Punyashlok Ahilyadevi Holkar Solapur University, Solapur

पुण्यश्लोक अहिल्यादेवी होळकर
सोलापूर विद्यापीठ
।। विद्यया संपन्नता ।।

NAAC Accredited-2022
'B^{++}'Grade (CGPA2.96)

Name of the Faculty: Science &Technology

(As per New Education Policy 2020)

Syllabus: Environmental Science

Name of the Course: B.Sc. I (Sem. I & II)

(Syllabus to be implemented from June 2024)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty: Science and Technology

Program: Bachelor of Science (B.Sc.) Part-I

Sem-I and II

Environmental ScienceProgram

Preamble

Education serves the vital purpose of nurturing a holistic development of an individual's personality, and the educational system plays a pivotal role in facilitating this process. It equips learners with a comprehensive array of knowledge and skills essential for their personal growth and societal contribution. Within this framework, Environmental Science emerges as a cornerstone discipline, encompassing the dynamic interplay between the Earth's systems and its inhabitants, including life forms, and the atmosphere. This field also delves into the Earth's interior dynamics and its immediate spatial surroundings.

The contemporary curriculum is structured to cover foundational aspects of environmental studies, Earth's dynamic processes, climate dynamics, ecology, ecosystems, biodiversity, pollution management, environmental education, fossil records, biogeochemical cycles, energy-environment nexus, Sustainable Development Goals (SDGs), Environmental, Social, and Governance (ESG) principles, current environmental challenges, environmental chemistry, statistical methodologies, global environmental trends, environmental geology, hazards and disaster mitigation, and applications of remote sensing and Geographic Information Systems (GIS) in environmental analysis.

By engaging with the syllabus, students gain a profound understanding of Earth sciences, including seismic activities like earthquakes and volcanic eruptions, and grasp the nature and repercussions of various natural stressors acting on and beneath the Earth's surface.

Moreover, the study of environmental science equips students with applied knowledge drawn from disciplines such as chemistry, biology, geology, geography, climatology, physics, statistics, microbiology, and biotechnology. This interdisciplinary approach fosters a multifaceted understanding of environmental issues and solutions.

The syllabus for Environmental Science is meticulously designed to ensure the holistic development of students' personalities. It provides avenues for exposure to Discipline-Specific Courses, Generic Elective Courses, Value Enhancement Courses, and Skill Enhancement Courses. Through hands-on practical sessions and innovative instructional methods, students acquire specialized skills that are pertinent to their academic and professional pursuits, thus preparing them to tackle real-environment challenges effectively. The course contents are prepared as per UGC Model Curriculum under the Credit Framework guidelines of National Education Policy (NEP) 2020 and the guidelines given by Punyashlok Ahilyadevi Holkar Solapur University, Solapur for implementation of NEP.

Program Objectives:

- To develop conscience towards social responsibility about environment and sustainable development through curriculum and extra-curricular study.
- To develop scientific temperament with strong fundamental knowledge of the subject.
- To develop analytical thinking and problem-solving skills needed for various entrance and competitive examinations and Post Graduate Studies.
- To train students laboratory skills and hands on equipment trainings along with soft

~ About National Education Policy (NEP) – 2020 ~

With the directions and guidelines issued by **Government of Maharashtra resolution dated 20th April 2023 and 16th May, 2023** regarding the implementation of NEP at UG and PG level, the Punyashlok Ahilyadevi Holkar Solapur University, Solapur has taken decision to implement NEP 2020 with Choice Based Credit System (CBCS) at Undergraduate level and Post Graduate level. This has been done to achieve the goals and objectives set in NEP-2020 such as- worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate and post-graduate degree.

The CBCS provides an opportunity for the students to select from the prescribed courses comprising core, elective/minor or skill based. The courses can be evaluated following the grading system,which is considered to be better than the conventional marks system. Therefore, it is necessary tointroduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing performance of candidates.

1. OUTLINE OF NEP: The structure of the Three/Four-year bachelor's degree programme allows the opportunity to the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning in different institutions. The structure allows students to learn various components like:

(a) Major (Core) Subject (DSC): Comprises of Mandatory & Elective Courses for students to achieve:

- Minimum 50% of total credits corresponding to Three/Four - year UG Degree- Mandatory Courses are offered in all four years;
- 2 credit courses on Major Specific IKS shall be included under Major;
- Elective courses of Major will be offered in the third and/or final year;
- Vocational Skill Courses, Internship/Apprenticeship, Field Projects, Research Projects

(b) Minor Subject (18-20 Credits)

- The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether;
- The credits of Minor subjects shall be completed in the first three years of UG Programme

(c) Generic/ Open Elective Courses (OE) (10-12 credits)

- GE/OE are to be offered in I and/or II year;
- Faculty-wise baskets of OE shall be prepared.
- OE/GE is to be chosen compulsorily from faculty other than that of the Major or as per the directions issued by NEP-Steering Committee

(d) Vocational and Skill Enhancement Courses (VSEC)

i) Vocational Skill Courses (VSC): (8-10 credits): Includes Hands on Training corresponding to the Major and/or Minor Subjects:

- To be offered in first three years;
- Wherever applicable vocational courses include skills based on advanced laboratory practical's

ii) Skill Enhancement Courses (SEC): (06 credits)

- To be offered in I and II year;
- To be selected from the basket of Skill Courses approved

(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): (14 Credits)

i) AEC: (08 credits): To be offered in I and II year

- English: 04 Credits and Modern Indian Language: 04 credits
- To be offered from the Basket approved. The focus for both languages should be on linguistic and communication skills.

ii) IKS: (2 Credits): To be offered in I Year

- Courses on IKS to be selected from the basket of IKS courses approved

iii) VEC: 04 Credits:To be offered in I year

- Value Education Courses (VEC) such as Understanding India, Environmental Science/Education, and Digital and Technological Solutions.

(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project

- Internship/Apprenticeship corresponding to the Major (Core) Subject: (8 Credits)
- Field Projects/Community Engagement and Service (CEP) corresponding to the Major (Core) Subject (minimum 4-6 credits)

To be offered in II and III years of UG Degree Programmes.

- Co-curricular Courses (CC 8-credits) such as Health and Wellness, Yoga education, sports and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts: offered in I and/or II year
- Research Projects: (12 credits)
  -To be offered in the final year for 4-year Honor's with Research UG Degree

CREDIT:

- Credit is a numerical value that indicates students work load (Contact Hours, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured.
- **Theory: '**15 contact hours' for theory course constitute 'one credit'
- **Practical/Tutorial: '**30 contact hours' for practical course constitute 'one credit'.
- **Workshop based activities/Skill based activities:** Minimum 30 contact hours per credit in a semester is required
- **Internship/On-Job Training: '**30 contact hours' per credit in a semester is required (1 credit/week)
- **Community Engagement and Service-CEP/Field Project:** 30 contact hours per credit in a semester is required
- **Credit Framework under Three/Four Years UG Programme with Multiple Entry and Multiple Exit Options:**

The minimum and maximum credit structure for different levels under three- or four-year UG Programme with multiple entry and multiple exit options are as given below:

Levels	Code	Qualification Titles	Credit Requirements		Semester	Year
			Minimum	Maximum		
4.5	100-199	UG Certificate	40	44	2	1
5.0	200-299	UG Diploma	80	88	4	2
5.5	300-399	Three Year Bachelor's Degree	120	132	6	3
6.0	400-499	Bachelor's Degree Honours OR Bachelor's Degree-Honours with Research	160	176	8	4
	500-599	First Year PG & or PG Diploma	40	44	2	1

2. CHOICE BASED CREDIT SYSTEM (CBCS):

Each course carries a defined number of credits. The credits are based on the course structure, including the teaching mode and the number of contact hours for lecture, tutorial, and practical classes. One hour of theory/tutorial teaching per week equals one credit, and two hours of laboratory/demonstration classes per week equals one credit. Credits are considered based on the number of contact hours, course content, teaching methodology, allotted maximum marks.

While calculating the grading, one credit is equal to 25 marks in a semester. Thus, 4 credit courses will receive 100 marks, 2 credit courses will receive 50 marks, and a single credit course will receive 25 marks. The proportion of marks earned in a course and the credits given to that course will be used to calculate the Semester Grade Point Average (SGPA) or Cumulative Grade Point Average (CGPA).

General Education credit refers to a unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching [lecture or tutorial] or two hours of practical work/field work per week. Accordingly, one Credit would mean equivalent to 15 hrs' of theory or 30 hrs' of workshop/ lab/Internship/OJT/FP/CEP/CC work per semester. Break-up of credits with respect to general education component is as in table below:

Sr. No.	One Credit	Number of Contact Hours
1	Theory	15 Contact Hours
2	Practical	30 Contact Hours
3	Experiential learning including relevant experience and professional levels acquired	30 Contact Hours

3. DEFINITIONS OF KEYWORDS:

a) **Academic Year**: Two consecutive (one odd + one even) semesters constitute one academic year.

b) **Choice Based Credit System (CBCS):** The CBCS will provides options for students to select courses from the prescribed courses (core, open elective, discipline elective, ability and skill enhancement language, soft skill courses and so on).

c) **Course**: Usually referred to as 'papers' is a component of a programme. All courses need not carry the same weight. The courses will define learning objectives and learning outcomes. A course will be designed to comprise Contact Hours / tutorials / laboratory work / field work / project work / vocational training / viva / seminars / term papers / assignments/ presentations / self-study or a combination of some of these.

d) **Credit-Based Semester System (CBSS)**: Under the CBSS, the requirement for awarding a degree /diploma /certificate is prescribed in terms of the number of credits to be earned.

e) **Credit**: A unit by which the course work is measured. It determines the number of hours of instructions required per week in a semester. One credit is equivalent to one hour of lecture or tutorial or two hours of practical work/field work per week in a semester. It will generally be equal to 15 hours of instructions.

f) **Grade Point**: It is a numerical weight allotted to each letter grade on a 10-point scale.

g) **Credit Point**: It is the product of grade points and the number of credits for a course.

h) **Letter Grade:** It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, D and F.

i) **Programme**: A programme leading to the award of a degree, diploma, or Certificate.

j) **Semester**: Each semester will consist of over 15 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be generally scheduled from June to November and even semester from January to May.

k) **Semester Grade Point Average (SGPA)**: It is a measure of performance of work done in a semester. It is the ratio of total credit points secured by a student in various courses registered in a semester and the full course credits taken during that semester. It shall be expressed up to two decimal places.

l) **Cumulative Grade Point Average (CGPA)**: It measures the overall cumulative performance of a student over all the semesters of a programme. The CGPA is the ratio of total credit points secured by a student in various courses in all the semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

m) **Transcript or Grade Card or Certificate:** Based on the grades earned, a graded certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured).

Eligibility for Admission: A Candidate passing 10+2 passed from state syllabus / CBSE /equivalent with minimum passing percentage of as per the directives of the higher education and P.A.H. Solapur University, Solapur.

Medium of Instruction: English

Program Structure

Duration: Four Years (Eight Semesters): As the University follows semester system, an academic year shall consist of two semesters. Program is designed to provide flexibility and multiple exit options to accommodate students' varying academic and career goals. The program structure is as follows:

1. Undergraduate Certificate **in Environmental Science**: Students who exit after the first year (two semesters) will receive a UG Certificate based on completed credits.
2. Undergraduate Diploma **in Environmental Science**: Students who decide to withdraw after the second year (four semesters) will receive a UG Diploma, provided they have completed the required credits.
3. Three-Year Undergraduate Degree i.e. B.Sc **in Environmental Science** : Students may leave the program after completing the third year (six semesters) to receive a three-year undergraduate degree.
4. B.Sc. Degree with Honours- The fourth year offers an advanced curriculum with a focus on research, allowing students to graduate with an **Honors Degree in Environmental Science**.

Re-entry Option:
Students who leave the program with a UG Certificate or UG Diploma are allowed to re-enter within three years to complete the degree program.

Scheme of Evaluation

As per the norms of the grading system of evaluation, out of 50 marks, the candidate has to appear for continuous/ internal assessment of 20 marks and external evaluation (University assessment) of 30 marks. For B.Sc. Part-I Environmental Science Sem I & II, the internal assessment will be based on Internal tests, home assignment, Tutorials, Seminars, Group discussion, Brain storming sessions etc.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty: Science and Technology
Program: Bachelor of Science (B.Sc.) Part-I
Sem-I and II
Environmental Science
Program Outcomes (POs)

Students graduating from the Bachelor of Science in Environmental Science program will be able to:

Major Courses

- **PO1**: Demonstrate in-depth knowledge and understanding of core concepts, theories, and methodologies in the chosen major discipline.
- **PO2**: Apply disciplinary knowledge to solve complex problems, analyze data, and make informed decisions in professional and research contexts.

Minor Courses:

- **PO3**: Acquire complementary knowledge and skills from a related or distinct discipline, enhancing interdisciplinary understanding and versatility.

Open Electives/General Electives:

- **PO4**: Explore diverse subjects beyond the core discipline, fostering a broad-based education and cultivating critical thinking and creativity.

Vocational and Skill Enhancement Courses:

- **PO5**: Gain hands-on experience and technical proficiency in specific vocational areas, preparing for immediate career opportunities.

Ability Enhancement Courses (AEC), Indian Knowledge System (IKS), and Value Education Courses (VEC):

- **PO6**: Understand and appreciate the rich heritage of the Indian Knowledge System, integrating traditional wisdom with modern education.
- **PO7**: Develop ability enhancement skills like communication and life skills along with ethical values, social responsibility, and a strong sense of citizenship, contributing positively to society.

Field Projects/Internship/Apprenticeship/Community Engagement Projects/ On Job Training/ Internship/Apprenticeship:

- **PO8**: Apply theoretical knowledge to real-world situations through field projects, internships, community engagement and On job Training for gaining practical experience and problem-solving skills.

Research Methodologies and Research Project:

- PO9: Acquire research skills, including data collection, analysis, and interpretation, fostering a scientific approach to problem-solving to develop independent research projects handling capabilities

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Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty: Science and Technology

Program: Bachelor of Science (B.Sc.) Part-I

Sem-I and II

Environmental Science

Program Specific Outcomes (PSOs)

After completing degree program, the student will have ability for

- **PSO1: Comprehensive Understanding of Environmental Systems:** Graduates will possess a thorough comprehension of the Earth's environmental systems, including the interactions between the atmosphere, hydrosphere, lithosphere, and biosphere.
- **PSO2: Proficiency in Environmental Analysis:** Students will develop skills in analyzing environmental data, conducting fieldwork, and employing laboratory techniques to assess environmental quality and identify potential hazards.
- **PSO3: Sustainable Resource Management:** Graduates will be equipped with the knowledge and tools to develop sustainable strategies for managing natural resources, minimizing environmental degradation, and promoting conservation efforts.
- **PSO4: Problem-Solving Skills:** Through coursework and practical experience, students will enhance their critical thinking and problem-solving abilities, enabling them to address complex environmental challenges effectively.
- **PSO5: Awareness of Environmental Policies and Regulations:** Students will gain an understanding of environmental laws, regulations, and policies at local, national, and international levels, preparing them for careers in compliance, advocacy, and policymaking.
- **PSO6: Effective Communication:** Graduates will be proficient in communicating scientific concepts and findings to diverse audiences, including policymakers, stakeholders, and the general public, facilitating informed decision-making and public engagement.
- **PSO7: Interdisciplinary Approach:** The interdisciplinary nature of environmental science education will enable graduates to integrate knowledge from various fields, such as biology, chemistry, geology, geography, and sociology, to address complex environmental issues comprehensively.
- **PSO8: Research and Innovation:** Students will have the opportunity to engage in research projects, exploring cutting-edge topics in environmental science and contributing to the advancement of knowledge in the field.
- **PSO9: Career Opportunities:** Completion of a B. Sc in Environmental Science opens up a wide range of career opportunities in sectors such as environmental consulting, resource management, conservation organizations, government agencies, non-profit organizations, academia, and private industry.
- **PSO10: Global Citizenship:** Graduates will emerge as environmentally conscious global citizens, equipped with the skills, knowledge, and values necessary to contribute positively to environmental sustainability and address pressing environmental challenges facing society.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science and Technology

Structure for B.Sc. Part- I (Environmental Science)

(As per NEP-2020)
Three Majors in First Year structure

Level/ Difficulty	Sem.	Faculty			Generic/ Open Elective GE/ OE	Vocational and Skill Enhancement Courses (SEC/VSC)	Ability Enhancement Course(AEC), IKS, VEC	Field Project/ RP/CC/Internship/Apprenticeship/ Community Engagement & Services	Credits	Cumulative Credits
		Major		Minor						
		DSC	DSE							
4.5 100-200	I	**DSC1-1 Introduction to the Environment(2+2)**	--	--	**GE-1/OE-1 (2)** Earth and Earth Surface Processes	**SEC-1(2) Practical -** Mapping of Earth's System and Environmental Process	L1-1(2) **IKS** General IKS (2) **VEC-1** Indian Constitution and Democracy (2)	--	22	**44 UG Certificate (44)**
		DSC2-1 (2+2)	--	--						
	II	DSC3-1 (2+2)	--	--						
		DSC1-2 Environmental Physics and Chemistry(2+2)	--	--	**GE-2/OE-2 (2)** Divisions of the Environment	**SEC-2(2) Practical** Environment and Society	L1-2(2) **VEC-2** (Environmental Studies) (2)	CC-1 (2)	22	
		DSC2-2 (2+2)	--	--						
		DSC3-2 (2+2)	--	--						
Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credit score NSQF course /Internship OR Continue with Major and Minor										

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR B.Sc. I: Environmental Science (As per NEP2020)						
Semester– I						
Coarse Type	**Coarse Vertical**	**Title of Course (Paper)**	**Distribution of Marks**			**Total Credits**
			IA	**UA**	**Total**	
Major	DSC1-1 GO4-0112	Introduction to the Environment	20	30	50	2
Major Practical	PRDSC1-1 GO4-0112P	Practical based on DSC1-1	20	30	50	2
Major	DSC2-1	To be selected from Basket (Other than Environmental Science)	20	30	50	2
Major Practical	PRDSC2-1	Practical based on DSC2-1	20	30	50	2
Major	DSC3-1	To be selected from Basket (Other than Environmental Science)	20	30	50	2
Major Practical	PRDSC3-1	Practical based on DSC3-1	20	30	50	2
GE/OE	GE-1/OE-1 GO4-GE-OE-0112	Earth and Earth Surface Processes	20	30	50	2
SEC	PRSEC 1 GO4-SEC-0112	Mapping of Earth's System and Environmental Process	20	30	50	2
IKS	IKS **Generic** GO4-IKS-0112	General Indian knowledge system	20	30	50	2
AEC	L1-1 GO4-ENG-0112	English	20	30	50	2
VEC	VEC1 GO4-ICD-0112	Indian Constitution and Democracy	20	30	50	2
Total Marks +Credit for Semester–I			**220**	**330**	**550**	**22**
Semester-II						
Major	DSC1-2 GO4-0212	Environmental Physics and Chemistry	20	30	50	2
Major Practical	PRDSC1-2 GO4-0212P	Practical based on DSC1-2	20	30	50	2
Major	DSC2-2	To be selected from Basket (Other than Environmental Science)	20	30	50	2
Major Practical	PRDSC2-2	Practical based on DSC2-2	20	30	50	2
Major	DSC3-2	To be selected from Basket (Other than Environmental Science)	20	30	50	2
Major Practical	PRDSC3-2	Practical based on DSC3-2	20	30	50	2
GE/OE	GE-2/OE-2 GO4-GE-OE-0212	Divisions of the Environment	20	30	50	2
SEC	PRSEC-2 GO4-SEC-0212	Environment and Society	20	30	50	2
CC	CC1	Co-curricular Courses	20	30	50	2
AEC	L1-2 GO4-ENG-0212	English	20	30	50	2
VEC	VEC2 GO4-ENS24-0212	Environmental Studies	20	30	50	2
Total Marks +Credit for Semester-II			**220**	**330**	**550**	**22**

Total Marks + Credit for Semester-I	220	330	550	22
Total Marks + Credit for Semester-II	220	330	550	22
Total Marks and Credit	**440**	**660**	**1100**	**44**

Abbreviations:

GE/OE: Generic/ Open Electives	**FP:** Field projects
VSEC: Vocational Skill and Skill Enhancement Courses	**CC:** Co-curricular Courses
SEC: Skill Enhancement Courses	**RP:** Research Project
AEC: Ability Enhancement Courses	**IKS:** Indian Knowledge System

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B.Sc. Part-I, SEM-I: Environmental Science** **Vertical: Major (DSC1-1) Paper-I** **Course Code: G04-0112** **Course Name: INTRODUCTION TO THE ENVIRONMENT**
***Teaching Scheme: Credits:** 02 **Total Contact Hrs:** 30 **Lectures:** 02 Hours/Week	***Examination Scheme: Total Marks :** 50 **UA:** 30 Marks **IA/CA:** 20 Marks

Course Objectives: During this course, the student is expected to:

- Introduce the basic understanding of Environment and Earth System, its components and origin.
- Understand environment and earth system including its components, dynamics and history and study of different ecosystems.

Course Outcomes (COs): At the end of this course,:

- CO1: Students will appreciate the Knowledge about the environment and the role of human beings in shaping the environment
- CO2: Students will understand various components of the environment and interfaces

Unit 1: Introduction to Earth and Environment	**Contact Hrs-15**	**Weightage: ~23 Marks**
• Fundamentals of Environment, Functions of Environment, Concept of Biosphere, Scope and Importance of Environment. Environmental Science, Multidisciplinary and dynamic nature, Solar system formation and planetary differentiation, History of Earth, Theories of Geological evolution, Geological time scale, Age of reduction and Atmospheric equilibrium, Holocene and the emergence of humans Role of humans in shaping landscapes.		
Unit 2: Earth & its Structural Components: Formation of the Earth	**Contact Hrs-15**	**Weightage: ~23 Marks**
• Internal Structure of Earth, Formation and composition of core, mantle, crust Theories of geological evolution: Wagener's Continental Drift Theory, Plate Tectonic Theory, Sea floor spreading, Types of Rocks – Igneous, Sedimentary Metamorphic. Rock cycle, Rock-forming minerals –quartz, feldspar, micas, clay minerals, calcite, dolomite etc. • Weathering and Soil: Soil, Soil Profile, Soil Formation, Soil classification, Physical & chemical properties of soil, Macro &micro plant nutrients, Importance and Significance of Soil, Soil erosion Types, causes and effects. • Atmospheric phenomenon, Evolution of earth's atmosphere, Composition of atmosphere and its vulnerability to climate change • Atmospheric Pressure and wind: Introduction, Measurement, Factors affecting the atmospheric pressure, Atmospheric pressure winds, Factors affecting wind, types of wind.		

Text Books / Reference Books:

1. A Text Book of Environmental Sciences, S. S. Purohit, Q. J. Shammi and A. K. Agarwal, Student Edition (Agrobios), Jodhpur.
2. A Text Book of Environmental Studies, D. K. Asthana and Meera Asthana, S. Chand, New Delhi.
3. Air Pollution, M.N. Rao and H.V.N. Rao, Tata McGraw Hill, New Delhi.
4. An Introduction to Air Pollution, R. K. Trivedy and P. K. Goel, B. S. Publications, Hyderabad.
5. Aerial Photography & Image Interpretation: Resource Management, Paine D.P., John Wiley & Sons.
6. Chemical & Biological Methods for Water Pollution Studies, R.K. Trivedy and P. K. Goel, Environmental Publications, Karad.
7. Disaster Management in Hills, Dr. Satendra, Concept Publishing Co., New Delhi.
8. Ecology and Environment, P.D. Sharma, Rastogi Pub., New Delhi.
9. Environmental Science, S.C. Santara, New Central Book Agency (P) Ltd., Kolkota.

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B.Sc. Part-I, SEM-I: Environmental Science** **Vertical: Major(DSC1-1) Laboratory Practical-I** **Course Code: G04-0112-P** **Course Name: Practical: INTRODUCTION TO EARTH AND ENVIRONMENT**
***Teaching Scheme: Credits:** 02 **Total Contact Hrs:** 60 **Practical:** 04 Hours/Week	***Examination Scheme: Total Marks :** 50 **UA:** 30 Marks **IA/CA:** 20 Marks

Course Objectives: During this course, the student is expected to:

- Know the basic understanding of Environment and Earth System, its components and origin practically.
- Practically understand environment and earth system including its components, dynamics and history and study of different ecosystems.

Course Outcomes (COs): At the end of this course,:

- CO1: Strengthens the knowledge of students of any discipline with respect to understanding the earth and environment practically.
- CO2: Students will understand Illustrate the hydrological cycle with its components. Critically appreciate the environmental concerns.

Introduction to Earth and Environment	**No. of Practical Hrs: 60**	**Weightage: 50 Marks**

1. Laboratory safety rules and introduction to laboratory equipment.
2. Collection and preservation of water samples (Field Practical).
3. Collection and preservation of soil samples (Field Practical).
4. Identification of different Rock specimens from their physical properties.
5. Identification of different Mineral specimens from their physical properties.
6. Study of Topographic sheets – Contours, Natural and Man-made features
7. Draw labelled diagrams Outer and Inner planets
8. Study of different Geomorphic models of River, Ocean, Wind
9. Draw diagram of Soil Profile
10. Describe different types of Soils of India
11. Study of seismic zone map of India
12. Visit to the geology museum.
13. Visit to Geological site
14. Use of social media for e-networking and dissemination of ideas on environmental issues.

Text Books / Reference Books:

1. A Text Book of Environmental Sciences, S. S. Purohit, Q. J. Shammi and A. K. Agarwal, Student Edition (Agrobios), Jodhpur.
2. A Text Book of Environmental Studies, D. K. Asthana and Meera Asthana, S. Chand, New Delhi.
3. Air Pollution, M.N. Rao and H.V.N. Rao, Tata McGraw Hill, New Delhi.
4. An Introduction to Air Pollution, R. K. Trivedy and P. K. Goel, B. S. Publications, Hyderabad.
5. Aerial Photography & Image Interpretation: Resource Management, Paine D.P., John Wiley & Sons.
6. Chemical & Biological Methods for Water Pollution Studies, R.K. Trivedy and P. K. Goel, Environmental Publications, Karad.
7. Disaster Management in Hills, Dr. Satendra, Concept Publishing Co., New Delhi.
8. Ecology and Environment, P.D. Sharma, Rastogi Pub., New Delhi.
9. Environmental Science, S.C. Santara, New Central Book Agency (P) Ltd., Kolkota.

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B.Sc. Part-I, SEM-I: Environmental Science** **Vertical: Generic Elective/Open Elective Paper-I (GE-1/OE-1)** **Course Code: G04-GE-OE-112** **Course Name: EARTH AND EARTH SURFACE PROCESSES**
***Teaching Scheme: Credits:** 02 **Total Contact Hrs:** 30 **Lectures:** 02 Hours/Week	***Examination Scheme: Total Marks :** 50 **UA:** 30 Marks **IA/CA:** 20 Marks

Course Objectives: During this course, the students are expected to:

- Know fundamental concepts related to the Earth's structure and the processes that shape its surface.
- Combines lectures with practical fieldwork or laboratory exercises to provide hands-on experience in understanding Earth's dynamic systems.

Course Outcomes (COs): At the end of this course, the students

- CO1: Are equip with a comprehensive understanding of how Earth's processes shape its surface and impact the environment
- CO2: Gain knowledge about the Earth's internal layers and their properties, and how these layers influence surface processes. Understanding of plate tectonics, including how tectonic plates move, interact, and lead to geological phenomena such as earthquakes, volcanic activity, and mountain building.

Unit 1: History of Earth:	**Contact Hrs-15**	**Weightage: ~23 Marks**
• Formation and composition of core, mantle, crust, atmosphere and hydrosphere; chemical composition of Earth; geological time scale and major changes on the Earth's surface. Movement of lithosphere plates; mantle convection and plate tectonics, sea floor spread; earthquakes; volcanic activities; orogeny; origin of the main geomagnetic field; continental drift, Pangaea and present-day continents, Minerals and rocks: Minerals and important rock forming minerals, rock cycle, Rock laws; rock types and structures, weathering and erosion process.		
Unit 2: Earth surface processes	**Contact Hrs-15**	**Weightage: ~23 Marks**
• Atmosphere: Composition of atmosphere, physical and optical properties, circulation; interfaces: atmosphere–ocean interface, atmosphere–land interface, ocean–land interface, rivers and geomorphology; types of glaciers, glacier dynamics, formation of Peninsular Indian Mountain systems - Western and Eastern Ghats, Vindhyas, Aravalli's, etc. Formation of the Himalaya; development of glaciers, perennial river systems, formation of Indo-Gangetic Plains		

Textbooks and Reference Books:

1. Bridge, J., & Demicco, R. 2008. Earth Surface Processes, Landforms and Sediment deposits. Cambridge University Press.
2. Duff, P. M. D., & Duff, D. (Eds.). 1993. Holmes' Principles of Physical Geology. Taylor & Francis.
3. Gupta, A. K., Anderson, D. M., & Overpeck, J. T. 2003. Abrupt changes in the Asian southwest monsoon during the Holocene and their links to the North Atlantic Ocean. Nature 421: 354-357.
4. Gupta, A. K., Anderson, D. M., Pandey, D. N., & Singhvi, A. K. 2006. Adaptation and human migration, and evidence of agriculture coincident with changes in the Indian summer monsoon during the Holocene. Current Science 90: 1082-1090.
5. Keller, E.A. 2011. Introduction to Environmental Geology (5th edition). Pearson Prentice Hall.
6. Krishnan, M. S. 1982. Geology of India and Burma. CBS Publishers & istributors.
7. Leeder, M., Arlucea, M.P. 2005. Physical Processes in Earth and Environmental Sciences. Blackwell Publishing.
8. Pelletier, J. D. 2008. Quantitative Modelling of Earth Surface Processes (Vol. 304). Cambridge: Cambridge University Press. Chicago.

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B.Sc. Part-I, SEM-I: Environmental Science** **Vertical: Skill Enhancement Course (SEC) Laboratory Practical-I** **Course Code: G04-SEC-112-P** **Course Name: Practical: MAPPING OF EARTH'S SYSTEM AND ENVIRONMENTAL PROCESS**
***Teaching Scheme: Credits:** 02 **Total Contact Hrs:** 60 **Practical:** 04 Hours/Week	***Examination Scheme: Total Marks :** 50 **UA:** 30 Marks **IA/CA:** 20 Marks

Course Objectives: During this course, the student is expected to:

- Focus on hands-on skills and techniques for creating and analysing maps related to Earth's systems and environmental processes.
- To gain practical experience in mapping and spatial analysis, essential for careers in geology, environmental science, and related fields.

Course Outcomes (COs): At the end of this course,: the students will gain

- CO1: Practical skills for careers in environmental science, geology, and related fields, focusing on the effective visualization and management of spatial and environmental data
- .CO2: Knowledge of how to apply mapping techniques to real-world environmental issues, including resource management, hazard assessment, and conservation planning

Mapping of Earth's System and Environmental Process	**No. of Practical Hrs: 60**	**Weightage: 50 Marks**

1. Study of Topographic map
2. Study of signs, symbols, directions and legends / indexing for mapping
3. Preparation of profile / section and determination of slopes of different directions.
4. Study of toposheets and contour mappings
5. Study of Model for continental drift
6. Identification of rocks and minerals.
7. Study and interpretation of Geological time scale.
8. Study of landscapes of urban, semi-urban and rural areas.
9. Overview of Google Earth and mapping
10. Overview of Remote sensing images and mapping
11. Overview of various GIS software's and their applications in mapping

Text Books / Reference Books:

1. A Text Book of Environmental Sciences, S. S. Purohit, Q. J. Shammi and A. K. Agarwal, Student Edition (Agrobios), Jodhpur.
2. A Text Book of Environmental Studies, D. K. Asthana and Meera Asthana, S. Chand, New Delhi.
3. Air Pollution, M.N. Rao and H.V.N. Rao, Tata McGraw Hill, New Delhi.
4. An Introduction to Air Pollution, R. K. Trivedy and P. K. Goel, B. S. Publications, Hyderabad.
5. Aerial Photography & Image Interpretation: Resource Management, Paine D.P., John Wiley & Sons.
6. Chemical & Biological Methods for Water Pollution Studies, R.K. Trivedy and P. K. Goel, Environmental Publications, Karad.
7. Disaster Management in Hills, Dr. Satendra, Concept Publishing Co., New Delhi.
8. Ecology and Environment, P.D. Sharma, Rastogi Pub., New Delhi.
9. Environmental Science, S.C. Santara, New Central Book Agency (P) Ltd., Kolkota.

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B.Sc. Part-I, SEM-II: Environmental Science** **Vertical: Major (DSC1-2) Paper-II** **Course Code: G04-0212** **Course Name: ENVIRONMENTAL PHYSICS AND CHEMISTRY**
***Teaching Scheme: Credits:** 02 **Total Contact Hrs:** 30 **Lectures:** 02 Hours/Week	***Examination Scheme: Total Marks :** 50 **UA:** 30 Marks **IA/CA:** 20 Marks

Course Objectives: During this course, the students are expected to:

- Learn the basic principles of physics and chemistry as they relate to the environment, including thermodynamics, kinetics, and chemical equilibrium, how physical and chemical processes operate within these systems.
- Examine the sources, fate, and transport of pollutants in the environment, as well as the chemical reactions that occur between pollutants and natural substances.

Course Outcomes (COs): At the end of this course, students have the ability in

- CO1: Understanding the fundamental principles governing the behavior of physical and chemical processes in the environment.
- CO2: Developing the skills to analyze and interpret environmental data.

Unit 1: Fundamentals of Environmental Physics and Chemistry	**Contact Hrs-15**	**Weightage: ~23 Marks**

- **Fundamentals of environmental physics:** Basic concepts of light and matter; black body radiation, spectroscopic concepts: Introduction to the concept of absorption and transmission of light, Beer–Lambert law. Basic concepts of pressure, force, work and energy; types of forces and their relation; concept of heat transfer, conduction, convection; concept of temperature, laws of thermodynamics
- **Fundamentals of environmental chemistry:** atomic structure, electronic configuration, periodic properties of, types of chemical bonds; mole concept, molarity and normality, quantitative volumetric analysis. types of chemical reactions; acids, bases and salts, solubility products; solutes and solvents; redox reactions, concepts of pH and pE.

Unit 2: Atmospheric, Water and Soil Chemistry	**Contact Hrs-15**	**Weightage: ~23 Marks**

- **a) Atmospheric chemistry**: Composition of atmosphere; photochemical reactions in atmosphere; smog formation, types of smog, aerosols; chemistry of acid rain, reactions of NO2 and SO2; free radicals and ozone layer depletion, role of CFCs in ozone depletion.
- **b) Water chemistry:** Chemical and physical properties of water; alkalinity and acidity of water, hardness of water, calculation of total hardness; solubility of metals, complex formation and chelation; colloidal particles; heavy metals in water.
- **c) Soil chemistry:** Soil composition; relation between organic carbon and organic matter, inorganic and organic components in soil; soil humus; cation and anion exchange reactions in soil; nitrogen, phosphorus and potassium in soil; phenolic compounds in soil.

Text Books / Reference Books:

1. Beard, J.M. 2013. Environmental Chemistry in Society (2ndedition). CRC Press.
2. Boeker, & Grondelle, 2011.Environmental Physics: Sustainable Energy Climate Change. Wiley.
3. Connell, D.W. 2005. Basic Concepts of Environmental Chemistry (2ndedition). CRC Press.
4. Forinash, K. 2010. Foundation of Environmental Physics. Island Press.
5. Girard, J. 2013. Principles of Environmental Chemistry (3rd edition). Jones & Bartlett.
6. Harnung, S.E. & Johnson, M.S. 2012. Chemistry and Environment. Cambridge University Press.
7. Hites, R.A. 2012. Elements of Environmental Chemistry (2nd edition). Wiley & Sons. 8. Manhan, S. E. 2000. Fundamentals of Environmental Chemistry. CRC Press. Pani, B. 2007.
8. Textbook of Environmental Chemistry. IK international Publishing House

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B.Sc. Part-I, SEM-II: Environmental Science** **Vertical: Major(DSC1-2) Laboratory Practical-II** **Course Code: G04-0212-P** **Course Name: Practical: ENVIRONMENTAL PHYSICS AND CHEMISTRY**
***Teaching Scheme: Credits:** 02 **Total Contact Hrs:** 60 **Practical:** 04 Hours/Week	***Examination Scheme: Total Marks :** 50 **UA:** 30 Marks **IA/CA:** 20 Marks

Course Objectives: During this course, the student is expected to:

- Know the practical techniques for monitoring and analyzing environmental pollutants.
- Practically cover the fundamental principles and concepts related to the interaction between physical and chemical processes in the environment**.**

Course Outcomes (COs): At the end of this course,: students

- CO1: Gain knowledge of the sources, fate, and effects of environmental pollutants, acquire the ability to assess and mitigate the environmental impact of human activities.
- CO2: Get aware about the importance of sustainable practices for preserving environmental quality.

Environmental Physics and Chemistry	**No. of Practical Hrs: 60**	**Weightage: 50 Marks**

1. Collection and preservation methods of water and wastewater samples
2. Collection and preservation methods of soil samples
3. Analysis of sample spectrophotometrically.
4. Determination of carbonate, hydroxide and total alkalinity of a given water sample. Determination of pH of various water samples.
5. Determination of temporary, permanent and total hardness of water.
6. To measure soil temperature, soil pH and water holding capacity and moisture percentage of soil.
7. Estimation of carbon footprint
8. Estimation of water footprint
9. Estimation of Green House Gas emissions
10. Visit to industrial treatment plants, polluted sites, dumping sites etc.

Text Books / Reference Books:

1. A Text Book of Environmental Sciences, S. S. Purohit, Q. J. Shammi and A. K. Agarwal, Student Edition (Agrobios), Jodhpur.
2. A Text Book of Environmental Studies, D. K. Asthana and Meera Asthana, S. Chand, New Delhi.
3. Air Pollution, M.N. Rao and H.V.N. Rao, Tata McGraw Hill, New Delhi.
4. An Introduction to Air Pollution, R. K. Trivedy and P. K. Goel, B. S. Publications, Hyderabad.
5. Aerial Photography & Image Interpretation: Resource Management, Paine D.P., John Wiley & Sons.
6. Chemical & Biological Methods for Water Pollution Studies, R.K. Trivedy and P. K. Goel, Environmental Publications, Karad.
7. Disaster Management in Hills, Dr. Satendra, Concept Publishing Co., New Delhi.
8. Ecology and Environment, P.D. Sharma, Rastogi Pub., New Delhi.
9. Environmental Science, S.C. Santara, New Central Book Agency (P) Ltd., Kolkota.

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B.Sc. Part-I, SEM-II: Environmental Science** **Vertical: Generic Elective/Open Elective Paper-II (GE-2/OE-2)** **Course Code: G04-GE-OE-212** **Course Name: DIVISIONS OF ENVIRONMENT**
***Teaching Scheme: Credits:** 02 **Total Contact Hrs:** 30 **Lectures:** 02 Hours/Week	***Examination Scheme: Total Marks :** 50 **UA:** 30 Marks **IA/CA:** 20 Marks

Course Objectives: During this course, the students are expected in:

- Understanding of basics of environment, biotic and abiotic factors, segments or divisions of environment includes atmosphere, hydrosphere, lithosphere and biosphere.
- Knowing fundamental concepts related to Earth's structure and the processes that shape its surface.

Course Outcomes (COs): At the end of this course, the students

- CO1: Become aware about the importance of segments or divisions of environment.
- CO2: Will know the fundamentals of environmental science as applied to the interaction between human activity and the divisions of the environment in terms of Atmosphere, Hydrosphere, Lithosphere and Biosphere.

Unit 1: Atmosphere and Hydrosphere	**Contact Hrs-15**	**Weightage: ~23 Marks**

Divisions or segments of the environment and their interactions, Factors Biotic and Abiotic factors- types.

- **a) Atmosphere:** Chemical composition and thermal structure; heat budget and earth's albedo. Weather and climate, Weather Elements atmospheric pressure, temperature, relative humidity, precipitation, wind; Major climatic zones of the world, Agro- climatic zones of India.
- **b) Hydrosphere:** Definition, Importance and characteristics. Lentic and Lotic systems Ice-caps, oceans, rivers, lakes, pond and ground water, Hydrologic cycle. Human usage of surface and Ground water, Water as a resource and its availability, types ofaquifers and springs. Ground water potential. Water Budget.

Unit 2: Lithosphere and Biosphere	**Contact Hrs-15**	**Weightage: ~23 Marks**

- **c) Lithosphere:** Definition, structure and scope internal structure of earth; Different kinds of minerals and rocks - Igneous, metamorphic and sedimentary formation and types; Major landforms, Soil formation, soil profile and classification. Physical, chemical, mineralogical and biological properties of soil. Soil Biota.
- **d) Biosphere:** Definition and extent, Biomes types, characteristics, diversity and density Tundra, Taiga, Temperature and Deciduous Forest, Grassland, Desert, Tropical rain forest; A brief introduction to biogeography; India's biogeography.

Textbooks and Reference Books:

1) Text Book of Environmental Studies. Asthana, D. K. 2006. S. Chand Publishing.
2) Fundamentals of Environmental Studies, Basu, Xavier. 2016. Cambridge University Press, India.
3) Fundamentals of Environmental Science: G.S. Dhaliwal, G.S. Sangha and P.K. Raina, Kalyani Publication
4) Environmental Science (6TH ED) (1997): Jr. G.T. Miller, Wadsworth Pub. Co. Environmental Science (8th Edition) (2010): Daniel D. Chiras, Jones &Barlett Ltd.
5) Barry, G.R. and Chorley, J.R. 2003. Atmosphere, Weather and Climate. Routledge, London.
6) Critchfield, H.J. 1995. General Climatology. Printice Hall of India.
7) Daji, J.A. 1988. Textbook of Soil Science. Media Promoters and
8) Publishers. 6. Goldman, C.R. and Horne, A.J. 1983. Limnology. Mc Graw Hill.
9) Lutgens, F.K. and Tarbuck, E.J. 1982. Atmosphere Introduction to Meteorology. Prentice Hall Inc.
10) Menon, P.A. 1989. Our Weather. National Book Trust.
11) Nair, B.N. and Thampy, D.M. 1980. Marine Ecology. Macmillan Co. of India

	Punyashlok Ahilyadevi Holkar Solapur University, Solapur **B.Sc. Part-I, SEM-II: Environmental Science** **Vertical: Skill Enhancement Course (SEC) Laboratory Practical-II** **Course Code: G04-SEC-212-P** **Course Name: Practical: ENVIRONMENT AND SOCIETY**
***Teaching Scheme: Credits:** 02 **Total Contact Hrs:** 60 **Practical:** 04 Hours/Week	***Examination Scheme: Total Marks :** 50 **UA:** 30 Marks **IA/CA:** 20 Marks

Course Objectives: During this course, the student is expected to:

- Gain a comprehensive understanding of how environmental and social systems are interconnected and to develop skills for addressing environmental challenges through both theoretical knowledge and practical experience
- Examine how social structures, cultural practices, and economic systems impact the environment and, conversely, how environmental changes affect human societies.

Course Outcomes (COs): At the end of this course,: the students will gain

- CO1: Practical Experience: Hands-on experience through fieldwork or case studies, allowing them to apply theoretical knowledge to real-world environmental problems and solutions.
- CO2: Analytical Skills: Development of skills to analyze and interpret data related to environmental issues and their societal impacts, using both qualitative and quantitative methods.

ENVIRONMENT AND SOCIETY	**No. of Practical Hrs: 60**	**Weightage: 50 Marks**

1. Study of different components of environment
2. Prepare a chart of biodegradable and non-biodegradable pollutants generated in your locality.
3. Study of a representative type of ecosystem.
4. To prepare a checklist of invasive species.
5. Study of factors responsible for ecological degradation and air pollution
6. Study of different control measures for air pollution and noise pollution.
7. Filed visit to nearby meteorological station
8. Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
9. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
10. Study of simple ecosystems-pond, river etc. and submit a report

Text Books / Reference Books:

1. A Text Book of Environmental Sciences, S. S. Purohit, Q. J. Shammi and A. K. Agarwal, Student Edition (Agrobios), Jodhpur.
2. A Text Book of Environmental Studies, D. K. Asthana and Meera Asthana, S. Chand, New Delhi.
3. Air Pollution, M.N. Rao and H.V.N. Rao, Tata McGraw Hill, New Delhi.
4. An Introduction to Air Pollution, R. K. Trivedy and P. K. Goel, B. S. Publications, Hyderabad.
5. Aerial Photography & Image Interpretation: Resource Management, Paine D.P., John Wiley & Sons.
6. Chemical & Biological Methods for Water Pollution Studies, R.K. Trivedy and P. K. Goel, Environmental Publications, Karad.
7. Disaster Management in Hills, Dr. Satendra, Concept Publishing Co., New Delhi.
8. Ecology and Environment, P.D. Sharma, Rastogi Pub., New Delhi.
9. Environmental Science, S.C. Santara, New Central Book Agency (P) Ltd., Kolkota.

UA
Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science & Technology.
Nature of Question Paper for CBCS Pattern NEP-2020
B. Sc. (Part- I) w.e.f. AY 2024-25

Time: Total Marks: 30

Instructions
1) All Questions are compulsory
2) Figure to right indicate full marks.

Q.1 Choose correct alternative. (MCQ) **06 Marks**

1)
a) b) c) d)
2)
a) b) c) d)
3)
a) b) c) d)
4)
a) b) c) d)
5)
a) b) c) d)
6)
a) b) c) d)

Q.2. Answer the following. (Any three) **6 (2+2+2)**

A)
B)
C)
D)
E)

Q.3. Answer the following (Any two). **6 (3+3)**

A)
B)
C)

Q.4. Answer the following (Any two). **6 (3+3)**

A)
B)
C)

Q.5. Answer the following (Any one). **6 Marks**

A)
B)

IA/CA
Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science & Technology
Nature of Question Paper for CBCS Pattern
B. Sc. (Part- I) w.e.f. AY 2024-25

Time: Total Marks: 20

- **Internal Evaluation System for 20 Marks**
  - Choose any two of the following
  - Home Assignment / Unit Test / Tutorial /Seminar

- **Pattern of Examination:**
  - External Evaluation + Internal Evaluation
  - 30 Marks + 20 Marks = 50 Marks
- **Passing Criteria:**
  - University Written Exam (UA) – 12 out of 30
  - Internal/Continuous Assessment (IA/CA) – 08 out of 20
