTION AND THE LAW

- 2.1 Environment (Protection) Act, 1986 : Salient Features.
- 2.2 Powers of Central Government under EPA
- 2.3 Prevention , Control & abatement of environmental pollution under EPA
- 2.4 Hazardous wastes (Management, Handling and Transportation) Rules, 2008
- 2.5 Public Liability Insurance Act, 1991.
(Note : Only relevant provision of the above Acts)

UNIT - III : POLLUTION ABATEMENT AND THE LAW

- 3.1 Water ((Prevention & Control of Pollution) Act, 1974 : Salient Features
- 3.2 Powers and Functions of CPCB & SPCB under Water Act
- 3.3 Air (Prevention & Control of Pollution) Act, 1981.
- 3.4 Powers and Functions of CPCB & SPCB under Air Act
- 3.5 Noise pollution (Regulation and Control) Rules, 2000
(Note : Only relevant provisions of the above Acts)

UNIT - IV: NATURAL RESOURCE CONSERVATION AND THE LAW

- 4.1 Wildlife (Protection) Act , 1972 : Salient Features
- 4.2 Protected Areas and Trade & Commerce under WPA
- 4.3 National Forest Policy
- 4.4 Forest Conservation Act, 1986
- 4.5 Biological Diversity Act, 2002
(Note : Only relevant provisions of the above Acts)

UNIT - V : JUDICIAL ACTIVISM AND ENVIRONMENTAL PROTECTION

- 5.1 Indian Constitution and Environmental Protection
- 5.2 Judicial Response towards Environmental Protection
- 5.3 Public Nuisance under IPC (Sections 268,277,278,284, 290,291)
- 5.4 Sections 133-143 of Criminal Procedure Code, 1973.
- 5.5 Role of NGO's for the promotion and protection of Environment.

LITERATURE RECOMMENDED :

1. Diwan,P. (1997). Environmental Administration - Law & Judicial Attitude, Vol. I, II. Deep & Deep Pub. New Delhi.
2. Divan, S.and Roscencranj, A. (2001). Environmental Law & Policy in India. Oxford Pub. New Delhi.
3. Lal, S. (1990). Commentaries on Water, Air pollution & Environment (protection) Law. Law Pub. Pvt. Ltd. India.
4. Leelakrishnan, P. (1999) . Environmental Law in India. Butterworths Publications, N.Delhi.
5. Singh, G. (1995). Environmental Law : International & National Perspectives.

ARTICLES :

1. Jariwala, C.M. (2000). Complex Enviro-Technoscience Issues. 42 (1), Jr. Of Indian Law Institute. 29.
2. Jasrotia, A. (2002). Environmental Odyssey in India : People's response & judicial vigilance - An estimate. Punjab Univ. Law Review. 132-137.
3. Jasrotia, A. (2003). Global Environmental Law : Emerging concepts & dimensions. Kashmir Univ. Law Review. Vol. X. 171-190.
4. Jasrotia, A. (2003). Survival of the Earth : Vedic Profundity In S.C. Raina et.al. (Ed.) Law & Development : An anthology of topical legal studies. Regency Pub. New Delhi. 102-109.
5. Tiwari, G.S.(2001). Conservation of Biodiversity & Techniques of people's activism. 43(2). Jr. Of Indian Law Institute. 191.

Detailed Syllabus Semester – IV

Course No.: PSESTC402

Title : Disaster Management

Credit : 4

Syllabus for examination to be held in June,2015 ; June2016, and June 2017

OBJECTIVES :

Disasters are all pervading phenomena in human affairs. These disasters strike sudden, unexpected & are wide spread. Environmental degradation which is often a result of economic development & associated human settlement patterns that ignore appropriate resource management can increase a country's vulnerability to natural hazards & aggravate the impacts. This course is designed to familiarise the students with various concepts of disasters & their management which include causes & effects of disaster, types, predictability, preparedness, nature of damage caused & also disaster mitigation, pre & post disaster management. The course will upgrade the information, knowledge & skill of the students which in turn will enable them to act with confidence in pre & post disaster situations.

UNIT –I DISASTER INTRODUCTION AND MAN-MADE DISASTERS -I

- 1.1 Disasters: Meaning, difference between disaster and hazard, causal factors.
- 1.2. Disaster management cycle.
- 1.3 Man- Made Disasters, types, nature of man-made disasters, general effects, concerns for manmade disasters.
- 1.4 Biological disasters: meaning, types, vulnerability, effects, preparedness and mitigation.
- 1.5 Chemical Disasters: Causes and impacts, chemical disaster management, mitigation, preparedness and response

UNIT-II MAN-MADE DISASTERS - II

- 2.1 Nuclear disaster: causes, effects, management.
- 2.2 Fires-I: Characteristics of fires; Building, coal, and chemical fires; causes; safety and prevention, safety norms and disaster management..
- 2.3 Fires II: Forest fires, their types, causes, impacts, mitigation and control.
- 2.4 Desertification: Causes, general characteristics and effects & mitigation measures.
- 2.5 Transportation Accidents: types, causes , impacts and disaster management.

UNIT -III NATURAL DISASTERS- I

- 3.1 Natural disasters: introduction, meaning and nature, types of natural disasters, general effects.
- 3.2 Earthquake: General characteristics, vulnerability, causes, impacts related to earthquakes, prediction, warning and mitigation measures.
- 3.3 Volcanic eruptions: Nature and causes, volcanic hazard monitoring, mitigation.

- 3.4 Landslides: General characteristics, Causes, vulnerability, effects, prediction & warning, risk reduction mitigation measures.
- 3.5 Snow Avalanches: Avalanches formation and classification, hazard mitigation and management.

UNIT IV NATURAL DISASTERS- II

- 4.1 Cyclone: Formation, General characteristics, vulnerability, effects, Forecasting & warning, mitigation measures.
- 4.2 Floods: General characteristics, vulnerability Causes and impacts, forecasts & warning, Flood Plain zonation, mitigation measures.
- 4.3 Drought: Meaning, types, General characteristics, Causes and impacts, vulnerability, prediction & warning and mitigation measures.
- 4.4 Heat and Cold Waves: introduction causes and impacts, prevention and preparedness, Response.
- 4.5 Tsunami: General characteristics, causes, impacts and mitigation.

UNIT - V :

- 5.1 Disaster Response: Disaster response plans, Search, Rescue and evacuation, Community Health and Casualty Management and damage assessment.
- 5.2. Risk and Vulnerability assessment: Risk, Vulnerability, their concepts, elements at risk, Risk analysis techniques, vulnerability identification and factors associated with vulnerability.
- 5.3 Disaster preparedness: Concept and nature, Disaster preparedness plans, Role of Information, education, communication, & awareness.
- 5.4 Disaster mitigation: Concept, principles, mitigation approaches and strategies.
- 5.5 Recovery: Rehabilitation, its social and economic aspects, Housing to resist disasters, relocation, retrofitting, repairing and strengthening of houses.

LITERATURE RECOMMENDED :

1. Bryant, E.A. (1991). Natural Hazards, Cambridge University Press, Cambridge, New York.
2. Carter, W. nick (1992). Disaster Management : A Disaster manager's handbook. ADB Publication, Manila.
3. Cuny, F. (1983) Disasters and Development, Oxford University Press, England.
4. Cutter, Susan, L. (1999). Environmental Risks & Hazards. Prentice Hall of India Pvt. Ltd. N. Delhi
5. Green, S. (1980). International Disaster Relief towards a Responsive system: Mc.GrawHill Book Co. New York.
6. Gupta, H. (2003). Disaster Management, University Press, Hyderabad.
7. Prakash, I. (1995). Disaster Management, Rashtra Ghaziabad.
8. Sahini, P. & Ariabandu, M. N. (2003). Disaster Risk Reduction in South Asia. Prentice Hall of India Pvt. Ltd. New Delhi.
9. Sahni, P and Malalgoda, M. (2003). Disaster Risk Reduction in South Asia. Prentice-Hall of India, New Delhi.
10. Sinha, P.C. (1998). Encyclopaedia of Disaster Management series. Anmol Pub., New Delhi.
11. Smith, K. (1996) . Environmental Hazards, Assessing risk & Reducing disaster, London.

Detailed Syllabus Semester - IV

Course No. PSESTC403 Title : Basic course in Environmental Economics Credits :2

Syllabus for the examinations to be held in June,2015 ; June2016, and June 2017

OBJECTIVES:

The relationship between economic development and the environment requires many choices. Some basis for making rational choices is absolutely necessary for making any decision. The economic approach views the environment as a composite asset, supplying a variety of services to society . The intensity & composition of these services depend on the actions of humans as constrained by the physical laws. Economics has different means of enhancing the understanding of environmental & natural resource economics. These approaches are useful in describing the actions of the people and the impact of those actions on the environmental asset and provide guidance on how optimal service flows can be defined and achieved. This course has been designed with an objective to make the students with Environmental Sciences background aware about the causes and consequences of economic growth, role of natural resources and environmental control , in the growth process and better understanding about how choices are made in economic & political systems and how these choices affect, and are affected by the natural environment.

UNIT -1 : ENVIRONMENTAL ECONOMICS AND ENVIRONMENTAL VALUATION

- 1.1 Environmental economics : concept and scope
- 1.2 Market failure and Externalities : concept and an overview.
- 1.3 Environmental valuation : concept, need and methods
- 1.4 An introduction to Valuation methods : Hedonic property values and household production models.
- 1.5 Cost- Benefit Analysis for Environmental Assessment : An overview.

UNIT - 2 : ECONOMICS OF NATURAL RESOURCES MANAGEMENT AND SUSTAINABLE DEVELOPMENT

- 2.1 Economics of exhaustible natural resources.
- 2.2 Sustainable Development : Concept and indicators.
- 2.3 Environmental accounting for sustainable development
- 2.4 Environmentally corrected GDP- An introduction.
- 2.5 ISO - 14001 an outline.

UNIT - 3 : DEVELOPMENT AND ENVIRONMENT

- 3.1 Linkages between population, poverty and environment.
- 3.2 Common property resources & people's participation in their management.
- 3.3 Economic instruments for sustainable environmental management
- 3.4 Environmental Policy, its needs, National Env. Policy 2006
- 3.5 Clean development mechanism and carbon trading to combat Global Climate Change

LITERATURE RECOMMENDED :

1. Alan Gilpin (1999). Environmental Economics : A Critical Overview, John Wiley & Sons Ltd., New York.
2. Bromely, D.W. (Ed) (1995). Handbook of Environmental Economics. Blackwell, London.
3. Crones,R. And T. Sandler (1989). The Theory of Externalities and Public Goods. Cambridge Univ. Press, Cambridge.
4. ESCAP (1997). Accounting and Valuation of Environment - A Primer for Developing Countries, Vol.1. U. Nations, New York.
5. Fisher, A.C. (1981). Resource & Environmental Economics , Cambridge.
6. Hanley,Nick & Colin J.Roberts(2002).Issues in Environmental Economics.Blackwell Pub. Ltd.
7. Hussen, A.N.(1999). Principles of Environmental Economics , Rutledge, London.
8. Jeroen, C.J.M. (1999). Handbook of Environmental and Resource Economics, Edward, Elgar Pub. Ltd. , U.K.
9. Joshi,M.V. (2001). Theories & Approach of Environmental Economics. Atlantic Pub. & Distributors , New Delhi.
10. Kerr, J.M. (1997). Natural Resource Economics: Theory & Applications in India. Oxford and IBH Publications.
11. Kolstad, C.D. (1999). Environmental Economics, Oxford University Press, New Delhi.
12. Mitchell, R.C. & R.T.Carson (1993).Using Surveys to Value Public Goods:Resource for the Future, Washington, D.C.
13. Sankar, U. (Ed) (2001). Environmental Economics, Oxford University Press, New Delhi.
14. Sengupta, R.P. (2001). Ecology & Economics- An Approach to Sustainable Development Oxford University Press, New Delhi.
15. Smith,V. Kerry(1996). Estimating Economic Values for Nature : Methods for Non-market Valuation. Edward Elgar, U.K.

Detailed Syllabus Semester - IV

Course No. PSESTC404

Title : Environmental Biotechnology

Credit : 2

Syllabus for the examinations to be held in June,2015 ; June2016, and June 2017

OBJECTIVES:

The study of this course will help the students to protect the environment from pollution & to conserve natural resources because the rapid industrialization , urbanisation & other developments are constant threat to the clean environment & to the depleting natural resources. Moreover, the threats to the environment are also from release of genetically engineered organisms in the atmosphere & due to release of effluents from biotechnological companies. Thus, the study of course will help to develop cleaner & sustainable environment in future.

UNIT -I : INTRODUCTION & POLLUTION CONTROL

- 1.1 Definition, Historical background, scope & importance of biotechnology.
- 1.2 Biosorption - use of bacteria, fungi and algae in biosorption.
- 1.3 Bioabatement of metal pollution using higher and lower plants

- 1.4 Biodegradation of Pesticides
- 1.5 Microbial treatment of oil pollution.

UNIT -II : RECYCLING AND RECLAMATION

- 2.1 Conventional waste water treatment strategies using biosystem, Activated sludge process, Trickling filter, Rotating Biological contactor (RBC) and Fluidized Beds.
- 2.2 Role of Biotechnology in :
 - 2.2.1. Eenergy production from Biomass
 - 2.2.2. Fuel Alcohol production.
 - 2.2.3. Hydrogen production.
- 2.3 Biotechnology for restoration of degraded land
 - 2.3.1. Reforestation through micropropogation.
 - 2.3.2. Use of mycorrhizae in reforestation.
 - 2.3.3. Use of microbes in improving soil fertility.
- 2.4 Use of microbes as bioinsecticide
- 2.5 Use of microbes as biofungicide and bioherbicides.

UNIT -III : NOVEL METHODS FOR POLLUTION CONTROL

- 3.1 Biotechniques for Air pollution Abatement & odour control-Bioscrubbers, Biobeds, Biotrickling filters
- 3.2 Production of bio- fertilizers
- 3.3 Vermitechnology
- 3.4 Waste water treatment using aquatic plants
- 3.5 Biodegradable plastics - Bioplastics

LITERATURE RECOMMENDED :

1. Abbasi, S.A. & Ramasami,E. (1999). Biotechnological Methods of Pollution Control. Unviersities Press (India) Ltd., Hyderabad.
2. Chaterjii,A.K. (2002). Introduction to Environmental Biotechnology. Prentice Hall of India. Pvt. Ltd. N. Delhi.
3. Gupta, P.K. (1994).Elements of Biotechnology.Rastogi & Co. Meerut
4. Higgins et.al.(1984).Biotechnology-Fundamentals & Principles.Blackwell Publishers, London.
5. Jogdand, S.N.(1995). Environmental Biotechnology. Himalayan Publishing House, New Delhi
6. Mukherjee, R.N. (1992). Down stream processing in Biotechnology. Tata McGraw Hill Pub. Co.New Delhi.
7. Purohit,S.S. &Mathur,S.K.(1996).Biotechnology Fundamentals &Applications.Agro botanical Publication, New Delhi.
8. Sohal, H.S. & Srviastava,A.K. (1994).Environment & Biotechnology.Ashish Pub. House, New Delhi.

Detailed Syllabus
Semester - IV

Course No. *PSESTE405

Title: Man and Environment : Issues & Policies Credits:4

Syllabus for the examinations to be held in
June,2015 ; June2016, and June 2017

UNIT -I : ENVIRONMENTAL PROCESSES

- 1.1 Environment: concept and components, Characteristics of environment.
- 1.2 Evolution of environment, Origin and evolution of life
- 1.3 Population growth - biological growth curves and carrying capacity.
- 1.4 Population. Poverty, development and environmental linkages.
- 1.5 Environmental ethics : Social development and environment

UNIT -II : IMPACT OF HUMAN'S ON ENVIRONMENT - I

- 2.1 Human impact on biodiversity
- 2.2 Human degradation of water resources. Eutrophication - causes and control measures.
- 2.3 Human impact on air quality
- 2.4 Impact of Tourism on environment
- 2.4 Impact of development on Land resources.

UNIT -III : IMPACT OF HUMAN'S ON ENVIRONMENT -II

- 3.1 Radiation and Noise pollution
- 3.2 Thermal pollution, Oil Pollution
- 3.3 Electronic waste (E-waste)
- 3.4 Global climate change
- 3.5 Ozone depletion

UNIT -IV : ENVIRONMENTAL MOVEMENTS IN INDIA

- 4.1 Women and environment in India
- 4.2 Role of people in sustainable development
- 4.3 Movements related to environment sacred groves, Bishnoi tradition, Chipko movement
- 4.4 Tehri dam, Sardar Sarovar, Narmada dam, Almatti dam, Silent Valley movement
- 4.5 Supreme Court Cases – Ratlam Municipality, Ganga Action Plan, Taj Trapezium, Delhi CNG, Tamil Nadu Tanneries, Oleum gas case

UNIT -V : ENVIRONMENTAL POLICIES AND REGULATIONS

- 5.1 Stockholm Conference on Human Environment, 1972
- 5.2 Fundamental principles of environmental protection - sustainable development- Brundtland Report 1987.
- 5.3 Earth Summit at Rio de Janeiro, 1992; Kyoto Protocol, 1997
- 5.4 Role of International Environmental Agencies -UNEP, GEF, UNFCCC and IPCC
- 5.5 Environmental Laws in India

LITERATURE RECOMMENDED :

1. Renewable Energy – Environment and Development: M. Dayal; Konark Pub. Pvt. Ltd.
2. Alternative Energy: S. Vandana; APH Publishing Corporation
3. Air pollution – threat and response: D. A. Lynn
4. Air pollution and Environmental Protection – Legislative policies, Judicial trend and Social perceptions: N. Kumar; Mittal Publication
5. Chapman, J.L. And Reiss, M.J.(1995). Ecology- Principles and applications.
6. Odum, E.P. (1996). Fundamentals of Ecology. Natraj Publishers, Dehradun.
7. Baird, C (2000). Environmental Chemistry. W. H. Freeman and Company, USA.
8. Girard, J. E.(2005).Principals of Environmental Chemistry.Jones and Bartlett Publishers,
9. Sodhi,G.S.(2006).Fundamental concepts of environmental chemistry.Narosa Publishing House, New Delhi.
10. Brady, N.C. (1974).The nature & properties of soil McMillan & Co.
11. Dasmann,R.F.(1981). Wildlife Biology.2nd edition. John Wiley & Sons.New York
12. Gupta,K.C.(2002). Energy & Environment in India - A study of Energy Management. Gyan Publishing House, New Delhi.
13. Owen,O.S. & Chiras, D.D. (1995). Natural Resources Conservation. Prentice Hall India
14. VanLoon G.W. &Duffy S.J. (2010) Environmental Chemistry: A global perspective. Oxford University Press
15. [Flagan](#) R.C. & Seinfeld J.H.(2012) Fundamentals of Air Poll. Engineering Dover Pub.
16. Rao, M.N. & Rao, H.U. (1998). Air Pollution. Tata McGraw Hill Pub. Company, ND
17. Singh, G. (1995). Environmental Law : International & National Perspectives.
18. Leelakrishnan,P.(1999).Environmental Law in India. Butterworths Publications, N. Delhi
19. Divan, S.and Roscencranj, A. (2001). Environmental Law & Policy in India. Oxford Pub.