SOPHIA COLLEGE

(AUTONOMOUS)

Affiliated to the University of Mumbai

Syllabus for Semesters V to VI

Program: B.Sc.

Course: Environmental Science (Applied Component)

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

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.

T.Y. B.Sc. Syllabus

Choice based Credit and Grading System

Environmental Science & Pollution (Applied Component) Syllabus

(To be implemented from the Academic year 2022-2023)

Semester V

Applied Environmental Sciences

Theory (All four units compulsory)				
COURSE CODE	**UNIT**	**TOPIC HEADINGS**	**CREDITS**	**LECTURES**
SBSAPC502	**1**	Introduction to Environment and exploitation of natural resources: Adopting appropriate testing strategies and remedial measures	**2**	**4**
	2	Environmental Education & Legislation Objective		
	3	Green /Environmental Economics		
	4	Introduction to Environmental Management and Sustainable development		
SBSAPCP502	Practical		**2**	**4**

SEMESTER VI

Environmental Management

Theory (All four units compulsory)				
COURSE CODE	**UNIT**	**TOPIC HEADINGS**	**CREDITS**	**LECTURES**
SBSAPC602	**1**	Finance, Management Principles and Entrepreneurship	**2**	**4**
	2	Biodiversity Conservation & Ecotourism Objective		
	3	Neo Avenues Objective		
	4	Industrial consultancy and clearance		
SBSAPCP602	Practical		**2**	**4**

Semester V: Theory
Applied Environmental Sciences
Course code SBSAPC502
(All four units compulsory**)**
(Preliminary plan for project guideline to be submitted)

Objectives:

- To revise the important concepts of environment and its impact on the interrelationship between various components of the environment.
- To recognize and realize or raise awareness of the harmful effects of overexploitation of components in the environment resulting in balance shifts in ecosystems
- Analytic methods used for testing harmful chemicals/pollutants released in the environment
- To learn remediation techniques to mitigate the effects of anthropogenic activities on the environment

Lectures 60 **Credits 2**

Course Code	Unit	Topic headings	Lectures
SBSAPC502	**1**	**Introduction to Environment and exploitation of natural resources: Adopting appropriate testing strategies and remedial measures**	**15**
		Composition of various segments of environment with respect to composition and inter-relationship	
		Water resources: Use and over-utilization of surface and ground water, non-degradable pollution-E.g.: Flint	3
		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	3
		Atmosphere: 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	3
		Noise: 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	3
		Land resources: 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	3

SBSAPC502	**2**	**Environmental Education & Legislation Objective**: 2.1 Goals, objectives & principles of environmental education. 2.2 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 2.3 Environmental organizations & agencies/ NGOs- CITES, EPA & MAB. 2.4 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 2.5. 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.	**15** 1 1 3 5 5
SBSAPC502	**3**	**Green /Environmental Economics** 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 Environment sustainability strategies: • Green Revolution • White Revolution • Sustainable meat production and processing • Recycling (Plastic/e-waste) 3.3 A case study of green accounting in Sweden/refinery/cement industry.	**15** 15 7 6 2
SBSAPC502	**4**	**Introduction to Environmental Management and Sustainable development:** 4.1 Population, Consumption, and Technology 4.2 Carbon footprint 4.3 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	**15** 3 2 5

		(eg. Sustainable model villages) 4.4 Green chemistry- twelve principles, areas highlighted by Agenda 21, transition from Industrial economy to Green economy	5
SBSAPCP502		**Practical:** 1. Study of Physico-chemical properties of sewage/ effluent water: conductivity, turbidity, dissolved oxygen, salinity & total hardness. 2. Estimation of Pollution: BOD & COD. 3. Microbiological parameters: MPN and Gram staining 4. Study of air micro flora. 5. Measurement of intensity of light by Lux meter. 6. Bioassay studies using water hyacinth or any suitable material. 7. Study of types of pollution: water, air, land. 8. Study of product derived by application of green chemistry (Laundry detergents, Polylactic acid packaging, Green paints, Pharmaceutical drugs- Ibuprofen) 9. Study of application of alternative energy resources (Solar panel, Biogas plant, Photovoltaic cell, Windmill, Nuclear reactor, Harnessing tidal energy) 10. Study of applications of various Spectroscopy (any 4), Chromatography and Electrophoresis instruments. 11. Study of logistic services for medical, toxic waste (Containers, Incinerator, Autoclave). 12. Study of indoor plants for reduction of pollution (Adiantum, Ocimum sanctum, Ivy, Chlorophytum, Monstera, Philodendron, Dracena, Chrysanthemum, Gerbera). 13. Photographic documentation of environment related issues/ conservation Submission of soft & hard copy of 5 original photographs taken by the learner (Ex if details required) 14. Assignment (may be submitted in a group not exceeding three students).	

Semester VI: Theory
Environmental Management
Course code: SBSAPC602
(All four units compulsory)

Objectives:

- To introduce the various concepts of costing, book keeping and final accounts.
- To make students aware of entrepreneurship and motivate them to identify opportunities
- To explore possibilities within learners to be nature enthusiasts, passionate naturalists, adventurists and eco friendly tourists.
- To tap the ecotourism avenues within and outside the country
- To expose and augment the avenues of employability and entrepreneurship in the arena of industrial consultancy
- Learner will develop an acumen to tap the potential for entrepreneurship with respect to environment related products and indoor plants

Lectures 60 **Credits 2**

Course Code	Unit	Topic headings	Lectures
SBSAPC602	**1**	**Finance, Management Principles and Entrepreneurship** **Costing** Basic concept: Types of cost (historical, standard and marginal). **Basic accountancy:** ▪ Basic terms, golden rules in accounts, types of accounts (Indian), journal entry, ledger Posting, subsidiary book, single column cash book, double column cash book. ▪ Depreciation: fixed installment, reducing balance method. ▪ Bank reconciliation. ▪ Final account. **Management Principles:** Organizational structure Marketing management Finance management Human resource management **Entrepreneurship** Basics of entrepreneurship, Women Entrepreneur Micro Small and Medium Enterprises(MSME), Sources of Finance, Secured and Unsecured Loans	**15** 3 4 4 4

SBSAPC602	**2**	**Biodiversity Conservation & Ecotourism Objective:** • Introduction, Scope and significance of Biodiversity • Values of Biodiversity- Direct and Indirect use values and threats. • Strategies for biodiversity conversation (in-situ and ex- situ). • Hotspots of biodiversity and biosphere reserve. • Commercial wildlife photography. • Ecotourism-Principle, Benefits and Negative effects of ecotourism (E.g. Jim Corbett National park) • Revenue generating mechanisms- Home stay and conservation efforts at Ladakh (Snow leopard)	**15** 2 3 1 1 1 5 2
SBSAPC602	**3**	**Neo Avenues Objective:** 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. Indoor Plants to Reduce Pollution: ▪ Radiation absorbing plant, example – *Adiantum capillus-veneris* (Venus orBlack Maiden hair fern), *Ocimum sanctum* (Holy basil or Tulsi), *Hedera helix* (Ivy). ▪ Natural air filtering system, example – *Chlorophytum comosum* (Spider plant), *Monstera deliciosa* (Swiss cheese plant) ▪ Smoke absorbing plant, example– *Philodendron bipinnatifidum* (Lacy tree philodendron or Selloum), *Dracena reflexa* (Song of India), *Dendrante hemagrandiflora (*Chrysanthemum or Shevanthi), *Gerberajamesonii* (Transvaaldaisy) Interior landscaping solutions to green office space- e.g. Studies assessing the effect of green spaces on employee health and productivity	**15** 6 2 2 2 3

SBSAPC602	4	**Industrial consultancy and clearance ÷** 4.1 Role of Environment consultant 4.2 Requirements for Environmental Clearance 4.3 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) 4.4 Need for Research and development.	**15** 1 1 1 5 5 2
SBSAPCP602		**Practical:** 1. Study of soil microflora and determination of sedimentation rate. 2. Study of physical properties of soil: Temperature, moisture, & texture of soil. 3. Study of chemical properties of soil: pH, Organic matter and Calcium carbonate. 4. Detection of heavy metal cations: Zinc, Cadmium, Lead from soil sample. 5. Population analysis by Quadrant method &Line transect method. 6. Observation & study of indicator species. 7. Study of air &noise pollution monitoring device, geospatial instrument. 8. Study of any five biodiversity hotspots, bio reserves of India. 9. Study of any four effects of global warming and climate change. 10. Study of ANN chart and statistical model. 11. Study of microbes & plants used in bioremediation. 12. Study of biodegradable plastic products, biopesticides brands. 13. Visit to any industry/laboratory/plant/national park and submission of report. 14. Project and submission of report (Project report may be submitted in a group not exceeding three students).	

References and Additional Reading

1. A Text Book in Environmental Science, V. Subramanian, Narosa PublishingHouse.2002.
2. An Advanced Textbook on Biodiversity, K.V. Krishnamurthy, Oxford &IBH Publishing Co. Pvt.Ltd.2009.
3. Atmosphere, Weather & Climate, R.G. Barry & R.I. Charley,ELBS1982.
4. Bioresource Ecology, T. N. Anatha krishnan, Oxford &IBM Publishing Company, NewDelhi 1982.
5. Concepts of Ecology, E. J. Kormandy, Prentice Hall of India(Pvt.)Ltd.
6. Ecological Methods of Field & Laboratory Investigations, P. Michael, Tata McGrawHill.
7. Ecology & Quality of our Environment, Charles H. Southwid, D. Van Nostrand Co.N.Y.1976.
8. Ecotourism, Ecorestoration & Development, Solomon Raju, New Central bookagency,2007.
9. Environment, e-book,ShankarA.G.
10. Environmental Accounting, N. Das, S. Chand &Company.1997.
11. Environmental Biology, P.D. Sharma, RastogiPublications1996.
12. Environmental, Chemical & Biological Analysis, H.V. Jadhav & S.N.Jogdand,Himalaya PublishingHouse.
13. Environmental Impact Assessment Methodologies, Anjaneyulu Y., B.S Publication, Hyderabad. 2002.
14. Environmental Management, Khitolia, ChandPublications.
15. Environmental Management. Environmental Engineering Series; Vijay Kulkarni &T. V. Ramchandra, Publ. Commonwealth of Learning, Indian Institute of Science(IISC), Bangalore. 2011.
16. Environmental Pollution & Health Hazards in India, R. Kumar, Abhish Publ. House, New Delhi 1987.
17. Environmental Pollution & Management, Pramod Singh, Chugh Publ.Allahabad1985.
18. Environmental Science Ahluwalia V.K. & Malhotra Sunita:. Ane BooksIndia2006.
19. Environmental Science, J. Turk, A. Turk &K. Arms, Saunders CollegePublishing1983.
20. Environmental Science, S.C. Santra, New Central Book Agency (P)Ltd.2001.
21. EnvironmentalScience–EarthaslivingPlanet,DanielBotkin& EdwardKellere, J.WileySons 1995.
22. Environmental Studies, Sharma Narendra,PrashantPublications.
23. Environmental Studies: From crisis to cure, Rajagopalan R., OxfordHigherEducation.
24. Fundamentals of Ecology, E. P. Odum, W.B.SaundersCompany.

25. Global Environmental Issues – A Climatological Approach, David D. Kemp, RoultLedge Company, London & N.Y.1990.

26. Indicator of Environmental Quality, Williams A. Thomas, Plenum Press, N.Y. &London1971.

27. Industrial Hygiene & Chemical Safety, Fulekar .M.H., I. K. International PvtLtd,2006.

28. Introduction to Climatology for the Tropics, J.O. Ayoade, J. Wiley & Sons 1983. 29) Management of Municipal solid waste; Environmental Engineering Series, T. V. Ramchandra, Publ.Commonwealth of Learning, Indian Institute ofScience(IISCBangalore.2011.

29. Pollution Control in Process Industries, S.P. Mahajan,TMH1988.

30. Practical Methods in Ecology & Environmental Science,Trivedi, Goel &Trisal,Environmental Publications,Karad1987.
31. Text book of Environmental Chemistry & Pollution Control. Revised edition,Dara S.S.& Mishra D.D.,S.ChandPublications.

32. Waste Water Treatment for Pollution Control, Soli J. Arcivala,TMH1986.

33. Water & Water Pollution Handbook, L.L. Caccio, Marcel Dekker Inc.N.Y.1971.

34. Wildlife photography- Advanced field techniques for amazing images,Classen,Joe.

35. Ghosh ,Amitav : The great derangement : Climate change and theunthinkable.

36. Climate Change and Paris Agreement:Challenges after US Withdrawa