

## Lesson Plan for Academic Year July, 2020

### Paper: AECC-Environmental Science

#### Session-Ist Sem: (November, 2020-March, 2021)

**Name: Dr Priyambada Patri**

#### **Syllabus:**

##### **Unit 1**

##### **Introduction to Environmental Studies (2 lectures)**

- Multidisciplinary nature of environmental studies; components of environment: atmosphere, hydrosphere, lithosphere, and biosphere
- Scope and importance; Concept of sustainability and sustainable development; Brief history of environmentalism

##### **Unit 2**

##### **Ecosystems (6 lectures)**

- Definition and concept of Ecosystem
- Structure of ecosystem (biotic and abiotic components); Functions of Ecosystem: Physical (energy flow), Biological (food chains, food web, ecological succession), and Biogeochemical (nutrient cycling) processes. Concepts of productivity, ecological pyramids and homeostasis
- Types of Ecosystems: Tundra, Forest, Grassland, Desert, Aquatic (ponds, streams, lakes, rivers, oceans, estuaries); importance and threats with relevant examples from India
- Ecosystem services (Provisioning, Regulating, Cultural, and Supporting); Ecosystem preservation and conservation strategies; Basics of Ecosystem restoration

##### **Unit 3**

##### **Natural Resources (8 lectures)**

- Land resources: Minerals, soil, agricultural crops, natural forest products, medicinal plants, and forest-based industries and livelihoods; Land cover, land use change, land degradation, soil erosion, and desertification; Causes of deforestation; Impacts of mining and dam building on environment, forests, biodiversity, and tribal communities
- Water resources: Natural and man-made sources; Uses of water; Over exploitation of surface and ground water resources; Floods, droughts, and international & inter-state conflicts over water
- Energy resources: Renewable and non-renewable energy sources; Use of alternate energy sources; Growing energy needs; Energy contents of coal,

*petroleum, natural gas and bio gas; Agro-residues as a biomass energy source*

- *Case studies: Contemporary Indian issues related to mining, dams, forests, energy, etc (e.g., National Solar Mission, Cauvery river water conflict, Sardar Sarovar dam, Chipko movement, Appiko movement, Tarun Bharat Sangh, etc)*

## **Unit 4**

### **Biodiversity and Conservation (8 lectures)**

- *Definition of Biodiversity; Levels of biological diversity: genetic, species and ecosystem diversity*
- *India as a mega-biodiversity nation; Biogeographic zones of India; Biodiversity hotspots; Endemic and endangered species of India; IUCN Red list criteria and categories*
- *Value of biodiversity: Ecological, economic, social, ethical, aesthetic, and informational values of biodiversity with examples; sacred groves and their importance with examples*
- *Threats to biodiversity: Habitat loss, degradation, and fragmentation; Poaching of wildlife; Man-wildlife conflicts; Biological invasion with emphasis on Indian biodiversity; Current mass extinction crisis*
- *Biodiversity conservation strategies: in-situ and ex-situ methods of conservation; National Parks, Wildlife Sanctuaries, and Biosphere reserves; Keystone, Flagship, Umbrella, and Indicator species; Species reintroduction and translocation*
- *Case studies: Contemporary Indian wildlife and biodiversity issues, movements, and projects (e.g., Project Tiger, Project Elephant, Vulture breeding program, Project Great Indian Bustard, Crocodile conservation project, Silent Valley movement, Save Western Ghats movement, etc)*

## **Unit 5**

### **Environmental Pollution (8 lectures)**

- *Environmental pollution (Air, water, soil, thermal, and noise): causes, effects, and controls; Primary and secondary air pollutants; Air and water quality standards*
- *Nuclear hazards and human health risks*
- *Solid waste management: Control measures for various types of urban, industrial waste, Hazardous waste, E-waste, etc; Waste segregation and disposal*
- *Pollution case studies: Ganga Action plan (GAP), Delhi air pollution and public health issues, Plastic waste management rules, Bhopal gas tragedy, etc*

## **Unit 6**

### **Global Environmental Issues and Policies (7 lectures)**

- *Causes of Climate change, Global warming, Ozone layer depletion, and Acid rain; Impacts on human communities, biodiversity, global economy, and agriculture*
- *International agreements and programmes: Earth Summit, UNFCCC, Montreal and Kyoto protocols, Convention on Biological Diversity(CBD), Ramsar convention, The Chemical Weapons Convention (CWC), UNEP, CITES, etc*
- *Sustainable Development Goals: India's National Action Plan on Climate Change and its major missions*
- *Environment legislation in India: Wildlife Protection Act, 1972; Water (Prevention and Control of Pollution) Act, 1974; Forest (Conservation) Act 1980; Air (Prevention & Control of Pollution) Act, 1981; Environment Protection Act, 1986; Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006*

## **Unit 7**

### **Human Communities and the Environment (6 lectures)**

- *Human population growth: Impacts on environment, human health, and welfare; Carbon foot-print*
- *Resettlement and rehabilitation of developmental project affected persons and communities; relevant case studies*
- *Environmental movements: Chipko movement, Appiko movement, Silent valley movement, Bishnois of Rajasthan, Narmada Bachao Andolan, etc*
- *Environmental justice: National Green Tribunal and its importance*
- *Environmental philosophy: Environmental ethics; Role of various religions and cultural practices in environmental conservation*
- *Environmental communication and public awareness: case studies (e.g., CNG vehicles in Delhi, Swachh Bharat Abhiyan, National Environment Awareness Campaign (NEAC), National Green Corps (NGC) "Eco-club" programme, etc)*

## **Unit 8**

### **Field work/ Practicals**

*(Equal to 5 lectures, including two mandatory field visits)*

- *Virtual Field visit to any of the ecosystems found in Delhi like Delhi Ridge/ Sanjay lake/Yamuna river and its floodplains etc., or any nearby lake or pond, explaining the theoretical aspects taught in the class room*
- *Virtual Visit to any biodiversity park/ reserve forest/ protected area/ zoo/ nursery/ natural history museum in and around Delhi, such as Okhla bird sanctuary/ Asola Bhatti Wildlife Sanctuary/ Yamuna Biodiversity Park/ Sultanpur National Park, explaining the theoretical aspects taught in the classroom*
- *Virtual Visit to a local polluted site (urban/rural/industrial/agricultural), wastewater treatment plants, or landfill sites, etc*
- *Study of common plants and animals; basic principles of identification*

- *Organize a seminar/ conference/ workshop/ panel discussion on relevant topics for enhancing awareness, capacity building, and critical reasoning among students*

### **Course Descriptions:**

Compulsory course on Environmental Science at UG level (AECC I)

The course will empower the undergraduate students by helping them to:

- i. Gain in-depth knowledge on natural processes and resources that sustain life and govern economy.
- ii. Understand the consequences of human actions on the web of life, global economy, and quality of human life.
- iii. Develop critical thinking for shaping strategies (scientific, social, economic, administrative, and legal) for environmental protection, conservation of biodiversity, environmental equity, and sustainable development.
- iv. Acquire values and attitudes towards understanding complex environmental- economic- social challenges, and active participation in solving current environmental problems and preventing the future ones.
- v. Adopt sustainability as a practice in life, society, and industry.

**Teaching time (No. of weeks): 15**

**Classes- 50-60**

### **Unit wise break up of syllabus**

#### **Unit-1**

##### **Week 1**

Lecture 1: Multidisciplinary nature of environmental studies; components of environment: atmosphere, hydrosphere, lithosphere, and biosphere

Lecture 2: Scope and importance; Concept of sustainability and sustainable development; Brief history of environmentalism

#### **Unit -2**

##### **Week 2**

Lecture 3: Definition and concept of Ecosystem: Structure of ecosystem (biotic and abiotic components);

Lecture 4: Functions of Ecosystem: Physical (energy flow), Biological (food chains, food web, ecological succession),

Lecture 5: Biogeochemical (nutrient cycling) processes. Concepts of productivity, ecological pyramids and homeostasis

Lecture 6: Interactive class

##### **Week 3**

Lecture 7: Types of Ecosystems: Tundra, Forest, Grassland,  
Lecture 8: Desert, Aquatic (ponds, streams, lakes, rivers)  
Lecture 9: oceans, estuaries; importance and threats with relevant examples from India  
Lecture 10: Interactive class on Ecosystem services (Provisioning, Regulating, Cultural, and Supporting); Ecosystem preservation and conservation strategies; Basics of Ecosystem restoration

### **Unit 3**

#### **Week 4**

Lecture 11: Land cover, land use change, land degradation, soil erosion, and desertification; Causes of deforestation;  
Lecture 12: Impacts of mining and dam building on environment, forests, biodiversity, and tribal communities  
Lecture 13: Natural and man-made sources of water; Uses of water; Over exploitation of surface and ground water resources;  
Lecture 14: Interactive class on Floods, droughts, and international & inter-state conflicts over water

#### **Week 5**

Lecture 15: Renewable and non-renewable energy sources;  
Lecture 16: Growing energy needs; Energy contents of coal, petroleum, natural gas and bio gas; Agro-residues as a biomass energy source  
Lecture 17: Use of alternate energy sources;  
Lecture 18: Interactive class on Case studies: Contemporary Indian issues related to mining, dams, forests, energy, etc (e.g., National Solar Mission, Cauvery river water conflict, Sardar Sarovar dam, Chipko movement, Appiko movement, Tarun Bharat Sangh, etc).

### **Unit 4**

#### **Week 6**

Lecture 19: Definition of Biodiversity; Levels of biological diversity; India as a mega-biodiversity nation;  
Lecture 20: Biogeographic zones of India; Biodiversity hotspots; Endemic and endangered species of India; IUCN Red list criteria and categories  
Lecture 21: Interactive class on Value of biodiversity: Ecological, economic, social, ethical, aesthetic, and informational values of biodiversity with examples; sacred groves and their importance with examples  
Lecture 22: Practical study on biodiversity inside the college campus

#### **Week 7**

Lecture 23: Threats to biodiversity: Habitat loss, degradation, and fragmentation; Poaching of wildlife;  
Lecture 24: Interactive class on Man-wildlife conflicts; Biological invasion with emphasis on Indian biodiversity; Current mass extinction crisis;

Lecture 25: Biodiversity conservation strategies: in-situ and ex-situ methods of conservation; National Parks, Wildlife Sanctuaries, and Biosphere reserves;

Lecture 26: Keystone, Flagship, Umbrella, and Indicator species; Species reintroduction and translocation

#### **Week 8:**

Lecture 27, 28, 29, 30: Power point presentation by the students on Case studies: Contemporary Indian wildlife and biodiversity issues, movements, and projects (e.g., Project Tiger, Project Elephant, Vulture breeding program, Project Great Indian Bustard, Crocodile conservation project, Silent Valley movement, Save Western Ghats movement, etc)

#### **Unit 5**

##### **Week 9**

Lecture 31: Environmental pollution, causes, effects, and controls; Primary and secondary air pollutants;

Lecture 32: Air Pollution, causes, effects and air quality Index

Lecture 33: Effects and control of air pollution

Lecture 34: Water pollution, causes, effects and water quality standards,

##### **Week 10**

Lecture 35: Control and treatment of water pollution, Related case studies

Lecture 36: Nuclear hazards and human health risks; Control measures

Lecture 37: various types of urban, industrial waste, Hazardous waste, E-waste, etc and their management

Lecture 38: Interactive class on Waste segregation and disposal Related case studies

#### **Unit 6**

##### **Week 11**

Lecture 39: Causes of Climate change, Global warming,

Lecture 40: Ozone layer depletion, and Acid rain;

Lecture 41: Interactive class on Impacts on human communities, biodiversity, global economy, and agriculture

Lecture 42: International agreements and programmes: Earth Summit, UNFCCC, Montreal and Kyoto protocols,

##### **Week 12**

Lecture 43: Convention on Biological Diversity(CBD), Ramsar convention, The Chemical Weapons Convention (CWC), UNEP, CITES, etc

Lecture 44: Sustainable Development Goals: India's National Action Plan on Climate Change and its major missions

Lecture 45: Wildlife Protection Act, 1972; Water (Prevention and Control of Pollution) Act, 1974; Forest (Conservation) Act 1980;

Lecture 46: Air (Prevention & Control of Pollution) Act, 1981; Environment Protection Act, 1986; Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006

#### **Unit 7**

##### **Week 13**

Lecture 47: Human population growth: Demographic transition, Characteristics

Lecture 48: Impacts on environment, human health, and welfare;

Lecture 49: Carbon foot-print; Resettlement and rehabilitation of developmental project affected persons and communities;

Lecture 50: Interactive class on relevant case studies; Environmental movements: Chipko movement, Appiko movement, Silent valley movement, Bishnois of Rajasthan, Narmada Bachao Andolan, etc; Environmental justice:

#### **Week 14**

Lecture 51: National Green Tribunal and its importance

Lecture 52: Environmental philosophy: Environmental ethics; Role of various religions and cultural practices in environmental conservation

Lecture 53: Environmental communication and public awareness: case studies (e.g., CNG vehicles in Delhi, Swachh Bharat Abhiyan, National Environment Awareness Campaign (NEAC), National Green Corps(NGC) "Eco-club" programme, etc)

#### **Unit -8**

#### **Week 15-16**

#### **Practical/project (Equal to 5 lectures)**

- Virtual Field visit to some of the ecosystems found in Delhi like Delhi Ridge/ Sanjay lake/ Yamuna river and its floodplains etc., or any nearby lake or pond, explaining the theoretical aspects taught in the class room
- Virtual Visit to any biodiversity park/ reserve forest/ protected area/ zoo/ nursery/ natural history museum in and around Delhi, such as Okhla bird sanctuary/ Asola Bhatti Wildlife Sanctuary/ Yamuna Biodiversity Park/ Sultanpur National Park, explaining the theoretical aspects taught in the classroom
- Virtual Visit to a local polluted site (urban/rural/industrial/agricultural), wastewater treatment plants, or landfill sites, etc (Documentary film)
- Virtual webinar/ workshop/ group discussion on relevant topics for enhancing awareness, capacity building, and critical reasoning among students
- Basic exercise to Calculate and Assess carbon footprint
- Power point presentation of students on important environmental issues
- Poster/Collage making
- Plantation, biocomposting
- Project Report on local environmental issues

#### **Internal Assessment methods (Continuous assessment)**

- Group research project on any contemporary environmental issue
- Maintenance of class record (Notebook)
- Poster/Collage/Doodle/pamphlet to raise the environmental awareness
- PPT presentation on any environmental issue
- Class room discussion

- Think globally, act locally (Plantation, Bio-composting, Rainwater harvesting, Solar energy, calculation of carbon footprint)
- Innovative solutions (Best out of waste)
- Exhibition with Extempore talk by the students/Organise events
- Virtual Field visit

### **Essential Readings:**

1. Brusseau, M.L., Pepper, I.L., and Gerba, C.P. (2019). Environmental and Pollution Science, 3rd Edition. Academic Press, USA. (pp. 1-520).
2. Divan, S. and Rosencranz, A. (2002). Environmental Law and Policy in India: Cases, Material & Statutes, 2nd Edition. Oxford University Press, India. (pp. 1-837).
3. Gadgil, M., and Guha, R. (1993). This Fissured Land: An Ecological History of India. University of California Press, Berkeley, USA. (pp. 1-245).
4. Raven, P.H, Hassenzahl, D.M., Hager, M.C, Gift, N.Y., and Berg, L.R. (2015). Environment, 8th Edition. Wiley Publishing, USA. (pp. 1-472).
5. Singh, J.S., Singh, S.P., and Gupta, S.R. (2017). Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi. (pp.1-842).

### **Suggested readings: Unit-1**

1. Raven, P.H, Hassenzahl, D.M., Hager, M.C, Gift, N.Y., and Berg, L.R. (2015). Environment, 8th Edition. Wiley Publishing, USA. Chapter 1 (Pages: 1-17); Chapter 2 (Pages: 22-23); Chapter 3 (Pages: 40, 41); Chapter 4 (Pages: 64, 66).
2. Singh, J.S., Singh, S.P., and Gupta, S.R. (2017). Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi. Chapter 1 (Page: 3-28).

### **Suggested Readings: Unit 2**

1. Odum, E.P., Odum, H.T., and Andrews, J. (1971). Fundamentals of Ecology. Saunders, Philadelphia, USA. Chapter 1 (Pages: 1-16); Chapter 2 (Pages: 18-76); Chapter 10 (Pages: 414-458).
2. Raven, P.H, Hassenzahl, D.M., Hager, M.C, Gift, N.Y., and Berg, L.R. (2015). Environment, 9th Edition. Wiley Publishing, USA. Chapter 3 (Pages: 38-52); Chapter 4 (Pages: 53-62); Chapter 5 (Pages: 100-103); Chapter 6 (Pages: 106-128).
3. Singh, J.S., Singh, S.P., and Gupta, S.R. (2017). Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi. Chapter 13 (Pages: 307-323); Chapter 18 (Pages: 420-442); Chapter 28 (Pages: 747-769).

### **Suggested Readings: Unit 3**

1. Gadgil, M. and Guha, R. (1993). This Fissured Land: An Ecological History of India. University of California Press, Berkeley, USA. (pp. 1-245).



2. McCully, P. (1996). Rivers no more: the environmental effects of dams, In: *Silenced Rivers: The Ecology and Politics of Large Dams*, Zed Books, New York, USA. Page. 29-64.
3. Raven, P.H, Hassenzahl, D.M., Hager, M.C, Gift, N.Y. and Berg, L.R. (2015). *Environment*, 9th Edition. Wiley Publishing, USA. Chapters 10, 11, 12, 13 (Pages: 180-263); Chapter 14 (Pages: 272-275); Chapter 15 (Pages: 286-289).
4. Singh, J.S., Singh, S.P. and Gupta, S.R. (2017). *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi. Chapter 25 (Pages: 623-663).

#### **Suggested Readings: Unit 4**

1. Primack, R.B. (2014). *Essentials of Conservation Biology*, Oxford University Press, USA. Page.1-536.
2. Raven, P.H, Hassenzahl, D.M., Hager, M.C, Gift, N.Y. and Berg, L.R. (2015). *Environment*, 9th Edition. Wiley Publishing, USA. Chapter 5 (Pages: 97-99); Chapter 16 (Pages: 299-318).
3. Singh, J.S., Singh, S.P. and Gupta, S.R. (2017). *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi. Chapters 24 (Pages: 599-690); Chapter 26 (Pages: 664-714).

#### **Suggested Readings: Unit 5**

1. Brusseau, M.L., Pepper, I.L. and Gerba, C.P. (2019). *Environmental and Pollution Science*, 3rd Edition. Academic Press, USA. Chapter 16 (Pages: 243-255); Chapter 18 (Pages: 280-305); Chapter 21 (Pages: 352-358); Chapter 22 (Pages: 365-374); Chapter 23 (Pages: 378-388); Chapter 25 (Pages: 416-426).
2. Carson, R. (2002). *Silent Spring*. Houghton Mifflin Harcourt, USA. Pp. 1-264.
3. Raven, P.H, Hassenzahl, D.M., Hager, M.C, Gift, N.Y. and Berg, L.R. (2015). *Environment*, 9th Edition. Wiley Publishing, USA. Chapter 19 (Pages: 359-381); Chapter 21 (Pages: 401-421); Chapter 23 (Pages: 440-453).
4. Singh, J.S., Singh, S.P. and Gupta, S.R. (2017). *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi. Chapters 19, 20, 12 (Pages: 445-535).

#### **Suggested Readings: Unit 6**

1. Divan, S. and Rosencranz, A. (2002). *Environmental Law and Policy in India: Cases, Material & Statutes*, 2nd Edition. Oxford University Press, India. Chapter 2 (Pages: 23-39); Chapter 3 (Pages: 41-86).
2. Raven, P.H, Hassenzahl, D.M., Hager, M.C, Gift, N.Y. and Berg, L.R. (2015). *Environment*, 9th Edition. Wiley Publishing, USA. Chapter 19 (Pages: 370-376); Chapter 20 (Pages: 385-399).

3. Singh, J.S., Singh, S.P. and Gupta, S.R. (2017). Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi. Chapter 23 (Pages: 555-598); Chapter 30 (Pages: 801-807).

**Suggested Readings: Unit 7**

1. Divan, S. and Rosencranz, A. (2002). Environmental Law and Policy in India: Cases, Material& Statutes, 2nd Edition. Oxford University Press, India. Chapter 10 (Pages: 416-473).
2. Raven, P.H, Hassenzahl, D.M., Hager, M.C, Gift, N.Y. and Berg, L.R. (2015). Environment, 9th Edition. Wiley Publishing, USA. Chapter 2 (Pages: 33-36); Chapter 8 (Pages: 148-162).
3. Singh, J.S., Singh, S.P. and Gupta, S.R. (2017). Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi. Chapter 1 (Pages: 23-26); Chapter 31 (Pages: 826-842).

