BANGALORE UNIVERSITY

Curriculum Framework for Three-year Undergraduate Programme - B.Sc under SEP

Syllabus

For
Environmental Science
(First and Second Semester)

DEPARTMENT OF ENVIRONMENTAL SCIENCE

Commencing from 2024 - 25

BANAGALORE UNIVERSITY
DEPARTMENT OF ENVIRONMENTAL SCIENCE
BANGALORE - 560056

Proceedings of the Board of Studies (UG) meeting held on 4th of July 2024 in the Department of Environmental Science, Bangalore University, Bengaluru – 560056.

A meeting of BOS (UG) was convened on 4th of July 2024 10.30am in the Department of Environmental Science, Jnana Bharathi Campus, Bangalore University, Bengaluru – 560056.

The Chairman welcomed all the members of the BOS(UG) and the members were invited to discuss on the following agenda in the meeting;

1. Approval of Under Graduate First year syllabus (I & II Semester) for implementation from the academic year 2024-25 as per the State Education Policy (SEP).
2. Course pattern and Scheme of Examination, 2024-25
3. Approval of Panel of Examiners (UG) Environmental Science for the academic year 2024 -25

Members have examined the scheme and syllabus for First and second semester UG Environmental Science and Environmental Studies (Constitution Values) and Panel of Examiners (UG) Environmental Science for the academic year 2024 -25. The committee members have discussed and approved the scheme and syllabus for first and second semester UG course for implementation from the academic year 2024-25 and Panel of Examiners (UG) Environmental Science for the academic year 2024 -25. The meeting ended with vote of thanks by the chairman.

Members Present

1. Prof. Suresh S
2. Dr. Kumar M 04/07/2024

04/07/2024
(Dr. K.L. Prakash)
Chairman

Dr. K.L. PRAKASH Ph.D.
Professor & Chairman
Dept. of Environmental Science
Bangalore University
Bengaluru - 560 056.

BANGALORE UNIVERSITY

Distribution of Courses/ Papers in Undergraduates Programme I to VI Semester as per State Education Policy (SEP)
Proposed for B.Sc., Courses

B.Sc., Environmental Science: SYLLABUS: (Major with General) effect from 2024-25

Semester No.	Course Category	Course Code	Title of the Paper	Marks			Teaching hours / week			Credits	Duration of Exams (Hrs
				Sem. Exam	IA	Total	L	T	P		
FIRST	Language			-	-	-	-	-	-	-	-
	Language			-	-	-	-	-	-	-	-
	CC/CV			-	-	-	-	-	-	-	-
	DSC1	EVSC1-T	Ecology and Environment	80	20	100	4	-	-	4	3
	DSC2	-	-	80	20	100	4	-	-	4	3
	DSC3	-	-	80	20	100	4	-	-	4	3
	DSC	EVSC1-P	Ecology and Environment	40	10	50	-	-	4	2	3
	DSC	-		40	10	50	-	-	4	2	3
	DSC	-		40	10	50	-	-	4	2	3
SECOND	Language			-	-	-	-	-	-	-	-
	Language			-	-	-	-	-	-	-	-
	CC/CV			-	-	-	-	-	-	-	-
	DSC	EVSC2-T	Atmosphere and Climate Change	80	20	100	4	-	-	4	3
	DSC	-	-	80	20	100	4	-	-	4	3
	DSC	-	-	80	20	100	4	-	-	4	3
	DSC	EVSC2-P	Atmosphere and Climate Change	40	10	50	-	-	4	2	3
	DSC	-	-	40	10	50	-	-	4	2	3
	DSC	-	-	40	10	50	-	-	4	2	3
THIRD	Language			-	-	-	-	-	-	-	-
	Language			-	-	-	-	-	-	-	-
	DSC	EVSC3-T	Natural Resource and Sustainability	80	20	100	4	-	-	4	3
	DSC	-	-	80	20	100	4	-	-	4	3
	DSC	-	-	80	20	100	4	-	-	4	3
	CV	-									
	DSC	EVSC3-P	Natural Resource and Sustainability	40	10	50	-	-	4	2	3
	DSC		-	40	10	50	-	-	4	2	3
	DSC		-	40	10	50	-	-	4	2	3
FOURTH	Language			-	-	-	-	-	-	-	-
	Language			-	-	-	-	-	-	-	-
	DSC	EVSC4-T	Biodiversity and Conservation	80	20	100	4	-	-	4	3
	DSC	-	-	80	20	100	4	-	-	4	3
	DSC	-	-	80	20	100	4	-	-	4	3
	CV	-									
	DSC	EVSC4-P	Biodiversity and Conservation	40	10	50	-	-	4	2	3
	DSC	-	-	40	10	50	-	-	4	2	3
	DSC	-	-	40	10	50	-	-	4	2	3
FIFTH	DSC	EVSC5-T	Environmental Chemistry and Pollution	80	20	100	4	-	-	4	3
	DSC	-	-	80	20	100	4	-	-	4	3
	DSC	-	-	80	20	100	4	-	-	4	3
	DSC	EVSC5-P	Environmental Chemistry and Pollution	40	10	50	-	-	4	2	3
	DSC	-	-	40	10	50	-	-	4	2	3
	DSC	-	-	40	10	50	-	-	4	2	3
	SEC	-		-	-	-	-	-	-	-	-
SIXTH	DSC	EVSC6-T	Environmental Protection and Management	80	20	100	4	-	-	4	3
	DSC	-	-	80	20	100	4	-	-	4	3
	DSC	-	-	80	20	100	4	-	-	4	3
	DSC	EVSC6-P	Environmental Protection and Management	40	10	50	-	-	4	2	3
	DSC	-	-	40	10	50	-	-	4	2	3
	DSC	-	-	40	10	50	-	-	4	2	3
	SEC	-		-	-	-	-	-	-	-	-

Note: Course = paper; CC/CV: Compulsory Course/ Constitutional Value; DSC: Discipline Specific Core Course; SEC=Skill Enhancement Course;
DSE= Discipline Specific Elective; SEC= Skill Enhancement Courses; ABC= Activity Based Courses, (L= Lecture; T=Tutorial; P= Practical);
MIL= Modern Indian Language, CC/CV paper shall be approved by the BOS of Environmental Science, BUB

Programme Outcomes (POs):

POs O1	**:**	Ability to recognize the need for learning the topic and develop foundational knowledge on the topic
POs O2	**:**	Acquisition of knowledge on structure, to develop critical thinking and problem-solving skills to solve interdisciplinary issues related to the topic
POs O3	**:**	Understanding of various relationships between natural and manmade systems
POs O4	**:**	Understanding of the major elements of variation that exist in the living world through apply technical methods and innovative techniques in classroom, field and laboratory to analyze scientific data
POs O5	**:**	Ability to develop lifelong learning and professional skills
POs O6	**:**	Ability to design and execute a scientific project, write scientific reports, and develop research
POs O7	**:**	Ability to spread awareness about the environment around us, development and conduct outreach activities
POs O8	**:**	Internalization of the concept of conservation and evolution through the channel of spirit of inquiry
POs 09	**:**	Ability to gain empirical knowledge on the topic and contribute in decision-making processes
POs 10		To recognize human activities, to identify trends and patterns, environmental data globally by using effective communication.
POs 11		Find solution to environmental and Human issues.
POs 12		Conflicts of interest and other factors interaction, management of physical and human environments to bring environmental sustainability

1st Semester B.Sc

Environmental Science

Programme	**B.Sc Environmental Science**
Semester	**First**
Course Title	**Paper – I – Ecology and Environment**
Course Code	**EVSC1 - T**
Credits	**04**
Contact Hours	**4hours/Week, Total – 56 hours**
Duration of Exam	**03 hours**
Formative Assessment	**20 Marks**
Summative Assessment	**80 Marks**

COURSE OUTCOMES (COs): Students are able to	
COs 01	Define the interdependence between people and nature, that is vital for food production, maintaining clean air, water and sustainable biodiversity
COs 02	Explain the biotic and abiotic factors of terrestrial and aquatic ecosystems with ecological succession.
COs 03	Describe the ecological dynamics and regulation of vital processes on earth as biogeochemical cycles
COs 04	Interpret ecosystem services, ecological resilience, ecological economics, and landscape ecology.
COs 05	Infer the forces impacting on ecosystems viz., climate change, stress, population, consumerism, globalization, land use change

Unit	Content	Hours
I	**Fundamentals of Ecology:** Definition, types of ecosystems. Structure and function of an ecosystem – abiotic and biotic components of an ecosystem. Energy flow – Laws of Thermodynamics in relation to energy flow. Food chain - Grazing and detritus. Food web. Ecological pyramids - Pyramid of number, biomass and energy. Productivity - Primary secondary and net productivity. Bio magnification. **Major Ecosystem:** Types and characteristics of Terrestrial ecosystem - Forest ecosystem, Mangrove, grassland, arid land, wetland; Aquatic ecosystem - ponds, rivers, Marine and estuary ecosystem. Crop land ecosystem.	14
II	**Abiotic factors:** Nature of response of organisms to abiotic factors. Essential elements and limiting factors; Liebig-Black Man Laws of limiting factors and Shelford's Law of Tolerance. Classification of organisms according to temperature tolerance and regulation. Thermal adaptation of plants and animals. Effect of light on plants and animals. **Ecological succession** – Primary and Secondary succession – Natural and man-influenced succession, – Hydrarch and Xerarch. Ecotone and Edge effect; Ecotypes and Ecophenes; Ecological indicators. Ecological Niche: Concept and Types of niches. Biomes: Definition and concept, Classification of Biomes.	14

III	**Biogeochemical cycles:** Definition, types, organic and biotic phases of geochemical cycles; types of biogeochemical cycles, i) water cycle, ii) Gaseous cycles - the Carbon cycle, the Nitrogen cycle, Oxygen cycle; iii) Sedimentary cycles - Sulphur cycle and Phosphorous cycle. Role of Biogeochemical cycles in natural resource conservation and management.	14
IV	**Population Ecology:** Population definition, Population characteristics - density, natality, mortality, life table, age distribution; age pyramids, sex ratio, biotic potential and environmental resistance; population growth rate, dispersion-emigration, immigration, migration and regulation of population size. Community Ecology: Definition, Characteristic of a community – Species diversity, growth and structure, dominance, relative abundance and trophic structure.	14

Course Articulation Matrix: mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (COs)/ Program Outcomes (POs)	**Program Outcomes (POs)**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO 1	1	2	1	1	3	1	1	1	1	2	1	1
CO 2	1	-	1	2	2	1	3	2	1	1	1	1
CO 3	-	1	3	1	1	-	2	3	2	1	-	1
CO 4	1	1	1	2	3	2	1	-	1	1	1	1
CO 5	1	1	1	2	2	2	1	1	1	1	1	1

Pedagogy:

Teaching Strategies: Use of Digital tools and platforms for teaching, learning and research/ dissertation analysis. Inquiry-based learning, group discussions, Interactive Lectures, quiz, group work, Field –oriented studies, Study trip, case studies and debates, hands on training.

Continuous Assessment and Evaluation: Formative and Summative Assessments, Feedback and oral examinations

Formative Assessment for Theory	
Assessment type	**Marks**
Sessional Tests- 1	10
Attendance	05
Assignment/Seminar	05
Total	**20 marks**
Formative Assessment as per SEP Guidelines	

Paper I: EVSC1-P: ECOLOGY AND ENVIRONMENT

Number hrs/week	**Duration of the exam**	**Total hours**	**Credits**
4 hours	**3 hours**	**56**	**2**
Formative Assessment	Test = 05	Summative assessment	Exam = 30
	Attendance = 05		Viva = 05
			Record = 05
	Total = 10		Total = 40

List of Practical:

1. Demonstration of Microscope
2. Identification of aquatic micro-flora and fauna
3. Study of ecological adaptations, morphology and anatomy of leaf and stem of Hydrophytes
4. Study of ecological adaptations, morphology and anatomy of leaf and stem of Xerophytes
5. Study of ecological adaptations, morphology and anatomy of leaf and stem of Epiphytes
6. Study of plant community- quadrat method and calculate the frequency percentage of different species of plants in an area.
7. A study of artificial/manmade ecosystem.
8. Estimation of carbon capture and storage by trees.
9. Estimation of primary productivity of a pond – Light and Dark bottle method
10. Estimation of primary productivity of terrestrial vegetation–chlorophyl method.
11. Estimation of primary productivity of grasses – Harvest method
12. Determination of turbidity of water sample using Sacchi disc.
13. Determination of color and temperature of pond and lake water.
14. Visit to national parks/social forestry/urban forestry/ wild life sanctuary/forest ecosystem.

References:

1. Ecological Methods for Field and Laboratory Investigations - Michael, P. (1986). Tata Mc Graw-Hill Publishing Co. Ltd.
2. Laboratory and Field Investigations in General Ecology - Rolan, R. G. (1973). Macmillan Co.
3. Standard Methods for Examination of Water and Wastewater. (2017). APHA–WEF.
4. Ecology - Subrahmanyam, N. S. and Sambamurty, A. V. S. S. (2000). Narosa Publishing House.
5. Chemical and Biological Methods of Water Pollution Studies -Trivedi, P. K. and Goel, P. K. (1984). Environmental Publications.
6. Environmental Science – Turk A. (1974). Saunders.
7. Environmental Science –Eugen, E.D. (1983). W.C. Brown Co.
8. Man, and Biosphere Today-Dusman R.S. (1974). Sterling Pub. Co.
9. Fundamentals of Ecology – E. Odum (1983). Holt – Saunders (Japan).
10. Concepts of Ecology – Kormondy, (1984), Englewood Cliffs, N.J.: Prentice-Hall
11. Introduction to Ecology - Colinvaux, P.A. (1973). John Wiley.
12. Ecology of Tropical Oceans – Longhurst, A.R. and Daniel Pauly, Academic Press
13. Ecology of Inland waters and Estuaries – Reid, G.K. (1961). Reinhold Pub.
14. Practical Methods in Ecology and Environmental Science – Trivedi R.K, P.K. Goel and C.L. Trisal (1987). Environmental Publications, Karad, India.
15. Encyclopaedia of Environmental Science – Parker S.P. (1980). McGraw-Hill.
16. Ecology study of Ecosystems – D.N.Rao, R.S.Ambasht, K.L. Mukherjee Misra K.C (1970). Wheeler and comp. Allahabad
17. New Approaches to Monitoring Aquatic Ecosystems – Boylo T.P. (1987). ASTM Philadelphia
18. Essentials of Ecologyand Environmental Science IV edn. SVS Rana (2010). Eastern Economy Edition PHI.
19. Ecology Principles and Application II EDn - J.L Chapman and M.J. Reiss (2010). Cambridge University Press.
20. Ecology 2ndedn: - N.S. Subramanyam and A.V.S.S. Sambamurty (2008). Narosa publishing House.
21. Biological invasions: economic and environmental costs of alien plant, animal, and microbes - Pimentel, D (2011). CRC publication

2nd Semester B.Sc

Environmental Science

Programme	**B.Sc Environmental Science**
Semester	**Second**
Course Title	**Paper – II – Atmosphere and Climate Change**
Course Code	**EVSC2 - T**
Credits	**04**
Contact Hours	**4hours/Week, Total – 56 hours**
Duration of Exam	**03 hours**
Formative Assessment	**20 Marks**
Summative Assessment	**80 Marks**

COURSE OUTCOMES: Students are able to	
1.	Outline the Earth's atmosphere, hydrosphere and meteorology
2.	Define the weather and climate parameters and heat budget of the earth's atmosphere
3.	Discuss the current global environmental issues and mitigation/remedial measures to it.
4.	Discuss the environmental policy, frame work and guidelines laid through international conventions and conferences.
5.	Infer the role of individual citizen in achieving Sustainable development Goals (SDG's).

Unit	Content	Hours
I	**Introduction to Atmosphere:** Definition, scope and theoretical and applied aspects of atmospheric components. Inland and Oceanic atmosphere - Natural and manmade atmosphere. **Gaseous segment**: Atmosphere**:** Nature, origin and evolution of atmosphere. Atmospheric structure and composition, Hydrological cycle, definition, Types and forms precipitation, Bergeron process – Cloud formation and classification. Forms of condensation. Interaction of atmosphere and land subsurface features.	14
II	**Weather and Climate:** Definition, scope and importance. Meteorological parameters - temperature, pressure, precipitation, humidity, wind speed and direction. Nature of solar energy radiations, Insolation-Factors affecting the insolation, transfer of insolation – absorption, scattering. Reflectance, diffusion and transmission. Terrestrial radiation and heat budget of the earth atmosphere. Monsoons Climates – Definition, Tropical cyclone-formation, structure, movement and path and its effects. Anticyclones -characteristics and origin. Thunder storms and tornadoes. Weather forecasting and modification, El Nino and La Nina effect. Indian monsoon climate.	14

III	**Climate Change -** Greenhouse gases and global warming: Definition, impacts, major greenhouse gases, sources and sinks of greenhouse gases; Urban Heat Islands; global dimming. Carbon sequestration, Carbon footprint, Ecological footprint and Hand prints. Impacts of global climate change-Increased surface mean temperature, vector borne/zoonotic diseases, forest fire, influence on agriculture, increase in floods and drought, loss of biodiversity and extinction of species, sea level rise. Climate change and food security. Vulnerable populations – The Kiribati story.	14
IV	**Climate change policy frame works:** UNEP Earth Summit; United Nation Framework Convention on climate change (UNFCCC), The United Nations Conference on Environment and Development, Intergovernmental Panel on Climate Change (IPCC), Ministry of Environment, Forests & Climate Change (MoEF&CC), National Action Plan on Climate Change (NAPCC), Agenda 21, The Kyoto protocol, Paris agreement. Overview of Conference of Parties (CoP). Evolution of climate change negotiations. Convention on climate change; carbon credit and carbon trading; Green Climate Fund and Adopatation fund. Role of individuals in achieving Sustainable Development Goals.	14

Course Articulation Matrix: mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

Course Outcomes (Cos)/ Program Outcomes (POs)	**Program Outcomes (POs)**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO 1	1	2	1	1	3	1	1	1	1	2	1	1
CO 2	1	-	1	2	2	1	3	2	1	1	1	1
CO 3	-	1	3	1	1	-	2	3	2	1	-	1
CO 4	1	1	1	2	3	2	1	-	1	1	1	1
CO 5	1	1	1	2	2	2	1	1	1	1	1	1

Pedagogy:

Teaching Strategies: Use of Digital tools and platforms for teaching, learning and research/ dissertation analysis. Inquiry-based learning, group discussions, Interactive Lectures, quiz, group work, Field –oriented studies, Study trip, case studies and debates, hands on training.

Continuous Assessment and Evaluation: Formative and Summative Assessments, Feedback and oral examinations

Formative Assessment for Theory	
Assessment type	**Marks**
Sessional Tests- 1	10
Attendance	05
Assignment/Seminar	05
Total	**20 marks**
Formative Assessment as per SEP Guidelines	

Paper II: EVSC2-P: ATMOSPHERE AND CLIMATE CHANGE

<table>
<tr><th>Number hrs/week</th><th>Duration of the exam</th><th>Total hours</th><th>Credits</th></tr>
<tr><td>4 hours</td><td>3 hours</td><td>56</td><td>2</td></tr>
<tr><td rowspan="4">Formative Assessment</td><td>Test = 05</td><td rowspan="4">Summative assessment</td><td>Exam = 30</td></tr>
<tr><td rowspan="2">Attendance = 05</td><td>Viva = 05</td></tr>
<tr><td>Record = 05</td></tr>
<tr><td>Total = 10</td><td>Total = 40</td></tr>
</table>

List of Practical:

1. Determination of pH of Rain water sample
2. Determination of Humidity using Psychrometer/Hygrometer
3. Determination of Minimum and Maximum temperature using Wet and Dry bulb thermometer
4. Determination of Pressure: Aneroid barometer and Altimeter
5. Determination of Wind: direction and speed –wind vane and anemometer.
6. Study of construction of wind rose diagram
7. Demonstration of Rain gauge.
8. Calculation of mean rainfall over a drainage basin using Thiessen's Polygon method and Isohyetal method.
9. Estimation of Evaporation and transpiration
10. Determination of solar radiation.
11. Determination of solar illumination using Lux meter
12. Demonstration of Clouds and its types
13. Determination of ambient carbon dioxide

    ***Visit to Regional Meteorological Center**

Reference:

1. Fundamentals of Soil Science – Forth H.D. (1984). John Wiley.
2. Environmental Science – Turk J & Turk A (1984). Saunders publishers
3. Geography and Man's Environment Strahler, Arthur Newell (1977). Wiley, USA
4. Environmental Science – Eugen E.D. (1983). W.C. Brown Co.
5. Man, and Biosphere today –Dusman, R.S. (1974). Sterling Publication
6. Man, and the changing environment – Franke, R.G. (1975). Holt, Rinehart & Winston, Publisher.
7. The Earth: Our Physical Environment –Donn, Willium L. (1972). Wiley Publisher.
8. Atmosphere, Weather and climate - Barry, R.G. (2003). Routledge Press, UK.
9. Encyclopaedia of Global Warming and Climate Change - Philander, S G, 2012, (2nd Ed. Sage publication.
10. Climate Change and India - Mitra, Sharma, S., Bhattacharya, S., Garg. A., Devotta, S., & SenK (2004). Universities Press, India.
11. Physical Geography - Richard H Bryant. (2007). Rupa publication.
12. General Climatology IV edn - Howard J. Critchfield., (2004). EEE, Prentice –Hall India.
13. Atmosphere, Weather and Climate - Siddhartha. (2005). Kisalaya Publications Pvt.ltd.
14. The Atmosphere and Introduction to Meteorology 11 Ed - Frederick K. Lutgens., Edward J. Tarbuck., and D Taassa. (2012). EEE, PHI 2012.

THEORY EXAMINATION QUESTION PAPER PATERN FOR MAJOR SUBJECTS

I/II/III/IV/V/VI Semester B. Sc. Examination, ……..MONTH ……YEAR
(Semester Scheme: New Syllabus: -2024-25 onwards)
Subject: Environmental Science
Paper title:

Duration: 3 Hrs **Max Marks: 80**

Instruction: Answer all Sections. Section- A is compulsory

SECTION – A

Q. 1. Answer any TEN of the following. **10 × 2 = 20**

a.
b.
c.
d.
e.
f.
g.
h.
i.
j.
k.
l.

SECTION – B

Answer any SIX of the Following **06×05=30**

Q.2

Q.3

Q.4

Q.5

Q.6

Q.7

Q.8

Q.9

SECTION – C

Answer any THREE of the Following **03×10=30**

Q.10

Q.11

Q.12

Q.13

Q.14

Note: While drawing questions, all the units in the syllabus must be given equal weightage.