

1.3.1: Institution integrates crosscutting relevant to professional Ethics, Gender, Human values, Environmental and sustainability into the curriculum.

Department: Environmental studies (Co-ordinating dept. chemistry)

Name of the paper: Environmental science

SEMESTER II: ENVIRONMENTAL SCIENCE

Paper: ENV-AE-2014:

Credits: 4

60 Lectures

Unit 1: Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance; Concept of sustainability and sustainable development. (2 lectures)

Unit 2: Ecosystems

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems:

- a) Forest ecosystem
- b) Grassland ecosystem
- c) Desert ecosystem
- d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (6 lectures)

Unit 3: Natural Resources: Renewable and Non-renewable Resources

- Land resources and land use change; Land degradation, soil erosion and desertification
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
- Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies. (8 lectures)

Unit 4: Biodiversity and Conservation

- Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega – biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity: Habitat loss, poaching of wildlife, man –
 - Wildlife conflicts, biological invasions; Conservation of biodiversity: In situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value (8 lectures)

Unit 5: Environmental Pollution

- Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste.
- Pollution case studies. (8 lectures)

Unit 6: Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context. (7 lectures)

Unit 7: Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare.
 - Resettlement and rehabilitation of project affected persons; case studies.
 - Disaster management: floods, earthquake, cyclones and landslides.
 - Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.
 - Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
 - Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).
- (6 lectures)**

Unit 8: Field work

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted site--_Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems--_pond, river, Delhi Ridge, etc.

(Equal to 5 lectures)

References

1. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt
2. Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press
3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London,
4. Gleick, P. H. 1993. Water in Crisis: Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env Institute, Oxford Univ. Press
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams, Science, 339: 36-37
7. McCully, P. 1996. Rivers no more: the environmental effects of dams (pp. 29--64). Zed Books
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology, Philadelphia: Saunders
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science, Academic Press
11. Rao, M.N. & Datta, A.K. 1987. Waste Water Treatment: Oxford and IBH Publishing Co. Pvt. Ltd
12. Raven P.H., Hassenzahl, D.M. & Berg, L. R. 2012. Environment, 8th edition. John Wiley & Sons
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. Environmental law and policy in India. Tripathi 1992
14. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons
17. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent
18. Warren, C. E. 1971. Biology and Water Pollution Control: WB Saunders
19. Wilson, E. O. 2006. The Creation: An appeal to save life on earth. New York: Norton
20. World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press

Department: Anthropology

Name of the paper: Anthropology of religion, politics and economy.

ANT-HE-5026 Anthropology of Religion, Politics and Economy

Credit:6 (Theory: 4; Practical:2)

COURSE OBJECTIVE: To impart the knowledge of anthropological theories of religion, the economies and political institutions, along with their interrelationship.

COURSE OUTCOME:

- The knowledge on the anthropological theories of religion, economies and political institutions will be gained.
- The knowledge on the interrelationship between religion, economies and political institutions will be achieved.

Theory

UNIT I: Anthropological approaches to understand religion- magic, animism, animatism, totemism, naturism; witchcraft and sorcery; Religious specialists: shaman, priests, mystics; Overview of Anthropological Theories of Religion; Religion as the sacrality of ecological adaptation and socialness

Unit II: Economic institutions: principles of production, distribution, and consumption in simple and complex societies; critical examination of relationship between economy and society through neo-classical, substantivist, and neo-marxist approaches, various forms of exchange: barter, trade and market; Forms of currencies; reciprocities: generalized, balanced and negative.

Unit III: Political institutions: concepts of power and authority; types of authority; state and stateless societies; law and justice in simple and complex societies; the prospects for democracy and tolerance among and within the world's diverse civilizations; the meaning and sources of identity in complex contemporary societies; the origins of modern politics, its institutions, and cultures, both Western and non-Western

Unit IV: Interrelationship between religion, politics and economy; religious conversion and movements, emergence of new religious sects in the global order.

Practical

Case study of any of the social institute (religion, economic, political) with respect to culture perspective

Suggested Readings

1. Durkheim E. (1986). The elementary forms of the religious life, a study in religious sociology. New York:Macmillan.
2. Benedict A. (2006). Imagined Communities: Reflections on the Origin and Spread of Nationalism. Verso
3. Gledhill J. (2000). Power and Its Disguises: Anthropological Perspectives on Politics. 2nd ed. London: Pluto Press.
4. Ellis F. (2000). A framework for livelihood analysis. In Rural Livelihoods and Diversity in Developing Countries . Oxford: Oxford University Press.
5. Henrich J, Boyd R, Bowles S, Camerer C, Fehr E, Gintis H, McElreath R, Alvard M et al. (2005). 'Economic Man' in cross-cultural perspective: Behavioral experiments in 15 small-scale societies. Behavior and Brain Science. 28(6):795-815;
6. Henrich J. (2002). Decision-making, cultural transmission, and adaptation in economic anthropology. In: J. Ensminger (Ed.), Theory in Economic Anthropology (pp. 251-295). Walnut Creek, CA: Altamira Press.
7. Eller JD. (2007). Introducing Anthropology of Religion. New York: Routledge.
8. Glazier SD. (1997). Anthropology of Religion: A Handbook. Westport, CT: Greenwood Press.
9. Frick GD and Langer R. (2010). Transfer and Spaces. Harrassowitz (Germany).
10. Evans-Pritchard EE. (1937). Witchcraft, Oracles and Magic among the Azande, Oxford: Clarendon Press.
11. Frazer JG. (1978). The Illustrated Golden Bough, London: Macmillan.
12. Barbara M. (2011). Cultural Anthropology. New Jersey: Pearson Education.
13. Ember CR. (2011). Anthropology. New Delhi: Dorling Kindersley.
14. Herskovits MJ. (1952). Economic Anthropology: A Study in Comparative Economics. New York: Alfred A Knopf Inc.
15. Malinowski B. (1922) Argonauts of the Western Pacific. London: Routledge.

Name of the paper: Public health & epidemiology

ANT-SE-4014 : Public Health and Epidemiology

COURSE OBJECTIVE: To provide an understanding of the anthropological dimension of health.

COURSE OUTCOME:

The students will learn different aspects of health, diseases and principles of epidemiology

Unit I: Principles of Epidemiology in Public Health:

Overview of epidemiology methods used in research studies to address disease patterns in community and clinic-based populations, distribution and determinants of health-related states or events in specific populations, and strategies to control health problems

Unit II: Statistical Methods for Health Science

Analysis and interpretation of data including data cleaning, data file construction and management; implementation of analytic strategies appropriate for the type of data, study design and research hypothesis; parametric and nonparametric methods, measures of association, Linear and Logistic regression, Generalized Linear Modeling, and Survival analysis

Unit III: Environmental Health

Effects of biological, chemical, and physical agents in environment on health (water, air, food and land resources); ecological model of population health; current legal framework, policies, and practices associated with environmental health and intended to improve public health

Unit IV: Psychological, Behavioural, and Social Issues in Public Health

Cultural, social, behavioural, psychological and economic factors that influence health and illness; behavioural science theory and methods to understanding and resolving public health problems; assess knowledge, attitudes, behaviours towards disease and patient compliance to treatment.

Unit V: Management of Health Care Program and Service Organizations

Techniques and procedures for monitoring achievement of a program's objectives, generating evidence of program effectiveness, assessing impacts in public health settings; evaluate framework that leads to evidence-based decision-making in public health. Organizational principles and practices including organizational theory, managerial role, managing groups, work design, and organization design at primary, secondary, and tertiary levels of care

Unit VI: Epidemiology of disease

Contemporary methods for surveillance, assessment, prevention, and control of infectious and chronic diseases, disabilities, HIV/AIDS; understanding etiology; determining change in trend over time; implementation of control measures

Suggested reading

1. Gordis L. (2004). Epidemiology. Third edition. Philadelphia: Elsevier Saunders.
2. Remington PL, Brownson RC, and Wegner MV. (2010). Chronic Disease Epidemiology and Control. American Public Health Association.
3. Pagano M and Gauvreau K. (2000). Principles of Biostatistics. Belmont, CA: Wadsworth.
4. Turnock B. (2011). Public health. Jones & Bartlett Publishers.
5. Edberg M. (2013). Essentials of Health Behavior. Social and Behavioral Theory in Public Health. Second Edition, Jones and Bartlett Publishers.
6. Griffith JR and White KR. (2010). The Well-Managed Healthcare Organization. Health Administration Press: Chicago, IL.
7. Kovner AR, McAlearney AS, Neuhauser D. (2013). Health Services Management: Cases, Readings, and Commentary. 10th Ed. Chicago, IL: Health Administration Press.
8. Lee LM. (2010). Principles and Practice of Public Health Surveillance. Oxford University Press
9. Turnock B. (2011). Essentials of Public Health. Jones & Bartlett Publishers
10. Merson M, Black RE, Mills A. (2006). International Public Health: Diseases, Programs, Systems and Policies. Jones & Bartlett Learning.
11. Aschengrau A and Seage GR. (2008). Essentials of Epidemiology in Public Health. Boston, Massachusetts.

Name of the paper: Biological diversity in human populations

ANT-HC-3036
Biological Diversity in Human Populations
Credit 6 (Theory: 4; Practical: 2)

COURSE OBJECTIVE: Provide an understanding of how to assess human biological diversity.

COURSE OUTCOME:

- The students will learn about markers for understanding biological diversity.
- Classical markers use for classifying races.
- Classification of Indian population.

Theory

- Unit I:** Concept of Biological Variability, Sources of Genetic Variation, Interpretation of Human Variation, Genetic Polymorphism (Serological, Biochemical and DNA markers).
- Unit II:** i. Classical approaches of classifying human population: Racial groups of mankind and racial criteria.
ii. A critical appraisal of contribution of Risley, Guha, Rickstett and Sarkar towards understanding ethnic elements in the Indian populations.
- Unit III:** Pre and Proto historic racial elements in India. Linguistic classification of Indian population.
- Unit IV:** Genetic diversity among Indian Population.
Racial elements in NE India, with special reference to Assam
- Unit V:** Recent understanding of human biological categories in the context of human genome research.
- Unit VI:** Demographic Perspective
Demographic Anthropology; Sources of Demographic Data, Demographic Processes, Demographic profile of Indian populations and its growth structure.

Practical

1. Craniometric Measurements (Skull and Mandible)

Students should be trained for identifying landmarks on the skull, taking accurate measurements on at least 3 skulls by following standards techniques.

- | | |
|---------------------------------------------|----------------------------|
| I. Linear measurements: | |
| Maximum cranial length | Maximum cranial breadth |
| Maximum bizygomatic breadth | Maximum frontal breadth |
| Minimum frontal breadth | Nasal height |
| Nasal breadth | Bi-mastoid breadth |
| II. Angular measurements | |
| Greatest occipital breadth | Upper facial height |
| Bi-maxillary breadth | Outer bi-orbital breadth |
| Inner bi-orbital breadth | Greatest Occipital breadth |
| Glabella-inion length | Nasion-inion length |
| Nasion-basion length | Nasion-prosthion length |
| Frontal chord | Parietal chord |
| Occipital chord | |
| III. Curvilinear or arc measurements | |
| Frontal arc | Parietal arc |
| Occipital arc | sagittal cranial arc |
| Horizontal circumference of head | |
| Metopic angle | Facial profile angle |
| Nasal profile angle | Alveolar profile angle |

2. Collection of demographic data from primary or secondary sources.

Suggested readings:

1. Baker P.T. and J.S. Weiner (ed.) (1996) *The Biology of Human Adaptability*. Oxford & New York, Oxford University Press.
2. Bhende A. and T. Kantikar (2006) *Principles of Population Studies*. Himalayan Publishing House, Mumbai
3. Bogin B. (1999). *Pattern of Human Growth*. 2nd edition CUP.
4. Cameron Noel and Barry Bogin (2012) *Human Growth and development*. Second edition, Academic Press Elsevier.
5. Eckhardt R.B. (1979) *The Study of Human Evolution*. McGraw-Hill Book Company, USA.
6. Frisancho R. (1993) *Human Adaptation and Accommodation*. Univ. of Michigan press
7. Harrison G.A., Tanner, J.M., Pilbeam, D.R., Baker, P.T. (1988) *Human Biology*. Oxford University Press.
8. Jurnain Robert Lynn Kilgore Wenda Trevathan and Ciochon (2010). *Introduction to Physical Anthropology*. Wadsworth Publishing, USA.
9. Kapoor A.K. and Satwanti Kapoor (ed) (1995). *Biology of Highlanders*. Jammu, Vinod Publisher & Distributor.
10. Kapoor A.K. and Satwanti Kapoor (eds) (2004) *India's Elderly-A Multidisciplinary Dimension*. Mittal Publication, New Delhi.
11. Klepinger L.L. (2006). *Fundamentals of Forensic Anthropology*. John Wiley & Sons., New Jersey.
12. Malhotra K.C. and B. Balakrishnan (1996) *Human Population Genetics in India*
13. Malina Robert M., Claude. Bouchard, Oded. Bar-Or. (2004) *Growth, and Physical activity. Human Kinetics*.
14. Stanford C., Allen, S.J. and Anton, C.S. (2013): *Biological Anthropology*. 3rd edition, Pearson, USA.

Department: Botany

Name of the paper: Natural resource management

BOT-HE-5016**Natural Resource Management**

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

1.1 THEORY**Unit 1 : Natural resources**

Definition and types.

(2 lectures)**Unit 2 : Sustainable utilization**

Concept, approaches (economic, ecological and socio-cultural).

(8 lectures)**Unit 3 : Land**

Utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation and management.

(8 lectures)**Unit 4 : Water**

Fresh water (rivers, lakes, groundwater, aquifers, watershed); Marine; Estuarine; Wetlands; Threats and management strategies.

(8 lectures)**Unit 5 : Biological Resources**

Biodiversity-definition and types; Significance; Threats; Management strategies; Bio-prospecting; IPR; CBD; National Biodiversity Action Plan).

(10 lectures)**Unit 6 : Forests**

Definition, Cover and its significance (with special reference to India); Major and minor forest products; Depletion; Management.

(6 lectures)**Unit 7 : Energy**

Renewable and non-renewable sources of energy.

(6 lectures)

Unit 8 : Contemporary practices in resource management

(8 lectures)

EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting, Waste management.

Unit 9 : National and international efforts in resource management and conservation

(4 lectures)

1.2 PRACTICAL

1. Estimation of solid waste generated by a domestic system (biodegradable and non-biodegradable) and its impact on land degradation.
2. Collection of data on forest cover of specific area.
3. Measurement of dominance of woody species by DBH (diameter at breast height) method.
4. Calculation and analysis of ecological footprint.
5. Uses of GPS and GIS (Mapping of an area).

Suggested Readings

1. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi.
2. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.
3. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

Name of the paper: Bio-fertilizer

BOT-SE-3014

Biofertilizers

Total Lectures : 60 Credits : 4

Unit 1 : General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.

(8 lectures)

Unit 2 : *Azospirillum*: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication.

(16 lectures)

Unit 3 : Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

(8 lectures)

Unit 4 : Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

(16 lectures)

Unit 5 : Organic farming – Green manuring and organic fertilizers, Recycling of bio-degradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.

(12 lectures)

Suggested Readings

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad

Name of paper: Plant diversity and human welfare.

BOT-SE-5024

Plant Diversity and Human Welfare

Total Lectures : 60 Credits : 4

Unit 1: Plant diversity and its scope- Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agrobiodiversity and cultivated plant taxa, wild taxa. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.

(16 Lectures)

Unit 2: Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss, Management of Plant Biodiversity: Organizations associated with biodiversity management- Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations, Biodiversity information management and communication.

(16 Lectures)

Unit 3: Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, In situ and ex situ conservation, Social approaches to conservation, Biodiversity awareness programmes, Sustainable development.

(16 Lectures)

Unit 4: Role of plants in relation to Human Welfare; a) Importance of forestry their utilization and commercial aspects b) Avenue trees, c) Ornamental plants of India. d) Alcoholic beverages through ages. Fruits and nuts: Important fruit crops their commercial importance. Wood and its uses.

(12 Lectures)

Suggested Readings

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi

Department: Chemistry

Name of the paper: Green chemistry

CHE-HE-6016 : GREEN CHEMISTRY

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

***Course Objective:** The learners will be taught about the emerging discipline of green chemistry particularly to differentiate as to how the principles of green chemistry may be applied to organic synthesis.*

***Learning Outcome:** Apart from introducing learners to the principles of green chemistry, this course will make them conversant with applications of green chemistry to organic synthesis. Students will be prepared for taking up entry level jobs in the chemical industry. They also will have the option of studying further in the area.*

Introduction to Green Chemistry

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry.

(4 Lectures)

Principles of Green Chemistry and Designing a Chemical synthesis

Twelve principles of Green Chemistry with their explanations and examples; Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts; maximum incorporation of the materials used in the process into the final products (Atom Economy); prevention/ minimization of hazardous/ toxic products; designing safer chemicals – different basic approaches to do so; selection of appropriate auxiliary substances (solvents, separation agents), green solvents, solventless processes, immobilized solvents and ionic liquids; energy requirements for reactions - use of microwaves, ultrasonic energy; selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups; use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; designing of biodegradable products; prevention of chemical accidents; strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

(24 Lectures)

Examples of Green Synthesis/ Reactions

1. Green Synthesis of the following compounds: adipic acid, catechol, BHT, methyl methacrylate, urethane, citral, ibuprofen, paracetamol, furfural.
2. Microwave assisted reactions in water: Oxidation of toluene, alcohols. Microwave assisted reactions in organic solvents: Esterification, Fries rearrangement, Diels-Alder Reaction. Microwave assisted solid state reactions: Deacetylation, Deprotection. Saponification of esters, Alkylation of reactive methylene compounds, reductions, benzimidazoles.
3. Selective methylation of active methylene group using dimethylcarbonate: Solid-state polymerization of amorphous polymers using diphenylcarbonate; Use of “Clayan”, a nonmetallic oxidative reagent for various reactions; Free Radical Bromination; Role of Tellurium in organic syntheses; Biocatalysis in organic syntheses.

(24 Lectures)

Future Trends in Green Chemistry

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Solventless reactions; Green chemistry in sustainable development.

(8 Lectures)

Recommended Books:

1. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers (2005).
2. P.T. Anastas & J.K. Warner: Oxford Green Chemistry- Theory and Practical, University Press (1998).
3. A.S. Matlack: Introduction to Green Chemistry, Marcel Dekker (2001).
4. M.C. Cann & M.E. Connely: Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).
5. M.A. Ryan & M. Tinnesand, Introduction to Green Chemistry, American Chemical Society, Washington (2002).

LAB

60 Lectures

1. Safer starting materials

The Vitamin C clock reaction using Vitamin C tablets, tincture of iodine, hydrogen peroxide and liquid laundry starch.

- (i) Effect of concentration on clock reaction
- (ii) Effect of temperature on clock reaction.

2. Using renewable resources

Preparation of biodiesel from vegetable oil.

3. Avoiding waste

Principle of atom economy.

Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry.

Preparation of propene by two methods can be studied

(I) Triethylamine ion + $\text{OH}^- \rightarrow$ propene + trimethylpropene + water

(II) 1-propanol $\xrightarrow{\text{H}_2\text{SO}_4/\Delta}$ propene + water

The other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.

4. Use of enzymes as catalysts

Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide

Alternative Green solvents

5. Diels Alder reaction in water

Reaction between furan and maleic acid in water and at room temperature rather than in benzene and reflux.

6. Extraction of D-limonene from orange peel using liquid CO₂ prepared from dry ice.

7. Mechanochemical solvent free synthesis of azomethines

8. Co-crystal controlled solid state synthesis (C₂S₃) of N-organophthalimide using phthalic anhydride and 3-aminobenzoic acid.

Alternative sources of energy

9. Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).

10. Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

Recommended Books:

1. Anastas, P.T & Warner, J.C. *Green Chemistry: Theory and Practice*, Oxford University Press (1998).
2. Kirchoff, M. & Ryan, M.A. *Greener approaches to undergraduate chemistry experiment*. American Chemical Society, Washington DC (2002).
3. Ryan, M.A. *Introduction to Green Chemistry*, Tinnesand; (Ed), American Chemical Society, Washington DC (2002).
4. Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K. *Green Chemistry Experiment*.

Department: Economics

Name of the paper: Environmental economics

ECO-HE-6016: ENVIRONMENTAL ECONOMICS

Course Description

This course focuses on economic causes of environmental problems. In particular, economic principles are applied to environmental questions and their management through various economic institutions, economic incentives and other instruments and policies. Economic implications of environmental policy are also addressed as well as valuation of environmental quality, quantification of environmental damages, tools for evaluation of environmental projects such as cost-benefit analysis and environmental impact assessments. Selected topics on international environmental problems are also discussed.

Course Outline

1. Introduction

Basic concepts: Environment, Ecology, Economy and the ecosystem. Definition and scope of environmental economics, why study environmental economics. Interaction between the environment and the economy, environmental economics and ecological economics, environmental economics and resource economics. Review of microeconomics and welfare economics: the utility function, social choice mechanism, the compensation Principle and social welfare function (concepts only).

2. The Theory of Externalities

Pareto optimality or Pareto efficiency, Externalities: meaning and types of externality, market failure: meaning, market failure in the presence of externalities; market failure and public goods, is environment a public good? Property rights and the coase theorem.

3. The Design and Implementation of Environmental Policy

Environmental Policies: an overview; Nonmarket and market based instruments of Environmental Policy: command and control (CAC) approach, economic instruments like pigovian taxes and effluent fees, tradable permits and mixed instruments. Monitoring and Enforcement: What is monitoring and enforcement? Penalties, cost of abatement. Damages from pollution. Incentives to sources to comply with environmental regulations.

4. International Environmental Problems

Nature of environmental problems: transboundary pollution –Climate change, global warming, ozone depletion and bio-diversity loss; Trade and environment: pollution haven hypothesis.

5. Measuring the Benefits of Environmental Improvements

Non-Market values: use and non-use values and optional value, measurement methods: Direct method-contingent valuation and indirect method-hedonic pricing methods, value of statistical life; their applications and limitations.

6. Sustainable Development

Conventional development model: a critique, Alternative approach: Sustainable Development and its origin, objectives of Sustainable Development, Approaches to Sustainable Development: weak sustainability, strong sustainability, Safe minimum standard approach, ecological perspective and social perspective, Rules and indicators of Sustainable Development.

Readings:

1. Charles Kolstad, *Intermediate Environmental Economics*, Oxford University Press, 2nd edition, 2010.
2. Robert N. Stavins (ed.), *Economics of the Environment: Selected Readings*, W.W. Norton, 5th edition, 2005.
3. Roger Perman, Yue Ma, James McGilvray and Michael Common, *Natural Resource and Environmental Economics*, Pearson Education/Addison Wesley, 3rd edition, 2003.
4. Maureen L. Cropper and Wallace E. Oates, 1992, —Environmental Economics: A Survey, *Journal of Economic Literature*, Volume 30:675-740.
5. Subhashini Muthukrishnan, *Economics of Environment*, PHI Learning Private Limited, 2nd edition, 2015.
6. Bhattacharyya R, *Environmental Economics*, Oxford University Press.
7. Nick Hanley, Jason F. Shogren and Ben White, *Introduction to Environmental Economics*, Oxford University Press.
8. Gautam Purkayastha, *Environmental Economics: Theory ,Problems and Solutions*, Kalyani Publishers , Reprinted 2016

Name of the paper: Public finance

ECO-HE-5036: PUBLIC FINANCE

Course Description

This course is a non-technical overview of government finances with special reference to India. The course does not require any prior knowledge of economics. It will look into the efficiency and equity aspects of taxation of the centre, states and the local governments and the issues of fiscal federalism and decentralisation in India. The course will be useful for students aiming towards careers in the government sector, policy analysis, business and journalism.

Course Outline

Part 1: Theory

1. Normative Theory of Public Finance –Nature and Scope: Allocation Function, Distribution Function and Stabilization Function. Coordinating the functions.
2. Public Goods and their characteristics. Free Rider Problem and Market Failure, Externalities vis-à-vis Public Good.
3. Direct and Indirect Tax. Concepts of taxation: tax rate, buoyancy & elasticity of a tax. Proportional, Progressive and Regressive Taxation. Benefit Principle and Ability to Pay Theory.

Part 2: Issues from Indian Public Finance

4. Fiscal Policies: Definition and Objectives. Instruments of Fiscal Policy. Adopting Monetary Policy to complement Fiscal Policy: The Indian Experience.
5. Indian Tax System. Direct Taxes: Income Tax, Corporate Tax, Customs Duty etc. Reforms in the Indirect Tax Structure: Goods and Service Tax.
6. Structure of the Public Budget. Types of Deficits and their significance: Revenue Deficit, Fiscal Deficit and Primary Deficit
7. Fiscal Federalism in India: Principles of Fiscal Devolution, Horizontal and Vertical Fiscal Balance. Federal Finance and the Finance Commission.
8. State and Local Finances. The State Subjects and its Budget. Fiscal decentralization: Role of Municipalities and Gaon Panchayats.

Readings

1. Musgrave, R.A. and P.B. Musgrave, *Public Finance in Theory and Practice*, Mc-Graw Hill, 1989.
2. Mahesh Purohit , “Value Added Tax: Experience of India and Other Countries”, Gayatri Publications, 2007.
3. Kaushik Basu, and A. Maertens (ed.), *The Oxford Companion to Economics in India*, Oxford University Press, 2007.
4. M.M. Suri, *Government Budgeting in India*, Commonwealth Publishers, 1990.
5. Shankar Acharya, “Thirty years of tax reform” in India, *Economic and Political Weekly*, May 2005.
6. Government of India, *Report of the 13th Finance Commission*.
7. *Economic Survey*, Government of India (latest).
8. State Finances: A Study of Budgets, *Reserve Bank of India* (latest).

Department: Education

Name of the paper: Public speaking skill

EDU-SEC- 3014

PUBLIC SPEAKING SKILL

Total Marks-60 (External-30 Internal-30)

Credit – 4

Course Outcome:

After completing this course, students will be able to acquire the capacities of public speaking skill.

Course contents

a. Theory (2 Credits)

Units	Contents
Unit-1	Public Speaking and Communication Skill <ul style="list-style-type: none">• Meaning and Importance of Public Speaking• Components of Public Speaking: Illustration, Voice modulation, The Power of Pause, Visual Aids, Sense of humour, Articulation• Principles of Effective Public Speaking: Principle of Preciseness, Principle of Clarity, Principle of Completeness, Principle of Consciousness, Principle of Adaption• Ways of becoming Better Public Speaker• Concept and Nature of Communication• Types of Communication: Verbal and non-Verbal• Barriers of Communication• Ways of Effective Communication
Unit-2	Personality Development and Motivation as Means for Effective Public Speaking <ul style="list-style-type: none">• Concept and Nature of Personality• Types of Personality: Extrovert and Introvert• Role of Personality in Effective Communication• Concept of Balanced Personality• Meaning and Nature of Motivation• Ways or means of motivating audience

b. Practical (2 Credits)

Students shall prepare a write-up based on topic selected for speech.

Guidelines:

- The students will be trained on public speaking
- Teachers will give demonstrations on public speaking
- It will cover: Style of presentation, voice modulation, body language, communication with audience, eye contact
- Topics of speech will be selected by the students discussing with teachers.

Mode of Delivery:

Teachers should use lecture, demonstration and any other method as per required for explaining the contents for the students.

Evaluation Plan:

- For theory part, written examination will be conducted with 50 marks.
- Evaluation for practical examination (Public Speaking Skill+Write-up of the speech) will be done by an External Examiner.

Recommended Readings:

- Mangal, S. K. (2013). *Essentials of Educational Psychology*. Delhi: PHI Learning Private Limited.
- Manoharan, P. K. (2008). *Education and Personality Development*. New Delhi: APH Publishing Corporation.
- Morgan, Clifford T. (1993). *Introduction to Psychology*. New Delhi: Tata McGraw Hill Publishing Company Limited.
- Nikitina, Arina (2011). *Successful Public Speaking*. Arina Nikitina & bookboon.com

Name of the paper: Mental health and hygiene.

EDU-HE-6016
MENTAL HEALTH AND HYGIENE
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Acquaint with the fundamentals and development of mental health and the characteristics of a mentally healthy person.
- Understand the concept and importance of mental hygiene and its relationship with mental health.
- Acquire knowledge about the principles, factors promoting mental health and the role of home, school, and society in maintaining proper mental health.
- Learn the meaning and problem of adjustment and also the different adjustment mechanisms.
- Familiarise with the concept and issues of positive psychology, mental health of women, role of WHO and stress management.

Course Contents

Units	Content
Unit-1	Fundamentals of Mental Health <ul style="list-style-type: none">• Mental Health – Meaning and Definitions• Scope of Mental Health• Dimensions of Mental Health• Need and importance of Mental Health• Characteristics of a mentally healthy person• History of development of Mental Health
Unit-2	Mental Hygiene – Meaning and Definitions <ul style="list-style-type: none">• Mental Hygiene – Meaning and Definitions• Goals of Mental Hygiene• Functions of Mental Hygiene• Need and importance of Mental hygiene• Relationship between Mental health and hygiene
Unit-3	Education and Mental Health <ul style="list-style-type: none">• Principles of sound Mental Health• Factors affecting Mental Health• Mental Health Hazards• Mental Health of Students<ul style="list-style-type: none">-Role of Home-Role of School-Role of Society• Mental Health of Teachers
Unit-4	Preservation of Mental Health and Hygiene <ul style="list-style-type: none">• Positive Psychology – Meaning and Nature• Importance of Positive Psychology• Contribution of WHO on Mental Health• Stress management• Mental Health Care Act, 2017
Unit-5	Mental Health and Yoga <ul style="list-style-type: none">• Concept of Yoga• Importance of Yoga for Physical and Mental Health• Role of Yoga for Personality Development• Role of Yoga for management of Stress• Principles of Yoga for Healthy Living• Pranayama and Meditation for Promoting Mental Health

Recommended Readings:

- Baumgardner, S. And Crother, M. (2009). *Positive Psychology*. New Delhi: Pearson India Education Services Pvt. Ltd.
- Chauhan, S.S. (2007). *Advanced Educational Psychology*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Crow, L.D. and Crow, A. (1951). *Mental Hygiene*. New York: McGraw Hill
- Gururani, G.D. (2006). *Textbook on Mental Health and Hygiene*. New Delhi: Akansha Publishing House.
- Mangal, S.K. (1999). *Essentials of Educational Psychology*. New Delhi: PHI Learning Pvt. Ltd.
- Mangal, S.K. (2008). *Abnormal Psychology*. New Delhi: Sterling Publication
- Safaya, R.N., Shukla, C.S. and Bhatia, B.D. (2002). *Modern Educational Psychology*. Delhi: Dhanpat Rai Publishing Company.

Name of the paper: Women and society

EDU-HE-6046
WOMEN AND SOCIETY

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to

- Know the changing role of women in India
- Understand gender discrimination in Indian society
- Make the students understand the constitutional provisions for women and their rights.
- Make the students understand women empowerment
- Develop an awareness and sensitivity towards women

Units	Contents
Unit-1	Status and role of women <ul style="list-style-type: none">• Women in ancient and medieval India• Changing role of Women in India• Women's health and related issues• Role of women in family , school and society• Women's role in social and environmental movement
Unit-2	Constitutional provisions and Rights of women <ul style="list-style-type: none">• Constitutional Provision for equality of Women (Educational and Legal Provisions)• National Policy on Education (1986) on women education• National Council for Women Education• Property Right• National Policy for Empowerment of Women, 2001
Unit-3	Gender inequalities in School and society <ul style="list-style-type: none">• Family attitude• Gender bias in Textbook• Curricular Choices• Teachers' attitude• Classroom Interaction• Peer Culture• Gender inequality in workplace
Unit-4	Women Empowerment <ul style="list-style-type: none">• Concept of women empowerment, importance• Types of women empowerment- Economic, political, Educational , legal• Women entrepreneurship• Barriers of women empowerment• Role of education in women empowerment
Unit-5	The new roles of men and women and its Implications <ul style="list-style-type: none">• Changes in family patterns• Gender roles in transition• New gender roles• Factor influencing gender role• Women as peace builder• Gender sensitivity- new gender roles and its implications for family and society

Recommended Readings:

- Acker, S. (1987). *Feminist Theory and the Study of Gender and Education*. Jstor.
- Agarwal, N. (1993). *Women Education & Population in India*. Allahabad: Chugh Publications,
- Aggarwal J.C.(1976). *Indian Women: Education and Status*. New Delhi: Arya Book Depot.
- Bhatia , R. L. & Ahuja , B. N. (2006). *Modern Indian Education and it's Problems*. Delhi: Surjeet Publication.
- Bhatt B.D. & Sharma S.R. (1992). *Women's Education and Social Development*. Delhi: Kanishka Publishing House.
- Kaur I.(1983). *Status of Hindu Women in India*. Allahabad: Chugh Publications,
- Reddy, V. Govinda (2017). *Gender Perspectives in Peace Education*. Delhi: Manglam Publishers and Distributors.

Department: English

Name of the paper: History of English literature and forms

Paper 5: ENG-HC-3016 History of English Literature and Forms

Credits: 5 (Theory) +1 (Tutorial)

Marks: 80 (End-Semester Examination) + 20 (Internal Assessment)

This paper introduces students to the History of English Literature and the major literary forms. It adopts a chronological approach to the study of poetry, drama, fiction and non-fictional prose, showing the development of each form as it moves through the various periods of English literature and its expansion into global English writing. While authors have been named in some instances as representative of forms and periods, in other cases, especially in the 20th and 21st centuries, the expansion of the field has meant that individual authors are too numerous to name. Hence certain directions and areas of study have been indicated.

Questions in this paper should be linked to the manner in which the different Units have been structured with focus on forms and periods and the authors named used as examples. The sections on 20th and 21st century developments are too complex and widespread to have individual authors named – this may be read and evaluated in terms of a general picture and authors of choice.

Objectives: To prepare the ground for the detailed study of the literature featured in subsequent papers and give a strong historical sense of literary development.

Outcomes:

- Gain understanding of the contexts in which literary forms and individual texts emerge.
- Learn to analyze texts as representative of broad generic explorations.

Unit 1: Poetry from Chaucer to the Present:

- Chaucer and narrative poetry
- Spenser, Shakespeare, Milton (sonnet, sonnet sequences and the epic poem)
- John Donne and metaphysical poetry
- Dryden, Pope and the heroic couplet
- Romantic Poetry (lyric, sonnet, ode, pastoral, blank verse)
- Tennyson, Browning, Hopkins (from Victorian to Modern)
- Modern and postmodern Poetry and its international associations
- Walcott, Ramanujan and Postcolonial poetry

Unit 2: Drama from Everyman to the Present

- Miracles, Moralities and Interludes
- Marlowe and the University Wits
- Elizabethan Stage, Shakespeare and Jonson
- Jacobean Drama, Webster
- Restoration, Wycherley and Congreve
- Goldsmith, Sheridan and the sentimental drama
- The Irish drama
- Modern and postmodern Drama (England, Europe, America)
- Postcolonial drama (India, Africa, West Indies)

Unit 3: Fiction

- Narrative precursors
- The Eighteenth century novel (Defoe, Richardson, Fielding, Sterne)
- The Gothic novel (Walpole, Beckford, Radcliffe)
- Walter Scott and the historical novel
- The nineteenth century women novelists
- The Victorian novel (Dickens, Thackeray, Hardy)
- Modernism and the novel (Conrad, Lawrence, Virginia Woolf, James Joyce)
- Postmodernism and the Novel (England and America)
- Postcolonialism and the novel (South Asia and Africa)

Unit 4: Non Fictional Prose (Life Writing, Essays, Philosophical and Historical Prose, Satire)

- 16th century prose (John Foxe, Hooker, Hakluyt, Burton, Bacon)
- 17th and 18th century prose
 - Thomas Browne, Jeremy Taylor, Milton, Izaak Walton, Dryden)
 - Hobbes, Locke and Swift
 - Addison and Steele (the rise of the periodicals)
 - Berkeley, Hume, Gibbon
 - Johnson, Boswell, Burke
- 19th Century Prose (Essays, Criticism, Scientific Prose, Life Writing)
 - Lamb, Hazlitt, de Quincey,
 - Wollstonecraft, Godwin
 - Coleridge, Wordsworth,

- Darwin
- Carlyle, Ruskin, Pater, Arnold
- Lytton Strachey
- 20th and 21st century prose
- Literary Criticism and Theory
- Nationalist movements and polemical writing
- Letters, Autobiographies, Biographies
- Travel writing
- Journalistic prose (editorials, op-ed pieces, reports)

Recommended Books:

- B. Ifor Evans: *A Short History of English Literature* (available for purchase and on the internet archive)
- Andrew Sanders: *The Short Oxford History of English Literature* (1994)
- John Peck and Martin Coyle: *A Brief History of English Literature* (2002)
- Dinah Birch (Editor): *The Oxford Companion to English Literature* (7th edition, 2009)
- *The Norton Anthology of English Literature* (All volumes - for library) (10th edition, 2018)

Name of the paper: British Poetry and Drama: 17th and 18th Centuries

Paper 7: ENG-HC-3036 British Poetry and Drama: 17th and 18th Centuries

Credits: 5 (Theory) + 1 (Tutorial)

Marks: 80 (End-Semester Examination) + 20 (Internal Assessment)

This paper aims to familiarize the students with British literature in the 17th and 18th centuries, a time-period which sees the emergence and establishment of greatly diverse kinds of writings. The selected texts may encourage the students to look at the economic, political and social changes in (primarily) Britain during this period, such as the shifts from the Puritan Age to the Restoration and Neoclassical periods. The paper also seeks to familiarize the students with the larger contexts that generated such literatures as well as the possible impacts of the literature on society. The significance of the scientific revolution during this period may also be studied in relation to the literary productions.

Texts:

- John Milton: *Paradise Lost*: Book I
- John Webster: *The Duchess of Malfi*
- Aphra Behn: *The Rover*
- John Dryden: *Mac Flecknoe*
- Alexander Pope: *The Rape of the Lock*

Suggested Topics and Background Prose Readings for Class Presentations

Topics

- Religious and Secular thought in the 17th Century
- The Stage, the State and the Market
- The Mock-epic and Satire
- Women in the 17th Century
- The Comedy of Manners

Readings

- The Holy Bible, *Genesis*, chaps. 1–4, *The Gospel according to St. Luke*, chaps. 1–7 and 22–4.
- Niccolo Machiavelli, *The Prince*, ed. and tr. Robert M. Adams (New York: Norton, 1992) chaps. 15, 16, 18, and 25.
- Thomas Hobbes, selections from *The Leviathan*, pt. I (New York: Norton, 2006) chaps. 8, 11, and 13.
- John Dryden, 'A Discourse Concerning the Origin and Progress of Satire', in *The Norton Anthology of English Literature*, vol. 1, 9th edn, ed. Stephen Greenblatt (New York: Norton 2012) pp. 1767–8.

Name of the paper: Popular literature

Paper 1: ENG-HE-5016 Popular Literature

Credits: 5 (Theory) + 1 (Tutorial)

Marks: 80 (End-Semester Examination) + 20 (Internal Assessment)

Over the years popular literature has moved from the margins to earn for itself a fairly important place in the literary and critical consciousness. This paper seeks to highlight the nature of 'popular' literature as a genre and the critical ideas underpinning the theorization of popular literature. This will be done through a practical engagement with various texts falling under its ambit.

Texts:

- Lewis Carroll: *Alice in Wonderland*
- Agatha Christie: *The Murder of Roger Ackroyd*
- J. K. Rowling: *Harry Potter and the Philosopher's Stone*
- Durgabai Vyam and Subhash Vyam: *Bhimayana: Experiences of Untouchability/ Autobiographical Notes on Ambedkar* (For the Visually Challenged students)

Suggested Topics and Background Prose Readings for Class Presentations

Topics

- Coming of Age
- The Canonical and the Popular
- Caste, Gender and Identity
- Ethics and Education in Children's Literature
- Sense and Nonsense
- The Graphic Novel

Readings

- Sumathi Ramaswamy, 'Introduction', in *Beyond Appearances?: Visual Practices and Ideologies in Modern India* (Sage: Delhi, 2003) pp. xiii–xxix.
- Leslie Fiedler, 'Towards a Definition of Popular Literature', in *Super Culture: American Popular Culture and Europe*, ed. C.W.E. Bigsby (Ohio: Bowling Green University Press, 1975) pp. 29–38.
- Felicity Hughes, 'Children's Literature: Theory and Practice', *English Literary History*, vol. 45, 1978, pp. 542–61.

Name of the paper: Women's writing

Paper 12: ENG-HC-5026 Women's Writing

Credits: 5 (Theory) + 1 (Tutorial)

Marks: 80 (End-Semester Examination) + 20 (Internal Assessment)

This paper seeks to direct the students' attention to nineteenth and twentieth century writings by women living in different geographical and socio cultural settings. Students will get acquainted with the situationally distinct experiences of women articulated in a variety of genres-poetry, novels, short stories, and autobiography, while the selections from Mary Wollstonecraft-the only 18th century text prescribed, will acquaint students with the ideas contained in one of the earliest feminist treatises of the western world. Apart from an examination of the themes and styles in the prescribed texts, students will be required to engage themselves with the specificities of the contexts from which the texts emerged and also analyze the women writers' handling of the different genres to articulate their women-centric experiences.

Themes: Gender, sexual/textual politics, feminism, body, identity, class, location, voice, space, gender and narrative.

Texts:

- Mary Wollstonecraft: *A Vindication of the Rights of Woman* (New York: Norton, 1988) chap. 1, pp. 11–19; chap. 2, pp. 19–38.
- Rassundari Debi: Excerpts from *Amar Jiban* in Susie Tharu and K. Lalita, eds., *Women's Writing in India*, vol. 1 (New Delhi: OUP, 1989) pp. 191–2.
- Katherine Mansfield: 'Bliss'
- Sylvia Plath: 'Daddy'; 'Lady Lazarus'
- Alice Walker: *The Color Purple*
- Mahashweta Devi: 'Draupadi', tr. Gayatri Chakravorty Spivak (Calcutta: Seagull, 2002)
- Nirupama Bargohain: 'Celebration'
- Adrienne Rich: 'Orion'
- Eunice De Souza: 'Advice to Women'; 'Bequest'

Department: Geography

Name of the paper: Environmental geography and disaster management

Course Name: Environmental Geography and Disaster management

Paper Code: GGY - HC - 4016

Course objectives

- This paper is a core paper that intends to introduce students to geography and environment interface
- It seeks to develop new insights among students on the relevance of environmental studies from a spatial perspective.

Course outcomes

- The paper will be useful for students in developing ideas on environmental issues that geographers usually address
- The paper will be useful for students preparing for UGC NET/SLET exams and other competitive exams including the civil services.

Environmental Geography

1. Environmental Geography – Concept, Scope and Significance
2. Human-Environment Relationships – Historical Progression, Adaptation in different Biomes.
3. Eco-system: concept, types and components, structure and functions; Ecology– Concept and principles.
4. Major Global Environmental Problems: Pollution, Deforestation, Desertification, Global Warming, Bio-Depletion
5. Environmental Programmes and Policies – Global, National and Local

Reading List

1. Chandna R. C., 2002: *Environmental Geography*, Kalyani, Ludhiana.
2. Cunningham W. P. and Cunningham M. A., 2004: *Principals of Environmental Science: Inquiry and Applications*, Tata Macgraw Hill, New Delhi.
3. Goudie A., 2001: *The Nature of the Environment*, Blackwell, Oxford.
4. Singh, R.B. (Eds.) (2009) *Biogeography and Biodiversity*. Rawat Publication, Jaipur

5. Miller G. T., 2004: *Environmental Science: Working with the Earth*, Thomson BrooksCole, Singapore.
6. MoEF, 2006: *National Environmental Policy-2006*, Ministry of Environment and Forests, Government of India.
7. Singh, R.B. and Hietala, R. (Eds.) (2014) *Livelihood security in Northwestern Himalaya: Case studies from changing socio-economic environments in Himachal Pradesh, India*. Advances in Geographical and Environmental Studies, Springer
8. Odum, E. P. et al, 2005: *Fundamentals of Ecology*, Cengage Learning India.
9. Singh S., 1997: *Environmental Geography*, Prayag Pustak Bhawan, Allahabad.
10. UNEP, 2007: *Global Environment Outlook: GEO4: Environment For Development*, United Nations Environment Programme.
11. Singh, M., Singh, R.B. and Hassan, M.I. (Eds.) (2014) *Climate change and biodiversity: Proceedings of IGU Rohtak Conference, Volume 1*. Advances in Geographical and Environmental Studies, Springer
12. Singh, R.B. (1998) *Ecological Techniques and Approaches to Vulnerable Environment*, New Delhi, Oxford & IBH Pub..
13. Singh, Savindra 2001. *Paryavaran Bhugol*, Prayag Pustak Bhawan, Allahabad. (in Hindi)

Name of the paper: Climate Change, Vulnerability and Adaptation

Course Name: Climate Change: Vulnerability and Adaptation

Paper Code: GGY-HE-5016

Credit: 6

Total Marks 100

(Theory: 60, Practical: 20 and Internal Assessment: 20)

Course objectives

- To make the students understand that climate change is a continuous process in both global and regional environments.
- To impart information and knowledge about the impacts of climate change and the different modes of human adaptation to climate change.
- To educate the students that climate change is a global issue and its management needs global concern and co-operation.

Course outcomes

- The students will acquire knowledge and skill to detect the noticeable impacts of climate change in their vicinity.
- (ii) The students may join various govt. and non-govt. agencies dealing with climate change study and mitigation.
- (iii) The students will be able to know the extent to which the people and their economic activities are vulnerable to climatic changes and may suggest some adaptation strategies to the affected people, especially in the agricultural sector.

Climate Change: Vulnerability and Adaptation

1. Science of Climate Change: Understanding Climate Change; Green House Gases and Global Warming; Global Climatic Assessment- IPCC
2. Climate Change and Vulnerability: Physical Vulnerability; Economic Vulnerability; Social Vulnerability
3. Impact of Climate Change: Agriculture and Water; Flora and Fauna; Human Health
4. Adaptation and Mitigation: Global Initiatives with Particular Reference to South Asia.
5. National Action Plan on Climate Change; Local Institutions (Urban Local Bodies, Panchayats)

Name of the paper: Geography of Resources and Development

CBCS-based U.G. Course in Geography, 2019
Syllabus of Core Course

Course Name: Geography of Resources and Development
Paper Code: GGY - HC - 6026

Course objectives

This theory course basically deals with concept of resource and its classification, and the distribution, utilization and management of land, water, forest and energy resources. It also focuses on the natural resource base of North-East India and its problems of conservation and management. Besides, it also provides basic idea about sustainable development of resources.

Course outcomes

- Understanding the basic concept of resource and its various types and their utilities
- Acquiring basic information about potentials and management of resources like land, water, forest and power in global context.
- Understanding the prevailing natural resource potential of North-East India and problems of management.

Resource Geography

1. Natural Resource: Concept and Classification
2. Distribution, Utilisation, Problems and Management of Land Resources and Water Resources
3. Distribution, Utilisation, Problems and Management of Forests and Energy Resources
4. Appraisal and Conservation of Natural Resources in North-East India
5. Sustainable Resource Development

Reading List

1. Cutter S. N., Renwick H. L. and Renwick W., 1991: *Exploitation, Conservation, Preservation: A Geographical Perspective on Natural Resources Use*, John Wiley and Sons, New York.
2. Gadgil M. and Guha R., 2005: *The Use and Abuse of Nature: Incorporating This Fissured Land: An Ecological History of India and Ecology and Equity*, Oxford University Press, USA.
3. Holechek J. L. C., Richard A., Fisher J. T. and Valdez R., 2003: *Natural Resources: Ecology, Economics and Policy*, Prentice Hall, New Jersey.
4. Jones G. and Hollier G., 1997: *Resources, Society and Environmental Management*, Paul Chapman, London.
5. Klee G., 1991: *Conservation of Natural Resources*, Prentice Hall, Englewood.
6. Mather A. S. and Chapman K., 1995: *Environmental Resources*, John Wiley and Sons, New York.
7. Mitchell B., 1997: *Resource and Environmental Management*, Longman Harlow, England.
8. Owen S. and Owen P. L., 1991: *Environment, Resources and Conservation*, Cambridge University Press, New York.
9. Rees J., 1990: *Natural Resources: Allocation, Economics and Policy*, Routledge, London.

Department: History

Name of the paper: Historical Tourism in North East India

HIS –SE-3014: Historical Tourism in North East India

Lecture : 03; Tutorial : 01 (per week)

Course Outcome:

After completing this course, students will be able to explain Tourism in North East India with special reference to the historical monuments, cultural and ecological elements and places of the north east India country as tourist and heritage sites of the nation. They will be able to relate to the growing vocation of tourism as an industry and the applicability of historical knowledge for its growth.

In-semester assessment: Students shall carry out a small project (submission not less than 2000 words) based on survey of an area or monument. The project should try to unearth the tourism potential of the surveyed area or monument. The project may also be on an existing tourist site. No sessional examination is required for this paper.

Unit I : Theoretical aspects of tourism, Elementary geography and bio – diversity of North East India

- [a] : Tourism – Concept, meaning and significance
- [b] : Different types of Tourism
- [c] : Physiographical divisions, water bodies and climatic conditions
- [d] : Important wildlife habitats : Kaziranga, Manas, Orang, Nameri, Dibru Saikhowa, Namdapha, Keibul Lamjao, Rain forests of Assam.

Unit II : Ancient remains and Important tourist places of the North – East India

- [a] : Ancient remains: Goalpara, Ambari, Tezpur, Deopahar, Malinithan, Doyang– Dhansiri Valley
- [b] : Tourist places: Shillong, Cherapunjee, Aizwal, Gangtok, Kohima, Tawang, Poa Mecca (Hajo), Azan Pir Dargah, Jatinga

Unit III : Architectural Heritage

- [a] : Dimapur, Kasomari, Maibong, Khaspur
- [b] : Charaideo, Garhgaon, Sivasagar and Rangpur
- [c] : Ujayanta palace, NeerMahal
- [d] : Kamakhya, HayagrivaMadhava, Tripura Sundari Temple, Rumtek monastery
- [e] : Kangla fort

Unit IV : Fairs and festivals of the North – East

- [a] : Festivals - Bihu, Ali Aye Lrigang, Mopin festival, Tai – Buddhist festivals in Assam
- [b] : Bhaona, Ras celebration in Majuli
- [c] : Fairs – Jonbil Mela, Ambubachi fair at Kamakhya
- [d] : Tourist festivals based on ethnic culture – Horn Bill festival, Sangai festival, Dihing Patkai festival

Readings :

- Bezbaruah, M : *Tourism in North East India*
Bora, S., & Bora, M.C., : *The Story of Tourism : An Enchanting Journey through India's North – East*, UBSPD, Delhi, 2004.
: *Paryatanar Ruprekha: Uttar PurbanchalarItihasAruSanskritirPatabhumi*
Bhatia, A. K. : *International Tourism – Fundamentals and Practices*, New Delhi, 1997
: *Tourism in India*
Nath, R.M. : *The Background of Assamese Culture*, Guwahati, 1978
Sarma, P. : *Architecture of Assam*, Delhi - 1988
Ahmed, Kamaluddin: *The Art and Architecture of Assam*, Spectrum Publication, Guwahati, 1994.
Bhattacharya, P. : *Tourism in Assam*, BaniMandir, Guwahati, 2004
Neog, M. : *Pavitra Asom*, LBS, Guwahati
: *Asamiya Sanskritir Ruprekha*, Guwahati - 1970
Boruah, P. : *Chitra-Bichitra Asom*, Guwahati, 2003
Taher&Ahmed : *Geography of North East India*, Mani Manik Prakash, Guwahati, 2010.
Gogoi, Atanu : *Paryatan Aru Uttar Purbanchal*, Bani Mandir, Guwahati, 2006

Name of the paper: Social and economic history of Assam.

HIS –RC-4016 : SOCIAL AND ECONOMIC HISTORY OF ASSAM

Lectures : 5; Tutorial : 1 (per week)

Course Outcome: Upon completion of this course, students will be able to analyse and explain the socio-economic history of Assam including among others the development of caste system, religious beliefs, agriculture and land system, the social organization, trade and commerce, various agricultural regulations, plantation economy, development of modern industries, transport system, education, the emergence of middle class, development of literature and press, and growth of public associations.

Unit I: Society and Economy in Early Assam

- [a] Proto-history Archaeology, land grants, *Agrahara*
- [b] Aryanisation debate
- [c] Rural life
- [d] Urban centres
- [e] Beliefs and practices

Unit II: Society in Medieval Assam

- [a] Social Organisation– Caste-Class Relationship, Nobility, *Paiks*, Slaves and Servants
- [b] Neo-Vaishnavite Movement in Assam – Impact on Society
- [c] Development of *Satra* Institutions

Unit III: Economy in Medieval Assam

- [a] Agriculture and Land System – Classification and Ownership of Land
- [b] Land Revenue and other Taxes
- [c] Trade and Commerce – Export and Import, Trade routes
- [d] Medium of Trade
- [e] Economic Relation between the Hills and the Valley : the *Pasa* system.

Unit IV: Economy in Colonial Assam

- [a] Agriculture Regulations and revenue system
- [b] Plantation Economy of the Tea Industry
- [c] Development of Modern Industries-Coal and Oil.
- [d] Development of Transport System

Unit V :Society in Colonial Assam

- [a] Growth of Modern Education and the role of Christian Missionaries.
- [b] Language Controversy in 19th century Assam
- [c] Emergence of Middle Class
- [d] Literary and Cultural Development, Impact of the Bengal Renaissance.
- [e] Development of Press and Growth of Public Associations – The Assam Sahitya Sabha.

Readings:

- Barpujari, H.K.: (ed) :*The Comprehensive History of Assam*, Vol. I, III, IV & V.
Barua B.K. :*A Cultural History of Assam*
Baruah, S.L. :*A Comprehensive History of Assam*, Munshiram Manoharlal Publishers Pvt. Ltd., New Delhi, 1985
Gogoi Nath, Jahnabi :*Agrarian System of Medieval Assam*, New Delhi-2002
Guha, Amalendu :*Planters Raj to Swaraj: Freedom Struggle and Electoral Politics in Assam 1826-1947*
Choudhury, P.C. :*History of Civilization of the People of Assam to the Twelfth Century A.D.*
Gait, E.A. :*A History of Assam*.
Guha, Amalendu :*Medieval and Early Colonial Assam*.
Medhi, S. B :*Transport System and Economic Development in Assam*, Publication Board, Assam.
Mahanta, P.K., *Asomiya Madhyabritya Srenir Itihas*
Nath, D :*Religion and Society in North East India*, DVS, Guwahati, 2011
Rhodes, N. and Bose, S.K. :*The Coinage of Assam, Vol. I, Pre-Ahom Period, Vol. II, Ahom Period*
Saikia, Rajen :*Social and Economic History of Assam (1853- 1921)*.
Sarma, S.N. :*Socio Economic and Cultural History of Medieval Assam*, Guwahati, 1989
Sharma, Monorama :*Social and Economic Change in Assam: Middle Class Hegemony*

Department: Political Science

Name of the paper: Public Opinion and Survey Research

POL SE 5014 Public Opinion and Survey Research

Course Objective: this course will introduce the students to the debates, principles and practices of public opinion polling in the context of democracies, with special reference to India. It will familiarize the students with how to conceptualize and measure public opinion using quantitative methods, with particular attention being paid to developing basic skills pertaining to the collection, analysis and utilization of quantitative data.

I. Introduction to the course (6 lectures)

Definition and characteristics of public opinion, conceptions and characteristics, debates about its role in a democratic political system, uses for opinion poll

II. Measuring Public Opinion with Surveys: Representation and sampling (7 lectures)

- a. Sampling: Meaning and needs
- b. Sampling error
- c. Types of sampling: Non random sampling; random sampling

III. Survey Research (3 lectures)

- a. Interviewing: Interview techniques pitfalls, different types of and forms of interview
- b. Questionnaire: Question wording; fairness and clarity.

IV. Quantitative Data Analysis (4 lectures)

- a. Quantitative data analysis: Meaning
- b. Basic concepts: correlational research, causation and prediction

Modalities for Practical Component: Field Study Report based on any issue i.e. environmental issue / socio-economic-political issues of the locality using the method of survey research etc.

READING LIST

UNIT I: Introduction to the course

R. Erikson and K. Tedin, (2011) *American Public Opinion*, 8th edition, New York: Pearson Longman Publishers, pp. 40-46.
G. Gallup, (1948) *A guide to public opinion polls* Princeton, Princeton University Press, 1948. Pp. 3-13.

UNIT II: Measuring Public Opinion with Surveys: Representation and sampling

G. Kalton, (1983) *Introduction to Survey Sampling* Beverly Hills, Sage Publication.
Lokniti Team (2009) 'National Election Study 2009: A Methodological Note', *Economic and Political Weekly*, Vol. XLIV (39)
Lokniti Team, (2004) 'National Election Study 2004', *Economic and Political Weekly*, Vol. XXXIX (51).
'Asking About Numbers: Why and How', *Political Analysis* (2013), Vol. 21(1): 48-69, (first published online November 21, 2012)

UNIT III: Survey Research

H. Asher, (2001) 'Chapters 3 and 5', in *Polling and the Public: What Every Citizen Should Know*, Washington DC: Congressional Quarterly Press.
R. Erikson and K. Tedin, (2011) *American Public Opinion*, 8th edition, New York, Pearson Longman Publishers, pp. 40-46.

UNIT IV: Quantitative Data Analysis

A. Agresti and B. Finlay, (2009) *Statistical methods for the Social Sciences*, 4th edition, Upper saddle river, NJ: Pearson-Prentice Hall.
S. Kumar and P. Rai, (2013) 'Chapter I', in *Measuring Voting Behaviour in India*, New Delhi: Sage.

Name of the paper: Conflict and peace building

POL SE 6014 Conflict and Peace Building

Course Objectives: This course is designed to help build an understanding of a variety of conflict situations among students in a way that they can relate to them through their lived experiences. It's an interdisciplinary course that draws its insights from various branches of social sciences and seeks to provide a lively learning environment for teaching and training students how to bring about political and social transformations at the local, national and international levels. The course encourages the use of new information technologies and innovative ways of understanding these issues by teaching students skills of managing and resolving conflicts and building peace through techniques such as role-play, simulations, street theatre, cinema and music on the one hand and by undertaking field visits, interacting with different segments of the civil society including those affected by conflicts as well as diplomats, journalists and experts, on the other.

I. Conflict and its concepts (6 lectures)

- a. Understanding Conflict
- b. Conflict Resolution and Peace Building

II. Dimensions of Conflict (6 lectures)

- a. Economic/Resource Sharing Conflicts
- b. Socio-Cultural Conflicts (Ethnic, Religious and Gender Based)

III. Conflict Responses: Skills and Techniques I (8 lectures)

- a. Negotiations: Trust Building
- b. Mediation: Skill Building: Active Listening

IV. Conflict Responses: Skills and Techniques II (10 lectures)

- a. Track I, Track II & Multi Track Diplomacy

Modalities for Practical Component: Project Report/Field Study Report on any issues i.e. ethnic/religious/gender based conflict issues, awareness campaign on sustaining peace etc.

Name of the paper: Human rights

POL HE 5016 Human Rights

Course Outcomes:

- To describe the basic concepts of human rights
- To comprehend different approaches regarding human rights
- To familiarise the role of UNO in the growth and development of human rights
- To describe different measures taken for the protection of human rights

Unit I: Introduction to Human Rights (14 lectures)

- Concept of Human Rights – meaning, nature, importance
- Growth and evolution of Human Rights
- Classification- three generation of Human Rights

Unit II: Approaches and perspectives (13 lectures)

- Universal Approach
- Cultural Relativist Approach
- Marxian Perspective

Unit III: Human Rights and UNO (16 lectures)

- International Bill of Rights – UDHR, ICCPR, ICESCR, Optional Protocols
- Conventions Convention on Elimination of All Forms of Discrimination Against Women, Convention on Rights of the Child
- Human Rights Council

Unit IV: Human rights and the role of NGOs (12 lectures)

- Amnesty International
- Human Rights Watch
- International Committee of the Red Cross

Name of the paper: Youth and nation buildings

POL SE 3024 Youth and Nation-Building

Course objectives:

The aim of this course is to highlight the importance of NCC and NSS. The students will be able to get involved with the NCC and the NSS and learn about its activities and undertake tasks under its aegis. The students will also be able to learn about the basics of disaster preparedness and its management.

Course Outcomes:

- To enable students to learn the importance of youth in NSS and NCC,
- To make students understand the activities related to NSS and NCC and its importance,
- To make students learn the basics of National Disaster Management and its importance.

Unit –I: Youth and National Service Scheme (NSS) (16 lectures)

- NSS: Organisation and Objectives
- NSS: Activities and Benefits
- NSS and its contribution

Unit-II: Youth and the National Cadet Corps (NCC) (16 lectures)

- Aims and objectives of the NCC
- Organisation and Training
- NCC and its benefits

Unit-III: Youth and National Disaster Management (16 lectures)

- Disaster Management Plan 2016-an overview
- National Disaster Management Authority
- Community involvement and preparedness: Assam

Modalities for Practical Component: Project Report/Field Study Report based on any activity i.e. awareness programme/campaign, group discussion, disaster management programme in collaboration with NCC and NSS unit etc.

READING LIST

Unit –I:

- NATIONAL SERVICE SCHEME MANUAL (REVISED), available at http://nss.wbut.ac.in/documents/NSS_manual_2006.pdf

Unit-II:

- ANO Handbook, NCC, Available at https://docs.google.com/viewerng/viewer?url=http://nccindia.nic.in/sites/default/files/ANO+Hand+Book_1.pdf

Unit-III:

- National Policy on Disaster Management, available at <https://ndma.gov.in/images/guidelines/national-dm-policy2009.pdf>
- National Disaster Management Plan
- Assam State Disaster Management Authority, <http://sdmassam.nic.in/ini2.html>

Department: Zoology

Name of the paper: parasitology

THEORY

(CREDITS 4)

Unit I: Introduction to Parasitology

3

Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector) Host parasite relationship

Unit II: Parasitic Protists

15

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Entamoeba histolytica*, *Giardia intestinalis*, *Trypanosoma magambiense*, *Leishmania donovani*, *Plasmodium vivax*

Unit III: Parasitic Platyhelminthes 15

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Fasciolopsis buski*, *Schistosoma haematobium*, *Taenia solium* and *Hymenolepis nana*

Unit IV: Parasitic Nematodes 15

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Wuchereria bancrofti* and *Trichinella spiralis*. Study of structure, life cycle and importance of *Meloidogyne* (root knot nematode), *Pratylenchus* (lesion nematode)

Unit IV: Parasitic Arthropoda 10

Biology, importance and control of ticks, mites, *Pediculus humanus* (head and body louse), *Xenopsylla cheopis* and *Cimex lectularius*

Unit V: Parasitic Vertebrates 2

A brief account of parasitic vertebrates; Cookcuter Shark, Candiru, Hood Mockingbird and Vampire bat

PRACTICAL (Credits 2)

□ Study of life stages of *Entamoeba histolytica*, *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani* and *Plasmodium vivax* through permanent slides/microphotographs

□ Study of adult and life stages of *Fasciolopsis buski*, *Schistosoma haematobium*, *Taenia solium* and *Hymenolepis nana* through permanent slides/microphotographs

□ Study of adult and life stages of *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Wuchereria bancrofti* and *Trichinella spiralis* through permanent slides/microphotographs

□ Study of plant parasitic root knot nematode, *Meloidogyne* from the soil sample

□ Study of *Pediculus humanus* (Head louse and Body louse), *Xenopsylla cheopis* and *Cimex lectularius* through permanent slides/photographs

□ Study of monogenea from the gills of fresh/marine fish [Gills can be procured from fish market as by product of the industry]

□ Study of nematode/cestode parasites from the intestines of Poultry bird [Intestine can be procured from poultry/market as a byproduct]

Submission of a brief report on parasitic

vertebrates SUGGESTED READINGS

□ Arora, D. R and Arora, B. (2001) *Medical Parasitology*. II Edition. CBS Publications and Distributors

□ E.R. Noble and G.A. Noble (1982) *Parasitology: The biology of animal parasites*. V Edition, Lea & Febiger

□ Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) *Biology of Disease*. Taylor and Francis Group

□ Parija, S. C. Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition, All India Publishers & Distributors, Medical Books Publishers, Chennai, Delhi

□ Rattan Lal Ichhpujani and Rajesh Bhatia. Medical Parasitology, III Edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi

□ Meyer, Olsen & Schmidt's Essentials of Parasitology, Murray, D. Dailey, W.C. Brown Publishers

K. D. Chatterjee (2009). *Parasitology: Protozoology and Helminthology*. XIII Edition, CBS Publishers & Distributors (P) Ltd

Name of the paper: Ornamental Fish & Fisheries

CODE: ZOO-SE-3014
Ornamental Fish & Fisheries

Credit-4

1. Ornamental Fish Diversity of North East India.
2. Aquarium plant diversity in the wetland of Assam.
3. Construction and management of Home Aquarium.
4. Natural feed of Ornamental Fish
5. Strategies for maintenance of natural colour of Ornamental Fish
6. Natural Breeding of Tricogaster species
7. Health management of Ornamental Fish
8. Feed formulation of Ornamental Fish
9. Development of Biological filtration in Aquarium
10. Pure culture of planktons

Practical's

11. Identification of Ornamental Fish
12. Culture of Indigenous ornamental fish in Aquarium
13. Estimation of Physico-chemical characteristics of Aquarium water
14. Biological filter for removal of Ammonia from Aquarium
15. Culture of Planktons