



# St. Xavier's College – Autonomous Mumbai

## Syllabus For 6<sup>th</sup> Semester Courses in **ENVIRONMENTAL SCIENCE** (June 2018 onwards)

### Contents:

Syllabus (theory and practicals) for Course:

SLSC6AC	Environment Sustainability and Legislation
SLSC06ACPR	Practicals

Template for theory and practical question paper  
Evaluation and Assessment Grid

### Percent revision:

2015-16: No revision

2016-17: No revision

2017-18: No revision

2018-19: 40-50% revision to practicals

2019-20: No revision

## LIFE SCIENCE

**T.Y.B.Sc.**

**Course No.: SLSC06AC**

### **Title: Environment Sustainability and Legislation**

#### **Learning Objectives:**

On completion of this course, a student must:

1. Know how waste is managed
2. Understand the need for and measures available for sustainable development & carbon management
3. Be aware of the various primary and renewable sources of energy
4. Be familiar with basic environmental legislations

**Number of lectures: 60**

#### **UNIT I**

**(15 lectures)**

1. Waste-water treatment: Water treatment systems: Primary, Secondary and Tertiary treatment of waste water, advanced techniques of water treatment, sewage treatment, water reuse and recycling in industries and agriculture. (8)
2. Solid and Hazardous waste management: (8)
  - a. Sources of solid waste – municipal, industrial, agricultural, biomedical, e-waste, radioactive wastes
  - b. Integrated waste management of solid waste
  - c. Case studies
3. Management of Spillage of petroleum products (Case Study – Bharat Petroleum) (1)

#### **UNIT II**

**(15 lectures)**

1. Treatment of polluted soils: Bioremediation, rejuvenation (2)
2. Clean Technologies- (5)

Concept of clean technology, green technology, green chemistry  
Case studies of various industries with respect to Good Manufacturing practices, Hazard Analysis Critical Control Points (HACCP), ISO certification, Cradle to cradle vs. Cradle to grave – manufacturing.
3. Sustainability & Business – cradle to cradle, greening supply chains, triple bottom line approach and Corporate Social responsibility (CSR).
4. Disaster Management (8)

Natural: Example- forest fires, Tsunami, floods, hurricanes, tornadoes, cyclones etc.  
Anthropogenic- nuclear reactors (Chernobyl/ 3- Mile Island), Bhopal Gas Tragedy, Oil Well fires

#### **UNIT III**

**(15 lectures)**

Renewable energy technologies:

1. Need for renewable resources
2. Solar energy-based technology – space & water heating devices, Solar collectors, PV (solar) cells, Solar ponds,
3. Wind Turbine technology – Principle & working of a wind turbine – Energy Laws in India – Case Study of Wind Farm Projects in India
4. Hydrogravitational energy – hydroelectric power plant, tidal energy towers

5. Fuel cell technology
6. Geothermal energy
7. Biomass – briquetting, gasification
8. Nuclear power – Fission reaction, design of a nuclear power plant, fissile uranium and transuranic waste, decommissioning of nuclear power plants; environmental impact of nuclear power plant (case studies: Japan, Kalpakam)

#### **UNIT IV**

**(15 lectures)**

1. Environmental legislations: **(10)**
  - a. National Action Plan on Climate Change (2008) – 8 Core Missions of (i) National Solar Mission, (ii) National Mission for Enhanced Energy Efficiency, (iii) National Water Mission, (iv) National Mission on Sustainable Habitat, (v) National Mission for Sustainable Agriculture, (vi) National Mission for Sustaining the Himalayan Ecosystems, (vii) National Mission for Green India and (viii) National Mission on Strategic Knowledge of Climate Change.
  - b. Air - Prevention and control of pollution Act
  - c. Water - Prevention and control of pollution Act
  - d. Wildlife Protection Act
  - e. Forest Conservation Act
  - f. Environmental Protection Act
  - g. International Legislation: Convention on Biological Diversity (CBD), Convention on International Trade in Endangered Species (CITES)  
(All of the above with cases studies)
  
2. Concept of Carbon Management **(5)**
  - a. Climate Change & Carbon Management
    - i. Causes & Effects of Climate Change
    - ii. Implications on the environment, society and economy
  - b. Kyoto and Montreal protocols
  - c. Concept of Carbon Credits with case studies in India
  - d. Concept of Carbon Footprinting & Carbon Disclosure Project (CDP)

## References:

### General

1. Hillary E. (1984). *Ecology 2000- The changing face of Earth*. Michael Joseph, London, UK.
2. *Down to the Wire, Confronting Climate Collapse*, Oxford University Press, 2009, David Orr.
3. C.P.R. Environmental Education Centre – *Plants And People*
4. Friedman Y. and Schaur E. (2003) *Environment and Self-Reliance*. Vigyan Prasar, New Delhi, India.
5. Friedman Y. (2003) *Energy and Self-Reliance*. Vigyan Prasar, New Delhi, India.
6. Chris Summerville (2006) *Looking Back, Moving Forward – An Environmental Course for the Next Generation, Reading And Discussion – Macmillan Languagehouse*
7. Kamla Chowdhry (1989) *Industrialisation Survival and Environment – A Dialogue on Development The INTACH Environmental Series*
8. Molly O'Mera Sheehan, Project Director (2007) – *State of the World –Our Urban Future – A World watch Institute Report on Progress Toward a Sustainable Society*. W. W. Norton & Company New York London
9. Relevant Publications from Center for Science & Environment (CSE).

### Water

10. *A Water Harvesting Manual for Urban Areas (Case Studies From Delhi and Mumbai)*. Centre for Science And Environment, New Delhi, India.
11. Shyam R Asolekar (Professor). (2007), *Wastewater Treatment For Pollution Control and Reuse – Third Edition - Tata McGraw-Hill Publishing Company Limited New Delhi*
12. Agarwal A., Narain S. and Khurana S. (eds) (2001). *Making Water Everybody's Business - Practice and Policy of Water Harvesting*. Centre for Science and Environment, New Delhi, India.

### Waste Management

13. Indian Centre for Plastics in the Environment (2003) *Plastics for Environment & Sustainable Development*, Thomson Press (India) Limited, New Delhi, India
14. Palnitkar S. (Dr, Mrs) *Solid Waste Management*. All India Institute of Local Self-Government, Mumbai, India
15. Palnitkar S. (Dr, Mrs) (2004). *The Wealth of Waste : Waste Recyclers For Solid Waste Management - A Study of Mumbai*. All India Institute of Local Self- Government, Mumbai, India

### Environmental Legislations

16. Divan S. and Rosencranz A. (2001). *Environmental Law And Policy In India*. Oxford India Paperbacks, India
17. Environmental Legislation in India By K.R. Gupta

### Renewable Energy Technology

18. Handbook of Renewable Energy Technology By Ahmed F. Zobaa, Ramesh Bansal
19. Renewable energy: technology, economics, and environment, Martin Kaltschmitt, Wolfgang Streicher (Ao. Univ.-Prof. Dipl.-Ing. Dr. techn.), Andreas Wiese, Andreas Wiese (Dr.-Ing.), Springer, 2007

### **Practicals: SLSC6ACPR**

1. SOIL ANALYSIS
  - a. Determination of pH
  - b. CaCO<sub>3</sub> estimation
  - c. Organic Matter
  - d. Moisture Content
  - e. Isolation and Gram Staining of *Azotobacter*
  
2. SEWAGE ANALYSIS
  - a. Determination of pH
  - b. TS, TDS and TSS in Effluents
  - c. Specific gravity
  - d. Biological Oxygen Demand (BOD)
  - e. Chemical Oxygen Demand (COD)
  
3. LIGHT
  - a. Measurement of light intensity using Luxmeter
  
4. MODEL-MAKING (preparation of a working model on any one of the following topics)
  - a. Renewable energy systems (solar cell/ solar collectors/ wind turbine etc)
  - b. Sewage Treatment Plant
  - c. Carbon Management in Industry
  - d. Energy efficient heating devices for housing complex / buildings
  - e. Water Harvesting System
  - f. Organic Farm
  - g. Vermiculture
  
5. Site visit ex: Visit to Suzlon Campus (Pune)
6. Case study ex: Study of ECO-LINK at Daman- recycled polyal- Vapi
7. Screening of Short Films

## **Template of Theory Question paper**

**Course: SLSC06AC**

**CIA I**– 20 marks, 45 mins.

Short/Essay questions, not more than 10 marks each

**CIA II** - 20 marks, 45 mins

Test (45 mins) /Survey /Assignment /Presentation /Poster /Essay /Review

**End Semester exam** – 60 marks, 2 hours.

**Question 1:** Unit I: maximum marks per sub-question - 6 marks

15 marks to be answered out of 22-23 marks

**Question 2:** Unit II: maximum marks per sub-question - 6 marks

15 marks to be answered out of 22-23 marks

**Question 3:** Unit III: maximum marks per sub-question - 6 marks

15 marks to be answered out of 22-23 marks

**Question 4:** Unit IV: maximum marks per sub-question - 6 marks

15 marks to be answered out of 22-23 marks

## **Mark-distribution pattern for Practical**

**Course: 06ACPR**

**CIA & End Semester Examination**

**Total marks: 50**

**CIA**

**Total marks: 20**

Q1. Model making

15 marks

Q2. Journal

05 marks

**End Semester Practical Examination**

**Total marks: 30**

Q1. Major experiment

20 marks

Q2. Minor experiment/ Case Study Report/ Field Visit Report

10 marks

**DEPARTMENT OF LIFE SCIENCES AND BIOCHEMISTRY**

<b>T.Y.B.Sc. APPLIED COMPONENT (ENVIRONMENTAL SCIENCE) - SEMESTER 6</b>					
<b>Course</b>	<b>Exam</b>	<b>Knowledge and Information</b>	<b>Understanding</b>	<b>Application/Analysis</b>	<b>Total</b>
<b>06AC</b>	CIA	10	7	3	20
	CIA	8	7	5	20
	End semester	25	20	15	60