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 2019-2020)

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 students 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 2019-2020)

Semester V

Applied Environmental Sciences

Theory (All four units compulsory)				
COURSE CODE	**UNIT**	**TOPIC HEADINGS**	**CREDITS**	**LECTURES**
SBSLSCAC501	**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 Audit and Environmental Forensics		
	4	Introduction to Environmental Management and Sustainable development		
SBSLSCACP501	Practical		**2**	**4**

SEMESTER VI

Environmental Management

Theory (All four units compulsory)				
COURSE CODE	**UNIT**	**TOPIC HEADINGS**	**CREDITS**	**LECTURES**
SBSLSCAC601	**1**	Finance, Management Principles and Entrepreneurship	**2**	**4**
	2	Biodiversity Conservation & Ecotourism Objective		
	3	Neo Avenues Objective		
	4	Industrial consultancy Objective		
SBSLSCACP601	Practical		**2**	**4**

Semester V: Theory
Applied Environmental Sciences
Course code SBSLSCAC501
(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
SBSLSCAC501	**1**	**Introduction to Environment and exploitation of natural resources: Adopting appropriate testing strategies and remedial measures**	**15**
		1.1 Composition of various segments of environment with respect to composition and inter-relationship	3
		1.2 Water resources: 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	3
		1.3 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
		1.4 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
		1.5 Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification,	3

		methods of monitoring and remediation of land resources, waste management and disposal	
SBSLSCAC501	**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, IUCN & 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 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
SBSLSCAC501	**3**	**Green /Environmental Audit and Environmental Forensics:** 3.1 Concept & economics of pollution control. 3.2 Environmental accounting: definition, concept & issues. 3.3 Concept of environmental audit. 3.4 Benefits of environmental auditing. 3.5 Environmental audit programmes in India. 3.6 Environmental Forensics and the importance of source identification 3.7 An Environmental Forensics Focus on Petroleum Hydrocarbons 3.8 Tracking of chlorinated solvents in the environment, Ground water Fingerprinting: The emerging role, Microbial Techniques for Environmental Forensics	**15** 1 1 1 2 3 3 2 2
SBSLSCAC501	**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
SBSLSCACP501		**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 (Exif details required) 14. Assignment (may be submitted in a group not exceeding three students).	

Semester VI: Theory
Environmental Management
Course code: SBSLSCAC601
(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
SBSLSCAC601	**1**	**Finance, Management Principles and Entrepreneurship**	**15**
		1.1. Costing 1.1.1. Basic concept: Types of cost (historical, standard and managerial). 1.1.2. Budget: Budgetary control (process, batch, job and service). 1.1.3. Variances: Material, labor and overheads.	3
		1.2. Basic accountancy: 1.2.1. Basic terms, golden rules in accounts, types of accounts (Indian), journal entry, ledger Posting, subsidiary book, single column cash book, double column cash book. 1.2.2. Depreciation: fixed installment, reducing balance method. 1.2.3. Bank reconciliation. 1.2.4. Final account.	4
		1.3 Management Principles: 1.3.1 Organizational structure 1.3.2 Marketing management 1.3.3 Finance management 1.3.4 Human resource management	4

		1.4 Entrepreneurship 1.4.1 Basics of entrepreneurship 1.4.2 Women Entrepreneur 1.4.3 Micro Small and Medium Enterprises (MSME) 1.4.4 Sources of Finance, Secured and Unsecured Loans	4
SBSLSCAC601	**2**	**Biodiversity Conservation & Ecotourism Objective:** 2.1 Hotspots of biodiversity and biosphere reserve. 2.2 Strategies for biodiversity conversation (in-situ and ex-situ). 2.3 Commercial wildlife photography. 2.4 Ecotourism (E.g. Jim Corbett National park, Home Stay-A Rural Tourism Entrepreneurship Business) 2.4.1 Visitor site planning and sustainable Infrastructure design 2.4.2 Visitor Impact Monitoring and Management 2.4.3 Preparation of a feasibility analysis report 2.4.4 Revenue generating mechanisms 2.4.5 Business considerations, preparation of a business plan and financing of an ecotourism project	**15** 2 3 2 8
SBSLSCAC601	**3**	**Neo Avenues Objective:** 3.1 Understanding market niche of domestic pollution control devices–air purifiers, smoke absorbers and chimneys, Heating, Ventilation and A.C. Systems (HVAC). 3.2 Green marketing: 3.2.1 Greenhouse gas reduction market. 3.2.2 LOHAS (Lifestyle Of Health and Sustainability) and Green Washing. 3.3 Indoor Plants to Reduce Pollution: 3.3.1 Radiation absorbing plant, example – *Adiantum capillus-veneris* (Venus or Black Maiden hair fern), *Ocimum sanctum* (Holy basil or Tulsi), *Hedera helix* (Ivy). 3.3.2 Natural air filtering system, example – *Chlorophytum comosum* (Spider plant),*Monstera deliciosa* (Swiss cheese plant) 3.3.3 Smoke absorbing plant, example – *Philodendron bipinnatifidum* (Lacy tree philodendron or Selloum), *Dracena reflexa* (Song of India), *Dendrantehemagrandiflora* (Chrysanthemum or Shevanthi), *Gerberajamesonii* (Transvaal daisy) 3.3 Interior landscaping solutions to green office space-	**15**

		e.g. Studies assessing the effect of green spaces on employee health and productivity	
SBSLSCAC601	4	**Industrial consultancy Objective:** 4.1 Types of consultancies. 4.2 Calculating consultancy fees. 4.3 Industrial marketing. 4.4 Logistic services for medical, microbiological, carcinogenic, toxic, nuclear waste. 4.5 MPCB and CPCB norms and liaison.	**15** 3 3 3 3 3
SBSLSCACP601		**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, bio pesticides 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 Publishing House. 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, ELBS 1982.
4. Bioresource Ecology, T. N. Anatha krishnan, Oxford & IBM Publishing Company, New Delhi 1982.
5. Concepts of Ecology, E. J. Kormandy, Prentice Hall of India (Pvt.) Ltd.
6. Ecological Methods of Field & Laboratory Investigations, P. Michael, Tata Mc Graw Hill.
7. Ecology & Quality of our Environment, Charles H. Southwid, D. Van Nostrand Co. N.Y. 1976.
8. Ecotourism, Ecorestoration & Development, Solomon Raju, New Central book agency, 2007.
9. Environment, e-book, Shankar A.G.
10. Environmental Accounting, N. Das, S. Chand & Company. 1997.
11. Environmental Biology, P.D. Sharma, Rastogi Publications 1996.
12. Environmental, Chemical & Biological Analysis, H.V. Jadhav & S.N. Jogdand, Himalaya Publishing House.
13. Environmental Impact Assessment Methodologies, Anjaneyulu Y., B.S Publication, Hyderabad. 2002.
14. Environmental Management, Khitolia, Chand Publications.
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. Allahabad 1985.
18. Environmental Science Ahluwalia V.K. & Malhotra Sunita:. Ane Books India 2006.
19. Environmental Science, J. Turk, A. Turk & K. Arms, Saunders College Publishing 1983.
20. Environmental Science, S.C. Santra, New Central Book Agency (P) Ltd. 2001.
21. Environmental Science – Earth as living Planet, Daniel Botkin & Edward Kellere, J. WileySons 1995.
22. Environmental Studies, Sharma Narendra, Prashant Publications.
23. Environmental Studies: From crisis to cure, Rajagopalan R., Oxford Higher Education.
24. Fundamentals of Ecology, E. P. Odum, W.B. Saunders Company.

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

26. Indicator of Environmental Quality, Williams A. Thomas, Plenum Press, N.Y. & London 1971.

27. Industrial Hygiene & Chemical Safety, Fulekar .M.H., I. K. International Pvt Ltd, 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 of Science (IISCBangalore.2011.

29. Pollution Control in Process Industries, S.P. Mahajan, TMH 1988.

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. Chand Publications.

32. Waste Water Treatment for Pollution Control, Soli J. Arcivala, TMH 1986.

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 the unthinkable.

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