

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**



NAAC Accredited-2022

'B++' Grade (CGPA2.96)

**Name of the Faculty: Science & Technology**

**Syllabus as per NEP 2020**

**B.Sc. in Environmental Science (Hons.)**

**B.Sc. I (Sem. I and II)**

**(Syllabus to be implemented from June 2024)**

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur,**

Faculty of Science & Technology

Choice Based Credit System (CBCS) (w.e.f. June 2024)

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**~ About National Education Policy (NEP) – 2020 ~**

With the directions and guidelines issued by **Government of Maharashtra resolution dated 20<sup>th</sup> April 2023 and 16<sup>th</sup> 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 to introduce 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 the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

**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):** This comprises of Mandatory and Elective Courses that require 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 are related to Major

**(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 by Autonomous College.
- 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 will include skills based on advanced laboratory practical's of Major

**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 by Autonomous College

**(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
- Modern Indian Language: 04 credits
- To be offered from the Basket approved by Autonomous College; 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 by Autonomous College

**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) such as Health and Wellness, Yoga education, sports and fitness, Cultural

Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts: (8 credits) -

To be 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
6.5	600-699	PG Degree	80	88	4	2
8.0	700-799	Ph.D.	16+ Ph.D. Work		---	---

## 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. For the ease of calculation, the break-up of credits with respect to general education component is as in the table below:

**Table 1: Break-Up of Credits and contact hours per credit is as follows**

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).

#### **4. Eligibility Criteria:**

A candidate should have bachelor's degree in Zoology/Life Sciences/Equivalent subjects (three years course after 10+2) from the recognized university.

#### **5. Examination and Evaluation:**

As suggested in NEP 2020, continuous internal evaluation is proposed. Total evaluation proposed is 80:20 ratio for external: internal evaluation. There will be no internal evaluation for lab courses (Excluding project/dissertation).

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**

**Faculty of Science and Technology**

**NEP Choice Based Credit System (CBCS) (W.e.f. June 2024)**

**Title of the Course: B.Sc. Part-I**

**Subject: Environmental Science**

**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, oceans, 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-world challenges effectively.



## Course outcomes:

After completing the course, the student will be able to

- **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.
- **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.
- **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.
- **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.
- **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.
- **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.
- **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.
- **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.
- **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.
- **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.

**Eligibility and 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 PAH Solapur University, Solapur.

**Duration:** The duration for this program is of 3 years with semester pattern (06 Semesters) and 4 Years with 08 semesters as B. Sc (Hons.)

**Medium of Instruction:** English

**Syllabus Structure:**

The University follows semester system. An academic year shall consist of two semesters

Each B.Sc. course shall consist of three years i.e. six semesters.

B.Sc. Part-I Environmental Science shall consist of two semesters: Semester I and Semester II.

In semester I, there will be two core papers is having paper I and paper II of 100 marks.

Similarly in Semester II there will be two core papers is having paper I and paper II of 100 marks.

The scheme of evaluation of performance of candidates shall be based on University Assessment (UA) as well as College Internal Assessment (CA) as given below.

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. as given below.

**Scheme of Evaluation**

As per the norms of the grading system of evaluation, out of 100 marks, the candidate has to appear for college internal assessment of 40 marks and external evaluation (University assessment) of 60 marks.

**Semester-I: Theory:(100 marks)**

University Examination (60 marks): No. of theory papers:2(paper I and paper II of 30 marks each)

Internal Continuous Assessment:(40 marks and 20 marks each for two papers)

(a) Internal test-Home assignment/tutorials/seminars/viva/group discussion/outreach programs.

**II Semester: - Theory:(100 marks)**

University Examination (60marks): No. of theory papers:2 (paper III and paper IV of 30 marks each)

Internal Continuous Assessment:(40 marks and 2 marks each for two papers)

(a)Internal test-Home assignment/tutorials/seminars/viva/group discussion/outreach programs.

Internal Continuous Assessment:(20 marks):

(a) Internal practical test-Scheme of marking:**10 marks**

(b) Viva/group discussion/model or chart/attitude/attendance/overallbehavior:**10 marks**

**B.Sc. I Semester- I &II, ENVIRONMENTAL SCIENCE**  
**Choice Based Credit System (CBCS) Structure (2024)**

**Semester-I Major (Theory)**

<b>Paper</b>	<b>Title</b>	<b>Marks</b>
DSC1-1	<b>Introduction to the Environment</b>	<b>50</b> <b>(30-UA and 20-CA)</b>

**Semester-II Major (Theory)**

<b>Paper</b>	<b>Title</b>	<b>Marks</b>
DSC1-2 (2)	<b>Environmental Physics and Chemistry</b>	<b>50</b> <b>(30-UA and 20-CA)</b>

**Faculty of Science and Technology**

**4- Year Multidisciplinary UG Program with DSC as a Major (4 -Year Bachelor of Science (Honors)/(Honors with Research) )**

**B.Sc.- I (Environmental Science)**

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/Internshi p/Appre nticeship/ Community Engagement & Services	Credits	Cumulative Credits
		Major		Minor						
		DSC	DSE							
4.5  100-200	I	DSC1-1 Introduction to the Environment (2+2)				SEC1 (2) Sustainable Development and SDG	L1-1(2) IKS General IKS (2)	CC1 (2)	22	44 UG Certificate (44)
		DSC2-1 (2+2)					VEC-1 Constitution of India (2)			
		DSC3-1 (2+2)								
	II	DSC1-2 Environmental Physics and Chemistry (2+2)			GE1 Divisions of the environment (2)	SEC 2 Man, and Environment (2)	L1-2(2)	CC2 (2)	22	
		DSC2-2 (2+2)					VEC - 2 (Environmental Studies) (2)			
		DSC3-2 (2+2)								

**Exit option:** Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

## Structure as per NEP-2020

### B. Sc. I (Environmental Science)

Level	Sem.	Major		Minor	VSC/ SEC	OE/GE	IKS	CC	Total Credits	Cumulative Credits
		T	P	T						
C	I	2	1		SEC 1-2		2 - IKS(Major) 2 - L1-1 2 - VEC 1	2	22	44
4.5	II	2	1	2	VSC 2-2	2	2 – L1-2 2- VEC 2	2	22	
		2	1	2	SEC -2					
SEM -I										
S.No.	Course Type		Course Code			Paper Title			Credit	
1.	Major		DSC 1-1			Environmental Science - I Introduction to the Environment			2	
2.	Practical based on DSC1-1		Practical -I			Practical -I Introduction to the Environment			2	
3.	Major		DSC 2-1			To be selected from Other than Environmental Science			2	
4.	Major		DSC 3-1			To be selected from Other than Environmental Science			2	
5	SEC		Skill Enhancement Course- I - SEC1			Sustainable Development and SDG			2	
6.	IKS		IKS			General IKS			2	
7.	AEC		L1-1			English			2	
8.	VEC		VEC 1			Constitution of India			2	
9.	CC1		CC1			CC			2	
						Total			22	
SEM II										
10.	Major		DSC 2-1			Environmental Science - II Environmental Physics and Chemistry			2	
11.	Practical based on DSC 2-1		Practical - II			Practical - II Environmental Physics and Chemistry			2	
12.	Major		DSC 2-2			To be selected from Other than Environmental Science			2	
13.	Major		DSC 2-3			To be selected from Other than Environmental Science			2	
14.	OE-I/GE-I		OE-I/GE-I			Divisions of the Environment			2	
15.	SEC		SEC2			Man, and Environment			2	
16.	AEC		L1-2			English			2	
17.	VEC		VEC 2			Environmental Studies			2	
18.	CC2		CC2			CC			2	
						Total			22	

#### Abbreviations:

**OE:** Generic/ Open Electives

**VSEC:** Vocational Skill and Skill Enhancement Courses

**SEC:** Skill Enhancement Courses

**AEC:** Ability Enhancement Courses

**FP:** Field projects

**CC:** Co-curricular Courses

**RP:** Research Project

**IKS:** Indian Knowledge System

PAH SOLAPUR UNIVERSITY, SOLAPUR (As per NEP 2020) – Environmental Science					
Semester – I					
Course Code	Title of Papers	Distribution of Marks for Examination			Total credit
		CA	UA	Total	
DSC1-1 (2)	<b>Introduction to the Environment</b>	20	30	50	2
PR DSC1-1 (2)	Practical based on DSC1	20	30	50	2
SEC 1(2)	<b>Sustainable Development and SDG</b>	20	30	50	2
IKS Generic (2)	General Indian knowledge system	20	30	50	2
<b>FP/RP/CC</b>	NCC/NSS/Culture/sports/Social Activities	20	30	50	2
L1-1 (2)	English	20	30	50	2
VEC1 (2)	Constitution of India	20	30	50	2
<b>Total Marks + Credit for Semester – I</b>			20	30	<b>22</b>
Semester –II					
DSC1-2 (2)	<b>Environmental Physics and Chemistry</b>	20	30	50	2
PR DSC1-2 (2)	Practical based on DSC1-2	20	30	50	2
OE-1 (2)	<b>Divisions of the Environment</b>	20	30	50	2
SEC 2 (2)	<b>Man, and Environment</b>	20	30	50	2
<b>FP/RP/CC</b>	NCC/NSS/Culture/sports/Social activities	20	30	50	2
L1-1 (2)	English	20	30	50	2
VEC1 (2)	Environmental Science	20	30	50	2
<b>Total Marks + Credit for Semester - II</b>		<b>110</b>	<b>440</b>	<b>550</b>	<b>22</b>
Total Marks + Credit for Semester - I		110	440	550	22
Total Marks + Credit for Semester - II		110	440	550	22
<b>Total Marks and Credit</b>		<b>220</b>	<b>880</b>	<b>1100</b>	<b>44</b>

## **B. Sc in Environmental Science**

### **SEM -I**

#### **DSC 1- 1 (Theory)**

##### **Title of the Paper – Introduction to the Environment**

**Credits: 02**

**Total Marks: 50**

**Theory: 30 Periods**

##### **About the Course:**

The main objective of the course is to introduce the basic understanding of the Environment and Earth System, its components and origin. It is also intended to give an overall understanding of the environment and earth system including its components, dynamics and history and study of different ecosystems.

##### **Course Learning Outcome**

The study of this paper strengthens knowledge of students of any discipline with respect to understanding the earth and environmental science. The course outcomes are:

- Students will appreciate the Knowledge about the environment and the role of human beings in shaping the environment
- Students will appreciate the Knowledge about the environment and the role of human beings in shaping the environment
- Understand various components of the environment and interfaces
- Illustrate the hydrological cycle with its components. Critically appreciate the environmental concerns of today
- Explain different layers in atmospheric structure. Identify the change in lapse rate due to different processes of climate change in lapse rate due to different processes of climate change and other anthropogenic impacts.

<b>Unit No.</b>	<b>Title of topic and contents</b>	<b>Contact Hours</b>
I	<b>Introduction to Earth and Environment:</b> <ul style="list-style-type: none"><li>• 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.</li></ul>	15
II	<b>Earth &amp; its Structural Components: Formation of the Earth:</b> <ul style="list-style-type: none"><li>• Internal Structure of Earth, Formation and composition of core, mantle, crust Theories of geological evolution: Wager'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.</li><li>• Weathering and Soil: Soil, Soil Profile, Soil Formation, Soil classification, Physical &amp; chemical properties of soil, Macro &amp;</li></ul>	15

	<p>micro plant nutrients, Importance and Significance of Soil, Soil erosion Types, causes and effects.</p> <ul style="list-style-type: none"> <li>• Atmospheric phenomenon, Evolution of earth's atmosphere, Composition of atmosphere and its vulnerability to climate change</li> <li>• Atmospheric Pressure and wind: Introduction, Measurement, Factors affecting the atmospheric pressure, Atmospheric pressure winds, Factors affecting wind, types of wind.</li> </ul>	
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**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 & Co., 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 and Image Interpretation for Resource Management, Paine, D.P., John Wiley and 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., Kolkata.

**DSC 1 - 1 (Practical)**

**Title – Introduction to the Environment**

**Credits: 02**

**Total Marks: 50**

**Practical: 60 Contact Hrs**

<b>Practical titles / content</b>	<b>Contact Hours</b>
<ol style="list-style-type: none"> <li>1. Laboratory safety rules and introduction to laboratory equipment.</li> <li>2. Collection and preservation of water samples (Field Practical).</li> <li>3. Collection and preservation of soil samples (Field Practical).</li> <li>4. Identification of different Rock specimens from their physical properties.</li> <li>5. Identification of different Mineral specimens from their physical properties.</li> <li>6. Study of Topographic sheets – Contours, Natural and Man-made features</li> <li>7. Draw labelled diagrams Outer and Inner planets</li> <li>8. Study of different Geomorphic models of River, Ocean, Wind</li> <li>9. Draw diagram of Soil Profile</li> <li>10. Describe different types of Soils of India</li> <li>11. Study of seismic zone map of India</li> <li>12. Visit to the geology museum.</li> <li>13. Visit to Geological site</li> </ol>	04/week



14. Use of social media for e networking and dissemination of ideas on environmental issues.	
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## SEC -1 Skill Enhancement Course - I

### Title of the paper – Sustainable Development and SDG

**Credits: 02**

**Total Marks: 50**

**Theory: 30 Periods**

#### About the Course:

The main aim of the course is to Provide basic knowledge of sustainable development goals and list of SDGs. It also includes to upgrade and relate the theoretical knowledge of sustainability and environmental conservation. This course also introduces the basic principles and goals of sustainability.

#### Course Outcomes:

- This knowledge help students to learn and plan for a sustainability. It also identifies, list of environmental, social and economic aspects for sustainable development.
- Discuss scope, importance of SD and opportunities for sustainability studies.
- Examines pathways and requirements for sustainable development.
- Outline cross -cutting issues and role of international organization towards SD.

Unit No.	Title of topic and contents	Contact Hours
I	<b>Sustainable Development, Sustainability:</b> Development of the Concept, Dimensions, Critique, Education for Sustainable Development, Paris Agreement and Sustainable Development, Strategies for Sustainable Development, Public Engagement in Sustainable Development, UN Sustainable Development Knowledge Platform, Sustainable Forest Management, Cultural Elements in Sustainable Development Frameworks, <b>Pathways and Requirements:</b> Environmental Characteristics of Sustainable Cities, Land Use Changes, Agriculture and Food, Materials and Waste, Biodiversity and Ecosystem Services, Management of Human Consumption and Impacts, Improving on Economic and Social Aspects, Gender and Leadership in Sustainable Development, Barriers and Cross Cutting Issues.	15

II	<p><b>Sustainable Development Goals:</b> Contents of the 17 Goals, No poverty, Zero Hunger, Good Health and Well-Being, Peace, Quality Education, Gender Equality, Reduced Inequalities, Justice and Strong Institutions, Clean Water and Sanitation, Affordable Clean Energy, Climate Action, Life Below Water, Life on Land, Decent Work and Economic Growth, Industry, Innovation and Infrastructure, Sustainable Cities and Communities, Responsible Consumption and Production, Partnership for Sustainable Development.</p> <p><b>Reporting and Measurements</b> Challenges for Sustainable Development International Organizations and Sustainable Development, Monitoring Mechanism, Reporting and Progress, Sustainable Development Goal Targets and Indicators, Communication and Advocacy, Corporate Sustainability, Sustainability Metrics and Indices, Ecological and Carbon Footprint for Sustainability Measurement, Sustainability Measurement and Reporting Tool, Sustainability Case Studies Examples</p>	15
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**Textbooks and Reference Books:**

1. Clark, William; Harley, Alicia (2020). "Sustainability Science: Toward a Synthesis". Annual Review of Environment and Resources. 45 (1): 331-86.
2. United Nations General Assembly (1987) Report of the World Commission on Environment and Development: Our Common Future
3. Purvis, Ben; Mao, Yong, Robinson, Darren (2019). "Three pillars of sustainability: in search of conceptual origins". Sustainability Science. 14 (3): 681-695.
4. Berg, Christian (2020). Sustainable action: overcoming the barriers. Abingdon, Oxon. ISBN 978-0-429-57873-1. OCLC 1124780147.
5. Purvis, Ben; Mao, Yong; Robinson, Darren (2019). "Three pillars of sustainability: in search of conceptual origins". Sustainability Science. 14 (3): 681-695.
6. Sachs, Jeffrey D. (2015). The Age of Sustainable Development. New York: Columbia University Press. ISBN 9780231173155.
7. Sossa, Jhon (May 2019). "Barriers to sustainability for small and medium enterprises in the framework of sustainable development-Literature review". Business Strategy and the Environment. 28 (4): 512-524.
8. Environment and Sustainable Development by M.H. Fulekar, Bhawana Pathak, R K Kale, Springer Nature (2013)
9. Sustainable Development in the Digital Era by Dr. Aparna Mishra, Dr. Vikas Dahiya, Dr.Kamini Tandon, JSR Publishing House LLP: (2019).
10. The Age of Sustainable Development by Jeffrey D. Sachs and Ban Ki-moon, Columbia University Press (2015)
11. Target 3 Billion: Innovative Solutions Towards Sustainable Development by APJ Abdul Kalam, Srijan Pal Singh, Penguin India (2011)

## SEM -II

### DSC 1- 2 Environmental Science (Theory)

#### Title of the Paper – Environmental Physics and Chemistry

**Credits: 02**

**Total Marks: 50**

**Theory: 30 Periods**

#### About Course:

The course "Environmental Physics and Chemistry" typically covers the fundamental principles and concepts related to the interaction between physical and chemical processes in the environment. Students 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. Students examine the sources, fate, and transport of pollutants in the environment, as well as the chemical reactions that occur between pollutants and natural substances. The course also covers techniques for monitoring and analyzing environmental pollutants.

#### Course Outcome:

- Understanding the fundamental principles governing the behavior of physical and chemical processes in the environment.
- Developing the skills to analyze and interpret environmental data.
- Gaining knowledge of the sources, fate, and effects of environmental pollutants.
- Acquiring the ability to assess and mitigate the environmental impact of human activities.
- Fostering an awareness of the importance of sustainable practices for preserving environmental quality.

Unit No.	Title of topic and contents	Contact Hours
I	<b>Fundamentals of environmental physics:</b> 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 <b>Fundamentals of environmental chemistry:</b> 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.	15
II	<b>a) Atmospheric chemistry:</b> Composition of atmosphere; photochemical reactions in atmosphere; smog formation, types of smog, aerosols; chemistry of acid rain, reactions of NO <sub>2</sub> and SO <sub>2</sub> ; free radicals and ozone layer depletion, role of CFCs in ozone depletion. <b>b) Water chemistry:</b> 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. <b>c) Soil chemistry:</b> Soil composition; relation between organic carbon and organic matter, inorganic and organic components in soil; soil humus; cation and anion	15

	exchange reactions in soil; nitrogen, phosphorus and potassium in soil; phenolic compounds in soil.	
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**Text Book / References:**

1. Beard, J.M. 2013. Environmental Chemistry in Society (2nd edition). CRC Press.
2. Boeker, E. & Grondelle, R. 2011. Environmental Physics: Sustainable Energy and Climate Change. Wiley.
3. Connell, D.W. 2005. Basic Concepts of Environmental Chemistry (2nd edition). 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 the 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.
8. Pani, B. 2007. Textbook of Environmental Chemistry. IK international Publishing House.

## DSC 1 - 2 (Practical)

### Title of the Paper – Environmental Physics and Chemistry

**Credits: 02**

**Total Marks: 50**

**Practical: 60 Contact Hours**

Practical titles / content	Contact Hours
<ol style="list-style-type: none"> <li>1. Collection and preservation methods of water and wastewater samples</li> <li>2. Collection and preservation methods of soil samples</li> <li>3. Analysis of sample spectrophotometrically.</li> <li>4. Determination of carbonate, hydroxide and total alkalinity of a given water sample. Determination of pH of various water samples.</li> <li>5. Determination of temporary, permanent and total hardness of water.</li> <li>6. To measure soil temperature, soil pH and water holding capacity and moisture percentage of soil.</li> <li>7. Estimation of carbon footprint</li> <li>8. Estimation of water footprint</li> <li>9. Estimation of Green House Gas emissions</li> <li>10. Visit to industrial treatment plants, polluted sites, dumping sites etc.</li> </ol>	04/week

## (OE-I/GE-I) (Theory)

### Title of the paper: Divisions of Environment

**Credit: 02**

**Total Marks: 50**

**Theory: 30 Periods**

#### Course Objective

The course includes understanding of basics of environment, biotic and abiotic factors, segments or divisions of environment includes atmosphere, hydrosphere, lithosphere and biosphere.

#### Course Learning Outcome

Upon completion of the course, students will become aware of the importance of segments or divisions of environment. They also 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 No.	Title of topic and contents	Contact Hours
I	Divisions or segments of the environment and their interactions, Factors Biotic and Abiotic factors- types. <b>a) Atmosphere:</b> 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>b) Hydrosphere:</b> 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 of aquifers and springs. Ground water potential. Water Budget.	15
II	<b>c) Lithosphere:</b> 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. <b>d) Biosphere:</b> 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.	15

#### Text Books / Reference Book:

- 1) Text Book of Environmental Studies. Asthana, D. K. 2006. S. Chand Publishing.
- 2) Fundamentals of Environmental Studies, Basu, M., Xavier, S. 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) Miller, Jr. G.T. 1994. Living in the Environment: Principles, Connections and Solutions. Wadsworth Publishing Co.
- 12) Nair, B.N. and Thampy, D.M. 1980. Marine Ecology. Macmillan Co. of India
- 13) Rai, M.M. 1981. Principles of Soil Science. Macmillan Co. of India.

## SEC - II

### Title of the Paper – Man, and Environment

**Credits: 02**

**Total Marks: 50**

**Theory: 30 Periods**

#### **About Course:**

The course includes the study of fundamentals of environment, components, multidisciplinary and dynamic nature of environment, human interaction, environmental conservation and approaches in environmental management. Further, it also deals with the study of different technologies used in environmental management and entrepreneurship opportunities in environment.

#### **Course Outcome:**

The students will learn the man and environment interaction and relation.

- Interpret the Knowledge about the environment and the role of human beings in shaping the environment
- Understand various components of the environment and interfaces
- Categorize the various environmental issues. Critically appreciate the environmental management practices and better solutions
- Examine a method that practically implement various sustainable development goals and its importance.
- Identify the possible ways of environmental protection and conservation.

Unit No.	Title of topic and contents	Contact Hours
I	<b>a) Introduction to Environment:</b> Fundamentals of Environment and its components, Functions of Environment. Scope and Importance Environment. Multidisciplinary and dynamic nature Environmental Science, Natural Resources. <b>b) Human Interaction with Environment:</b> Environmental Issues: Local to global, Pollution, Impact of Developmental Activities, Environmental Footprints, Ecological footprint, Carbon footprint. <b>c) Environmental Conservation and protection:</b> Traditional Knowledge, Environmental Ethics, Introduction to Environmental Laws, Cost Benefit Analysis, Sustainable Development Goals.	15
II	<b>Approaches in Environmental Management:</b> <b>a) Industrial Environment Management:</b> Green Technologies for Industries, Environment, Social and Governance (ESG), Industrial Sustainability Practices, Environmental Management System, Certifications under ISO, Life Cycle Assessment, Industrial Health and Safety.	15

	<p><b>b) Technologies in Environment Management:</b> IOT and AI Applications in Environment Management, Software in Environmental Management, Requirements for Smart Cities, Carbon Sequestration Technologies, Recycling Robots, Automated Waste Collection, Sensors, Applications of GIS and RS in Environment, Green and Clean Energy Generation Technologies.</p> <p><b>c) Entrepreneurship Opportunities in Environment:</b> Innovation &amp; Entrepreneurship, Green Business Ideas, Environmental Management by Private Organizations, Governmental Policies and Job Opportunities, Success Stories in Environmental Entrepreneurship, Role &amp; Functions of MoEFCC.</p>	
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**Text Book / References:**

- 1) Environmental Science; Santra S.C.; New Central Book Agency (P) Ltd.; 2 Edt..
- 2) Environmental Science; Daniel Chiras.
- 3) Recent Trends in Environmental Science and Technology Hardcover-1 January 2017, by Singh Ram Pratap et. al., Write and Print Publications; 1st edition (1 January 2017).
- 4) Environmental Education Paperback – 1 January 2019, by S. Samuel Ravi, Atlantic Publishers and Distributors Pvt Ltd (1 January 2019).
- 5) Agarwal, B. 1997. Gender, Environment and Poverty Interlinks: Regional Variations and Temporal Shifts in Rural India: 1971-1991. World Development 25: 1-42. 37
- 6) Jackson, C. 1993. Doing what comes naturally? Women and environment in development World Development 21: 1947-63.
- 7) Stein, R. (ed.). 2004. New Perspectives on Environmental Justice: Gender, Sexuality, and Activism. Rutgers University Press.
- 8) Zwarteveen, M.Z. 1995. Linking women to the main canal: Gender and irrigation management. Gatekeeper Series 54, IIED.

UA

Punyashlok Ahilyadevi Holkar Solapur University, Solapur.

Faculty of Science & Technology.

Nature of Question Paper for CBCS Pattern NEP

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)
-



**CA**

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur.**

**Faculty of Science & Technology.**

**Nature of Question Paper for CBCS Pattern**

**B. Sc. / B.C.A. (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

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- **Pattern of Examination:**

- External Evaluation + Internal Evaluation
- 30 Marks + 20 Marks = 50 Marks

- **Passing Criteria:**

- Written Exam – 12 out of 30
  - Continuous Assessment (CA) – 08 out of 20
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