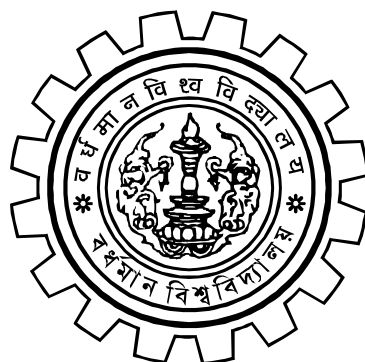


THE UNIVERSITY OF BURDWAN



SYLLABUS FOR 3-YEAR DEGREE/4-YEAR HONS. IN ENVIRONMENTAL SCIENCE

Under

**Curriculum and Credit Framework for Undergraduate
Program (CCFUP), as per N.E.P. 2020)**

w.e.f 2023 – '24

**FINAL UG SYLLABUS FOR ENVIRONMENTAL SCIENCE [CODE: ENVSC]
UNDER THE UNIVERSITY OF BURDWAN, BURDWAN
[As per NEP 2020]
3-Year Degree/4-Year Hons. in Environmental Science**

SEM ESTE R	Paper No	Code	Name of the Paper	Cr edits	L – T - P	Marks	Marks Dist. T – P - IA	
I	Major/Core Course	ENVSC 1011	Environment & Ecology	4	3 – 1 - 0	75	60 – 00 - 15	
	Minor Course [for other disciplines]	ENVSC 1021	Environment & Ecology	4	3 – 1 - 0	75	60 – 00 - 15	
	Multi-disciplinary Course [from pool of courses]	ENVSC 1031	Natural resources & Sustainable Development	3	2 – 1 - 0	50	40 – 00 – 10	
	Ability Enhancement Course (AEC)	AEC 1041	MIL (L ₁ - 1): (from Hindi /Bengali/ Sanskrit/ Santali /Arabic /Urdu) OR Eq. course from SWAYAM/other UGC recogn. platforms	2	2 – 0 - 0	50	40 – 00 - 10	
	SEC [from Major]	ENVSC 1051	Environmental Monitoring Techniques	3	2 – 1 – 0	50	40 - 00 – 10	
	Value Added Course (VAC)	CVA 1061	Environmental Science/ Education	4	3 – 0 - 1	100	60 – 20 - 20	
	Total			20		400		
II	Major/Core Course	ENVSC 2011	Ecosystem & Biomes	4	3 – 0 - 1	75	40 – 20 - 15	
	Minor Course [for other disciplines]	ENVSC 2021	Ecosystem & Biomes	4	3 – 0 - 1	75	40 – 20 - 15	
	Multi-disciplinary Course [from pool of courses]	ENVSC 2031	Biodiversity Conservation & Ecotourism	3	2 – 1 - 0	50	40 – 00 – 10	
	AEC (Communicative English)	ENGL 2041	MIL (L ₂ -1): English	2	2 – 0 - 0	50	40 – 00 - 10	
	SEC [from Major]	ENVSC 2051	Human Health and Conservation & Ecotourism	3	2 – 1 – 0	50	40 - 00 – 10	
	VAC	CVA 2061	Understanding India/Fitness & Hygiene & Yoga/Digital India	4	3 – 1 – 0 OR 3 – 0 - 1	100	80 – 00 – 20 OR 60 – 20 - 20	
	Skill based Vocational additional Course Cr. 4 (During Summer term for 8 weeks for Certificate award) - Students who want to exit after securing Cr 40				4			
	Total			20		400		

SEM ESTER	Paper No	Code	Name of the Paper	Credits	L – T - P	Marks	Marks Dist. T – P - IA
III	Major/Core Course	ENVSC 3011	Environmental Resources	5	4 – 1 - 0	75	60 – 00 - 15
	Major/Core Course	ENVSC 3012	Environmental Earth Science	5	4 – 0 - 1	75	40 – 20 - 15
	Minor Course	ENVSC 3021	Environmental Resources [may be offered for all students irrespective of discipline including Env Sc.] [Voc. Edn & Trng.]	4	3 – 1 - 0	75	60 – 00 - 15
	Multi-disciplinary Course	ENVSC 3031	Climate Change & Climate Action	3	2 – 1 - 0	50	40 – 00 - 10
	AEC	AEC 3041	MIL (L ₁ -2)	2	2 – 0 - 0	50	40 – 00 - 10
	SEC	ENVSC 3051	RS & GIS and Resource Mapping	3	2 – 1 - 0	50	40 – 00 - 10
	Total			22		375	
IV	Major/Core Course	ENVSC 4011	Environmental Chemistry & Physics	5	4 – 0 - 1	75	40 – 20 - 15
	Major/Core Course	ENVSC 4012	Energy & Environment	5	4 – 1 - 0	75	60 – 00 - 15
	Major/Core Course	ENVSC 4013	Ecotoxicology & Environmental Biotechnology (**)	5	4 – 0 - 1	75	40 – 20 - 15
	Minor Course	ENVSC 4021	Energy & Environment [may be offered for all students irrespective of discipline including Env Sc.] [Voc. Edn & Trng.]	4	3 – 1 - 0	75	60 – 00 - 15
	AEC (MIL)	AEC 4041	MIL (L ₂ -2) English	2	2 – 0 - 0	50	40 – 00 - 10
	Skill based Vocational additional Course Cr. 4 (During Summer term for 8 weeks for Certificate award) - Students who want to exit after securing Cr 83			4	0 – 0 - 4	50	00 – 50 - 00
	Total			21		400	

(**) Practical/Field visit

SEM ESTER	Paper No	Code	Name of the Paper	Credits	L – T - P	Marks	Marks Dist. T – P - IA
V	Major/Core Course	ENVSC 5011	Environmental Pollution	5	4 – 0 - 1	75	40 – 20 - 15
	Major/Core Course	ENVSC 5012	Environmental Laws, Policies & EIA	5	4 – 1 - 0	75	60 – 00 - 15
	Major/Core Course	ENVSC 5013	Environmental Analysis (Practical)	5	0 – 0 - 5	75	00 – 60 - 15
	Minor Course	ENVSC 5021	Environmental Pollution Measurement	4	3 – 0 - 1	75	40 – 20 - 15
	Internship for all	INT 5081		2	0 – 0 - 2	50	00 – 50 - 00
	Total			21		350	
VI	Major/Core Course	ENVSC 6011	Environmental Health & Stress Physiology	4	3 – 0 - 1	75	40 – 20 - 15
	Major/Core Course	ENVSC 6012	Environmental Engineering & Statistics	4	3 – 1 - 0	75	60 – 00 - 15
	Major/Core Course	ENVSC 6013	Environmental Economics & Management	4	3 – 1 - 0	75	60 – 00 - 15
	Major/Core Course	ENVSC 6014	Field visit Visit – 15 & Report - 60	4	0 – 0 - 4	75	00 – 60 - 15
	Minor Course	ENVSC 6021	Environmental Economics & Management [may be offered for all students irrespective of discipline including Env Sc.] [Voc. Edn & Trng.]	4	3 – 1 - 0	75	60 – 00 - 15
	Total			20		375	
	Total (I+II+III+IV+V+VI)			124		2250	

SEM ESTER	Paper No	Code	Name of the Paper	Credits	L - T - P	Marks	Marks Dist. T - P - IA
VII	Major/Core Course	ENVSC 7011	Natural Hazards & Management and Waste Management	6	4 - 0 - 2	75	40 - 20 - 15
	Major/Core Course	ENVSC 7012	Wildlife Management & Conservation	6	4 - 0 - 2	75	40 - 20 - 15
	Major/Core Course	ENVSC 7013	Environmental Biotechnology & Application	6	4 - 0 - 2	75	40 - 20 - 15
	Major/Core Course	ENVSC 7014	Bacteriological Investigation (Practical)	6	0 - 0 - 6	75	00 - 60 - 15
	Minor Course	ENVSC 7021	Advancement in Environmental Biotechnology	4	3 - 0 - 1	75	40 - 20 - 15
	Total				28		375
Initiation of Research Project/Dissertation from SEM VII							
VIII For UG Hons. with Res Proj.	Major/Core Course	ENVSC 8011	Green Technology	6	4 - 0 - 2	75	40 - 20 - 15
	Minor Course	ENVSC 8021	Green Chemistry	4	3 - 0 - 1	75	40 - 20 - 15
	Research Project/Dissertation	RESCH 8081	Seminar Preparation, submission & PPT [Dissertation: 135+ Viva: 90]	12	0 - 0 - 12	225	00 - 225 - 00
	Total			22			
VIII For UG Hons. without Res Proj.	Major/Core Course	ENVSC 8011	Green Technology	6	4 - 0 - 2	75	40 - 20 - 15
	Major/Core Course	ENVSC 8012	Atmosphere & Global Climate Change	4	3 - 0 - 1	75	40 - 20 - 15
	Major/Core Course	ENVSC 8013	Geospatial Science	4	3 - 1 - 0	75	60 - 00 - 15
	Major/Core Course	ENVSC 8014	Atmospheric Analysis & Geospatial Modelling (Practical)	4	0 - 0 - 4	75	00 - 60 - 15
	Minor Course	ENVSC 8021	Green Chemistry	4	3 - 0 - 1	75	40 - 20 - 15
	Total			22		375	
Total				174		3000	

SEMESTER- I
PAPER CODE: ENVSC1011 [ENVSC Major: COURSE NO. 1]
ENVIRONMENT & ECOLOGY
TOTAL CREDITS: 4

TIME: 3 Hours

MARKS: 60

Learning Objectives:

- *To get knowledge on environmental education, concept of an ecosystem & component, disturbances and modification of environment and their effects*
- *Understanding on the biosphere & biotic community and biological invasions*
- *To get knowledge on Geological interaction with environment and its interactions within geology*
- *Overall students will examine and explain how organisms modify their environments to sustain their needs*

Unit 1: Environment

(LECTURE – 30)

Concept/Definition and importance of environment; Types and components of environment; Lithosphere, Atmosphere, Hydrosphere, Biosphere; Scope and multidisciplinary nature of the subject; Man-environment relationships; Environmental awareness

Unit 2: Environmental Education

(LECTURE – 15)

Environmental education at primary, secondary and tertiary level; Goals of environmental education; Applications of and Career in Environmental Science

Unit 3: Concept of Ecology

(LECTURE – 45)

Concepts of Ecology: Definition and divisions of ecology; Ecological classification: Aquatic, desert and marine (plants & animals) and their morphological, physiological and biochemical adaptation; Ecotype; Ecological factors - climatic, edaphic, physiographic and biotic; Limiting factor and Shelford's Law of tolerance, Liebig law of minimum; Concept of Biological clock, circadian rhythm

Unit 4: Geology and Ecology:

(LECTURE – 10)

Geological interaction with biodiversity/environment; Concepts of community and keystone species, and relationship with geology; Role of geology in ecological restoration

Unit 5: Biological Invasions:

(LECTURE – 5)

Concepts of exotic and invasive species; Characteristics of invaders; Stages of invasion; Mechanisms of invasions

Learning outcomes:

- *Understanding the different complex environmental issues and interdisciplinary perspective.*
- *Understanding the ecological and physical sciences and their application in environmental problem-solving*
- *Knowledge on major physical, chemical, and biological components of the earth's systems and show how they function*
- *Understanding the ethical, cross-cultural and historical context of environmental issues and their links between human and natural systems*

SEMESTER- I
PAPER CODE: ENVSC1021 [ENVSC Minor: COURSE NO. 1]
ENVIRONMENT & ECOLOGY
TOTAL CREDITS: 4

TIME: 3 Hours

MARKS: 60

Learning Objectives:

- *To get knowledge on environmental education, concept of an ecosystem & component, disturbances and modification of environment and their effects*
- *Understanding on the biosphere & biotic community and biological invasions*
- *To get knowledge on Geological interaction with environment and its interactions within geology*
- *Overall students will examine and explain how organisms modify their environments to sustain their needs.*

Unit 1: Environment

(LECTURE – 30)

Concept/Definition and importance of environment; Types and components of environment; Lithosphere, Atmosphere, Hydrosphere, Biosphere; Scope and multidisciplinary nature of the subject; Man-environment relationships; Environmental awareness

Unit 2: Environmental Education

(LECTURE – 15)

Environmental education at primary, secondary and tertiary level; Goals of environmental education; Applications of and Career in Environmental Science

Unit 3: Concept of Ecology

(LECTURE – 45)

Concepts of Ecology: Definition and divisions of ecology; Ecological classification: Aquatic, desert and marine (plants & animals) and their morphological, physiological and biochemical adaptation; Ecotype; Ecological factors - climatic, edaphic, physiographic and biotic; Limiting factor and Shelford's Law of tolerance, Liebig law of minimum; Concept of Biological clock, circadian rhythm

Unit 4: Geology and Ecology:

(LECTURE – 10)

Geological interaction with biodiversity/environment; Concepts of community and keystone species, and relationship with geology; Role of geology in ecological restoration

Unit 5: Biological Invasions:

(LECTURE – 5)

Concepts of exotic and invasive species; Characteristics of invaders; Stages of invasion; Mechanisms of invasions

Learning outcomes:

- *Understanding the different complex environmental issues and interdisciplinary perspective.*
- *Understanding the ecological and physical sciences and their application in environmental problem-solving*
- *Knowledge on major physical, chemical, and biological components of the earth's systems and show how they function*
- *Understanding the ethical, cross-cultural and historical context of environmental issues and their links between human and natural systems*

SEMESTER- I
PAPER CODE: ENVSC 1031 [ENVSC Multidisciplinary: COURSE NO. 1]
NATURAL RESOURCES & SUSTAINABLE DEVELOPMENT

TOTAL CREDITS: 3

TIME: 2 Hours

MARKS: 40

Learning objectives

- *Explain the fundamentals of natural resources and their distribution*
- *Present available natural resources.*
- *Describe the judicial uses of natural resources*
- *Outline & basic elements of sustainable development*

Unit 1: Natural resources

(Lectures - 5)

Overview of natural resources: Definition of resources; Classification of natural resources – biotic and abiotic, renewable and non-renewable

Unit 2: Biotic and water resources

(Lectures - 10)

Major types of biotic resources: Forests, Grasslands, Wildlife and Aquatic

Types of water resources: Freshwater and marine water resources; Availability and use of water resources; Conflicts over water resource – International and National perspectives

Unit 3: Soil and mineral resources

(Lectures - 10)

Soil types and distribution in India; Major degradation of soil; Major minerals in India; Over exploitation and environmental problems

Unit 4: Energy resources

(Lectures - 10)

Types of energy sources; Renewable resources (Solar, Hydro, Ocean and biomass); Non-renewable sources (Coal, Petroleum and Nuclear resources)

Unit 5: Sustainable Development

(Lectures - 10)

Concept, SDGs – Goals, Targets & Indicators; Challenges & strategies of SDGs in India

Learning outcome (After completion of this unit students would be able to:)

- *Understand the concept of natural resources; identify types of natural resources, their distribution and use with special reference to India*
- *Discuss the factors affecting the availability of natural resources, their conservation and management*
- *Explain sustainable development, its goal, targets, challenges and Indian strategies for SDGs*

Proposed faculty involvement

Unit 1 & 2: Social Science/ Botany/ Zoology

Unit 3: Geography/ Botany/ Zoology/ History

Unit 4: Geography/ Social Science/ Physics

Unit 5: Political Science/Social Science

SEMESTER- I
PAPER CODE: ENVSC1051 [ENVSC Skill Enhancement: COURSE NO. 1]
ENVIRONMENTAL MONITORING TECHNIQUES
TOTAL CREDITS: 3

TIME: 2 Hours

MARKS: 50

Learning objectives

- *To provide theoretical and practical knowledge on various aspects of environmental monitoring techniques*
- *To develop sampling and analytical skills for environmental monitoring*
- *To get knowledge on various standard protocols used in environmental monitoring*

Unit 1: Air quality Monitoring

(LECTURE – 10)

Collection of air sample [High volume sampler, Glass fiber filter paper, co/co,₂/O₃. meter, particulate matter (PM_{2.5}, PM₁₀)]; Concept of SPM and RSPM.

Unit 2: Water quality monitoring

(LECTURE – 10)

Water quality parameters; Water sampling techniques & measurements and instruments (Titrimetric and Gravimetric methods, Portable pH meter, conductivity meter, Spectrophotometer); Calibration, Reagent blank, Reference material, standard curve

Unit 3: Soil quality Monitoring

(LECTURE – 5)

Classification of texture (International pipette and Hygrometer method); Soil sampling and measurement of different soil parameters [pH meter, conductivity meter, Soil organic carbon (Titrimetric method), Nitrogen (modified Kjeldahl's method), & Flame photometer]

Unit 4: Noise monitoring

(LECTURE – 5)

Concept of sound and noise, sound pressure; Instrumentation and measurement of noise (Noise meter); Equal loudness contours; Percentile Indices of noise.

Unit 5: Biological and Microbiological monitoring

(LECTURE – 20)

Bacteriological techniques: Preparation of media (solid and liquid media), identification [Principle of staining; Simple, negative and differential staining (Gram staining)], MPN technique, Sterilization; Inoculation and incubation; Preparation of slants; Pure culture techniques (spread plate, pour plate, streak plate); instrumentation (Principle of autoclave, laminar air flow, BOD incubator, Shaker, Centrifuge, Magnetic Stirrer, Concept of BLAST)

Biological monitoring: Quantification (Sedgwick Rafter counter) & qualification of freshwater plankton (phyto- & zoo-plankton), aquatic macrophytes of importance); Types of plankton net.

Learning outcomes

- *Undertake field and laboratory experiments in a systematic way*
- *Understanding of physicochemical and microbiological methods used to test air, water, soil or food for environmental health purposes*
- *Getting training in analytical and conceptual skills required for environmental monitoring techniques and methods*

SEMESTER- II**PAPER CODE: ENVSC2021 [ENVSC Major: COURSE NO. 1]****ECOSYSTEM & BIOMES****TOTAL CREDITS: 4****TIME: 2 Hours****MARKS: 40****Learning objectives:**

- *Understanding the fundamental structure and function of an ecosystem as well as levels of ecological organization like organism, population, community, ecosystem, biome and biosphere*
- *Knowledge on establishment of interactions and relationships (e.g., competition, predation, symbiosis) in an ecosystem*
- *Knowledge on energy flows through an ecosystem (e.g., food chains, food webs, energy pyramids)*
- *Understand the biogeochemical cycles through an ecosystem (i.e., water cycle, carbon cycle, oxygen cycle and nitrogen cycle)*
- *Understanding the major biomes and the communities*

Unit 1: Concept of Ecosystem**(LECTURE – 20)**

Ecosystems: Concept & classification (terrestrial and aquatic); Structure and function of ecosystems: trophic levels, food chain, food web and ecological pyramids; Energy flow in ecosystem: Energy flow models (single and double channel model); Productivity (concept & types: primary and secondary); Biogeochemical cycles (carbon, nitrogen and phosphorous cycle)

Unit 2: Major Ecosystem types**(LECTURE – 15)**

Terrestrial ecosystems (Grassland ecosystem, forest ecosystem, agro-ecosystem); Aquatic ecosystems (Lentic and lotic ecosystem, wetland ecosystem, estuarine ecosystem, and marine ecosystem)

Unit 3: Population ecology**(LECTURE – 20)**

Concept and characteristics of population (natality, mortality, age structure, population pyramids, population density, population dispersion, population growth, exponential, logistics, Density dependent, Limits of population growth; life table and survivorship curves; Population interactions (competition, predation, parasitism, symbiosis, commensalism, mutualism, and ammensalism)

Unit 4: Community ecology**(LECTURE – 15)**

Concept of community & classification; Community structure (horizontal and vertical stratification); Biomass, Keystone Species, Ecotone and Edge effects; Ecological Succession (concept, processes, stages and types of successions); Concept of Climax

Unit 5: Biomes**(LECTURE – 20)**

Concept and characteristics of biome; Types and distribution of major biomes (e.g., desert, grass lands, tropical evergreen rain forests and tundra); Endemism and endemic species of India

Learning outcome

- *Understand the complexity of an ecosystem and biomes*
- *Understand the energy cycle within ecosystems*
- *Unique facts about the biomes of our world*
- *Understanding their learning to the balance required in ecosystems*

SEMESTER- II**PAPER CODE: ENVSC2011 [ENVSC Major: COURSE NO. 1]
ECOSYSTEM & BIOMES [Practical]****TIME: 2 Hours****MARKS: 20****PRACTICAL**

Description of Items	Distribution of Marks
1) One Major experiment	: 07
2) Identification	: 03
3) Laboratory Note Book	: 02
4) <i>Viva-voce</i>	: 03
5) Internal Assessment	: 10

PRACTICAL COURSES

Major Experiments:

1. Estimation of water parameters—pH, DO, Free and Combined CO₂, Hardness, Alkalinity, Acidity, Chloride
2. Estimation of soil parameters—pH, Temperature, soil moisture, Organic carbon
3. Identification with reasons (at least one from each A & B must be set during examination): Study on Aquatic organisms (Plankton and Macrophytes)

SEMESTER- II

**PAPER CODE: ENVSC2021 [ENVSC Minor: COURSE NO. 1]
ECOSYSTEM & BIOMES
TOTAL CREDITS: 4**

TIME: 2 Hours**MARKS: 40****Learning objectives:**

- *Understanding the fundamental structure and function of an ecosystem as well as levels of ecological organization like organism, population, community, ecosystem, biome and biosphere*
- *Knowledge on establishment of interactions and relationships (e.g., competition, predation, symbiosis) in an ecosystem*
- *Knowledge on energy flows through an ecosystem (e.g., food chains, food webs, energy pyramids)*
- *Understand the biogeochemical cycles through an ecosystem (i.e., water cycle, carbon cycle, oxygen cycle and nitrogen cycle)*
- *Understanding the major biomes and the communities*

Unit 1: Concept of Ecosystem**(LECTURE – 20)**

Ecosystems: Concept & classification (terrestrial and aquatic); Structure and function of ecosystems: trophic levels, food chain, food web and ecological pyramids; Energy flow in ecosystem: Energy flow models (single and double channel model); Productivity (concept & types: primary and secondary); Biogeochemical cycles (carbon, nitrogen and phosphorous cycle)

Unit 2: Major Ecosystem types**(LECTURE – 15)**

Terrestrial ecosystems (Grassland ecosystem, forest ecosystem, agro-ecosystem); Aquatic ecosystems (Lentic and lotic ecosystem, wetland ecosystem, estuarine ecosystem, and marine ecosystem)

Unit 3: Population ecology**(LECTURE – 20)**

Concept and characteristics of population (natality, mortality, age structure, population pyramids, population density, population dispersion, population growth, exponential, logistics, Density dependent, Limits of population growth; life table and survivorship curves; Population interactions (competition, predation, parasitism, symbiosis, commensalism, mutualism, and ammensalism)

Unit 4: Community ecology**(LECTURE – 15)**

Concept of community & classification; Community structure (horizontal and vertical stratification); Biomass, Keystone Species, Ecotone and Edge effects; Ecological Succession (concept, processes, stages and types of successions); Concept of Climax

Unit 5: Biomes**(LECTURE – 20)**

Concept and characteristics of biome; Types and distribution of major biomes (e.g., desert, grass lands, tropical evergreen rain forests and tundra); Endemism and endemic species of India

Learning outcome

- *Understand the complexity of an ecosystem and biomes*
- *Understand the energy cycle within ecosystems*
- *Unique facts about the biomes of our world*
- *Understanding their learning to the balance required in ecosystems*

SEMESTER- II**PAPER CODE: ENVSC2021 [ENVSC Minor: COURSE NO. 1]
ECOSYSTEM & BIOMES [Practical]****TIME: 2 Hours****MARKS: 20****PRACTICAL**

Description of Items	Distribution of Marks
1) One Major experiment	: 07
2) Identification	: 03
3) Laboratory Note Book	: 02
4) <i>Viva-voce</i>	: 03
5) Internal Assessment	: 10

PRACTICAL COURSES

Major Experiments:

3. Estimation of water parameters—pH, DO, Free and Combined CO₂, Hardness, Alkalinity, Acidity, Chloride
4. Estimation of soil parameters—pH, Temperature, soil moisture, Organic carbon
3. Identification with reasons (at least one from each A & B must be set during examination): Study on Aquatic organisms (Plankton and Macrophytes)

SEMESTER- II
PAPER CODE: ENVSC2051 [ENVSC Skill Enhancement Course: COURSE NO. 1]
HUMAN HEALTH AND CONSERVATION & ECOTOURISM
TOTAL CREDITS: 3

TIME: 2 Hours

MARKS: 40

Learning objectives

- *To understand the basic concept of health & disease, and immunology and immunodeficiency diseases*
- *Understanding the diagnosis and prevention of infectious diseases including immunization vaccination for the prevention of communicable diseases and health programme in India*
- *Knowledge of importance of natural resource conservation, benefits and sustainable tourism development*
- *Understanding the dangers and limitations of ecotourism*

Unit 1: Human Health

(LECTURE – 5)

Concept of health and disease; Principles of epidemiology and epidemiological methods; Health Programs in India; Nutrition and health; Health education

Unit 2: Diseases

(LECTURE – 10)

Concept on air, water, vector borne diseases; some communicable diseases (Viral hepatitis, dengue); Non-communicable diseases (cardiovascular, diabetes); Immunology- elementary ideas about antigens and antibody; Immunodeficiency diseases

Unit 3: Conservation

(LECTURE – 10)

Concept of Wildlife Conservation - Reserves design, survey techniques of tiger, birds, elephants and insect; Major conservation policies: *in-situ* and *ex-situ* approaches; Major protected areas; National and International instruments for biodiversity conservation; Role of traditional knowledge; Community based conservation; Gender and conservation; Concept of Zoo management

Unit 4: Ecotourism

(LECTURE – 15)

Tourism and Leisure; Types of Tourism; Ecotourism – Growth and developments, Impact and management of ecotourism; Home stay tourism; Elementary idea of Rural tourism, Role of ecotourism for addressing Sustainable Development Goals (SDGs)

Learning outcome:

- *Knowledge to relate to the internal, external and environmental factors that impact on health and well-being of individuals as well as health programmes in India*
- *Understanding on the reasons of occurrence of diseases*
- *Knowledge on conservation methods of biodiversity*
- *Understanding the ecotourism and the major challenges in sustainable tourism*
- *Knowledge on role of nutrients and its relationship with health*

SEMESTER- II
PAPER CODE: ENVSC 2031 [ENVSC Multidisciplinary: COURSE NO. 1]
BIODIVERSITY CONSERVATION AND ECOTOURISM
TOTAL CREDITS: 3

TIME: 2 Hours

MARKS: 40

Course objectives

- *Concept of biodiversity*
- *Factors affecting biodiversity*
- *Understanding the major conservation policies*
- *Getting knowledge on ecotourism with home-stay tourism approach*

Unit 1: Biodiversity & its distribution

(Lectures – 15)

Definition & Concept of biodiversity, levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots and Megadiversity countries

Unit 2: Threats to biodiversity:

(Lectures – 10)

Types & causes of biodiversity loss - Land use and Land cover changes, commercial exploitation of species, invasive species, fire, disaster and climate change

Unit 3: Conservation policies

(Lectures – 10)

Importance & major policies – in situ and ex situ conservation; Major protected areas; National & International instruments for biodiversity conservation; Role of traditional knowledge for conservation; Community-based conservation, concept of Zoo management

Unit 4: Tourism & Leisure

(Lectures – 10)

Types of Tourism; Ecotourism – Concept, Growth and Developments; Impacts and management of ecotourism; Home stay tourism

Learning outcome (After completion of this unit students would be able to:)

- *Understand the concepts of biodiversity and conservation*
- *Understand the factors impacting biodiversity loss in India and the World*
- *Major conservation strategies taken in India*
- *Ideas on ecotourism with special emphasis on home-stay tourism*

Proposed faculty involvement

Unit 1 & 2 & 3: Social Science/ Botany/ Zoology/ Political Science/ History

Unit 4: Management/ Economics/ Commerce/ Humanities subjects

Suggested readings for Environmental Science (SEM I & II)

1. Gore, A. 2009. *Our Choice: A Plan to Solve the Climate Crisis*, Rodale Books
2. Girardet, H. 2007. *Surviving the Century: Facing Climate Chaos and Other Global Challenges*, Earth Scan
3. Plimer, I. 2005. *Heaven and Earth: Global Warming – The Missing Science*, Connor Court Publishing.
4. Thunberg, G. 2022. *The Climate Book*, Penguin Random House.
5. World Meteorological Organization (2012). *Greenhouse Gas Bulletins*.
6. Lawson, N. 2008. *An Appeal to Reason: A Cool Look at Global Warming*, Overlook Duckworth (UK).
7. Cambridge University (2013). *Climate Change: Action, Trends and Implications for Business*. IISD, UNITAR & UNEP (2009).
8. IEA Training Material: *Vulnerability and Climate Change Impact Assessment for Adaptation*.
9. IPCC (2013). *Climate Change 2013. The Physical Science Basis - Summary for Policymakers*.
10. OECD (2009): *Guidance on Integrating Climate Change Adaptation into Development Co-operation*. 11. UNEP (2009). *Climate Change Science Compendium*
12. UNEP (2009). *Climate in Peril, a Popular Guide to the Latest IPCC Report*.
13. UNFCCC (2008). *Compendium on Methods and Tools to Evaluate Impacts of, and Vulnerability and Adaptation to, Climate Change*.
14. UNFCCC (2006). *UNFCCC Handbook*.
15. World Bank Report (2012). *Turn Down the Heat*.

Natural resources:

- Brebbia, C.A. 2013. *Water Resources Management VII*. WIT Press.
- CEA. 2011. *Water Resources and Power Maps of India*. Central Board of Irrigation & Power.
- Dasgupta and Heal (1979): *Economic Theory of Exhaustible Resources*; CUP
- Groom.B.&Jenkins.M.2000.*GlobalBiodiversity:Earth'sLivingResourcesinthe21stCent*
Ury
- John W. Twidell and Anthony D. (2015). *Renewable Energy Sources*, 3rd Edition, Weir Publisher (ELBS)
- Klee, G.A. 1991. *Conservation of Natural Resources*. Prentice Hall Publication.
- Kneese & Sweeny (1993): *Handbook of natural Resource and Energy Economics/3 Volumes*; North-Holland
- Mays, L.W. 2006. *WaterResources Sustainability*. The McGraw-Hill Publications.
- Owen,O.S,Chiras,D.D,&Reganold,I.P.1998.*NaturalResourceCanservation- Management for Sustainable Future* (7thedition). Prentice Hall.
- Parikh (1993): *Natural Resources Accounting: A Framework for India*
- The Economic Approach to Environmental & Natural Resources*, James R. Kahn., George Proval

Biodiversity and its conservation:

- Bawa, K.S., Oomen, M.A. and Primack, R. (2011) *Conservation Biology: A Primer for South Asia*. Universities Press.
- Bhagwat, Shonil (Editor) (2018) *Conservation and Development in India: Reimagining Wilderness*, Earthscan Conservation and Development, Routledge.
- BharuchaErach, *The Biodiversity Biology of India*, Mapin Publishing Pvt. Ltd. Ahmedbad,India
- ErachBharucha, 2016. *Text Book of Environmental Studies for Undergraduate Courses (Second Edition)* for UGC. University Press.
- Gadgil, M. 1993. *Biodiversity and India's degraded lands. Ambio***22**: 167-172.
- Gaston, KJ. & Spicer, J.I. 1998. *Biodiversity: An Introduction*. Blackwell Science, London,
- Heywood,V.h&Watson,R.T. 1995. *Global Biodiversity Assessment*. Cambridge UniversityPress.
- Krishnamurthy, K.V. (2003) *Textbook of Biodiversity*, Science Publishers, Plymouth, UK
- Pandit, M.K. *et al.*, 2007. *Unreported yet massive deforestation driving loss of endemic biodiversity in Indian Himalaya. Biodiversity Conservation* **16**: 153-163.
- Santra S.C. 2005. *Environmental Science*, New Central Book Agency (P) Ltd. Kolkata
- Saha T.K. 2010. *Ecology and Environmental Biology*, Books and Allied (P) Ltd. Kolkata.
- Sharma, P. D. 2012. *Ecology and Environment*, Rastogi Publication
- Sinha, N. (2020) *Wild and Wilful*. Harper Collins, India.
- Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022) *Conservation through Sustainable Use: Lessons from India*. Routledge.

Climate change and Climate action:

- Barry, R. G. 2003. *Atmosphere, Weather and Climate*. Routledge Press, UK.
- Boeker, E. & Grondelle, R. 2011. *Environmental Physics: Sustainable Energy and Climate Change*. Wiley.
- Gillespie, A. 2006. *Climate Change, Ozone Depletion and Air Pollution: Legal Commentaries with Policy and Science Considerations*. MartinusNijhoff Publishers.
- Lal D.S. 2006, *Climatology*, Sharda Pustak Bhawan, Allahabad
- Siddhartha K. 2005, *Atmosphere, Weather and Climate*, Kisalaya Publications Pvt. Ltd, New Delhi
- Singh S. 2009, *Climatology*, Prayag Pustak Bhawan, Allahabad
- Hardy, J.T. 2003. *Climate Change: Causes, Effects and Solutions*. John Wiley & Sons.
- Harvey, D. 2000. *Climate and Global Climate Change*. Prentice Hall.
- Manahan, S.E. 2010. *Environmental Chemistry*. CRC Press, Taylor and Francis Group.
- Maslin, M. 2014. *Climate Change: A Very Short Introduction*. Oxford Publications.
- Mathez, E.A. 2009. *Climate Change: The Science of Global Warming and our Energy Future*. Columbia University Press.
- Mitra, A.P., Sharma, S., Bhattacharya, S., Garg, A., Devotta, S. & Sen, K. 2004. *Climate Change and India*. Universities Press, India.
- Philander, S.G. 2012. *Encyclopedia of Global Warming and Climate Change (2nd edition)* Sage Publications