SYLLABUS OF BACHELOR IN ENVIRONMENTAL SCIENCES (HONS)

(20 PERCENT REDUCED)

FOR COLLEGES AFFILIATED TO BODOLAND UNIVERSITY

Curriculum Structures
Bachelor in Environment Science (Hons.)

SEM I						
Paper code	**Course title**	**Credit**	**Credit distribution (L+T+P)**	**End semester marks**	**Internal marks**	**Total marks**
EVS-101H	C1-Earth and Earth Surface Processes	6	4+0+2	60(Theo)+20(Pract)	20	100
EVS-102H	C2-Physics & Chemistry of Environment	6	4+0+2	60(Theo)+20(Pract)	20	100
EVS-103H	GE1- Environment & Society	6	4+0+2	60(Theo)+20(Pract)	20	100
EVS-104H	**AEC:** AECC1:English/ Communication/MIL	2	2+0+0	50	-	50
Total		**20**	**20**	**290**	**60**	**350**

Details of course under B.Sc. in Environmental Science (Hons.)

Course	**Credits***	
	Theory + Practical	**Theory + Tutorial**
I. Core Courses- Theory (14 Papers)	14x4=56	14 x 5=70
Core Course – Practical/Tutorial*	14 x 2=28	14 x 1=14
II. Elective Courses (8 Papers)		
A1. Discipline Specific Electives – Theory (4 Papers)	4 x 4=16	4 x 4=16
A2. Discipline Specific Electives Practical/Tutorial* - (4 Papers)	4 x 2=8	4 x 2=8

B1. Generic Electives/Interdisciplinary- Theory (4 Papers)	4 x 4=16	4 x 4=16
B2. Generic Electives/Interdisciplinary – Practical/Tutorial* (4 Papers)	4 x 2=8	4 x 2=8
III. Ability Enhancement Courses		
Ability Enhancement Compulsory Courses (AECC)- (2 Papers of 2 Credits each) vironment Science & English/MIL Communication	2 x 2=4	2 x 2=4
2. Skill Enhancement Courses (SEC) (2 Papers of 4 Credits each)	2 x 4=8	2 x 4=8
Total Credits	**144**	**144**

*wherever practical is mentioned there will be no tutorial and vice-versa

CORE COURSE-1: EARTH AND EARTH SURFACE PROCESSES

Theory (60 Lectures)

Preamble: The paper will introduce students to the basic structure and composition of the Earth and will explore various surface processes and their impact on and role in living systems. It will also deal with the interactive processes in the inner as well as outer Earth's surface.

Unit 1: History of Earth (10 lectures)

Solar system formation and planetary differentiation; formation of the Earth: formation and composition of core, mantle, crust, atmosphere and hydrosphere; chemical composition of Earth; geological time scale and major changes on the Earth's surface; Holocene and the emergence of humans, role of humans in shaping landscapes.

Unit 2: Earth system processes (10 lectures)

Movement of lithosphere plates; mantle convection and plate tectonics, major plates and hot spots, plate boundaries; sea floor spread; earthquakes; volcanic activities; orogeny; isostasy; gravitational and magnetic fields of the earth; origin of the main geomagnetic field; continental drift, Pangaea and present-day continents, paleontological evidences of plate tectonics;

Unit 3: Minerals and rocks (15 lectures)

Minerals and important rock forming minerals; rock cycle: lithification and metamorphism; Three rock laws; rock structure, igneous, sedimentary and metamorphic rocks; weathering: physical, biogeochemical processes; agents of erosion: rivers and streams, ~~glacial~~ and aeolian transportation and deposition of sediments by running water, wind and glaciers.

Unit 4: Earth surface processes (15 lectures)

Atmosphere: evolution of earth's atmosphere, composition of atmosphere, physical and optical properties, circulation land surface processes: fluvial and glacial processes, rivers and geomorphology; types of glaciers, glacier dynamics, and depositional processes and glaciated landscapes; coastal processes.

Unit 5: Importance of being a mountain (10 lectures)

Formation of Peninsular Indian mountain systems - Western and Eastern Ghats, Vindhyas, Formation of the Himalaya; development of glaciers, perennial river systems and evolution of monsoon in Indian subcontinent; formation of Indo-Gangetic Plains, arrival of humans; evolution of Indus Valley civilization; withdrawing monsoon and lessons to draw.

Practical: Based on the theory/ fieldwork.

Suggested Readings

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

CORE COURSE 2: PHYSICS AND CHEMISTRY OF ENVIRONMENT
Theory (60 Lectures)

Preamble: This paper aims to build conceptual understanding of students by exposing them to the basic principles behind various environmental processes. The paper has been divided into two sections, with the view to introduce students to the concepts of physics and chemistry associated with particle movement, chemical processes and pollutant chemistry.

Unit 1: Fundamentals of environmental physics (15 lectures)

Part A: Basic concepts of light and matter; quantum mechanics (relation between energy, wavelength and frequency), black body radiation, Kirchhoff's law, Boltzmann equation, spectroscopic concepts: Introduction to the concept of absorption and transmission of light, Beer–Lambert law, photovoltaic and solar cells.

Part B: Basic concepts of pressure, force, work and energy; types of forces and their relation (pressure gradient, viscous, Coriolis, gravitational, centripetal, and centrifugal force); concept of heat transfer, conduction, convection; concept of temperature, lapse rate (dry and moist adiabatic); laws of thermodynamics; concept of heat and work.

Unit 2: Movement of pollutants in environment (6 lectures)

Diffusion and dispersion, point and area source pollutants, pollutant dispersal; Gaussian plume model, mixing heights, hydraulic potential,

Unit 3: Fundamentals of environmental chemistry (15 lectures)

Part A: Atomic structure, electronic configuration, periodic properties of elements (ionization potential, electron affinity and electronegativity), types of chemical bonds (ionic, covalent, coordinate and hydrogen bonds); mole concept, molarity and normality.

Part B: Thermodynamic system; types of chemical reactions; acids, bases and salts, solubility products; solutes and solvents; redox reactions, concepts of pH and pE, electrochemistry, Nernst equation, electrochemical cells.

Part C: Basic concepts of organic chemistry, hydrocarbons, aliphatic and aromatic compounds, organic functional groups, polarity of the functional groups.

Unit 4: Atmospheric chemistry (8 lectures)

Composition of atmosphere; photochemical reactions in atmosphere; smog formation, types of smog (sulphur smog and photochemical smog), aerosols; chemistry of acid rain, case studies; reactions of NO_2 and SO_2; free radicals and ozone layer depletion, role of CFCs in ozone depletion.

Unit 5: Water chemistry (8 lectures)

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.

Unit 6: Soil chemistry (8 lectures)

Soil composition; relation between organic carbon and organic matter, inorganic and organic components in soil; soil humus; cation and anion exchange reactions in soil; nitrogen, phosphorus and potassium in soil.

Practical: Based on the theory.

Suggested Readings

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.
9. Pani, B. 2007. *Textbook of Environmental Chemistry*. IK international Publishing House.

GENERAL ELECTIVE 1: ENVIRONMENT AND SOCIETY

Theory (60 Lectures)

Preamble: The course examines the relationship between the environment and society enabling the students to understand and appreciate the role played by environment, society, and, their interface in shaping environmental decisions. The students will be enabled to think critically on environmental issues.

Unit 1: Introduction (6 lectures)

Social and cultural construction of 'environment'; environmental thought from historical and contemporary perspective in light of the concepts of Gross Net Happiness and Aldo Leopold's Land Ethic.

Unit 2: Issues in environmentalism (10 lectures)

Significant global environmental issues such as acid rain, climate change, and resource depletion; historical developments in cultural, social and economic issues related to land, forest, and water management in a global context.

Unit 3: Development-environment conflict (10 lectures)

Developmental issues and related impacts such as ecological degradation; environmental pollution; development-induced displacement, discussion on Project Affected People (PAPs).

Unit 4: Urbanization and environment (10 lectures)

Production and consumption oriented approaches to environmental issues in Indian as well as global context; impact of industry and technology on environment; onflict between economic and environmental interests.

Unit 5: Environment and social inequalities(10 lectures)

Inequalities of gender, region, and nation-state in access to healthy and safe environments; history and politics surrounding environmental, ecological and social justice; environmental ethics, issues and possible solutions.

Unit 6: Regulatory framework (4 lectures)

Brief account of Forest Conservation Act 1980 1988; Forest Dwellers Act 2008; Land Acquisition Act1894, 2007, 2011, 2012; Land Acquisition Rehabilitation and Resettlement Act 2013.

Unit 7: Community participation (10 lectures)

State, corporate, civil society, community, and individual-level initiatives to ensure sustainable development; case studies of environmental movements (Appiko Movement, Chipko Movement, Narmada Bachao Andolan); environmental groups and movements, citizen groups; role played by NGOs; environmental education and awareness.

Practicals: Tutorials, analysis and exercise based.

Suggested Readings

1. Chokkan, K.B., Pandya, H. & Raghunathan, H. (eds). 2004. *Understanding Environment*. Sagar Publication India Pvt. Ltd., New Delhi.
2. Elliot, D. 2003. *Energy, Society and Environment, Technology for a Sustainable Future.* Routledge Press.
3. Guha, R. 1989. *Ecological change and peasant resistance in the Himalaya*. Unquiet Woods, Oxford University Press, Delhi.
4. Leopold, A. 1949. *The Land Ethic*. pp. 201-214. Chicago, USA.
5. National Research Council (NRC). 1996. *Linking Science and Technology to Society's Environmental Goals*. National Academy Press.
6. Pandit, M.K. 2013. Chipko: Failure of a Successful Conservation Movement. In: Sodhi, N.S., Gibson, L. & Raven, P.H. *Conservation Biology: Voices from the Tropics.* pp. 126-127. Wiley-Blackwell, Oxford, UK.