

# **The University of Burdwan**



**Syllabus for B.Sc.(Gen.)**

**in**

**Environmental Science**

**Under Choice Based Credit System**

**w.e.f. 2017-2018 onward**

# UG CBCS COURSE STRUCTURE FOR GENERAL ENVIRONMENTAL SCIENCE

## CORE COURSES

**Credit: 6 [Credit 1 for Tutorial (T) + 5 for Lecture (L)]/ [Credit 2 for Practical (P)+ 4 for Lecture]**

Course Code	Course Title	Nature of Course	Credits
<b>SEM I</b>			
CC1A	Environment & Society	L +T	5+1
CC2A	Other Discipline		6
CC3A	Other Discipline		6
AECC1	Environmental Studies	L	4
		<b>Total Credit</b>	<b>22</b>
<b>SEM II</b>			
CC1B	Environmental Resources	L+ T	5+1
CC2B	Other Discipline		6
CC3B	Other Discipline		6
AECC2	Communicative English/ MIL	L	2
		<b>Total Credit</b>	<b>20</b>
<b>SEM III</b>			
CC1C	Environmental Pollution	L+T	5+1
CC2C	Other Discipline		6
CC3C	Other Discipline		6
SEC1	Biological Techniques OR Remote Sensing and Geographical Information System	L	2
		<b>Total Credit</b>	<b>20</b>

	SEM IV		
CC1D	Green Technology	L+T	5+1
CC2D	Other Discipline		6
CC3D	Other Discipline		6
SEC2	Conservation and Ecotourism OR Environmental Health	L	2
		<b>Total Credit</b>	<b>20</b>
	SEM V		
DSE1A	Environmental Pollution and Monitoring Techniques OR Environmental Pollution and Laws	L+T	5+1
DSE2A	Other Discipline		6
DSE3A	Other Discipline		6
SEC3	Social Environmental Issues OR Environmental Economics and Management	L	2
		<b>Total Credit</b>	<b>20</b>
	SEM VI		
DSE1B	Disaster Management OR Human Wildlife Conflict and Management	L+T	5+1
DSE2B	Other Discipline		6
DSE3B	Other Discipline		6
SEC4	Environmental Microbiology OR Environmental Biotechnology	L	2
		<b>Total Credit</b>	<b>20</b>
		<b>Grand Total Credit</b>	<b>122</b>

## DSE COURSES

Course Code	Course Title	Nature of Course	Credits
DSE1A	Environmental pollution and Monitoring Techniques OR Environmental Pollution and Laws	L+T	5+1
DSE2A	Other Discipline		6
DSE3A	Other Discipline		6
DSE1B	Disaster Management OR Human Wildlife Conflict and Management	L+T	5+1
DSE2B	Other Discipline		6
DSE3B	Other Discipline		6
	<b>Total Credit</b>		<b>36</b>

## SKILL ENHANCEMENT COURSES

Course Code	Course Title	Credits
SEC1	Biological Techniques OR Remote Sensing and Geographical Information System	2
SEC2	Conservation and Ecotourism OR Environmental Health	2
SEC3	Social Environmental Issues OR Environmental Economics and Management	2
SEC4	Environmental Microbiology OR Environmental Biotechnology	2
	<b>Total Credit</b>	<b>08</b>

**ABILITY ENHANCEMENT COMPULSORY COURSES**

**ENVIRONMENTAL STUDIES**

**Credit: 4**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
AECC1	Environmental Studies	4
AECC2	Communicative English/MIL	2
	<b>Total Credit</b>	<b>06</b>

**SEMESTER- I**  
**CC1A: ENVIRONMENT & SOCIETY**  
**CREDITS – 5+1 = 6**

**Lectures - 60**

**Environment:** Types of environment; Multidisciplinary nature and scope of environment; Components of environment; Environmental education (10)

**Natural Resources:** Definition, concept on natural resources – water, land, forest, food and mining; Biodiversity – concept, value, threats, conservation (10)

**Ecology and Ecosystem:** Definition and concept of ecology; Phases of ecology; Concept of ecosystem; Structure and functional aspects of ecosystem; Productivity concept of ecosystem; Food chain and food webs in ecosystem; Ecological energetic (10)

**Environmental Pollution:** Sources and effects of pollution (air, water, soil, noise and radiation); Ozone layer depletion; Global warming; Greenhouse effect; Acid Rain; *El-Nino, La-Nina*; ENSO (10)

**Social Issues:** Raising environmental awareness in India; Sustainable Development; Global environmental issues; Environmental legislation; Environmental movement in India; Human population and environmental problems: Role of information technology on environment and human health; Green business and green design (20)

**SEMESTER- II**  
**CC1B: ENVIRONMENTAL RESOURCES**  
**CREDITS – 5+1 = 6**

**Lectures - 60**

**Natural Resources:** Current status of Water, Land, Forest, Food and Minerals resources (05)

**Soil:** Weathering processes and soil formation; Soil profile development; Basic concept of physical, chemical and mineralogical composition of soil; Soil types, porosity, permeability (10)

**Energy Resources:** Classification - conventional, non-conventional, renewable, non-renewable (05)

**Fossil Fuels:** Coal (composition, origin and classification); Petroleum (origin, mining, chemical composition, classification); Natural gas (concept on LNG, CNG, LPG); Oil (origin, utilization) (10)

**Renewable Resources:** Solar energy (PV cells, PG cells); Geothermal energy (origin, utilization); Ocean energy; Biomass energy; Hydroelectricity (10)

**Alternate Sources of Energy:** Process of energy extraction from waste; Basic concept of petro-plants, biofuel (10)

**Biological Wealth:** Concept; Values; Mega-diversity Hotspots; Hotspots of biodiversity; Red Data Book; Conservation of biodiversity (International & National); Threats of biodiversity (10)

### SEMESTER- III

#### CC1C: ENVIRONMENTAL POLLUTION

CREDITS– 5+1 = 6

Lectures - 60

**Pollution:** Fundamentals Pollution; Types of pollutants and pollution (05)

**Air Pollution:** Air pollutants—sources and effects of primary and secondary pollutants, particulate matters, indoor pollutants; Global climate change; Photochemical smog (10)

**Water Pollution:** Sources-direct and indirect sources and their impact on water bodies, viz., marine, coastal, wetlands; groundwater pollution; Eutrophication, Lake acidification, salt water intrusion (10)

**Soil Pollution:** Sources, types and effects of soil pollution (10)

**Thermal Pollution:** Definition, nature of pollutants, environmental effects of coal ash (10)

**Vehicular Pollution:** Characteristics of automobile emissions, effects of automobile pollutants (10)

**Fireworks Pollution:** Definition, characteristics, composition; Pollution and effects; Safety and laws (05)

### SEMESTER- IV

#### CC1D: GREEN TECHNOLOGY

CREDITS – 5+1 = 6

Lectures - 60

**Green Chemistry:** Concept, principles, applications of green chemistry, e. g., use of CO<sub>2</sub>, H<sub>2</sub>O<sub>2</sub>, TiO<sub>2</sub>; Chitin; Concept of octane number and antiknock compounds; Directions in practising green chemistry (15)

**Green Technology:** Green technology in waste management, Integrated Waste Management (IWM); Supercritical water oxidation (SCWO) of wastes; Rhizosphere in biodegradation of organic wastes; Green techniques in water treatments: Deionization, Desalinization, Electrodialysis, Reverse osmosis; Green sources of energy; Green treatments of industrial effluents - Cyanide, Chromate (15)

**Green Synthesis of Chemicals:** Methyl methacrylate, polyurethane, paracetamol; Production of 3<sup>rd</sup> & 4<sup>th</sup> generation pest controller, Integrated Pest Management (IPM); Biodiesel, Biopolymers, Bioplastics; Alternative Fluorocarbons (AFCs) (15)

**Instrumental Methods:** Chemical analysis of environmental samples; Principles of AAS, X-Ray Fluorescence spectrophotometer, Gas Chromatography, HPLC (15)

## SEMESTER- V

### DSE1A: ENVIRONMENTAL POLLUTION & MONITORING TECHNIQUES

6 Credits

Lectures – 60

**Radiation Pollution:** Nature and types of radiation; Radiation hazards; Measurement of radioactivity; Nuclear accidents (10)

**Pesticide Pollution:** Sources, categories; Pesticidal effects in water; Elementary idea on IPML (10)

**Metal Pollution:** Metals in soil, food and water; Elementary idea on Lead and Cadmium pollution (10)

**Analytical Techniques and Tools:** Sampling, preservation and storage techniques; Principle, application and limitations of titrimetry, gravimetry and potentiometry; Ultrasound characteristics and Environmental applications of acoustic RADAR and LASER (10)

**Bacteriological Examination of Water:** Standard Plate Count and Coliform test with reference to IS: 1622 (10)

**Data Collection and Representation Techniques:** Concept of sampling, mean, median, mode, frequency distribution, standard deviation and standard error (10)



**OR**  
**DSE1A: ENVIRONMENTAL POLLUTION & LAWS**  
**6 Credits**

**Lectures - 60**

**Environmental Pollution:** Concept of pollutant and contaminant; Primary and Secondary pollutants (5)

**Air pollution:** Definition, Sources and general effects and control measures; photochemical reactions in atmosphere; smog formation, types of smog (sulphur smog and photochemical smog), aerosols (10)

**Soil pollution:** Definition, Sources and effects; Soil degradation, Erosion, Desertification, Stalinization; Control of soil pollution (10)

**Water pollution:** Definition, Sources, Types and effects; Global impacts; Measurement of water pollution (10)

**Noise pollution:** Sources; Measurement of noise level; Effects of sound pollution; Control of noise pollution (5)

**Current environmental problems:** Acid rain; Global Warming; Global dimming; *El Nino*/Southern oscillation (ENSO); Global ozone depletion; Eutrophication; Bioaccumulation and biomagnifications (10)

**Environmental Legislation:** Article 48A & Article 51 A; Principles of environmental laws: The Indian Forest Act 1927; The Wildlife (Protection) Act 1972; The Water (Prevention and Control of Pollution) Act 1974; The Forests (Conservation) Act 1980; The Air (Prevention and Control of Pollution) Act 1981; The Environment (Protection) Act 1986; Noise Pollution (Regulation and Control) Rules 2000 (10)

**SEMESTER- VI**  
**DSE1B: DISASTER MANAGEMENT**  
**6 Credits**

**Lectures – 60**

**Understanding Disaster:** Concept and definitions of disaster; Hazard, vulnerability, risk, capacity: Types, trends, causes and consequences and control of various disasters, *viz.*, Geological, Hydro-meteorological, Biological and Technological disasters (15)

**Disaster Management:** Vulnerability of natural hazards in India; Disaster management cycle; Activities associated with various stages of cycles (15)

**Institutional Framework:** Constitutional frameworks in India – Role of Governments, Non-Governments and State Government agencies (15)

**Risk Assessment:** Concept and evaluation of risk; Hazard identification; Exposure assessment; Hazard assessment; Risk characterization; Man-made Environmental degradation; Problems related to toxic wastes and chemicals and radioactive substance disposal (15)

**OR**

### **DSE1B: HUMAN-WILDLIFE CONFLICT & MANAGEMENT**

**6 Credits**

**Lectures – 60**

**Wildlife Management:** Need of environmental management; Wildlife conservation: moral obligation; Philosophy of wildlife management; Human wildlife conflicts; Role of government, wildlife biologists and social scientists; concept of deep and shallow ecology (20)

**Human Wildlife Co-existence:** Symbiotic relationship between tribals and forest, forest and development; Community participation in forest management, case study of Chipko movement, sacred groves forests, India's Bishnoi community and their conservation practices; Ecological-economic welfare and development; Man and biosphere programmes; Concept of conservation reserves and community reserves, importance of wildlife corridors (20)

**Wildlife Conservation Laws in India:** Types of protected areas (Wildlife Sanctuaries, National Parks, Biosphere Reserves); IUCN categories of protected areas, Natural World Heritage sites; Concept of core and buffer area in a protected range; Brief introduction to Wildlife Protection Act of 1972; Forest Act of 1927; Environmental Protection Act of 1986; Forest Conservation Act of 1920; Tiger task force, Status of current protected areas in India (20)

### **SEMESTER- III**

#### **SEC1: BIOLOGICAL TECHNIQUES**

**2 Credits**

**Lectures -20**

**Basic Histological and Cytological Techniques:** Fixation and Fixatives; Tissue-processing & Microtomy; Staining (5)

**Microscopy:** Components of microscope; magnification and illumination; Types of microscope – Light, Electron, Phase, Polarised, Fluorescence (10)

**Biological Analysis:** Collection and preservation of plankton; Enumeration of net plankton, counting in Sedgwick Rafter cell (5)

**OR**

**SEC1: REMOTE SENSING & GEOGRAPHICAL INFORMATION SYSTEM (GIS)**

**2 Credits**

**Lectures -20**

**Remote Sensing:** Principles, properties; Electromagnetic radiation and its interaction with atmosphere; Spectral reflectance of Earth's surface features; Types and characteristics of different data acquisition platforms; Satellite geometry, sensors and resolutions; Data products and their characteristics; Basic principle of visual interpretation (15)

**GIS:** Concept of GIS; Spatial data model; Attribute data management; Process of GIS (5)

**SEMESTER- IV**

**SEC2: CONSERVATION & ECOTOURISM**

**2 Credits**

**Lectures -20**

**Conservation:** Concept of Wildlife Conservation - Reserves design, survey techniques of tiger, birds, deer, bison, elephants and insect; *In-situ* habitat management of wild animal; Concept of Zoo management; Nursery technology, Plantation technique in India, (10)

**Ecotourism:** Elementary idea of Mass tourism and its Impact on environment and culture; Concept of Ecotourism, Guideline and policy (National and International) of ecotourism; Planning of ecotourism; Ecotourism circuit development; Types of Alternative Tourism, Elementary idea of Rural tourism, Adventure tourism; Development, economical benefits and impacts of Ecotourism (10)

**OR**

**SEC2: ENVIRONMENTAL HEALTH**

**2 Credits**

**Lectures -20**

**Environmental Health:** Concept of health and disease; Principles of epidemiology and epidemiological methods, aims of epidemiology (5)

**Diseases:** Concept on water, air, vector borne diseases; Some communicable diseases-- Viral hepatitis, dengue, Leishmaniasis; Non-communicable diseases - cardiovascular, diabetes; (10)

**Health Programs:** Health Programs in India; Demography and family planning; Nutrition and health; Health education; World health report; Health impact assessment; Role of Information Technology in environment and human health (5)

## SEMESTER- V

### SEC3: SOCIAL ENVIRONMENTAL ISSUES

2 Credits

Lectures -20

**Man-Environment Relationship:** History and relationship; Need for public awareness; Ecosystem services to society; Environmental movements in India; Human population growth and problems, regulation of population (5)

**Social Issues:** Global environmental issues; Unsustainable to Sustainable Development; Groups; Environmental awareness; Environmental ethics; Women and Child welfare; (5)

**Environmental sustainability:** Concept of sustainable city, urban planning, social responsibility; International treaties & Conventions [Wetlands (Ramsar)], International Trade in Endangered Species (CITES), Biodiversity (CBD), Transboundary Movements of Hazardous Waste (Basal), Climate Change (Kyoto Protocol) (10)

OR

### SEC3: ENVIRONMENTAL ECONOMICS & MANAGEMENT

2 Credits

Lectures -20

**Environmental Economics:** Concept, scope and interrelation; Concept of supply and demand; Types of economic system, Concept of Ecological economics (5)

**Principles of Management:** Definition and concept on environmental management; Environmental quality measurement (ISO:14000), Environmental management system; Management of air pollution,

water pollution, noise pollution in respect to Indian scenario; Waste Water Treatment; Strategies for sustainable Water Management; Drinking Water Standard; Ganga Action Plan (GAP), Yamuna Action Plan (YAP) (15)

## SEMESTER- VI

### SEC4: ENVIRONMENTAL MICROBIOLOGY

2 Credits

Lectures -20

**Bacteriology:** Bacterial morphology: Shape, size, structure and function of bacterial cell membrane, cell wall, capsule, flagella (10)

**Virology:** Descriptive properties of virus; Morphology and structure of bacteriophages (10)

## OR

### SEC4: ENVIRONMENTAL BIOTECHNOLOGY

2 Credits

Lectures -20

**Role of Microbes with relation to Environment:** Bacteria, Fungi, Protozoa, Virus (5)

**Waste Treatment:** Wastewater treatment techniques; Solid waste treatment methods (vermiculture, landfill. hazardous waste treatment); Phytoremediation (10)

**Agricultural Biotechnology:** Biofertilizer, Biopesticide, Integrated pest management; Biofuel (5)

## Suggested Readings

### SEM - I

1. Environmental Science: S.C. Santra , New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamental of Ecology: E.P.Odum.,W.B.Sauders Company,USA
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Botkin & Keller (1998): Environmental Science: Earth as a Living Planet; John Wiley & Sons
6. Elements of Ecology: Thomas M Smith & Robert Leo Smith; LPE, Pearson Education
7. Principles of Environmental Science: Inquiry and Applications: William P Cunningham & Mary Ann Cunningham; The McGraw-Hill Companies, 4<sup>th</sup> Edn.
8. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
9. Fundamentals of Environmental Studies: Mahua Basu & S. Xavier; Cambridge University Press, 2016

## SEM-II

1. The Economic Approach to Environmental & Natural Resources, James R. Kahn., George Proval
2. Economics of Environment, Dorfman and Dorfmann
3. Pearce and Turner (1991): The Economics of Natural Resource and Environment, Harvester & Wheatsheaf
4. Dasgupta and Heal (1979): Economic Theory of Exhaustible Resources; CUP
5. Kneese & Sweeney (1993): Handbook of natural Resource and Energy Economics/3 Volumes; North-Holland
6. Crooper & Dates (1992): Environmental Economics: A survey/OEL
7. Dorfman & Dorfman (1994): Economics of Environment/3
8. Parikh (1993): Natural Resources Accounting: A Framework for India
9. Charles D Kolstad (2000): Environmental Economics, Oxford University Press
10. Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. *Ecology, Environment and Resource Conservation*. Anamaya Publications.
11. Peterson, G. D., Cumming, G. S. & Carpenter, S. R. 2003. Scenario planning: a tool for conservation in an uncertain world. *Conservation Biology* 17: 358-366.
12. Pimentel, D. (Ed.). 2011. *Biological invasions: Economic and environmental costs of alien plant, animal, and microbe species*. CRC Press.
13. Fundamentals of Ecology: EP Odum. WB Saunders Com, 3<sup>rd</sup> Edition
14. Fundamentals of Ecology: M C Dash, Mc Graw Hill Publishers

## SEM-III

1. Fazal S. 2008, GIS Basics, New Age International Publishers, New Delhi
2. Bridge, J., & Demicco, R. 2008. *Earth Surface Processes, Landforms and Sediment deposits*. Cambridge University Press.
3. A Textbook of Soil Science: D K Das, Kalyani Publishers
4. Clean technology, Johansson, A., Lewis Publishers.
5. Zero Pollution Industry, Nemerow, N.L. Wiley Intersciences
6. Industrial Pollution Prevention Handbook, Freeman, H.M., McGraw Hill
7. Landfill Waste Pollution and Control, Kenneth Westlake., Albion Publishing
8. Hazardous waste Management, Wentz, C.A., McGraw Hill
  
9. Bansil, P.C. 2004. *Water Management in India*. Concept Publishing Company, India.
10. Brady, N.C. & Well, R.R. 2007. *The Nature and Properties of Soils* (13<sup>th</sup> edition), Pearson Education Inc.
11. Demers, M.N. 2005. *Fundamentals of Geographic Information System*. Wiley & Sons.
12. Engineering and General Geology: Parbin Singh, S. K. Kataria Publishers
13. Keller, E.A. 2011. *Introduction to Environmental Geology* (5<sup>th</sup> edition). Pearson Prentice Hall.
14. Mays, L.W. 2006. *Water Resources Sustainability*. The McGraw-Hill Publications.
15. Schward & Zhang, 2003. *Fundamentals of Groundwater*. John Willey and Sons.
16. Siddhartha K. 2005, *Atmosphere, Weather and Climate*, Kisalaya Publications Pvt. Ltd, New Delhi
17. Richards, J. A. & Jia, X. 1999. *Remote Sensing and Digital Image Processing*. Springer.

## SEM-IV

1. Boeker, E. & Grondelle, R. 2011. *Environmental Physics: Sustainable Energy and Climate Change*. Wiley.

2. Beard, J.M. 2013. *Environmental Chemistry in Society* (2<sup>nd</sup> edition). CRC Press.
3. Connell, D.W. 2005. *Basic Concepts of Environmental Chemistry* (2<sup>nd</sup> edition). CRC Press.
4. Environmental Chemistry with Green Chemistry: Asim K Das; Books and Allied.
5. Environmental Chemistry with Green Chemistry, Asim K Das, Books and Allied (P) Ltd., 2010
6. Geomorphology & Environment, Editors Savindra Singh, H S Sharma and Sunil K De., ACB Publications, 2004.
7. Green Chemistry (PB): Nova; Luque
9. Forinash, K. 2010. *Foundation of Environmental Physics*. Island Press.
10. Hites, R.A. 2012. *Elements of Environmental Chemistry* (2<sup>nd</sup> edition). Wiley & Sons.
11. Johnson, D.L. 2006. *Land Degradation* (2<sup>nd</sup> edition). Rowman & Littlefield Publishers.
12. Leeder, M., Arlucea, M.P. 2005. *Physical Processes in Earth and Environmental Sciences*. Blackwell Publishing.
13. Manahan, S.E. 2010. *Environmental Chemistry*. CRC Press, Taylor and Francis Group.
14. Manhan, S. E. 2000. *Fundamentals of Environmental Chemistry*. CRC Press.
15. Pani, B. 2007. *Textbook of Environmental Chemistry*. IK international Publishing House.

### Sem V

1. D'Monte, Darryl. 1985. *Industry versus Environment Temples or Tombs*. Three Controversies, Delhi, CSE.
2. Zwartveen, M.Z. 1995. *Linking women to the main canal: Gender and irrigation management*. Gatekeeper Series 54, IIED.
3. Dickman, A. J. 2010. Complexities of conflict: the importance of considering social factors for effectively resolving human-wildlife conflict. *Animal Conservation* **13**: 458-466.
4. Elliot, D. 2003. *Energy, Society and Environment, Technology for a Sustainable Future*. Routledge Press.
5. Environment Economics: Kohler, Academic Press
6. Environmental and Social Impact Assessment-An Introduction: C J Barrow, Arnold Press
7. Environmental Economics-An Indian Perspectives, Edited by R. N. Bhattacharya, Oxford University Press
8. Environmental Impact Assessment: 2<sup>nd</sup> Edition, L W Carter, Mc Graw Hill
9. Environmental Sanitation: K V S G Murali, Krishna Reem Publications
10. Leopold, A. 1949. *The Land Ethic*. pp. 201-214. Chicago, USA.
11. Gillespie, A. 2006. *Climate Change, Ozone Depletion and Air Pollution: Legal Commentaries with Policy and Science Considerations*. MartinusNijhoff Publishers.
12. Grimm, N. B., Faeth, S. H., et al. 2008. Global Change and the Ecology of Cities. *Science* **319**: 756-760.
13. Hardy, J.T. 2003. *Climate Change: Causes, Effects and Solutions*. John Wiley & Sons.
14. Harvey, D. 2000. *Climate and Global Climate Change*. Prentice Hall.
15. Hinchliffe, S. & Whatmore, S. 2006. Living cities: Towards a politics of conviviality. *Science as Culture* **15**: 123-138.
16. Vickers, A. ,Universal's Environment and Pollution Laws: S K Mohanty, Universal Law Publishing Co. Pvt. Ltd. 2001
17. Stein, R. (ed.). 2004. *New Perspectives on Environmental Justice: Gender, Sexuality, and Activism*. Rutgers University Press.

### SEM-VI

1. Conover, M. 2001. *Resolving Human Wildlife Conflicts*, CRC Press.
2. A text book of Microbiology: Dubey & Maheswari
3. Environmental microbiology and Biotechnology: D.P. Singh and S.K. Dwivedi; New Age International publications

4. Evans, G.G. & Furlong, J. 2010. *Environmental Biotechnology: Theory and Application* (2<sup>nd</sup> edition). Wiley-Blackwell Publications.
5. General Microbiology: Powar and Dagainawala, Himalaya Publishing House
6. A K Chatterjee, Introduction to Environmental Biotechnology: Prentice Hall of India Pvt. Ltd.
7. Jordening, H.J. & Winter J. 2005. *Environmental Biotechnology: Concepts and Applications*. John Wiley & Sons.
8. Woodroffe, R., Thirgood, S., & Rabinowitz, A. 2005. *People and Wildlife, Conflict or Co-existence?* (No.9). Cambridge University Press.
9. Wainwright, M. 1999. *An Introduction to Environmental Biotechnology*. Springer.
10. Scagg, A.H. 2005. *Environmental Biotechnology*. Oxford University Press.
11. *Molecular Cell Biology*. W.H. Freeman.
12. Rittman, B.E. & McCarty, P.L. 2001. *Environmental Biotechnology. Principles and Applications*. McGraw-Hill, New York.