

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar
(Autonomous)

**(Affiliated to Savitribai Phule Pune University,
Pune)**



Choice Based Credit System (CBCS)

Bachelor of Science (B.Sc.)

Syllabus of

S. Y. B.Sc. Environmental Science

Implemented from

Academic Year 2022 - 23

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar
(Autonomous)

Board of studies in Environmental Science

Sr. No.	Name	Designation
1.	Dr. Satish D .Kulkarni	Chairman
2.	Prof. Dr. N. R. Bandella	Academic Council Nominee
3.	Dr. Nilesh Wagh	Academic Council Nominee
4.	Dr. Deepali Nimbalkar	Vice-Chancellor Nominee
5.	Dr. D. D. Ahire	Member
6.	Dr. A.P. Pandit	Member
7.	Prof. Dr. D.C. Meshram	Member (co-opt)
8.	Dr. Ashish V. Mane	Member (co-opt)
9.	Mr. Kaliprasad Ningurkar	Alumni
10.	Dr. Prakash Mundhe	Industry Expert

Prologue/ Introduction of the programme:

The course curriculum for undergraduate studies under choice based credit system (CBCS) for B.Sc. in Environmental Science. The course curriculum outlined here is designed in an inclusive and interdisciplinary manner and draws content from various allied disciplines. Ideally, an undergraduate programme in environmental science should focus equally on theory and practice so that students are able to pick up necessary skills enabling them to find gainful employment at the job market. Therefore, a number of skill-based courses have been identified and made a part of the curriculum. Attention was also paid to structuring various core courses so as to make them appealing from a practitioner's point of view. It is hoped that a student with a B.Sc. Environmental Science degree, after having read the courses outlined here, should feel adequately equipped to meet the challenges of career development. At the same time, there is sufficient content for those who wish to continue academic life at the university beyond undergraduate level. That said, due care has been taken to maintain necessary academic rigor and depth in the course content so that the learning outcomes from these courses will lead to intellectual growth of a student.

During the first year of the programme, the students are trained on basic concepts of Environmental science. From second year students are allowed to concentrate on specific areas of the subject, on which they complete their practical and field survey reports. After completing the course, the students will be amply prepared for professional careers in M.Sc. in Environmental Science.

This is a job oriented programme and relevant to the current needs of our society. The extent (scope, depth and outcomes) of B.Sc. Environment Sciences programme has taken into account the extent of the knowledge provided at school level in 10th, 11th and 12th standard according to syllabi of NCERT and state boards. It has been designed to bridge the gap between the school level and M.Sc. programmes on environment. This is essential because of the interdisciplinary nature of the subject. More so, there is a current trend to look at the environment through a transdisciplinary approach which is relevant by the nature of the subject and the socio-economic fabric of India.

1. Programme outcomes (POs) (B.Sc. Environmental Science)

1. Provide students with the scope to develop knowledge base covering all attributes of the environment and enable them to attain scientific/technological capabilities to find answers to the fundamental questions before the society with regards to human action and environmental effects with due diligence.
2. Enhance the ability to apply this knowledge and proficiency to find solutions relating to environmental concerns of varied dimensions of present times
3. Provide with a direction and technical capability to carry on lifelong learning and show teamwork and collaborative endeavor and decision making
4. Improve the employability of the graduates including the enhancement of selfemployment potential and entrepreneurial aptitude, and fill the technical resource gap especially in the Indian context
5. Help graduates appreciate requirement of framing environmental policy guidelines.
6. Motivate graduates to appreciate that they are an integral stakeholder in the environmental management of India irrespective of their future jobs or working environments in accordance of the provisions vide Article 48A (Directive Principles of State Policy)and Article 51A(g) (Fundamental Duties) of the Constitution of India.
7. Help graduates to understand the concerns related to Sustainable Development Goals (SDGs) and the Indian obligations

3. Programme Structure and Course Titles: (All academic years)

F. Y. B. Sc. Environmental Science

SEMESTER -I

Course	Course Code	Name of the Course	Credit
DSCC T	BSC-EN- 101 T	Fundamental of Environmental Biology	2
DSCC T	BSC-EN- 102 T	Fundamental of Environmental Chemistry and Physics	2
DSCC P	BSC-EN- 103 P	Environmental Sciences Practical based on EN-101 and EN-102	2

SEMESTER -II

Course	Course Code	Name of the Course	Credit
DSCC T	BSC-EN-201T	Fundamental of Environmental Geosciences	2
DSCC T	BSC-EN-202 T	Fundamental of Environmental Pollution	2
DSCC P	BSC-EN-203P	Environmental Sciences Practical based on EN- 201 and EN-202	2

SEMESTER -III

Course	Course Code	Name of the Course	Credit
DSCC T	BSC-EN- 301 T	Ecology and Ecosystem	2
DSCC	BSC-EN- 302 T	Natural Resources Conservation and Management	2
DSCC P	BSC-EN- 303 P	Environmental Sciences Practical based on EN-301 and EN-302	2

SEMESTER -IV

Course	Course Code	Name of the Course	Credit
DSCC T	BSC-EN-401T	Biological Diversity and its Conservation	2
DSCC T	BSC-EN-402 T	Environmental Pollution Control Technology	2
DSCC P	BSC-EN-403P	Environmental Sciences Practical based on EN- 401 and EN-402	2

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Semester – III	Paper – I
Course Code: BSC-EN-301	Title of the Course: EN301 Ecology and Ecosystem
Credits: 02	Total Lectures: 30 Hrs.

Course Outcomes (COs):

- Understand the theories and fundamentals concepts of ecology and ecosystem.
- Students will aware distribution and importance of ecology and ecosystem.
- Understand the concepts related to structural and functional aspects of ecosystems.
- Understand dynamic nature of ecological processes in maintaining the equilibrium in nature.

Unit No.	Name of the Unit	Course Contents	Numbers of Lectures
1	Introduction of Ecology	<ul style="list-style-type: none"> • Definition, Principles, Objectives, • Scope and Classification, • Levels of Organization • Interdisciplinary nature of Ecology, 	04
2	Ecosystem	<ul style="list-style-type: none"> • Significance, Ecosystem Components, Functioning and types; • Food Chain and Food Web, Ecological Pyramids, Ecological Energy Flow- Single Channel and Y shaped model • Biomass of Productivity energy – i) Primary Production. ii) Secondary Production. • Bio magnifications, homeostasis, Ecological Niche. 	06
3	Ecosystem Function : Nutrient Cycling	<ul style="list-style-type: none"> • Biogeochemical Cycles-Gaseous Cycles- • Carbon, Oxygen, Nitrogen, • Sedimentary Cycles • Ecosystem Nutrient Cycling Model – Intra-system Cycling and Extra-system Transfers. • Succession – Types, Causes , Mechanism and Models 	08

4	Population and Environment	<ul style="list-style-type: none"> • Introduction and Basic Concepts, • Population Characteristics, Population Growth curves and structures • Population and Distribution , • Population dynamics – Exponential and logistic models • The Concept of Carrying Capacity 	06
5	Community Ecology and Succession	<ul style="list-style-type: none"> • The structure and Function of Communities, • Characteristics of Community , • Inter-specific and Intra-specific Relationships. 	05

Reference Books

1. Understanding Environment; Chokkar K. B., Pandya M. and Raghunathan M.; Centre for Environment Education; Sage Publication, New Delhi.
 2. An Advanced Textbook on Biodiversity – Principles and Practice; Krishnamurthy K.V.; Oxford and IBH Publishing Co. Pvt. Ltd.; New Delhi.
 3. Ecology-Principles and Applications; Chapman J. L. and Reiss M. J., Cambridge University Press.
 4. Fundamentals of Ecology; Odum P.E.; Natraj Publishers; Dehradun; 3 Edt..
 5. Ecology, Environment and Resource Conservation; Singh J.S., Singh S.P. and Gupta S.R.; Annamaya Publishers; New Delhi.
 6. Ecology and Environment; Sharma P.D.; Rastogi Publication; Meerut; 11 Rev. Edt..
 7. Environment Science; Tyler M.G.; Wadsworth Publishing Co.; 1997.
 8. Environmental Science; Santra S.C.; New Central Book Agency (P) Ltd.; 2 Edt..
 9. Perspectives in Environmental Studies ; Anubha Kaushik and C.P. Kaushik; New Age International Publishers., New Delhi
 10. A Textbook of Plant Ecology; Shukla R.S. and Chandel P.S. , S. Chand and Company LTD. Publishers, New Delhi.
 11. Ecology and Environmental Science ; S.V.S. Rana 5th Edition, PHI Learning private Limited , New Delhi.
 12. Environmental Biology ; Verma P.S. and Agarwal V.K. ; S.Chand Company LTD. Publishers, New Delhi.
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Semester – III	Paper – II
Course Code: BSC-EN-302	Title of the Course: EN302 Natural Resources Conservation and Management
Credits: 02	Total Lectures: 30 Hrs.

Course Outcomes (COs):

- Understand the fundamentals concepts of Natural Resources
- Understand best agricultural practices
- Give knowledge about sustainable practices

Unit No.	Name of the Unit	Course Contents	Numbers of Lectures
1	Natural Resources	<ul style="list-style-type: none"> • Definition, Classification, • Importance and use of Resources, • Regenerative and Assimilative Capacity, • Man's Interaction and problems with Natural Resources. 	05
2	Land and Mineral Resources	<ul style="list-style-type: none"> • Soil Degradation, Soil Erosion, • Consequences, Conservation of Soil, • Mineral Resources: Origin, Need, Overexploitation, Conservation, • Effects of Mining on Ecosystem with case studies. 	06
3	Water Resources	<ul style="list-style-type: none"> • Surface Water and Ground Water, • Use and over-utilization, 	07
		<ul style="list-style-type: none"> • Ground water pollution, Water Crisis, • Conflicts over water, • Conservation and Management, • Rain-water Harvesting, • Watershed Management, • Flood plain management 	

4	Food and Agricultural Resources	<ul style="list-style-type: none"> • World Food Demand, Malnutrition, • The Green Revolution in India, • Genetically Modified Crops and Regulations in India, • Traditional and Modern Practices for Sustainable Agriculture Development, • Fertilizer-Pesticide Problems. 	06
5	Forest Resources	<ul style="list-style-type: none"> • Definition, Function and importance of Forest Resources • Man's Interaction and problem with Forest and its resources, • Forest Management in India, • Case studies on Timber extraction, • Dam construction and its effect on tribal people, 	06

Reference Books

1. Understanding Environment; Chokkar K. B., Pandya M. and Raghunathan M.; Centre for Environment Education; Sage Publication, New Delhi.
 2. An Advanced Textbook on Biodiversity – Principles and Practice; Krishnamurthy K.V.; Oxford and IBH Publishing Co. Pvt. Ltd.; New Delhi.
 3. Ecology – Principles and Applications; Chapman J. L. and Reiss M. J.; Cambridge University Press.
 4. Fundamentals of Ecology; Odum P.E.; Natraj Publishers; Dehradun; 3 Edt..
 5. Ecology, Environment and Resource Conservation; Singh J.S., Singh S.P. and Gupta S.R.; Annamaya Publishers; New Delhi.
 6. Ecology and Environment; Sharma P.D.; Rastogi Publication; Meerut; 11 Rev. Edt..
 7. Environment Science; Tyler M.G.; Wadsworth Publishing Co.; 1997.
 8. Environmental Science; Santra S.C.; New Central Book Agency (P) Ltd.; 2 Edt..
 9. Environmental Studies -A text book , Dr. D.K. Asthana and Dr. Asthana Meera 2006 , S – Chand and Company Limited , New Delhi.
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Semester – III	Paper – III
Course Code: BSC-EN-303P	Title of the Course:EN303 Practical's based on EN 301 and EN302
Credits: 2	Total Practical's: 30 hrs

Course Outcomes (COs):

- Monitor parameters of forest and grassland ecosystem.
- Learn field techniques related vegetation and bird sampling and analysis.
- Perform assessment of soil nutrient with the help of standard instruments.
- Visit and understand working of district soil survey department.
- Observe and interpret the data related to Ecosystems.

Unit No.	Course Contents	Numbers of Lectures
1.	To study the Different types of Quadrat method- Point Frame Method, Transect (Line and Belt)	01
2.	Determination of Frequency and Abundance of species across terrestrial or aquatic ecosystem transitional zone, by Line and Belt Transect Method	01
3.	Study of vegetation by List Count Quadrat Method to determine the Frequency, Density and Abundance.	01
4.	Measurement of Primary Productivity of grassland by Harvest Method	01
5.	Estimation of Chlorophyll-a, Chlorophyll-b and Total Chlorophyll from Clean and Polluted environment area plants.	01
6.	To Study Ecological and Economical importance of ecological resources.	01
7.	Estimation of Animal Population Size by Mark-Recapture Method.	01

8.	Identify the rock with Physical properties	01
9.	Identify the minerals with Physical properties	01
10.	Study of soil sampling Technique	01
11.	Analysis of Soil texture	01
12.	Estimation of available nitrogen from given soil sample.	01
13.	Estimation of available phosphorous in given soil sample.	01
14.	Estimation of potassium in given soil sample.	01
15.	Estimation of organic carbon from given sample Walkley- Black method	01
16.	Identification of advanced Agricultural equipment in the Local market	01
17.	Visit to Soil Survey Department	01
18.	To study Different structures used in conservation of Water and soil.	01
19.	To Visit Watershed management department	01

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Semester – IV	Paper – I
Course Code: BSC-EN-401	Title of the Course: EN 401 Biological Diversity and its Conservation
Credits: 02	Total Lectures: 30 Hrs.

Course Outcomes (COs):

- Understand the Diversity of Biology
- Understand and acquire knowledge about its distribution and importance
- Gain knowledge about distribution of life in earth
- Understand and develop the skills of identification of plants and animals in diversity, its distribution
- Understand the importance of conservation
- Understand and acquire knowledge about skill of conservation method
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Unit No.	Name of the Unit	Course Contents	Numbers of Lectures
1	Biological Diversity – Ecosystem Diversity	<ul style="list-style-type: none"> • Definition, Importance, Types and Classification of Ecosystem Diversity • Hotspots in India, • Endemic , Extinct and Rare species, IUCN and Red Data book 	06
2	Species Diversity	<ul style="list-style-type: none"> • Definition , Characteristics of species diversity, • Measuring Species Diversity, • Species diversity index, Extinction, • Keystone species • Species diversity in India, 	06
3	Genetic Diversity	<ul style="list-style-type: none"> • Definition , Genetic Variability and Variations, • Importance Genetic Biodiversity, • Factors affecting Genetic Diversity- Mutation, Genetic drift, Gene flow, Natural Selection, • Genetic diversity in India, 	06

4	Significance and Threat to Biodiversity	<ul style="list-style-type: none"> • Significances – Ecological Significances, and Values of biodiversity, • Threats- Habitat Destruction and Fragmentation, Forestry Practices, Invasion, Over-exploitation, Environment Pollution, Global Climate Change, Loss of Traditional Knowledge, Human Wildlife Conflict • Anthropogenic Impact on Western Ghats 	06
5	Biodiversity Conservation	<ul style="list-style-type: none"> • Goals, Types of Conservation Methods – <i>In-situ</i>, <i>Ex-situ</i> , Protected Areas and Sacred Grooves, • National and International Conservation Organization, • Biological Diversity Act 2002, Ramsar Convention, • Role and Function of National and state biodiversity conservation board / policy 	06

Reference Books

1. Ecology – Principles and Applications; Chapman J. L. and Reiss M. J.; Cambridge University Press.
2. Fundamentals of Ecology; Odum P.E.; Natraj Publishers; Dehradun; 3 Edt..
3. Ecology, Environment and Resource Conservation; Singh J.S., Singh S.P. and Gupta S.R.; Annamaya Publishers; New Delhi.
4. Ecology and Environment; Sharma P.D.; Rastogi Publication; Meerut; 11 Rev. Edt..
5. Environment Science; Tyler M.G.; Wadsworth Publishing Co.; 1997.
6. Perspective in Environmental Studies; Kaushik and Kaushik; New Age International Pvt. Ltd. Publishers.
7. Environmental Science; Santra S.C.; New Central Book Agency (P) Ltd.; 2 Edt..
8. Biodiversity ; Fatik Mandal and Nepal Nandi ; 2nd edition , Asian Books Private Limited, New Delhi.
9. Perspectives in Environmental Studies ; Anubha Kaushik and C.P. Kaushik; New Age International Publishers., New Delhi
10. A Textbook of Plant Ecology; Shukla R.S. and Chandel P.S. , S. Chand and Company LTD. Publishers, New Delhi.
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Semester – IV	Paper – II
Course Code: BSC-EN-402	Title of the Course:EN402 Environmental Pollution Control Technology
Credits: 02	Total Lectures: 30 Hrs.

Course Outcomes (COs):

- To Study Different Aspects Of Environmental Contamination, which have adverse effects on Human Health.
- Understanding mechanisms of pollutants impacting on human health.
- Developing an understanding of different types of pollutants, their sources and mitigation measures.

Unit No.	Name of the Unit	Course Contents	Numbers of Lectures
1	Air Quality Parameters and Monitoring	<ul style="list-style-type: none">• Introduction• Indoor air pollution• Sampling, site selection, collection, preservation and labeling of sample.• Analytical Technique used for Co₂, Sox, NO_x, Ozone , Ammonia, SPM(suspended particulate Matter Analysis.• National standards for ambient air quality by WHO.• Monitoring tools/instruments, Stack gases monitoring technique ,Plume behavior• Introduction-Air Quality Index, its significance and Application	04

2	Water Quality Monitoring	<ul style="list-style-type: none"> • Purpose/objectives of monitoring • Water Quality Monitoring Protocol • Sampling time, site Selection preservation and labeling of sample • Chemical ,biological and Physical examination of Water Sample • WHO,BIS and ICMR National Standards for Water quality 	06
3	Waste Water Treatment	<ul style="list-style-type: none"> • Primary Treatment – Screening, Grit removal, Sedimentation • Secondary Treatment- Aerobic Method and Anaerobic Method • Tertiary Method- Disinfection (Chlorination) 	04
4	Soil Quality Monitoring	<ul style="list-style-type: none"> • Objectives ,Sampling technique, site selection , preservation and labeling of soil sample • Soil Analysis- Physical, Chemical- Biological • Use of Bio fertilizers and Bio pesticides • Integrated Nutrient, Management (INM) Double Cropping, Mixed Cropping, crop rotation, Biological Pest Mgmt., Organic Farming 	06
5	Radioactive Pollution	<ul style="list-style-type: none"> • Definition, Sources - Natural and Anthropogenic • Effects of microwave, radio frequency radiation on man and plant. • Biological and genetic effect of radiation. • ICRP guidelines for disposal of radioactive waste • Safety standards and guidelines for handling storage and disposal 	06
6	Noise Quality Parameters	<ul style="list-style-type: none"> • Noise and Vibration Monitoring, • Measuring techniques for noise and vibration ,Noise monitoring methods • The Basic Noise Unit; Lmax, SEL, Leq(h), Ldn, 24-Hour Exposure from All Events, • Noise Control Techniques and abatement • National Standards for Noise quality • Noise pollution (Regulation and control) Rules-2000 in India 	04

Reference Books-

1. Understanding Environment; Chokkar K. B., Pandya M. and Raghunathan M.; Centre for Environment Education; Sage Publication, New Delhi.

2. 2.An Advanced Textbook on Biodiversity – Principles and Practice; Krishnamurthy K.V.; Oxford and IBH Publishing Co. Pvt. Ltd.; New Delhi.
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6. Ecology and Environment; Sharma P.D.; Rastogi Publication; Meerut; 11 Rev. Edt..
7. Environment Science; Tyler M.G.; Wadsworth Publishing Co.; 1997.
8. Perspective in Environmental Studies; Kaushik and Kaushik; New Age International Pvt. Ltd. Publishers.
9. Environmental Science; Santra S.C.; New Central Book Agency (P) Ltd.; 2 Edt..
10. Environmental Chemistry, Dey A. K.; New Age International Publishers; 6 Edt..
11. Air Pollution; Rao M.N. and Rao H.V.N.; Tata McGraw Hill; New Delhi; 1989.
12. Environmental Pollution Control and Environmental Engineering; Rao C. S.; Tata McGraw Hill; New Delhi; 1994.
13. Pollution Management; Agarwal S.K.
14. Environmental Science; Daniel Chiras.
15. Waste Water Engineering, Treatment, Disposal and Reuse; Metcalf and Eddy.
16. Manual for Field Ecology; Mishra R
17. Handbook of Methods in Environmental Studies Vol-I andII; Mailti S.K.; ABD Publishers; Jaipur.
18. Physico-Chemical Examination of Water, Sewage and Industrial Effluents; Manivasakam N.; Pragati Prakashan; Meerut; 1984
19. Chemical and Biological Methods for Water Pollution Studies; Trivedi R.K. and Goel P.K.; Environmental Publications; Karad; 1986.
20. Instrumental Methods of Analysis; Willard; cbpspd; 7 Edt..
21. Pollution Management; Agarwal S.K.
22. Waste Water Engineering, Treatment, Disposal and Reuse; Metcalf and Eddy
23. Advanced Air and Noise Pollution Control – L.K Wang and N.C Pereira
24. Textbook of Noise Pollution and Its Control – S.C. Bhatia
25. Waste Water Engineering, Treatment, Disposal and Reuse; Metcalf and Eddy
26. Environmental Pollution Control and Environmental Engineering; Rao C. S.; Tata McGraw Hill; New Delhi; 1994.
27. Air Pollution; Rao M.N. and Rao H.V.N.; Tata McGraw Hill; New Delhi; 1989

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Semester – IV	Paper – III
Course Code: BSC-EN-403P	Title of the Course: EN 403 Practical's based on EN-401 and EN-402
Credits: 2	Total Practical's: 30 hrs

Course Outcomes (COs):

- Understand and evaluate parameters of diversity
- Understand the conservation of method
- Monitor and audit natural resources like water, energy, etc.
- Analyse important resources through various instruments
- Visit various institutes working in the field of natural resource management

Unit No.	Course Contents	Numbers of Lectures
1.	Estimation of AGB, BGB and Carbon from sampling of trees	01
2.	Determination of Shannon Diversity Index of a vegetation (Data sheet)	01
3.	Determination of Simpson Diversity Index of a vegetation (Data sheet)	01
4.	Estimation of Productivity of Lake using DO method	01
5.	Enlist of Endangered and Endemic species common plants of in local study areas	01
6.	Study Biodiversity Conservation method (In-situ and Ex-situ	01

	conservation).	
7.	Identification of traditional Importance of Medicinal and Aromatic Plants (Seed collection)	01
8.	Sampling of Air by High Volume Sampler	01
9.	Determination wind velocity by anemometer	01
10.	Estimation of Suspended Particulate Matter (SPM)	01
11.	Determination of Nitrate / Phosphate from water (Spectrophotometer)	01
12.	Determination of Residual Chlorine from water sample	01
13.	Determination of Calcium / Sulphur/ Magnesium from soil sample	01
14.	Determination of micronutrient – Copper/ Iron/ zinc from Soil.	01
15.	Measurement of sounds by DB meter / SLM in silent, industrial, residential and commercial zones	01
16.	Visit to Nurseries/ Botanical Garden/ Zoological Park/ Soil Survey Department	01
17	Visit to National park / Biosphere Reserves/ Wetland	01
18.	Study the Digital herbarium and Impression of Flora and Fauna	01