



**SOPHIA COLLEGE, (AUTONOMOUS)**

Affiliated to

**UNIVERSITY OF MUMBAI**

**Programme: Life Sciences**

**Programme Code: SBSLSC**

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

(Choice Based Credit System with effect from the year 2022-23)

**Programme Outline: TYBScAC (SEMESTER 5)**

Course Code	Unit No	Name of the Unit	Credits
SBSAPC502		APPLIED ENVIRONMENTAL SCIENCES	4
	1	Introduction to Environment and exploitation of natural resources: Adopting appropriate testing strategies and remedial measure	
	2	Environmental Education & Legislation Objective	
	3	Green /Environmental Economics	
	4	Introduction to Environmental Management and Sustainable development	
SBSAPC502		Practicals	4

**Programme Outline: TYBScAC (SEMESTER 6)**

Course Code	Unit No	Name of the Unit	Credits
SBSAPC602		ENVIRONMENTAL MANAGEMENT	4
	1	Finance, Management Principles and Entrepreneurship	
	2	Biodiversity Conservation & Ecotourism Objective	
	3	Neo Avenues Objective	
	4	Industrial consultancy and clearance	
SBSAPC602		Practicals	4

## Preamble:

The revised syllabus is to enable students to have a holistic understanding of the components of our environment and the associated depletion of resources and pollution due to anthropogenic activities. The syllabus also focuses on conservation issues and involvement of general public in creating awareness regarding environmental issues. It also gives emphasis on sustainable utilisation of natural resources and conservation in economic planning and strategies at local, national and global level. Apart from this, the course would also encourage and enhance student's skills in research projects which is an integral component of practical.

This course would thus enable students to develop aptitude for self-employment as an environment consultant.

## PROGRAMME OBJECTIVES

<b>PO 1</b>	Understand and analyze fundamental biological concepts while merging perspectives from several domains related to modern biology
<b>PO 2</b>	Expand professional studies and research in disciplines such as neurology, genetics, cell biology, physiology, biochemistry, immunology, developmental biology, ecology, and biotechnology.
<b>PO 3</b>	Understand and apply information from a variety of scientific resources; assess and interpret graphical data; develop reliable hypotheses, plan experiments, and observational techniques in a laboratory setting; demonstrate problem-solving abilities; and present results from science in verbal and written form.
<b>PO 4</b>	Demonstrate expertise in scientific subjects such as biostatistics, bioinformatics, and analytical procedures required for productive biological research; understand biotechnological processes utilized in business; and anticipate need-based entrepreneurial opportunities in all areas of biology.
<b>PO 5</b>	Engage as a team, establish interpersonal communication skills, and get the confidence to pursue a career in any field of choice.

## PROGRAMME SPECIFIC OUTCOMES

<b>PSO 1</b>	The learner will be able to embrace the importance of sustainability, biodiversity and significance of different environmental agreements.
<b>PSO 2</b>	The learner will be able to develop a holistic understanding of the components of our environment and the associated depletion of resources and pollution due to anthropogenic activities.
<b>PSO 3</b>	The learner will be able to learn remediation techniques to mitigate the effects of anthropogenic activities on the environment.

## SEMESTER 5

NAME OF THE COURSE	<b>Applied Environmental Sciences</b>	
CLASS	TYBSCAC	
COURSE CODE	SBSAPC502	
NUMBER OF CREDITS	4	
NUMBER OF LECTURES PER WEEK	4	
TOTAL NUMBER OF LECTURES PER SEMESTER	75	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	50	50
PASSING MARKS	20	20

### **COURSE OBJECTIVES:**

CO 1.	Define key concepts in environmental science, including ecosystems, biodiversity, natural resources, and environmental sustainability.
CO 2.	Discuss the role of environmental education in promoting awareness, understanding, and responsible behavior towards the environment.
CO 3.	Outline the principles and objectives of environmental management, including risk assessment, pollution prevention, and environmental impact assessment (EIA).

### **COURSE LEARNING OUTCOMES:**

CLO 1.	The learner will be able to learn the important concepts of environment and its impact on the interrelationship between various components of the environment
CLO 2.	The learner will be able to recognize and raise awareness of the harmful effects of overexploitation of components in the environment resulting in balance shifts in ecosystems
CLO 3.	The learner will be able to learn remediation techniques to mitigate the effects of anthropogenic activities on the environment

UNIT 1	<b>INTRODUCTION TO ENVIRONMENT AND EXPLOITATION OF NATURAL RESOURCES: ADOPTING APPROPRIATE TESTING STRATEGIES AND REMEDIAL MEASURES (15 LECTURES)</b>
1.1	Composition of various segments of environment with respect to composition and inter-relationship <b>Water resources:</b> Use and over-utilization of surface and ground water, non-degradable pollution-E.g.: Flint Michigan Water crisis, Micro-plastics in oceans, conflicts over water E.g.: Cauvery water dispute, dams- benefits and problems E.g.: Tehri dam, remediation of water resources
1.2	<b>atmosphere:</b> Increased carbon emissions from industries, increased particulate matter, global warming, poor air quality in cities- Beijing as example, Methods of monitoring and control of air pollution. Air quality standards- analytic methods of testing, remedial measures
1.3	<b>Noise:</b> Examining sources of noise pollution- industrial, transportation, recreational, methods and instruments used to measure sound levels, regulatory cut-off levels, identifying methods to reduce noise pollution, areas of zero noise pollution
1.4	<b>Land resources:</b> Land as a resource, land degradation, man induced landslides, soil erosion and desertification, methods of monitoring and remediation of land resources, waste management and disposal
UNIT 2	<b>ENVIRONMENTAL EDUCATION &amp; LEGISLATION OBJECTIVE</b>
2.1	Goals, objectives & principles of environmental education. Environmental education programmes in India- e.g. Conservation India-enabling conservative action, Eco Sensitive Zones (ESZ)- Protection of Mangroves, Using satellite imagery to monitor ESZ Environmental organizations & agencies/ NGOs- CITES, EPA & MAB.
2.2	Global Environmental treaties/laws: Paris Agreement impact of USA withdrawal, Comprehensive Nuclear Test Ban Treaty 1996– IAEA( International Atomic Energy Agency), International convention for the Prevention of Pollution of the Sea by oil
2.3	Problems and challenges in Implementing the Acts in India, effective implementation of these legal provisions by using examples: Environmental laws in India: Wild life Protection Act, 1972, Water Prevention & Control of Pollution Act,1974, Air Prevention & Control of Pollution Act, 1981, Environment Protection Act, 1986 & Biological Diversity Act, 2002.
UNIT 3	<b>GREEN /ENVIRONMENTAL ECONOMICS</b>
3.1	Concept & economics of pollution control. Ambient air quality standards, BIS standards for drinking water, WHO water quality standards; Renewable v/s non- renewable. Solar (Domestic, transport) Biofuels (Petrocrops, ethanol production)

3.2	<p>Environment sustainability strategies:  Green Revolution  White Revolution  Sustainable meat production and processing  Recycling (Plastic/e-waste)</p>
3.3	<p>A case study of green accounting in Sweden/refinery/cement industry.</p>
UNIT 4	<p><b>INTRODUCTION TO ENVIRONMENTAL MANAGEMENT AND SUSTAINABLE DEVELOPMENT</b></p>
4.1	<p>Population, Consumption, and Technology  Carbon footprint  General thoughts on sustainability, sustainable lifestyles and education for sustainable consumption- use of alternative energy resources, organic markets and organic food as examples, sustainable development indicators</p>
4.2	<p>Green chemistry- twelve principles, areas highlighted by Agenda 21, transition from Industrial economy to Green economy</p>
SBSAPCP502	<ol style="list-style-type: none"> <li>1. Study of Physico-chemical properties of sewage/ effluent water: conductivity, turbidity, dissolved oxygen, salinity &amp; total hardness.</li> <li>2. Estimation of Pollution: BOD &amp; COD.</li> <li>3. Microbiological parameters: MPN and Gram staining</li> <li>4. Study of air micro flora.</li> <li>5. Measurement of intensity of light by Lux meter.</li> <li>6. Bioassay studies using water hyacinth or any suitable material.</li> <li>7. Study of types of pollution: water, air, land.</li> <li>8. Study of product derived by application of green chemistry (Laundry detergents, Polylactic acid packaging, Green paints, Pharmaceutical drugs Ibuprofen)</li> <li>9. Study of application of alternative energy resources (Solar panel, Biogas plant, Photovoltaic cell, Windmill, Nuclear reactor, Harnessing tidal energy)</li> <li>10. Study of applications of various Spectroscopy (any 4), Chromatography and Electrophoresis instruments.</li> <li>11. Study of logistic services for medical, toxic waste (Containers, Incinerator, Autoclave).</li> <li>12. Study of indoor plants for reduction of pollution (Adiantum, Ocimum sanctum, Ivy, Chlorophytum, Monstera, Philodendron, Dracena, Chrysanthemum, Gerbera).</li> <li>13. Photographic documentation of environment related issues/ conservation Submission of soft &amp; hard copy of 5 original photographs taken by the learner (Ex if details required)</li> <li>14. Assignment (may be submitted in a group not exceeding three students).</li> </ol>

## **SEMESTER 6**

NAME OF THE COURSE	<b>Environmental Management</b>	
CLASS	TYBSCAC	
COURSE CODE	SBSAPC602	
NUMBER OF CREDITS	4	
NUMBER OF LECTURES PER WEEK	4	
TOTAL NUMBER OF LECTURES PER SEMESTER	75	
EVALUATION METHOD	INTERNAL ASSESSMENT	SEMESTER END EXAMINATION
TOTAL MARKS	50	50
PASSING MARKS	20	20

### **COURSE OBJECTIVES:**

CO 1.	Define biodiversity and its significance in maintaining ecosystem services, resilience, and human well-being.
CO 2.	Define "neo avenues" in the context of contemporary business opportunities and emerging markets.
CO 3.	Explain the roles of regulatory bodies, environmental impact assessments (EIA), and compliance standards in industrial consultancy.

### **COURSE LEARNING OUTCOMES:**

CLO 1.	The learner will be able to explore possibilities within learners to be nature enthusiasts, passionate naturalists, adventurers and eco friendly tourists.
CLO 2.	The learner will be able to augment the avenues of employability and entrepreneurship in the arena of industrial consultancy
CLO 3.	The learner will be able to develop an acumen to tap the potential for entrepreneurship with respect to environment related products and indoor plants

UNIT 1	<b>FINANCE, MANAGEMENT PRINCIPLES AND ENTREPRENEURSHIP COSTING (15 LECTURES)</b>
1.1	<p>Basic concept: Types of cost (historical, standard and marginal).</p> <p><b>Basic accountancy:</b>  Basic terms, golden rules in accounts, types of accounts (Indian), journal entry, ledger Posting, subsidiary book, single column cash book, double column cash book.</p> <p>Depreciation: fixed installment, reducing balance method.  Bank reconciliation.  Final account.</p>
1.2	<p><b>Management Principles:</b>  Organizational structure  Marketing management  Finance management  Human resource management</p>
1.3	<p><b>Entrepreneurship</b>  Basics of entrepreneurship, Women Entrepreneur Micro Small and Medium Enterprises (MSME), Sources of Finance, Secured and Unsecured Loans</p>
UNIT 2	<b>BIODIVERSITY CONSERVATION &amp; ECOTOURISM OBJECTIVE</b>
2.1	<p>Introduction, Scope and significance of Biodiversity Values of Biodiversity- Direct and Indirect use values and threats.  Strategies for biodiversity conservation (in-situ and ex-situ).</p>
2.2	<p>Hotspots of biodiversity and biosphere reserve.  Commercial wildlife photography.  Ecotourism-Principle, Benefits and Negative effects of ecotourism (E.g. Jim Corbett National Park)</p>
2.3	<p>Revenue generating mechanisms- Home stay and conservation efforts at Ladakh (Snow leopard)</p>
UNIT 3	<b>NEO AVENUES OBJECTIVE</b>
3.1	<p>Understanding market niche of domestic pollution control devices- air purifiers, smoke absorbers and chimneys, Heating, Ventilation and A.C. Systems (HVAC). Green marketing: Greenhouse gas reduction market. LOHAS (Lifestyle Of Health and Sustainability) and Green Washing.</p>
3.2	<p>Indoor Plants to Reduce Pollution:  Radiation absorbing plant, example – <i>Adiantum capillus veneris</i> (Venus or Black Maiden hair fern), <i>Ocimum sanctum</i> (Holy basil or Tulsi), <i>Hedera helix</i> (Ivy).  Natural air filtering system, example – <i>Chlorophytum comosum</i> (Spider plant), <i>Monstera deliciosa</i> (Swiss cheese plant)  Smoke absorbing plant, example– <i>Philodendron</i></p>



	<p><i>bipinnatifidum</i> (Lacy tree philodendron or Selloum), <i>Dracena reflexa</i> (Song of India), <i>Dendrante hemagrandiflora</i> (Chrysanthemum or Shevanthi), <i>Gerberajamesonii</i> (Transvaaldaisy)</p> <p>Interior landscaping solutions to green office space- e.g. Studies assessing the effect of green spaces on employee health and productivity</p>
UNIT 4	<b>INDUSTRIAL CONSULTANCY AND CLEARANCE</b>
4.1	<p>Role of Environment consultant  Requirements for Environmental Clearance  Requirements for Green Clearance  Environment Biotechnology:  Bioremediation—Principles, factors responsible, microbial population for bioremediation, Environmental variation in field, Enzymatic – biodegrative pathway,  Genetic Engineering Approach, strategies;  Phytoremediation—(Metal and Organic)  Need for Research and development.</p>
SBSAPCP602	<ol style="list-style-type: none"> <li>1. Study of soil microflora and determination of sedimentation rate.</li> <li>2. Study of physical properties of soil: Temperature, moisture, &amp; texture of soil.</li> <li>3. Study of chemical properties of soil: pH, Organic matter and Calcium carbonate.</li> <li>4. Detection of heavy metal cations: Zinc, Cadmium, Lead from soil sample.</li> <li>5. Population analysis by Quadrant method &amp; Line transect method.</li> <li>6. Observation &amp; study of indicator species.</li> <li>7. Study of air &amp; noise pollution monitoring device, geospatial instrument.</li> <li>8. Study of any five biodiversity hotspots, bio reserves of India.</li> <li>9. Study of any four effects of global warming and climate change.</li> <li>10. Study of ANN chart and statistical model.</li> <li>11. Study of microbes &amp; plants used in bioremediation.</li> <li>12. Study of biodegradable plastic products, biopesticides brands.</li> <li>13. Visit to any industry/laboratory/plant/national park and submission of report.</li> <li>14. Project and submission of report (Project report may be submitted in a group not exceeding three students).</li> </ol>

## REFERENCES:

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### **ASSESSMENT DETAILS:( this will be same for all the theory papers)**

#### **Internal Assessment (50 marks)**

- Test (25 marks)-Students will be given a test from any of the units for 25 marks. The duration of the test will be 50 minutes. (Multiple choice questions- 10 marks, Answer in one word/sentence - 05 marks, Subjective questions - HWY, Justify, Differentiate between, Diagrammatically etc. - 10 marks.)
- An activity for 25 marks would be given in the form of a creative learning process. (Powerpoint presentation, Report and Viva, Model making and presentation, poster presentation, Analytical problems on higher order thinking, any other activity)

#### **Semester end examination (50 marks)**

- The duration of the paper will be two hours.
- Q1/Q2/Q3/Q4 - 20 marks each (2 X 5 = 40) Long answer questions (1 out of 2)- 5 marks each x 2 = 10 marks
- Q5 – mixed- short notes – (any two out of 4)- 5 marks each X 2 = 10marks

#### **Practical Assessment (for papers with practicals)**

- The students are allowed to write the paper if the attendance for practicals is more than 75%
- To appear in the practical exam, students must bring a properly certified journal.