

Scheme & Syllabus of

Bachelor of Science in Environmental Science

(B.Sc. Env Sci)

Batch 2020 onwards



By

Board of Study CIVIL AND ENVIRONMENTAL SCIENCE

Department of Academics

IK Gujral Punjab Technical University

IK Gujral Punjab Technical University
B.Sc. Environment Science

Bachelors of Science in Env Science (B.Sc. Env Sci):

It is an Under Graduate (UG) Programme of 3 years duration (6 semesters)

Eligibility for Admission: All Those candidates who have passed in 10 + 2 or its equivalent examination in any stream conducted by a recognized Board/University/Council

Courses & Examination Scheme:

First Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN101-20	Core Theory	Elements of Ecology	3	1	0	40	60	100	4
BSEN102-20	Core Theory	Basics of Biostatistics	3	1	0	40	60	100	4
BSEN103-20	Core Theory	Environmental Chemistry	3	1	0	40	60	100	4
BSEN104-20	Core Practical/Laboratory	Ecology Lab	0	0	4	60	40	100	2
BSEN105-20	Core Practical/Laboratory	Environmental Chemistry Lab	0	0	4	60	40	100	2
BSEN106-20	Core Practical/Laboratory	Biostatistics Lab	0	0	4	60	40	100	2
BTHU103/18	Ability Enhancement Compulsory Course (AECC)-I	English	1	0	0	40	60	100	1
BTHU104/18	Ability Enhancement Compulsory Course (AECC)	English Practical/Laboratory	0	0	2	30	20	50	1
HVPE101-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules	3	0	0	40	60	100	3
HVPE102-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules (Lab/ Seminar)	0	0	1	25	--**	25	1
BMPD102-18		Mentoring and Professional Development	0	0	1	25	--**	25	1
	TOTAL		13	03	16	460	440	900	25

**The Human Values, De-addiction and Traffic Rules (Lab/ Seminar) and Mentoring and Professional Development course will have internal evaluation only.

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Second Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN201-20	Core Theory	Biodiversity components	3	1	0	40	60	100	4
BSEN202-20	Core Theory	Ecosystem Dynamics	3	1	0	40	60	100	4
BSEN203-20	Core Theory	Natural Resources and Management	3	1	0	40	60	100	4
BSEN203-20	Core Practical/Laboratory	Biodiversity components lab	0	0	4	60	40	100	2
BSEN204-20	Core Practical/Laboratory	Ecosystem lab	0	0	4	60	40	100	2
BSEN205-20	Core Practical/Laboratory	Natural resources Management Lab	0	0	4	60	40	100	2
EVS102-18	Ability Enhancement Compulsory Course (AECC) -III	Environmental Science	2	0	0	40	60	100	2
BMPD202-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		11	03	13	365	360	725	21

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement

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Third Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN301-20	Core Theory	Renewable and Non-Renewable Energy Resources	3	1	0	40	60	100	4
BSEN302-20	Core Theory	Fundamentals of Nanotechnology	3	1	0	40	60	100	4
BSEN303-20	Core Theory	Environmental Microbiology and Biochemistry	3	1	0	40	60	100	4
BSEN304-20	Core Practical/Laboratory	Energy Resources lab	0	0	4	60	40	100	2
BSEN305-20	Core Practical/Laboratory	Nanotechnology Lab	0	0	4	60	40	100	2
BSEN306-20	Core Practical/Laboratory	Microbiology and biochemistry lab	0	0	4	60	40	100	2
BSEN307-20	Skill Enhancement Course-I	Basics of computers	1	0	0	40	60	100	1
BSEN308-20	Skill Enhancement Course- Laboratory	Computer Lab	0	0	2	30	20	50	1
BMPD302-18		Mentoring and Professional Development	0	0	1	25	--	25	1
TOTAL			10	03	15	395	380	775	21

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement

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Fourth Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN401-20	Core Theory	Environmental Pollution	3	1	0	40	60	100	4
BSEN402-20	Core Theory	Water and wastewater: treatment and conservation	3	1	0	40	60	100	4
BSEN403-20	Core Theory	Fundamentals of Bioinformatics	3	1	0	40	60	100	4
BSEN404-20	Core Practical/Laboratory	Pollution Monitoring Lab	0	0	4	60	40	100	2
BSEN405-20	Core Practical/Laboratory	Water and wastewater lab	0	0	4	60	40	100	2
BSEN406-20	Core Practical/Laboratory	Bioinformatics Lab	0	0	4	60	40	100	2
BSEN407-20	Skill Enhancement Course-II	Tissue Culture	1	0	0	40	60	100	1
BSEN408-20	Skill Enhancement Course- Laboratory	Tissue culture Lab	0	0	2	30	20	50	1
BMPD402-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		10	03	15	395	380	775	21

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement

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Fifth Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN501-20	Skill Enhancement Course-III	Environmental Monitoring and Techniques	1	0	0	40	60	100	1
BSEN502-20	Skill Enhancement Course- Laboratory	Advanced instrumentation techniques	0	0	2	30	20	50	1
BSEN503-20	Open Elective-I	Environmental Agriculture#	3	1	0	40	60	100	4
BSENXXX-20	Elective-I	Elective I	3	1	0	40	60	100	4
BSENXXX-20	Elective-II	Elective II	3	1	0	40	60	100	4
BSENXXX-20	Elective-I Laboratory	Elective I Lab	0	0	4	60	40	100	2
BSENXXX-20	Elective-II Laboratory	Elective –II Lab	0	0	4	60	40	100	2
BSEN520-20	Project	Minor Project	0	0	2	Satisfactory / Un Satisfactory			2
BMPD502-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		10	03	13	335	340	675	21

Any of the available courses in other programmes such as management or Sciences relevant to the field can also be considered with the approval of the BoS/University.

List of Elective

List of Elective-I

BSEN504-20Environmental Impact Assessment (EIA)

BSEN512-20EIA report writing

BSEN505-20Sustainability and Millennium Development Goals

BSEN513-20Sustainability Lab

BSEN506-20Environmental Ethics and Human Values

BSEN514-20Environmental Ethics report writing

BSEN507-20Toxicology

BSEN515-20Toxicology lab

BSEN508-20Hazards and Risk Assessment

List of Elective-II

BSEN509-20 Solid Waste Management

BSEN517-20 Solid waste management lab

BSEN510-20 Climatology

BSEN518-20 Climatology Lab

BSEN511-20 Aquaculture

BSEN519-20 Aquaculture Lab

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Sixth Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN601-20	Skill Enhancement Course-IV	Eco-restoration and Development	1	0	0	40	60	100	1
BSEN602-20	Skill Enhancement Course- Laboratory	Environmental Biotechnology Techniques	0	0	2	30	20	50	1
BSEN603-20	Open Elective-II	Environmental policy and economics#	3	1	0	40	60	100	4
BSENXX X-20	Elective-III	Elective-III	3	1	0	40	60	100	4
BSENXX X-20	Elective-IV	Elective-IV	3	1	0	40	60	100	4
BSENXX X-20	Elective-III Laboratory	Elective-III Lab	0	0	4	60	40	100	2
BSENXX X-20	Elective-IV Laboratory	Elective-IV Lab	0	0	4	60	40	100	2
BSEN622-20	Project	Major Project	0	0	6	Satisfactory / Un Satisfactory			6
BMPD602-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		10	03	17	335	340	675	25

Any of the available courses in other programmes such as management or Sciences relevant to the field can also be considered with the approval of the BoS/PTU.

List of Elective -III

BSEN604-20Environmental Management

BSEN613-20Environment Management Lab

BSEN605-20Environmental Law

BSEN614-20Environmental Law Report writing

BSEN606-20Urban Forestry

BSEN615-20Urban Forestry lab

BSEN607-20Wildlife Conservation

BSEN616-20Wildlife Conservation (visit and report writing)

BSEN608-20Disaster Management

BSEN617-20Disaster Management Lab

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BSEN609-20Ecotourism

BSEN618-20Ecotourism (visit and report writing)

List of Elective -IV

BSEN610-20Remote Sensing and GIS for Environmental Scientists

BSEN619-20Remote sensing and GIS Lab

BSEN611-20Environmental Geology

BSEN620-20Environment Geology Lab

BSEN612-20Water Resources Management

BSEN621-20Water resources lab

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Elements of Ecology

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN101-20	Core Theory	Elements of Ecology	3	1	0	40	60	100	4

Unit-1:

Definition, scope, types, components of environment (atmosphere, hydrosphere, lithosphere and biosphere). interrelationship and interactions, ecosystems, organisation, structure and models, people and environment. Climatic factors - solar radiation, temperature, water and precipitation

Unit-2:

Rock types and formation, the rock cycle. Soil formation process, soil types and its status, physical, chemical and biological characters of soil, soil profile and concept of soil erosion, topographic factors.

Unit-3:

Population: basic concepts, characteristics of population – density, natality, mortality, age-structure, dispersion and movement. Causes for population explosion, population growth and population regulation. Intraspecific and interspecific interactions among population – competition, predation, parasitism, mutualism and commensalism.

Unit-4:

Basic concepts of community, community structure, growth form, life form, stratification, methods of plant community analysis, Ecotone, edge effect, ecological niche, keystone species and ecological succession.

Unit-5

Carbon cycle; nitrogen cycle; phosphorus cycle; sulphur cycle; hydrological cycle; nutrient cycle models; ecosystem input of nutrients; biotic accumulation; ecosystem losses; nutrient supply and uptake; role of mycorrhizae; decomposition and nutrient release; nutrient use efficiency; nutrient budget; nutrient conservation strategies.

References:

1. Thomas M. Smith and Robert L. Smith (2012), Elements of Ecology (8th Edn), Pearson Benjamin Cummings,
2. George L. Clarck (1956), Elements of Ecology, John Wiley & Son Inc. New York
3. Charles Krebs (2013), Ecology: Pearson New International Edition (6th Edn),
4. Michael Begon, Colin R. Townsend and John L. Harper (2006), Ecology: From Individuals to Ecosystems (4th Edition), John Wiley & Sons, New Jersey.
5. Eugene P. Odum and Gary W. Barrett (1953), Fundamentals of Ecology (5th edn), Brooks/Cole, US
6. Krebs, Charles J (2009), Ecology: The Experimental Analysis of Distribution and Abundance (6th Edn), Benjamin-Cummings Publishing Company
7. Muller-Dombois, D. and Ellenberg, H. (1974). Aims and Methods of Vegetation Ecology, Wiley, New York.

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN102 -20	Core Theory	Basics of Biostatistics	3	1	0	40	60	100	4

Unit 1: Introduction to Statistics:

Definition and application of statistics, qualitative data, quantitative data, frequency distribution, cumulative frequency, diagrammatical representation of statistical data (bar, pie charts), graphical representation of frequency distribution (histogram, frequency polygon, cumulative frequency curves). Measures of central tendency: mean, median, mode, geometric mean (merits and demerits), measures of dispersion: range, standard deviation, variance, (merits and demerits), coefficient of variation.

Unit 2: Probability

Basic concepts of probability: trial, event, sure event, random event, sample space, definition of probability, mutually exclusive events, independent event, law's of probability – simple problems, probability distributions, normal curve and applications.

Unit 3 : Hypothesis Testing:

Hypothesis, types of hypothesis, level of significance, type 1 and type 2 error, standard error, degrees of freedom, chi square test, student's t test: sample t test, paired t test.

Unit 4: Correlation and Regression

Correlation: definition, types of correlation, karlpearson's coefficient of correlation, simple linear regression, ANNOVA.

Unit 5: SAMPLING

Basics of sampling, Random and Non-random sampling, advantages and disadvantages of sampling, concepts of simple random sampling, concepts of stratified random sampling, concepts systematic sampling

References:

1. Palanisamy, M (1989) A Text Book of Statistics, Paramount Publication, Palani
2. Vittal, R.R (1986) Business Mathematics and Statistics, Murugan Publications
3. Gupta, S.P. (1996) Statistical Methods, Sulthan Chand and Sons Publications, New Delhi
4. Banerjee, Pranab Kumar (2014) Introduction to Biostatistics , Publisher: S. Chand & Company Pvt. Ltd
5. Clarke, G.M. & Cooke, D., A (1998) Basic course in Statistics.

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN103-20	Core Theory	Environmental Chemistry	3	1	0	40	60	100	4

Unit 1:

Composition and structure of earth-atmosphere, hydrosphere, lithosphere, biosphere, Distribution of temperature and pressure in atmosphere, particles, ions, radicals in atmosphere, thermal inversion, chemical and photochemical reaction in atmosphere, oxygen and ozone chemistry, causes and effect of Greenhouse effect, Ozone Hole, Acid Rain, El-Nino and La Nino, oceanic circulation.

Unit 2:

Fundamentals of aquatic chemistry: dissolution/precipitation reactions, complexation reactions, chelation, species distribution in freshwaters, nutrients in water and sediments, organic matter and organic chemicals, seawater composition and chemistry- salinity concepts, major constituents, dissolved gases, nutrients, trace elements, sediments and sedimentary components

Unit 3:

oxidation-reduction, redox reactions, NERNST equation and chemical equilibrium, limits of pE in water, pE values in natural water systems, pE - pH diagrams, corrosion, stoichiometry, CO₂ equilibrium in natural water systems

Unit 4:

Chemistry of the solid earth: mineral components of soil, primary and secondary minerals, weathering processes, organic components, soil pH and redox potential, ion exchange (physisorption), ligand exchange (chemisorption), adsorption process, isotherms

Unit 5:

Fate of organic compounds, diversity of organic compounds, identifying sources of hydrocarbons, chemical partitioning, chemical transformation and degradation, light absorption and the beer-lambert law, photolysis in aqueous systems, photochemistry of brominated flame retardants, physical behaviour of particles in the atmosphere, the composition of inorganic particles, radioactive particles, composition of organic particles, effects of particles, water as particulate matter

References:

1. Brady, N.C. 1990. The nature and properties of Soils, Tenth Edition. Mac Millan Publishing Co., New York.
2. Botkin, D.B and Kodler E.A., 2000, Environmental Studies: The earth as a living planet. John Wiley and Sons Inc.
3. Rao M.N. and H.V.N. Rao, 1989 : Air Pollution, Tata McGraw Hill Publishing Co. Ltd., New Delhi
4. Tyler Miller Jr. G. 1990. Living in the Environment. Wadsworth Publishing Company, Belmont California.
5. Odum, E.P., 1983, Basic Ecology. Halt Saundurs, International Edition Japan.
6. De, A.K. 1990, Environmental Chemistry, Wiley Eastern Ltd., New Delhi.

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN104-20	Core Practical/Laboratory	Ecology Lab	0	0	4	60	40	100	2

1. Introductory Laboratory Techniques
2. Determination of requisite size of the quadrant for vegetation analysis.
3. Analysis of frequency distribution of plants in a piece of vegetation by quadrat method.
4. Analysis of soil grain size
5. Study of soil profile
6. Quantitative analysis of soil pH.
7. Quantitative analysis of soil conductivity.
8. To study pore space and water holding capacity of soil.
9. To study bulk density of soil.
10. Quantitative analysis of soil organic carbon
- 11 and 12. Case studies of visit to specific ecosystems and identifying the characteristics.

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN105-20	Core Practical/Laboratory	Environmental Chemistry Lab	0	0	4	60	40	100	2

1. Visualisation and verification atmospheric process and effects (showing some educational videos on the subject)
2. Collection and preservation of environmental samples
3. Determination of carbonate and bicarbonate in water samples
4. Correlation between acidity, alkalinity and hardness
5. Estimation trace elements and nutrients in water
6. Redox reactions: construction of pE – pH diagrams
7. Experiment on solubility and precipitation
8. Analysis of soil samples for various characteristics like pH, minerals, cation exchange capacity etc.
9. Adsorption experiments and preparation isotherms
10. Estimation of organic compounds in environmental samples
11. Chemical and biological degradation of organic compounds
12. Absorption and scattering of light due to particles.

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN106-20	Core Practical/Laboratory	Biostatistics Lab	0	0	4	60	40	100	2

1. Data collection from field or forests
2. Secondary data collection from existing literature
3. Classification and Tabulation of collected data
4. Frequency distribution and graphs from the collected data
5. Estimation of central tendency and dispersion from the collected data
6. Testing exercise for t-test
7. Exercises to find out the statistical parameters and correlation based on SPSS software and MS Excel
8. Exercise on multiple regression analysis on collected data
9. Time series data analysis on any environmental issues
10. To calculate ratio by one way annova method
11. Data analysis through statistical software for multivariate data
12. Exercise on correlation coefficient between two different variables

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BTHU103 /18	Ability Enhancement Compulsory Course (AECC)-I	English	1	0	0	40	60	100	1

Detailed Contents:

Unit- 1 (Introduction)

- Theory of Communication
- Types and modes of Communication

Unit- 2 (Language of Communication)

- Verbal and Non-verbal
- (Spoken and Written)
- Personal, Social and Business
- Barriers and Strategies
- Intra-personal, Inter-personal and Group communication

Unit-3 (Reading and Understanding)

- Close Reading
- Comprehension
- Summary Paraphrasing
- Analysis and Interpretation
- Translation(from Hindi/Punjabi to English and vice-versa)

OR

Precis writing /Paraphrasing (for International Students)

- Literary/Knowledge Texts

Unit-4 (Writing Skills)

- Documenting
- Report Writing
- Making notes
- Letter writing

Recommended Readings:

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. *Language, Literature and Creativity*, Orient Blackswan, 2013.
4. *Language through Literature* (forthcoming) ed. Dr. Gauri Mishra, DrRanjanaKaul, DrBratiBiswas
5. *On Writing Well*. William Zinsser. Harper Resource Book. 2001
6. *Study Writing*. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BTHU104 /18	Ability Enhancement Compulsory Course (AECC)	English Practical/Laboratory	0	0	2	30	20	50	1

Interactive practice sessions in Language Lab on Oral Communication

- Listening Comprehension
- Self Introduction, Group Discussion and Role Play
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations
- Monologue
- Effective Communication/ Mis- Communication
- Public Speaking

Recommended Readings:

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. *Practical English Usage*. Michael Swan. OUP. 1995.
4. *Communication Skills*. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
5. *Exercises in Spoken English*. Parts.I-III. CIEFL, Hyderabad. Oxford University Press

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
HVPE101-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules	0	0	2	30	20	50	1

Unit-1

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self-Exploration—what is it? - Its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Unit-2

Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’
2. Understanding the needs of Self (‘I’) and ‘Body’ - *Sukhand Suvidha*
3. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of ‘I’ and harmony in ‘I’
5. Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure *Sanyam* and *Swasthya*

- Practice Exercises and Case Studies will be taken up in Practice Sessions.

Unit-3

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. Understanding harmony in the Family- the basic unit of human interaction
2. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;

Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship

3. Understanding the meaning of *Vishwas*; Difference between intention and competence
4. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship

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5. Understanding the harmony in the society (society being an extension of family):
samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals
6. Visualizing a universal harmonious order in society- Undivided

Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha*)- from family to world family!

- Practice Exercises and Case Studies will be taken up in Practice Sessions.

Unit-4

4

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

1. Understanding the harmony in the nature
2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability
3. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in nature
4. Holistic perception of harmony at all levels of existence

- Practice Exercises and Case Studies will be taken up in Practice Sessions.

Unit-5

Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics:
 - a) Ability to utilize the professional competence for augmenting universal human order,
 - b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
 - c) Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order:
 - a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
 - b) At the level of society: as mutually enriching institutions and organizations

Text Book

1. R R Gaur, R Sangal, G P Bagaria, 2009, *A Foundation Course in Value Education*.

Reference Books

1. Ivan Illich, 1974, *Energy & Equity*, The Trinity Press, Worcester, and Harper Collins, USA.
2. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
3. A Nagraj, 1998, *JeevanVidyaekParichay*, Divya Path Sansthan, Amarkantak.
4. Susan George, 1976, *How the Other Half Dies*, Penguin Press. Reprinted 1986, 1991.
5. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Common wealth Publishers.
6. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.

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7. SubhasPalekar, 2000, *How to practice Natural Farming*, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limits to Growth – Club of Rome’s report*, Universe Books

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
HVPE102-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules (Lab/ Seminar)	0	0	1	25	--**	25	1

One each seminar will be organized on Drug De-addiction and Traffic Rules. Eminent scholar and experts of the subject will be called for the Seminar at least once during the semester. It will be binding for all the students to attend the seminar.

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			L*	T*	P	Internal	External		
BMPD102 -18		Mentoring and Professional Development	0	0	1	25	--**	25	1

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- • Overall Personality
- • Aptitude (Technical and General)
- • General Awareness (Current Affairs and GK)
- • Communication Skills
- • Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.

For achieving the above, suggestive list of activities to be conducted are:

Part – A

(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B

(Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN201-20	Core Theory	Biodiversity components	3	1	0	40	60	100	4

Unit-1:

Biodiversity: Basic concepts, importance and conservation need, Species diversity, Biological and phylogenetic species concept, speciation, natural longevity of species and optimum biodiversity, species extinction.

Unit-2:

Classification, taxonomic nomenclature, Principles of classification and nomenclature of plants, animals and micro-organism, Micro-organism: main taxonomic groups of micro-organism. Organization and function of a bacterial and fungal cell.

Unit-3

General Characteristics, habitat and economic importance of microorganism-Chemoautotrophs, Bacteria, Blue-Green Algae, Yeasts, Fungi and Algae, Microbial toxins in environment, Microbial Diseases of man

Unit-4:

Diversity of insects, nematodes, fishes, birds, reptile and other mammals, their role in environment and economic, food, fisheries, pollination and seed dispersal, importance of wild life, endangered species, Bryophytes and lichen, land habit in Bryophytes, role of bryophytes in soil building. Lichens as ecological indicators, Pteridophytes, gymnosperms and angiosperms, general characteristics, habitat, role in environment and economic uses

Unit-5

Concept of threatened species, Threatened and endangered animals of India, Importance and conservation of tropical regions, wetlands, mangroves, coral reefs, Ex-situ and In-situ conservation, Wild life sanctuaries, National Parks and Biosphere Reserve, Concept of genetic diversity, gene and germ-plasma banks, Biodiversity convention, Socio-cultural aspects of biodiversity,

References:

1. Chandel, K.P.S., Shukla, G. And Sharma, N. (1996). Biodiversity in Medicinal and Aromatic Plants in India Conservation and Utilization, National Bureau of Plant Genetic Resources, New Delhi.
2. Zachos, Frank E.; Habel, Jan Christian (2011) Biodiversity Hotspots, Distribution and Protection of Conservation Priority Areas, Springer
3. Council of Scientific and Industrial Research (1986). The Useful Plants of India Publication and Information Directorate, CSIR, New Delhi.
4. Nair, M.N.B. et. al. (Eds.) (1998). Sustainable Management of Non-wood Forest Products. Faculty of Forestry, University Putra. Malaysia. 434 004 PM Serdong, Selangor, Malaysia.
5. Soule, M.E. (ed.) (1986). Conservation Biology. The Science of Scarcity and Diversity. Sinaur Associates, Inc., Sunderland, Massachusetts.

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN202-20	Core Theory	Ecosystem Dynamics	3	1	0	40	60	100	4

Unit-1:

Ecosystem: Basic concepts, structure of ecosystem, Abiotic and Biotic components, food chains and food webs, Trophic levels, Ecological pyramids.

Unit-2 :

Function of ecology- material and Energy flow in ecological systems, energy efficiencies, Concept ecological pathways, conservation of matter.

Unit-3:

Significance of biogeochemical Cycles: gaseous and sedimentary cycles. Oxygen, Carbon, Nitrogen, Phosphorus and Sulphur Cycles, Hydrological cycles.

Unit-4:

Evolution and Succession: Concepts of succession, succession process- 'r' and 'k' hypothesis, Types of Succession. Clements' theory of succession, Climax and stability, seral community, Coevolution and group selection, Forest succession.

Unit-5:

Biomes and classification, Characteristics of major biomes-terrestrial fresh water and marine ecosystems, important terrestrial and aquatic ecosystems of India, Major biomes of the world.

References:

1. W. S. C. Gurney, R. M. Nisbet (1998), Ecological Dynamics, Oxford University Press.
2. Odum, E.P. (1983), Basic Ecology, Sanders, Philadelphia.
3. Robert Ricklefs (2001). The Ecology of Nature. Fifth Edition. W.H. Freeman and Company.
4. Singh K.P. and J.S. Singh (1992). Tropical Ecosystems: Ecology and Management. Wiley Eastern Limited, Lucknow, India.
5. Singh, J.S. (ed.) 1993. Restoration of Degraded Land: Concepts and Strategies. Rastogi Publications, Meerut.
6. Smith, R.L. (1996). Ecology and Field Biology, Harper Collins, New York.
7. Botkin, D.B. and Keller, E.A. 2000. Environment Science: Earth as a living planet. Third Edition. John Wiley and Sons Inc.

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN203-20	Core Theory	Natural Resources and Management	3	1	0	40	60	100	4

Unit –1:

Basic concepts, role in human civilization, World energy scenario, Renewable and non renewable sources of energy, Non Renewable Energy Resources: Fossil fuels and their reserves, Nuclear energy, types, uses and effects. Energy utilization and its effects on environment, Energy crisis

Unit –2:

Renewable Energy Resources: Hydropower, Solar energy, geothermal, tidal and wind energy, Energy conservation: In agriculture and industrial sector, Energy plantation; Petro crops, Hydrogen as a future energy source, waste to energy concept, Sustainable use of energy resources, Biotechnological approach of Energy management- Biomass, biogas, bioethanol, biohydrogen, advantages

Unit –3:

Biological resources: Types and uses of biological resources, Forest resources and conservation in India, Wild life conservation efforts in India, Project tiger, range management, Soil and Mineral resources: mineral resources in India, types of soil, soil erosion. soil conservation techniques. Types of land use, Land conservation strategies

Unit –4:

Water resources: Types and uses of water resources, Methods of enhancing fresh water supply, Watershed management & its importance, Sustainable management of water resources in agriculture, industry and urbanization, Remote sensing in resource management

Unit –5:

Concept of sustainable development and management of natural resources, Environment awareness and education, major conservation effort of National Agency- MoFE and CPCB, introduction to major international agency – WWF, IUCN, UNEP, CITES, ENVIS

References:

1. Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.
2. Donahue R.L. and Miller R.W. 1997 Soils In Our Environment, Prentice Hall of India Pvt. Ltd., New Delhi.
3. Morgen, M.D. Morgen J.M. and Wiersima J.H. 1993, Environmental Science: Managing Physical and Biological Resources Wm C Brown Publishers London.
4. Tyler Miller Jr. G. 2005. Living in the Environment. Wadsworth Publishing Company, Belmont California.
5. Botkin, D.B and Keller E.A., 2000, Environmental Studies: The earth as a living plant. Charles E. Merrill, Publishing Co. London.
6. Shastri M.N.1995, Energy Options: Himalaya Publishing House, New Delhi.

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7. Dhaliwal G.S., Sangha G.S. and Ralhan P.K. 2000, Fundamentals of Environmental Science, Kalyani Publishers, New Delhi.
8. Singh J.S., Singh S.P. and Gupta S.R., 2006, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN203-20	Core Practical/Laboratory	Biodiversity components lab	0	0	4	60	40	100	2

1. To determine chlorophyll content of the given plant material.
2. Quantitative analysis of soil organic carbon.
3. Preparation of field report based on the survey of local flora.
4. Preparation of field report based on the survey of local fauna
5. Visit to in situ or ex situ conservation centre
6. Study of centre of diversity of plants from maps.
7. Comments on life cycle of some economically important insects.
8. Identification of museum specimens of some economically important fishes.
9. Studies on life cycle of birds
10. Preparation of field report based on the visit to a Wild Life Sanctuary/National Park/Zoo/Biosphere Reserve.
11. To determine the soil pH, conductivity, soil texture and water holding capacity of soil.
12. Studies on aquatic weeds

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN204-20	Core Practical/Laboratory	Ecosystem lab	0	0	4	60	40	100	2

1. Sampling techniques.
2. To determine basal cover of trees in a forest ecosystem/forest plantation.
3. Demonstration of water conservation techniques.
4. Field Ecology – Terrestrial and aquatic flora
5. To prepare a report on various types of local fresh water ecosystem.
6. Characterization and categorization of threatened species and habitat for biodiversity conservation in peri-urban forest ecosystem
7. Study of flora of an urban terrestrial ecosystem
8. Study of fauna of an urban terrestrial ecosystem
9. Identification and classification of phytoplankton's from water sample
10. Identification and classification of zooplankton's from water provided sample
11. Estimation of biomass from grassland by harvest method
12. To determine the importance value index (IVI) and species diversity index of grassland ecosystem

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BSEN205-20	Core Practical/Laboratory	Natural resources Management Lab	0	0	4	60	40	100	2

1. Vegetation analysis: Frequency, Abundance and Density, Cover and Basal area, Important and Value Index
2. Identification of rocks on the basis of physical characteristics
3. Physical and chemical properties of minerals
4. Visit to forest areas with different site conditions
5. Determination wind velocity by anemometer.
6. Identification of biological specimens and economical important.
7. Identification of fresh water microbes
8. Small projects/ models on wind energy
9. Monitoring of micro-meteorological parameters, maximum and minimum temperature, relative humidity
10. Preparation of wind rose diagram
11. Identification of coal fields - Economic aspects, availability of coal or Usage of topographic maps - to study about land forms
12. Small projects on Biogas

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
EVS102-18	Ability Enhancement Compulsory Course (AECC) -III	Environmental Science	2	0	0	40	60	100	2

Unit-1 Introduction to Environmental Studies Multidisciplinary nature of Environmental Studies: Scope & Importance, Need for Public Awareness

Unit-2 : Natural Resources :Renewable and non-renewable resources

Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.

Unit-3 : Ecosystems : Concept of an ecosystem, Structure and function of an ecosystem, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems: a. Forest ecosystem b. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit-4 : Biodiversity and its conservation : Introduction – Definition : genetic, species and ecosystem diversity, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India

Unit-5 : Social Issues and the Environment : From Unsustainable to Sustainable development, Resettlement and rehabilitation of people; its problems and concerns., Environmental ethics : Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, Nuclear accidents and holocaust, Case Studies, Public awareness.

Field Work

Visit to a National Park, Biosphere Reserve, Wildlife Sanctuary
Documentation & preparation of a Biodiversity (flora & fauna) register of campus/river/forest
Visit to a local polluted site: Urban/Rural/Industrial/Agricultural
Identification & Photography of resident or migratory birds, insects (butterflies)
Public hearing on environmental issues in a village

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References & Books

1. Bharucha, E. Text Book for Environmental Studies. University Grants Commission, New Delhi.
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
4. Fundamental concepts in Environmental Studies, D D Mishra, S Chand & Co Ltd
5. Environment Biology by Agarwal, K. C., Nidi Publ. Ltd. Bikaner.
6. Principle of Environment Science by Cunningham, W.P.
7. Essentials of Environment Science by Joseph.
8. Perspectives in Environmental Studies by Kaushik, A.
9. Elements of Environment Science & Engineering by Meenakshi.
10. Elements of Environment Engineering by Duggal.

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Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
BMPD202-18		Mentoring and Professional Development	0	0	1	25	--	25	1

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

Part – A (Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B (Outdoor Activities)

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1. Sports/NSS/NCC
2. Society Activities of various students chapter

Evaluation shall be based on rubrics for Part – A & B.

Mentors/Faculty in charges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.