

Practical [Credits: 2]

1. Study of different species of Aquarium fishes and biology (Breeding, Feeding economic importance etc) of exotic and endemic fish.
2. Study of Sexual Dimorphism of Fresh water and Marine Aquarium Fish(Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish, Butterfly fish)
3. Type, composition and formulation of fish feed (using Pearson Square Methods)
4. Construction and maintenance of Glass Aquarium and Filter System Using Indigenous Locally available materials.
5. Monitoring of aquarium water quality (Temperature, pH, Dissolved Oxygen, Carbon dioxide, Ammonical N-Load) through titrimetry methods.
6. To write a project proposal for setting up a small aquarium fish keeping as a cottage industry to a funding agency for self-employment of youths or for helping poor farmers; after visiting any farm/enterprise.

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji Sandhu

कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Discipline Specific Elective
Biostatistics
(Credits: Theory-4, Practical-2)
THEORY
Lectures: 60

Unit 1: Biostatistics - definition - statistical methods - basic principles. Variables - measurements, functions, limitations and uses of statistics. (12 lectures)

Unit 2: Collection of data primary and secondary - types and methods of data collection procedures - merits and demerits. Classification - tabulation and presentation of data - sampling methods. (12 lectures)

Unit 3: Measures of central tendency - mean, median, mode, geometric mean - merits & demerits. Measures of dispersion - range, standard deviation, mean deviation, quartile deviation - merits and demerits; Co-efficient of variations. (14 lectures)

Unit 4: Correlation - types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression. (12 lectures)

Unit 5: Statistical inference - hypothesis - simple hypothesis - student 't' test - chi square test. (10 lectures)

Practical

- 1) Calculation of mean, standard deviation and standard error
- 2) Calculation of correlation coefficient values and finding out the probability
- 3) Calculation of 'F' value and finding out the probability value for the F value.

Suggested Readings

1. Biostatistic, Danniel, W.W., 1987. New York, John Wiley Sons.
2. An introduction to Biostatistics, 3rd edition, Sundarrao, P.S.S and Richards, J. Christian Medical College, Vellore
3. Statistical Analysis of epidemiological data, Selvin, S., 1991. New York University Press.
4. Statistics for Biology, Boston, Bishop, O.N. Houghton, Mifflin.
5. The Principles of scientific research, Freedman, P. New York, Pergamon Press.
6. Statistics for Biologists, Campbell, R.C., 1998. Cambridge University Press.

Discipline Specific Elective
Industrial and Environmental Microbiology
(Credits: Theory-4, Practical-2)
THEORY
Lectures: 60

Unit 1: Scope of microbes in industry and environment (6 lectures)

Unit 2: Bioreactors/Fermenters and fermentation processes (12 lectures)

Solid-state and liquid-state (stationary and submerged) fermentations; Batch and continuous fermentations. Components of a typical bioreactor, Types of bioreactors-laboratory, pilotscale and production fermenters; Constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter. A visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations.

Unit 3: Microbial production of industrial products (12 lectures)

Microorganisms involved, media, fermentation conditions, downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying; Hands on microbial fermentations for the production and estimation (qualitative and quantitative) of Enzyme: amylase or lipase activity, Organic acid (citric acid or glutamic acid), alcohol (Ethanol) and antibiotic (Penicillin)

Unit 4: Microbial enzymes of industrial interest and enzyme immobilization (8 lectures)

Microorganisms for industrial applications and hands on screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase).

Unit 5: Microbes and quality of environment. (6 lectures)

Distribution of microbes in air; Isolation of microorganisms from soil, air and water.

Unit 6: Microbial flora of water. (8 lectures)

Water pollution, role of microbes in sewage and domestic waste water treatment systems. Determination of BOD, COD, TDS and TOC of water samples; Microorganisms as indicators of water quality, check coliform and fecal coliform in water samples.

Unit 7: Microbes in agriculture and remediation of contaminated soils. (8 lectures)

Biological fixation; Mycorrhizae; Bioremediation of contaminated soils. Isolation of root nodulating bacteria, arbuscular mycorrhizal colonization in plant roots.

Practical

1. Principles and functioning of instruments in microbiology laboratory
2. Hands on sterilization techniques and preparation of culture media.

Suggested Readings

1. Pelzar, M.J. Jr., Chen E.C. S., Krieg, N.R. (2010). Microbiology: An application based approach. Tata McGraw Hill Education Pvt. Ltd., Delhi.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2007). Microbiology. Pearson Benjamin Cummings, San Francisco, U.S.A. 9th edition.

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027



SEC I Understanding Heritage

Course Objectives:

The aim of this paper is to make students familiar with the concept of heritage and its numerous forms. It will develop the contested character of heritage and why it needs to be conserved. Paper will also acquaint students with the evolution of heritage legislation and the ways in which its institutional framework developed. Accessing monumental or cultural heritage can be a very difficult task and economic and commercial consideration play an important role. The paper will be of particular value to those who are interested in seeking a career in the travel industry and art and cultural studies.

Learning Outcomes:

Upon completion of this course the student shall be able to:

- Explain the complex character of heritage.
- Analyse the historical processes which result into the making of heritage.
- Describe the significance of cultural diversity in the creation of heritage.
- Illustrate how heritage can be a medium to generate revenue
- Discern the nuances of heritage and will appreciate its importance.

Course Content:

Unit I: Defining heritage:

Meaning of 'antiquity', 'archaeological site', 'tangible heritage', 'intangible heritage' and 'art treasure'

Unit II: Evolution of heritage legislation and the institutional framework:

- Conventions and Acts -- national and international
- Heritage-related government departments, museums, regulatory bodies
- Conservation initiatives

Unit III: Challenges facing tangible and intangible heritage

Development, antiquity smuggling, conflict (specific cases studies)

Unit IV: Heritage and travel:

- Viewing heritage sites
- The relationship between cultural heritage, landscape and travel; recent trends

Unit V: A visit to a heritage site is an essential part of this course.

ESSENTIAL READINGS AND UNIT WISE TEACHING OUTCOMES:

Unit-I: This unit will introduce the meaning/s of heritage and associated politics. For a better understanding students will be encouraged to engage with terms like the meaning of 'antiquity', 'archaeological site', 'tangible heritage', 'intangible heritage' and 'art treasure'. **(Teaching time: 4 weeks Approx.)**

- Lowenthal, D. (2010). *Possessed By The Past: The Heritage Crusade and The Spoils of History*. Cambridge: Cambridge University Press.
- Lahiri, N. (2012). *Marshalling the Past- Ancient India and its Modern Histories*. Ranikhet: Permanent Black. (Chapter 4 and 5)
- Singh, U. (2016). *The Idea of Ancient India: Essays on Religion, Politics and Archaeology*. New Delhi: Sage. (Chapters 7, 8).

Unit-II: This unit deals with the history of heritage legislation. It also elaborates upon the institutional framework which manages heritage in India and at the global level. It will also examine the nature and relevance of conservation initiatives. **(Teaching time: 4 weeks Approx.)**

- Biswas, S.S. (1999). *Protecting the Cultural Heritage* (National Legislation and International Conventions). New Delhi: INTACH.
- Layton, R.P. Stone and J. Thomas. (2001). *Destruction and Conservation of Cultural Property*. London: Routledge.

Unit-III: This unit addresses the challenges posed in the conservation of tangible and intangible heritage. It also elaborates on the global character of the smuggling of antiquities and challenges faced by the national governments. **(Teaching time: 3 weeks Approx.)**

- Biswas, S.S. (1999). *Protecting the Cultural Heritage* (National Legislation and International Conventions). New Delhi: INTACH.
- Lowenthal, D. (2010). *Possessed By The Past: The Heritage Crusade and The Spoils of History*. Cambridge: Cambridge University Press.

Unit-IV: This unit deals with social efforts to identify heritage as something personal or national. Over time antiquities have frequently 'travelled' from their place of origin, the questions of 'belonging' are contentious and complex. **(Teaching time: 3 weeks Approx.)**

- Agrawal, O.P. (2006). *Essentials of Conservation and Museology*. Delhi: Motilal Banarsidas.

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*

कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.H.G. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)


कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)


कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)


कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)


कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)


कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)


कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)


कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Environment and Security. Stockholm Environmental Institute, Oxford University Press.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**DEPARTMENT OF ENVIRONMENTAL STUDIES
UNIVERSITY OF DELHI**

Environmental Studies*
(Six-month Module for Undergraduate Courses)

Unit 1 : Introduction to environmental studies

- Multidisciplinary nature of environmental studies
- Scope and importance
- Need for public awareness.

(2 lectures)

Unit 2 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Energy flow in an ecosystem: food chains, food webs and ecological pyramids.
- 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 as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification.
- Forests & forest resources : Use and over-exploitation, deforestation, case studies.
- Impacts of deforestation, mining, dam building on environment, forests, biodiversity and tribal populations.
- Resettlement and rehabilitation of project affected persons; problems and concerns, case studies
- Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state).
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- 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
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational values
- 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.

(8 lectures)

Unit 5 : Environmental Pollution

- What is environmental pollution and its types?
- Causes, effects and control measures of :
 - a) Air pollution

Attested by the Principal,
Shivaji College (University of Delhi)


कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

- b) Water pollution – freshwater and marine
- c) Soil pollution
- d) Noise pollution
- e) Thermal pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Role of an individual in prevention of pollution.
- Pollution case studies.

(8 lectures)

Unit 6 : Environmental Policies & Practices

- Concept of sustainability and sustainable development.
- Water conservation & watershed management.
- Climate change, global warming, acid rain, ozone layer depletion.
- Disaster management : floods, earthquake, cyclones and landslides.
- Wasteland reclamation.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Environment: rights and duties.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, demographic variation among nations.
- Environment, human health and welfare; infectious and lifestyle diseases in contemporary world.
- Value Education: Environmental ethics.
- Environmental communication and public awareness, case studies.

(6 lectures)

Unit 8 : Field work

- Visit to an area to document environmental assets river/ forest/ grassland/ hill/ mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

(Equal to 5 lectures)

Suggested Further Readings:

- 1 Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Cheney, J. 1989. Postmodern environmental ethics. *Environmental Ethics* 11: 117-134.
- 4 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 5 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 6 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 7 Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Development.
- 8 Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of conservation

Attested by the Principal,
Shivaji College (University of Delhi)

Shivaji *Sandhu*
कार्यवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027

Sunderland: Sinauer Associates, 2006.

- 9 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 10 Heywood V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge University Press.
- 11 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 12 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 13 Norton, B. G. 1984. Environmental ethics and weak anthropocentrism. *Environmental Ethics* 6: 131-148.
- 14 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- 15 Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
- 16 Philander, S. George (Ed.). (2012). *Encyclopedia of global warming & climate change*. (2nd ed., Vols. 1-3). Thousand Oaks, CA: SAGE Publications, Inc.
- 17 Rao MN and Datta AK, 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 18 Raven, P.H., David M. H., & Linda R. B. *Environment*. De Boeck, 2009.
- 19 Reaka-Kudla, Marjorie L., Don E. Wilson, and Edward O. Wilson, eds. 1996. *Biodiversity II: understanding and protecting our biological resources*. Joseph Henry Press.
- 20 Ricklefs, R. E., & Miller, G.L. 2000. *Ecology*. W. H. Freeman, New York.
- 21 Robbins, P. 2012. *Political ecology: A critical introduction*. John Wiley & Sons.
- 22 Rosencranz, A., Divan, S. & Noble, M.L.. *Environmental law and policy in India*. 2001. Tripathi 1992.
- 23 Rothmun, H.K. 1998. *The Greening of a Nation? Environmentalism in the United States since 1945*.
- 24 Sengupta, R. 2003. *Ecology and economics (OUP): An approach to sustainable development."* OUP Catalogue.
- 25 Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. *Ecology, Environment and Resource Ecology, Environment and Resource Conservation*. Anamaya Publishers.
- 26 Sodhi, N.S., Gibson, L. & Raven, P.HG. (eds). 2013. *Conservation biology: voices from the Tropics*. John Wiley & Sons.
- 27 Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- 28 Van Leeuwen, C. J., & Vermeire, T. G. 2007. *Risk assessment of chemicals*.
- 29 Warren, C.E. 1971. *Biology and water pollution control*.
- 30 Wilson, E. O. 2006. *The creation: An appeal to save life on earth*. New York: Norton.
- 31 World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.

***Note:** The course is uploaded as sent by the Department concerned. The scheme of marks and number of periods/lectures will be determined by the University and will be corrected in the syllabus according to Academic Council and Executive Council Minutes (dated 19th July 2014) and guidelines framed by the Course Implementation Committee, University of Delhi. Editing, typographical changes and formatting will be undertaken further.

Undergraduate Programme Secretariat

**Intellectual Property Right
(LSSE6)
Skill-Enhancement Elective Course - (SEC) Credit:4**

Course Objective(2-3)

To have knowledge of roles regulations, laws and processes of patents, copyright trademarks and concepts of traditional knowledge and protection of plant varieties.

Course Learning Outcomes

Students would have deep understanding of patents copyrights, their importance. They can think about the importance of traditional knowledge, bio-prospecting, biopiracy. They would gain the knowledge of farmers rights and the importance on indigenous plant varieties, concept of novelty and biotechnological inventions

Unit 1

Introduction to intellectual property right (IPR) (2 lectures)
Concept and kinds.Economic importance. IPR in India and world: Genesis and scope, some important examples.IPR and WTO (TRIPS, WIPO).

Unit 2

Patents (3 Lectures)
Objectives, Rights, Patent Act 1970 and its amendments. Procedure of obtaining patents, Working of patents.Infringement.

Unit 3

Copyrights (3 Lectures)

Introduction, Works protected under copyright law, Rights, Transfer of Copyright, Infringement

Unit 4

Trademarks (3 Lectures)

Objectives, Types, Rights, Protection of goodwill, Infringement, Passing off, Defences, Domain name

Unit 5

Geographical Indications (3 Lectures)

Objectives, Justification, International Position, Multilateral Treaties, National Level, Indian Position

Unit 6

Protection of Traditional Knowledge (4 Lectures)

Objective, Concept of Traditional Knowledge, Holders, Issues concerning, Bio- Prospecting and Bio-Piracy, Alternative ways, Protectability, need for a Sui-Generis regime, Traditional Knowledge on the International Arena, at WTO, at National level, Traditional Knowledge Digital Library.

Unit 7

Industrial Designs (2 Lectures) Objectives, Rights, Assignments, Infringements, Defences of Design Infringement

Unit 8

Protection of Plant Varieties (2 Lectures)

Plant Varieties Protection- Objectives, Justification, International Position, Plant varieties protection in India. Rights of Objective, Applications, Concept of Novelty, Concept of inventive step, Microorganisms, Moral Issues farmers, Breeders and Researchers. National gene bank, Benefit sharing. Protection of Plant Varieties and Farmers' Rights Act, 2001.

Unit 9

Information Technology Related Intellectual Property Rights (4 Lectures)
Computer Software and Intellectual Property, Database and Data Protection, Protection of
Semi-conductor chips, Domain Name Protection

Unit 10
Biotechnology and Intellectual Property Rights (4 Lectures)
Patenting Biotech Inventions

Practical

1. Patent search
 2. Trademark search
 3. copyright infringement (Plagiarism check by Urkund and other available software,
 4. Geographical Indicators
 5. food- Malabar pepper, Basmati rice, Darjeeling Tea, and Roquefort cheese,
 6. handlooms (Kota Doria, Banarasi Sari, Muga Silk, Kanchipuram),
 7. Industry (Mysore agarbatti, Feni Goa, Champagne France).
 8. Natural resources- Makrana marbles Two example of each category Biopiracy- neem, turmeric
 9. Industrial designs- Jewelry design, chair design, car design, Bottle design, Aircraft design,
 10. IPR e diary
-

References

1. Acharya, N.K. (2001). *Text Book on Intellectual Property Rights: (copyright, Trademark, Patent Design, Geographical Indications, Protection of New Plant Varieties & Farmers Rights and Protection of Biodiversity)*. Hyderabad: Asia Law House.
 2. Bhandari, M.K. (2017). *Central Law Publication's Law Relating to Intellectual Property Rights (IPR)*. Uttar Pradesh, Central Law Publications.
 3. Gogia, S.P. *Intellectual Property Rights (IPR) For B.S.L & L.L.B*. Hyderabad: Asia Law House.
-

Teaching Learning Process

Theory: The theory topics are covered in lectures with the help of PowerPoint presentations and the chalkboard. Students are encouraged to ask questions. The reading list has been suitably upgraded. When the entire syllabus is completed, a few lectures are devoted to discuss the previous years' question papers, thus preparing the students for the examination.

Syllabus for SEC Paper Apiculture-CBCS

Theory Syllabus:

Unit I: Biology of Bees-

1. History, Classification and Biology of Honey Bees,
2. Social Organization of Bee Colony.

Unit 2: Rearing of Bees

1. Artificial Bee rearing (Apiary), Beehives— Newton and Langstroth.
2. Bee Keeping Equipment
3. Bee Pasturage
4. Selection of Bee Species for Apiculture.
5. Methods of Extraction of Honey (Indigenous and Modern).

Unit 3: Diseases and Enemies

1. Bee Diseases and Enemies.
2. Control and Preventive measures.

Unit 4: Bee Economy

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc.

Unit 5: Entrepreneurship in Apiculture

Bee Keeping Industry — Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens.

Practical Syllabus:

1. To study the life history of *Apis mellifera*.
2. Submission of few products obtained from apiculture industry.
3. To prepare herbarium of nectar and pollen yielding flowering plants.
4. To study the structure of natural hive of *apis mellifera*.
5. To study the different types of artificial hives (Langstroth and Newtons Hive) and their parts.
6. To study the different equipment's used in Apiculture.
7. Field study by students by visiting different gardens and observing the activity of honey bees and different flowering plants. Preparation of report and submission.
8. To prepare a temporary mount of pollen grains from flower.
9. To prepare a temporary mount of legs of honey bee.
10. To study the various body parts of honey bee- Antennae, Mouth parts, Mandibles, Sting apparatus, Legs and Wings
11. Trip to an apiculture institute and submission of report. (Presently online).

Attested by the Principal,
Shivaji College (University of Delhi)


जयवाहक प्राचार्य / Officiating Principal
शिवजी महाविद्यालय / Shivaji College
(दिल्ली विश्वविद्यालय) / (University of Delhi)
राजा गार्डन, नई दिल्ली-110027
Raja Garden, New Delhi-110027