Shaheed Bhagat Singh State University, Ferozepur

B. Sc. Environmental Sciences

For Batches 2022 & Onwards

Govt. of Punjab Act No. 10 of 2021 registered under UGC section u/s 2(f)

Scheme of Syllabi

First Semester

Total contact hours =34

Course Code	Course Type	Course Name	Load Allocations			Marks Distribution		Total marks	Credits
			L	T	P	Internal	External		
BSEN-101C	Core Theory	Elements of Ecology	3	1	0	40	60	100	4
BSEN-102C	Core Theory	Basics of Biostatistics	3	1	0	40	60	100	4
BSEN-103C	Core Theory	Environmental Chemistry	3	1	0	40	60	100	4
BSEN-104C	Core Practical/Laboratory	Ecology Lab	0	0	4	60	40	100	2
BSEN-105C	Core Practical/Laboratory	Environmental Chemistry Lab	0	0	4	60	40	100	2
BSEN-106C	Core Practical/Laboratory	Biostatistics Lab	0	0	4	60	40	100	2
BPHU-103C	Ability Enhancement Compulsory Course (AECC)-I	English	1	0	0	40	60	100	1
BPHU-104C	Ability Enhancement Compulsory Course (AECC)	English Practical/Laboratory	0	0	2	30	20	50	1
HVPE-101C	Ability Enhancement Compulsory Course (AECC)	Human Values, Deaddiction and Traffic Rules	3	0	0	40	60	100	3
HVPE-102C	Ability Enhancement Compulsory Course (AECC)	Human Values, Deaddiction and Traffic Rules (Lab/ Seminar)	0	0	2	25	--**	25	1
BSEN-BCI	Bridge Course	Bridge Course-I (Basic Sciences)	2	0	0	40	--**	Sat/Unsat	0
BMPD-101C		Mentoring and Professional Development	0	0	2	25	--**	25	1
	Total		**15**	**3**	**18**	**500**	**440**	**900**	**25**

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

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Second Semester

Total contact hours =26

Course Code	Course Type	Course Name	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BSEN-201C	Core Theory	Biodiversity components	3	1	0	40	60	100	4
BSEN-202C	Core Theory	Ecosystem Dynamics	3	1	0	40	60	100	4
BSEN-203C	Core Theory	Natural Resources and Management	3	1	0	40	60	100	4
BSEN-204C	Core Theory	Health & Hygiene	2	0	0	40	60	100	2
BSEN-205C	Core Practical /Laboratory	Ecosystem lab	0	0	3	60	40	100	1.5
BSEN-206C	Core Practical / Laboratory	Natural resources Management Lab	0	0	3	60	40	100	1.5
BSEN-207C	Core Practical /Laboratory	Biodiversity components lab	0	0	4	60	40	100	2
BSEN-BCII	Bridge Course	Bridge Course-II (Mathematics)	2	0	0	40	--**	Sat/Unsat	0
SBS101C	Humanities and Social Sciences including Management courses	Introduction to Shaheed Bhagat Singh and his Co-patriotes	1	0	0	Satisfactory/ Unsatisfactory			0
BMPD-201C		Mentoring and Professional Development	0	0	2	25	--**	25	1
	TOTAL		**14**	**3**	**12**	**405**	**360**	**725**	**20**

**The Bridge Course-II and Mentoring and Professional Development course will have internal evaluation only.

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Third Semester

Total contact hours =28

Course Code	Course Type	Course Name	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BSEN-301C	Core Theory	Renewable and Non Renewable Energy Resources	3	1	0	40	60	100	4
BSEN-302C	Core Theory	Solid Waste Management	3	1	0	40	60	100	4
BSEN-303C	Core Theory	Environmental Microbiology and Biochemistry	3	1	0	40	60	100	4
BSEN-304C	Core Practical /Laboratory	Energy Resources Lab	0	0	3	60	40	100	1.5
BSEN-305C	Core Practical /Laboratory	Solid Waste Management Lab	0	0	3	60	40	100	1.5
BSEN-306C	Core Practical /Laboratory	Microbiology and Biochemistry Lab	0	0	3	60	40	100	1.5
BSEN-307C	Skill Enhancement Course-I	Basics of Computer	2	0	0	40	60	100	2
BSEN-308C	Skill Enhancement Course-I /Laboratory	Computer Lab	0	0	3	30	20	50	1.5
BMPD-301C		Mentoring and Professional Development	0	0	2	25	--**	25	1
		TOTAL	**11**	**03**	**14**	**395**	**380**	**775**	**21**

** Mentoring and Professional Development course will have internal evaluation only.

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Fourth Semester

Total contact hours =29

Course Code	Course Type	Course Name	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BSEN-401C	Core Theory	Air Pollution	3	1	0	40	60	100	4
BSEN-402C	Core Theory	Water and Wastewater Conservation	3	1	0	40	60	100	4
BSEN-403C	Core Theory	Environmental Toxicology	3	1	0	40	60	100	4
BSEN-404C	Core Practical /Laboratory	Air Pollution Monitoring Lab	0	0	3	60	40	100	1.5
BSEN-405C	Core Practical /Laboratory	Water and Wastewater Monitoring Lab	0	0	3	60	40	100	1.5
BSEN-406C	Core Practical /Laboratory	Environmental Toxicology Lab	0	0	3	60	40	100	1.5
BSEN-407C	Skill Enhancement Course-II	Environmental Impact Assessment (EIA)	3	0	0	40	60	100	3
BSEN-408C	Skill Enhancement Course/Laboratory	Environmental Impact Assessment Lab	0	0	3	30	20	50	1.5
BMPD-401C		Mentoring and Professional Development	0	0	2	25	--**	25	1
		TOTAL	**12**	**03**	**14**	**395**	**380**	**775**	**22**

** Mentoring and Professional Development course will have internal evaluation only.

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Fifth Semester

Total contact hours =29

Course Code	Course Type	Course Name	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BSEN-501C	Skill Enhancement Course-II	Environmental Monitoring and Techniques	2	0	0	40	60	100	2
BSEN-502C	Skill Enhancement Course Laboratory	Instrumentation Techniques Lab	0	0	2	30	20	50	1
BXXX	Open Elective-I		3	0	0	40	60	100	3
BSEN-5XXC*	Elective-I	Elective-I	3	1	0	40	60	100	4
BSEN-5XXC**	Elective-II	Elective-II	3	1	0	40	60	100	4
BSEN-5XXC*	Elective-I Laboratory	Elective-I Lab	0	0	3	60	40	100	1.5
BSEN-5XXC**	Elective-II Laboratory	Elective-II Lab	0	0	3	60	40	100	1.5
BSEN-503C	Project	Minor Project & Seminar	0	0	6	60	40	100	3
BMPD-501C		Mentoring and Professional Development	0	0	2	25	--**	25	1
		TOTAL	**11**	**02**	**16**	**395**	**380**	**775**	**21**

** Mentoring and Professional Development course will have internal evaluation only.

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Sixth Semester

Total contact hours =31

Course Code	Course Type	Course Name	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BSEN-601C	Skill Enhancement Course-IV	Eco- restoration and Development	2	0	0	40	60	100	2
BSEN-602C	Skill Enhancement Course Laboratory	Environmental Biotechnology Techniques Lab	0	0	2	30	20	50	1
BXXX	Open Elective-II	----------	3	0	0	40	60	100	3
BSEN-6XXC[#]	Elective-III	Elective-III	3	0	0	40	60	100	3
BSEN-6XXC[##]	Elective-IV	Elective-IV	3	0	0	40	60	100	3
BSEN-6XXC[#]	Elective-III Laboratory	Elective-III Lab	0	0	3	60	40	100	1.5
BSEN-6XXC[##]	Elective-IV Laboratory	Elective-IV Lab	0	0	3	60	40	100	1.5
BSEN-603C	Project	Major Project	0	0	10	60	40	100	5
BMPD-601C		Mentoring and Professional Development	0	0	2	25	--**	25	1
	TOTAL		**11**	**0**	**20**	**395**	**380**	**775**	**21**

** Mentoring and Professional Development course will have internal evaluation only.

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List of Electives

The Elective Lab course will be selected based upon the elective theory subject being studied.

***List of Elective-I**

BSEN-511C Sustainable Development Goals (SDG's)

BSEN-512C Environmental Ethics and Human Values

BSEN-513C Hazards and Risk Assessment

***List of Elective-I Labs**

BSEN-517C Sustainable Development Goals (SDG's) Lab

BSEN-518C Environmental Ethics report writing

BSEN-519C Hazards and Risk Assessment Lab

****List of Elective-II**

BSEN-514C Agriculture and Environment

BSEN-515C Climatology

BSEN-516C Environment and Society

****List of Elective-II Labs**

BSEN-520C Agriculture and Environment Lab

BSEN-521C Climatology Lab

BSEN-522C Environment and Society Lab

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#List of Elective –III

BSEN-611C Environmental Management System

BSEN-612 C Environmental Law

BSEN-613 C Urban Ecosystem

BSEN-614 C Disaster Management

##List of Elective –III Labs

BSEN-618 C Environmental Management Lab

BSEN-619 C Environmental Law Report Writing

BSEN-620 C Urban Ecosystem Lab

BSEN-621 C Disaster Management Lab

#List of Elective -IV

BSEN-615 C Remote Sensing and GIS

BSEN-616 C Environmental Geology

BSEN-617 C Water Resources Management

##List of Elective –IV Labs

BSEN-622 C Remote sensing and GIS Lab

BSEN-623 C Environmental Geology Lab

BSEN-624 C Water Resources Management Lab

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Syllabi (1st Semester)

BSEN101C Elements of Ecology

External Marks: 60	**L T P**
Internal Marks: 40	**3 1 0**
Total Marks: 100	

Unit-I:

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-II:

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-III:

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-IV:

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-V

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. Newyork
3. Charles Krebs (2013), Ecology: Pearson New International Edition (6th Edin),
4. Michael Begon, Colin R. Townsend and John L. Harper (2006), Ecology: From Individuals to Ecosystems (4th Edition), John Wiley & Sons, New Jerssy.
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-Dombols, D. and Ellenberg, H. (1974). Aims and Methods of Vegetation Ecology,Wiley, New York.

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BSEN102C Basic of Biostatistics

External Marks: 60	**L T P**
Internal Marks: 40	**3 1 0**
Total Marks: 100	

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, Karl Pearson'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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BSEN103C Environmental Chemistry

External Marks: 60	**L T P**
Internal Marks: 40	**3 1 0**
Total Marks: 100	

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, CO_2 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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BSEN104C Ecology Lab

External Marks: 40	**L T P**
Internal Marks: 60	**0 0 4**
Total Marks: 100	

List of Experiments:

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 quardrat 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. Case studies of visit to specific ecosystems and identifying the characteristics.

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BSEN105C Environmental Chemistry Lab

External Marks: 40	**L T P**
Internal Marks: 60	**0 0 4**
Total Marks: 100	

List of Experiments:

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.

BSEN106C Biostatistics Lab

External Marks: 40	**L T P**
Internal Marks: 60	**0 0 4**
Total Marks: 100	

List of Experiments:

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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BPHU103C English

	L	T	P
External Marks: 60			
Internal Marks: 40	**1**	**0**	**0**
Total Marks: 100			

Unit1- 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

References:

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, Dr. Ranjana Kaul, Dr.Brati Biswas
5. On Writing Well. William Zinsser. Harper Resource Book. 2001
6. Study Writing. Liz Hamp-Lyons and Ben Heasly.Cambridge University Press. 2006.

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BPHU104C English Practical/Laboratory

	L	T	P
External Marks: 30			
Internal Marks: 20	**0**	**0**	**2**
Total Marks: 50			

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

References:

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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HVPE101C Human Values, Deaddiction and Traffic Rules

External Marks: 60	**L T P**
Internal Marks: 40	**3 0 0**
Total Marks: 100	

Unit-I 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 fulfilment 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-II 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-III 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
5. Understanding the harmony in the society (society being an extension of family): samadhan, Samridhi, Abhay, Sah-astitvaas 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-IV Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

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

Unit-V 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:
   - Ability to utilize the professional competence for augmenting universal human order
   - Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems
   - Ability to identify and develop appropriate technologies and management patterns for above production systems.
   - Case studies of typical holistic technologies, management models and production systems
   - Strategy for transition from the present state to Universal Human Order:
     (i) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
     (ii)At the level of society: as mutually enriching institutions and organizations

References:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Value Education.
2. Ivan Illich, 1974, Energy & Equity,The Trinity Press, Worcester, and Harper Collins, USA.
3. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
4. A Nagraj, 1998, JeevanVidyaekParichay,Divya Path Sansthan, Amarkantak.
5. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991.
6. PL Dhar, RR Gaur, 1990, Science and Humanism, Common wealth Publishers.
7. A.N. Tripathy, 2003, Human Values,New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
9. 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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HVPE102C Human Values, De-addiction and Traffic Rules (Lab/ Seminar)

	L	T	P
External Marks: -			
Internal Marks: 25	**0**	**0**	**2**
Total Marks: 25			

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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BMPD101C Mentoring and Professional Development

	L	T	P
External Marks: -			
Internal Marks: 25	**0**	**0**	**2**
Total Marks: 25			

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 a proper record student wise of each activity conducted and the same shall be submitted to the department

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(2nd Semester)

BSEN201C Biodiversity Components

External Marks: 60 **L T P**
Internal Marks: 40 **3 1 0**
Total Marks: 100

Unit-I:

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-II:

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-III

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-IV:

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-V

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 IndiaConservation and Utilization, National Bureau of Plant Genetic Resources, New Delhi.
2. Zachos, Frank E.; Habel, Jan Christian (2011) Biodiversity Hotspots, Distribution and Protection ofConservation 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 ofForestry, 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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BSEN202C Ecosystem Dynamics

External Marks: 60 **L T P**
Internal Marks: 40 **3 1 0**
Total Marks: 100

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

Unit-II:
Function of ecology- material and Energy flow in ecological systems, energy efficiencies, Concept ecologicalpathways, conservation of matter.

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

Unit-IV:
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-V:
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. in.
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 EasternLimited, 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. JohnWiley and Sons Inc.

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BSEN203C Natural Resources and Management

External Marks: 60 **L T P**
Internal Marks: 40 **3 1 0**
Total Marks: 100

Unit –I:

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 –II:

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 –III:

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 conservationstrategies

Unit –IV:

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 –V:

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 andBiological Resources Wm C Brown Publishers London
4. Tyler Miller Jr. G. 2005. Living in the Environment. Wadsworth Publishing Company, Belmont California.
5. Shastri M.N.1995, Energy Options: Himalaya Publishing House, New Delhi.
6. Dhaliwal G.S., Sangha G.S. and Ralhan P.K. 2000, Fundamentals of Environmental Science, KalyaniPublishers, New Delhi.

7. Singh J.S., Singh S.P. and Gupta S.R., 2006, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.

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BSEN204C Health and Hygiene

External Marks: 60 **L T P**
Internal Marks: 40 **2 0 0**
Total Marks: 100

Unit –I

Health and hygiene, personal health, domestic hygiene, clean food and water, cooking with care, food hygiene and kitchen safety nutrients, malnutrition and processed food, food preservation and its impact, abstaining from habit forming substances, exercise, regular sleep and relaxation; Student generated questions.

Unit –II

Community health national programmes on community health, health education; Environmental hygiene, environmental pollution

Unit –III

Disease communicable and non-communicable diseases, epidemics, endemics communicable diseases spreading (direct and indirect); Measures to prevent diseases, protection from communicable diseases by immunization, innate immunity, acquired immunity; Think-pair share method

Unit –IV

First aid, bleeding, nose bleed, fainting, dehydration, animal bite burns; Occupational health; Recycling and reusing the biodegradables and dry waste; Case study.

References:

1. Disque, K. (2020), CPR, AED and First Aid Provider Handbook, Satori Continuum Publishing, USA.
2. Yadav, H., Chong, M., Lan, S. (2019), Community Health Nursing. Second Edition, Oxford University Press.
3. Indian First Aid Manual (2016) (7th edition), St. John Ambulance Association (India) – Indian Red Cross Society. Available online https://www.indianredcross.org/publications/FA-manual.pdf
4. WHO Guidelines on Hand Hygiene in Health Care (2009), World Health Organization.
5. Tillman, C. (2007), Principles of occupational health and hygiene: an introduction. Allen & Unwin, Australia.

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BSEN205C Ecosystem lab

External Marks: 40 **L T P**
Internal Marks: 60 **0 0 3**
Total Marks: 100

List of Experiments:

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-urbanforest 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 sample of water provided.
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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BSEN206C Natural Resources Management Lab

External Marks: 40 **L T P**
Internal Marks: 60 **0 0 3**
Total Marks: 100

List of Experiments:

1. Vegetation analysis: Frequency, Abundance and Density, Cover and Basal area, Important and ValueIndex
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 - tostudy about land forms
12. Small projects on Biogas

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BSEN207C Biodiversity Components lab

External Marks: 40 **L T P**
Internal Marks: 60 **0 0 4**
Total Marks: 100

List of Experiments:

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. Studies on aquatic weeds

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BMPD201C Mentoring and Professional Development

External Marks: -- **L T P**
Internal Marks: 25 **0 0 2**
Total Marks: 25

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

1. Overall Personality
2. Aptitude (Technical and General)
3. General Awareness (Current Affairs and GK)
4. Communication Skills
5. Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving theabove, 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
3. Evaluation shall be based on rubrics for Part – A & B.

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

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Syllabi (3rd Semester)

BSEN-301C Renewable and Non- Renewable Energy Resources

External Marks: 60	**L T P**
Internal Marks: 40	**3 1 0**
Total Marks: 100	

Unit 1: Introduction

Introduction to energy sources, Energy scenario in world and India, potential and perspectives of various energy sources in India, classification of energy resources-conventional and non-conventional, renewable and non- renewable, environmental implications of energy resources

Unit 2: Conventional energy

Fossil fuels (Coal, petroleum, LPG and natural gas) – origin, composition and physico-chemical characteristics and energy content, sources properties and production process; nuclear energy–fission and fusion, technologies–nuclear enrichment, nuclear reactors, nuclear waste disposal, policies and regulations.

Unit 3: Non-Conventional energy

Prospects of renewable non-conventional energy, Types-solar energy, wind energy, hydel, tidal and geothermal energy, OTEC: introduction, principle, generation. Solar collectors, applications of solar energy: Solar water heating, solar heating and cooling of buildings, solarphotovoltaic, solar distillation, solar cooking and solar ponds.

Unit 4: Geothermal Energy

Resources of geothermal energy, thermodynamics of geo-thermal energy conversion, electrical conversion, non-electrical conversion, environmental considerations

Unit 5: Wind Energy

Basic components of wind energy conversion system, types and applications of wind energy, Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversions systems

Unit 6: Bioenergy

Biomass energy as an energy source, characteristics of biomass, Energy plantations, Biomass conversion technologies. Types of biofuels–Biodiesel, bioethanol, biogas, biohydrogen– importance, production, technologies and applications

References:

1. Raja et al, Introduction to Non-Conventional Energy Resources. Scitech publications.
2. Twideu John and Weir Tony, Renewal Energy Resources, BSP Publications, 2006.
3. Rao M. V. R. Koteswara, Energy Resources: Conventional & Non-Conventional, BSP

Publications, 2006.

4. Chauhan D. S., Non-conventional Energy Resources, New Age International.
5. Solanki C. S., Renewal Energy Technologies: A Practical Guide for Beginners, PHI Learning.
6. Peter Auer, Advances in Energy System and Technology. Vol. 1 & II Edited by Academic Press.
7. Godfrey Boyle, Renewable Energy Power for a Sustainable Future, Oxford University Press.
8. Rao S. and Parulekar B. B., Energy Technology-Non-conventional, Renewable and Conventional Khanna Publishers (2000).
9. Gupta O. P., Elements of Fuel, Furnaces and Refractories, Khanna Publishers (1996).

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BSEN-302C Solid Waste Management

External Marks: 60	**L**	**T**	**P**
Internal Marks: 40	**3**	**1**	**0**
Total Marks: 100			

Unit I: Ecology and Environment

Principles of ecology and of ecosystem process, description, and measurement, with emphasis on ecosystem health assessment, Sources of Solid Wastes.

Unit II: Municipal solid waste

Definition - Sources and types of solid waste- composition and its determinants of Solid waste- factors influencing generation-quantity assessment of solid wastes-methods of sampling and characterization.

Unit III: Collection and Transfer Collection

Collection of Solid waste, collection services, collection system equipments, time and frequency of collection, factors affecting collection, analysis of collection system, collection routes, preparation of master schedules, Transfer and Transport: Need for transfer operation, transfer stations types, transport means and methods, location of transport stations.

Unit IV: Processing Techniques

Processing techniques purposes mechanical volume reduction, necessary equipment's, chemical volume reduction, incinerators, mechanical size reduction selection of equipment's, components separation methods, drying and dewatering, energy recovery, recoverable materials, sanitary landfill- methods of operation, advantages and disadvantages of sanitary land fill, site selection, reactions accruing in completed landfills, gas and leachate movement and control, Composting, Vermi-composting, e-Waste management techniques.

Unit V: Solid Waste Management Legislation

Municipal Solid Waste (Management and Handling) Rules, 2000, 2015, Hospital waste management, Biomedical Waste (Management and Handling) Rules, 1988; Fly ash management, Fly ash Management Rules, (1999), recycled plastic usage rules, batteries (management and handling) rules.

Reference Books

1. George Techobanoglous et al, Integrated Solid Waste Management McGraw Hill, 1993.
2. Techobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management, McGraw Hill 1997.
3. Landrefh R. E. and Rebers P. A., Municipal Solid Wastes - Problems & Solutions, Lewis, 1997.
4. Manual on Municipal 1 Solid waste Management, CPHEEO, Ministry of Urban Development, Govt. of India, New Delhi, 2000.
5. Blide A. D. & Sundaresan B.B, Solid Waste Management in Developing Countries, INSDOC, 1993.
6. Fourie Claude, Ferra Christian, Medori Paul, Devaux Tean, Ecology Science and Practice;

Oxford and IBH Publishing Co (Pvt) Ltd, Special Indian Edition.

7. Verma P. S., Agarwal V. K., Principles of Ecology, S. Chand & Company (Pvt) Ltd 1989.

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BSEN-303C Environmental Microbiology and Biochemistry

External Marks: 60	**L**	**T**	**P**
Internal Marks: 40	**3**	**1**	**0**
Total Marks: 100			

Unit 1 Basic Microbiology

The Characterization, Classification, and Identification of Microorganisms, The Morphology and Fine Structure of Bacteria, Cultivation of Bacteria, Microbial growth (physical characters - gaseous atmosphere, pH, other conditions and nutrition- nutritional classification. Culture media: components of media, natural and synthetic media, chemically defined media, complex media, selective, differential and enrichment media, Control of Microorganisms by Physical, chemical and chemotherapeutic Agents.

Unit II Environmental Microbiology

Basic concepts in Soil, air and water Microbiology, Principle and types of bioremediation. Overview on the microbial bioremediation of inorganic (metals) matter and biodegradation of common organic pollutants (pesticides, hydrocarbons, and, biosurfactants). Role of microbiology in Secondary tertiary sewage treatment techniques: oxidation ponds, Activated sludge process and septic tank, trickling filters etc.

Unit III Carbohydrates

Classification and structure of carbohydrates and their metabolism (Carbohydrate breakdown pathways), Classification of lipids, structure, function and their metabolism.

Unit IV Amino Acids and Proteins

Structure, function and classification of amino acids and proteins: peptide bond, primary, secondary (Ramachandran plot), tertiary and quaternary structure of proteins. Structure and function of nucleic acids, their biosynthesis and breakdown.

Unit V Lipids

Structural aspects – General introduction, Classification & Structure of Simple & Compound lipids, Properties of Lipid aggregates (elementary idea), Biological membrane, membrane protein – structural aspects, Lipoproteins (elementary idea). Structures and roles of Fatty acids & Glycerols, beta oxidation of saturated fatty acids, oxidation of unsaturated fatty acids, oxidation of odd chain fatty acids, energy yield, Ketone bodies.

Unit VI Nucleic acids

Structure and functions: Physical & chemical properties of Nucleic acids, Nucleosides & Nucleotides, purines & pyrimidines, Biologically important nucleotides, Double helical model of DNA structure and forces responsible for A, B & Z – DNA, denaturation and renaturation of DNA, Biosynthesis of purine & pyrimidine (de novo & salvage pathway); degradation of purine & pyrimidine.

References:

1 Pelczar J Michael E.C.S Chan, (2019). Microbiology. 2019. Mc Graw Hill, USA.

2 Nelson David L., Michael Cox, (2017). Lehninger principles of Biochemistry, 8th edition Macmillan learning, USA.

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BSEN-304C Energy Resources Lab

	L	T	P
External Marks: 40			
Internal Marks: 60	**0**	**0**	**3**
Total Marks: 100			

List of Experiments:

1. To estimate the calorific value of a solid fuel sample using bomb calorimeter.
2. To study the constructional details of a box type solar cooker.
3. Preparation of briquettes from biomass.
4. To study the production process of biodiesel.
5. Study of a biogas plants.
6. Study of a solar photovoltaic system.
7. Study of Horizontal Wind Mill.
8. Case study of a geothermal energy.
9. Study of Solar Distillation or Solar Still.
10. Study of Solar Radiation using a Pyranometer.

BSEN-305C Solid Waste Management Lab

External Marks: 40	**L T P**
Internal Marks: 60	**0 0 3**
Total Marks: 100	

List of Experiments:

1. Segregation of different types of solid waste.
2. To determine the composition of different types of solid waste.
3. Filling various forms related to disposal of solid waste.
4. Determination of pH of Municipal Solid Waste (MSW).
5. Identification of toxic/ non-toxic compound of e-wastes.
6. Identification of single use plastic items used in the campus.
7. Per capita quantification of domestic waste on weekly basis
8. Determination of Total Dissolved Solids (TDS), Fixed Solids, Volatile Solids and Total Solids (TS)
9. Lab scale study on vermicomposting/composting
10. Lab scale study of aerobic / anaerobic digesting of solid wastes (Both industrial & Municipal)
11. Visit to the Hazardous/ Municipal waste generation or disposal site.
12. Demonstration of working of incinerators
13. Visit to an effluent treatment plant (ETP)
14. Preparation of project report based on a case study of any campus: Study of the source, generation rates and characteristics of wastes and their handling, treatment, and disposal.

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BSEN-306C Microbiology and Biochemistry Lab

External Marks: 40	**L T P**
Internal Marks: 60	**0 0 3**
Total Marks: 100	

List of Experiments:

1. Microbiology Good Laboratory Practices (GLP) and Biosafety.
2. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology laboratory.
3. Preparation of culture media for bacterial cultivation; synthetic media, Complex media, Nutrient agar, MacConkey agar.
4. Determination of Most Probable Number (MPN) of microbes.
5. Isolation of pure cultures of bacteria by streaking method.
6. Estimation of CFU count by spread plate method/pour plate method.
7. Motility by hanging drop method.
8. Qualitative/Quantitative tests for carbohydrates, reducing sugars, non-reducing sugars.
9. Qualitative/Quantitative tests for lipids and proteins
10. Sterilization of water using boiling, autoclave and UV method.
11. Simple staining, negative, Gram staining.

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BSEN-307C Basics of Computers

External Marks: 60 **L T P**

Internal Marks: 40 **2 0 0**

Total Marks: 100

Unit-I Human Computer Interface

Concepts of Hardware and Software; Data and Information. Functional Units of Computer System: CPU, registers, system bus, main memory unit, cache memory, Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors. Devices: Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter. Memory: Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks. Data Representation: Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication).

Unit-II Concept of Computing

Types of Languages: Machine, assembly and High level Language; Operating system as user interface, utility programs. Word processing: Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.

Unit-III Spreadsheet

Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs. Presentation Graphics Software: Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.

References::

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
2. Goel A., Computer Fundamentals, 2010, Pearson Education.
3. Sinha P. K. & Sinha P., Fundamentals of Computers, 2007, BPB Publishers.IT Tools, R.K. Jain, Khanna Publishing House
4. Jain Satish, Rai Ambrish & Singh Shashi, Introduction to Information Technology, Paperback Edition, BPB Publications, 2014.
5. Introduction to Computers, Peter Norton
6. Sanders D. H., Computers Today, McGraw Hill.
7. Long Larry & Long Nancy, Computers, Twelfth edition, Prentice Hall of India.

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BSEN-308C Computer Lab

External Marks: 20	**L T P**
Internal Marks: 30	**0 0 3**
Total Marks: 50	

Word Orientation: The instructor needs to give an overview of word processor.
Details of the four tasks and features that would be covered Using word – Accessing, overview of toolbars,saving files, Using help and resources, rulers, format painter.

I. **Using word to create Resume Features to be covered:**

1. Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word.
2. Creating an Assignment Features to be covered: - Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
3. Creating a Newsletter Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs
4. Creating a Feedback form Features to be covered:- Forms, Text Fields, Inserting objects, Mail Merge in Word.

II. **Excel Orientation:** Excel – a Spreadsheet tool- Accessing, overview of toolbars, saving excel files.

1. Creating a Scheduler Features to be covered**:** Gridlines, Format Cells, Summation, auto fill, Formatting Text.
2. Calculations Features to be covered **:-** Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP
3. Game (like Cricket, badminton) Score Card Features to be covered :- Pivot Tables, Interactive Buttons, Importing Data, Data Protection, Data Validation Presentation Orientation:

III. **Power-point Presentation:**

1. Basic power point utilities and tools which help them create basic power point presentation: PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows
2. Making Power-point presentations interactive:
   Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts
3. Best practices in designing and preparing power point presentation:

Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc.), Inserting – Background, textures, Design Templates, Hidden slides. Auto content wizard, Slide Transition, Custom Animation, Auto Rehearsing

References:

1. Jain R.K., IT Tools, Khanna Publishing House.
2. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
3. Turban, Rainer and Potter, Introduction to information technology, John Wiley and Sons
4. Joseph Brady & Ellen F Monk, Problem Solving Cases in Microsoft Excel, Thomson Learning

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BMPD-301-C Mentoring and Professional Development

	L	T	P
External Marks: --			
Internal Marks: 25	**0**	**0**	**2**
Total Marks: 25			

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 and B Mentors/Faculty incharges shall maintain a proper student-wise record of each activity conducted and the same shall be submitted to the department.

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Syllabi (4th Semester)

BSEN-401C Air Pollution

External Marks: 60	**L T P**
Internal Marks: 40	**3 1 0**
Total Marks: 100	

Unit 1: Historical overview of air pollution (London Smog), composition and structure of atmosphere, units of measurements. Sources and classification of pollutants, physical characterization of particulates, settling and optical properties. Effect of particulate matter on human health, detection and analysis of particulate matter ($PM_{2.5}$ and PM_{10}), SO_2, NOx and Ozone. National Ambient Air Quality Standards (NAAQS), Bharat Stage Emission standards

Unit 2: Scale of meteorology, tropospheric heating processes, pressure, temperature, precipitation, humidity. Lapse rate and atmospheric stability, inversion, and mixing height, wind rose, effective stack height

Unit 3: Approaches to contaminant control: Dilution and control at source. Control devices for particulate matter: Principle and design of gravitational settler, centrifugal collector, wet collector, fabric filters and electrostatic precipitator; Control of gaseous contaminants through adsorption, absorption, condensation and combustion including catalytic combustion. Stack sampling (with special emphasis on isokinetic sampling) and analysis of temperature, flow velocity, composition

Unit 4: Air quality management concepts: Emission factors and emission inventories, Air Quality Index (AQI); Concept of Aerosol Optical Depth (AOD), Fetching of gridded AOD data from satellite; Fire Information for Resource Management System (FIRMS), Role of planet boundary layer in pollution and visibility; HYSPLIT model for air mass trajectory; Control of air pollution by process change

References Books:

1. Cooper, C.D. and Alley, F.C. (2010). Air Pollution Control: A Design Approach. Waveland Press
2. Fire Information for Resource Management System (FIRMS) available at https://earthdata.nasa.gov
3. Nevers, N.D. (2017). Air Pollution Control Engineering McGraw-Hill, New York.
4. NOAA-Air Resource Laboratory for HYSPLIT Trajectory Model available at https://www.ready.noaa.gov/HYSPLIT.php
5. Peavy, H.S., Rowe, D.R. and Tchobanoglous, G. (2017). Environmental Engineering: McGraw-Hill, Singapore.
6. Rao, C.S. (2018). Environmental pollution control engineering. New Age International
7. Rao, M.N. and Rao, H.V.N. (2017). Air Pollution, Tata McGraw, New Delhi.
8. Stern, A.C. and Boubel, A. (2000). Fundamentals of Air Pollution 3/e, Academic Press, New York

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BSEN-402C Water and Wastewater Conservation

External Marks: 60 **L T P**

Internal Marks: 40 **3 1 0**

Total Marks: 100

Unit 1: **Hydrology**: Sources of water and its characteristics, Distribution of water on Earth. Physical and Chemical properties of Water, Various types of water demands, per capita demand water quality standards for various uses. Water Pollution, Water quality standards for various uses, parameters, sources and types of Pollution

Unit 2: **Ground water Hydrology**: Occurrence of groundwater, Ground water zones, and Groundwater System; Porosity, permeability and types of Aquifers; The Water Table, ground water flow, functions and Topography, Ground water depletion, Ground water Quality, Ground water pollution.

Unit 3: **Water purification-Screening:** Treatment system- sedimentation, coagulation, filtration – rapid sand filter, slow sand filter, advantages and disadvantages. Disinfections – Methods of disinfections water softening process; Taste and odor removal (Aeration).

Unit 4: **Wastewater treatment:** Characteristics of wastewater, Screening & Grit chambers sedimentation and flocculation, overview to secondary treatment.

Unit 5: **Water Conservation:** Watershed and drainage basins; importance of watershed and watershed management; rain water harvesting in urban settings. Water resources and conflicts on its sharing, case studies on river water disputes between Punjab, Haryana and Rajasthan; Multipurpose river valley projects in India and their environmental and social impacts; water logging: causes, effects and remedial measures, case studies of dams - Narmada and Tehri dam issues

References:

1. Water and waste water Engineering, Vol.I and II, Fair, G.M. Geyer T.C. and Okun. D.A. (1984): John Wiley and Sons, Strauss, (1975) & (19840
2. Waste water treatment processes, Metcalf and Eddy Inc. Academic Press, New York (1979)
3. Standard Methods for Examination of Water and Waste Water
4. Waste Water Engineering, Metcalf and Eddy Tata Mc Graw Hill, Physico – Chemical Process for Water quality, Weber. W.J, Ann Arbor. and company, NewDelhi (1974)
5. Water and waste Engineering, Vol.I and II, Fair, G.M. Geyer T.C. and Okun. D.A. (1984): John Wiley and Sons, Strauss, (1975) & (1984)
6. Waste water treatment processes, Metcalf and Eddy Inc. Academic Press, New York. (1979)
7. Standard Methods for Examination of Water and Waste Water American Public Health Association (5th Ed) (1980)
8. Waste Water Engineering, Metcalf and Eddy Tata Mc Graw Hill,Physico – Chemical Process for Water quality, Weber. W.J, Ann Arbor

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BSEN-403C Environmental Toxicology

External Marks: 60 **L T P**

Internal Marks: 40 **3 1 0**

Total Marks: 100

Unit 1: Introduction to Environmental Toxicology

Definition, concept and scope of Environmental Toxicology; Common environmental toxicants Heavy metals: Sources and their effects on life and environment Pesticides: Types, uses and harmful effect of pesticides; brief note on biopesticides , persistant organic pesticides; Mutagenic and carcinogenic chemicals, polyaromatic hydrocarbons, nitrosamines, organic solvents, alcohol, carbon tetrachloride, anaesthetic (chloroform, ether, xylocaine) tobacco chewing and smoking

Unit 2: Toxicity Assessment

In-vivo and in-vitro toxicity assessment; Accute, subacute, sub chronic and chronic toxicity test; Skin and eye test, behavioural, neurotoxic, reproductive,mutagenic test, hypersensitivity and allergy; LD_{50}, LC_{50}, EC_{50}, and IC_{50} ; Factors affecting toxicity

Unit 3: Systemic Toxicity

Absorption, translocation and excretion Xenobiotics:Membrane permeability and mechanism of chemical transfer, Absorption of xenobiotics, distribution of toxicants, storage depots, translocation of xenobiotics, membrane barriers, excretion of xenobiotics (major detoxifying glands) Neuro toxicity, hepatotoxicity, immunotoxicity, cardio- vascular toxicity, respiratory disfunction and hypersensitivity

Unit 4: Biotransformtion, Bioaccumulation and Biomagnification

Bio transformation: Principle, sites, biotransformation enzymes, biotransformation for gaseous toxicants Bioaccumulation; Principle, sub-lethal and indirect effects of bioaccumulation; Biomagnification, bioconcentration; Bioremediation

Unit 5: Environmental Health and Risk Assessment

Risk assessment; Risk assessment models; Risk assessment methods; Risk Management

References:

1. Principles of Environmental Toxicology: I. C. Shaw and J. Chadwick; Taylor & Francis ltd
2. Basic Environmental Health (2001): AnnaleeYassi, TordKjellstom, Theo de Kok, TeeGuidotti
3. Environmental Health : Monroe T. Morgan
4. Handbook of Environmental Health and Safety – principle and practices : H. Koren;Lewis Publishers
5. Moore, G.S., 2002, Living with the Earth: concepts in Environmental Health Science (2nd Ed.), Lewis publishers, Michigan
6. Walker, C.H., Hopkin, S.P., Sibly, R.M., and Peakall, D.B. 2001. Principles ofEcotoxicology. 2 nd Ed. Taylor & Francis, London.
7. Environmental biology and Toxicology, by Sharma P.D. Rastogi and Lamporary

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BSEN-404C Air Pollution Monitoring Lab

	L	T	P
External Marks: 40			
Internal Marks: 60	**0**	**0**	**3**
Total Marks: 100			

List of Experiments:

1. Monitoring of PM_{10} and PM2.5
2. Determination of CO_2 emission at different places
3. Determination of SOx and NOx in ambient air
4. Analysis of Particulate matter and gaseous pollutants using a High volume sampler
5. Study of Plume behaviour
6. Study of electrostatic precipitators, Gravitational settler
7. Calibration of flow meters for high volume sampler
8. Sampling and analysis of Benzene in ambient air
9. Sampling and analysis of SPM in stationary sources.
10. Study of efficiency of filter media for particulate matter.

References:

1. W.H.O.: Selected Methods of Measuring Air Pollutants.
2. Pandey and Carney: Environmental Engineering
3. Standard Methods for Examination of Water and Waste Water American Public Health Association (5^{th} Ed) (1980)

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BSEN-405C Water and Wastewater Monitoring Lab

	L	T	P
External Marks: 40			
Internal Marks: 60	**0**	**0**	**3**
Total Marks: 100			

List of Experiments:

1. Determination of pH, TDS and Chloride content of Water
2. Determination of DO in water and wastewater samples
3. Determination of turbidity in water and wastewater samples
4. Determination of BOD
5. Determination of COD
6. Determination of porosity and permeability of different soils.
7. Determination of infiltration and runoff characteristics.
8. Determination of nitrite content of water samples
9. Determination of phosphate content of water samples
10. Visit to water & wastewater treatment plants

Reference Books:

1. Standard Methods for Examination of Water and Waste WaterAmerican Public Health Association (5th Ed) (1980)
2. Physico – Chemical Process for Water quality, Weber. W.J, AnnArbor. and company, New Delhi (1974)
3. Standard Methods for Examination of Water and Waste WaterAmerican Public Health Association (5th Ed) (1980)
4. Waste Water Engineering, Metcalf and Eddy Tata Mc Graw Hill,Physico – Chemical Process for Water quality, Weber. W.J, Ann Arbor

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BSEN–406C Environmental Toxicology Lab

	L	T	P
External Marks: 40			
Internal Marks: 60	**0**	**0**	**3**
Total Marks: 100			

List of Experiments:

1. Assessment of toxicity on an organism (fish or tadpole) through dose response relation (LC50/LC50)
2. Bioremediation experiment with the help of water hyacinth
3. Assessment of impact of high temperature on organisms (control experiment)
4. Study of risk assessment model through flow chart
5. Case study of bio magnification in any food chain
6. Quantitative analysis of heavy metals in environmental samples. Lead, Cadmium,Mercury, Chromium and Arsenic in air, water and soil samples

References:

1. Newman, M.C. (2012) Quantitative Ecotoxicology, Second Edition, CRC Press, New York.
2. Newman, M.C. (2009) Fundamentals of Ecotoxicology, Third Edition, CRC Press, USA.
3. Johnson, E (2010) Ecotoxicology, Academic Press, New York.
4. Walker, C.H., Sibly, R.M., Hopkin, S. P., Peakall, D.B. (2012). Principles of Ecotoxicology, Fourth Edition, CRC Press.
5. Calow, P.P. (2009). Handbook of Ecotoxicology, Wiley, USA.
6. Thompson, K.C., Wadhia, K., Loibner, A.P. (2005). Environmental Toxicity Testing, Taylor & Francis, UK.

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BSEN-407C Environmental Impact Assessment (EIA)

	L	T	P
External Marks: 60			
Internal Marks: 40	**3**	**0**	**0**
Total Marks: 100			

Unit 1: Environmental Impact Assessment (EIA)

Concept, scope and objectives of EIA; Evolution of EIA and its development; Developmental projects under EIA; Protocol for environmental impact statement (EIS); EIA Laws and Policy: An overview; EIA guidelines 1994: Notifications of Government of India; EIA Notification 2006 and subsequent modifications

Unit 2: Methods of Impact Analysis

Procedure of EIA; Screening, scoping and baseline data collection for EIA; Impact prediction on air, water, land, biota, socio-economic environment; Impact assessment methodologies (Ad-hoc, Simple Checklist, Overlays, Matrices, Network, Combination Computer aided); Concept of Cumulative Environmental Impact Assessment (CEIA); Case studies of EIA: River valley projects, mining, road construction, industries

Unit 3: Statuary Clearance Procedure and Public Consultation

Expert Appraisal Committee (EAC); Environmental Clearance, Wildlife Clearance and Forest Clearance; Permission for carrying out survey and investigation; State Expert Appraisal Committee (SEAC) and State EIA Authority (SEIAA); Concept and objectives of Public Consultation; Techniques and consultation approach for public Consultation

References:

1. EIA manual. Ministry of Environment and Forests, Government of India (http://www.envfor.nic.in/legis/eia/so195.pdf).
2. EIA notification, Gazette Notification: SO1533dated14-09-2006, MOEF. GOI (2006).
3. MunnRE, Environmental Impact Assessment -Principles and Procedures, Scientific Committee on Problems of the Environment (SCOPE)-5 (1979).
4. Petts J, Handbook of Environmental Impact Assessment, Taylor & Francis (1995).

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BSEN-408C Environment Impact Assessment Lab

	L	T	P
External Marks: 20			
Internal Marks: 30	**0**	**0**	**3**
Total Marks: 50			

List of Experiments:

1. Presentation of EIA through flowchart
2. Presentation of case study of EIA of any developmental project
3. Presentation of procedure of environmental auditing through flow chart
4. To prepare an audit report for submission to the regulatory body
5. Presentation of environmental clearance (EC) through flow chart
6. Presentation of forest clearance (FC) through flow chart
7. Presentation of wildlife clearance (WC) through flow chart

References:

1. Anjaneyulu, Y.(2002),Environmental Impact Assessment Methodologies.BSP BS Publications, Hyderabad.
2. Shukla S.K and Shrivastav P.R (1992).Concepts in Environmental Impact analysis. Commonwealth Publishers, New Delhi
3. Shukla S.K and Shrivastav P.R.(1992). Methodology of Environmental Monitoring and Assessment. Commonwealth Publishers, New Delhi.

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BMPD-401C Mentoring and Professional Development

External Marks: -	**L T P**
Internal Marks: 25	**0 0 2**
Total Marks: 25	

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:

Unit 1: (Class Activities)

Expert and video lectures; Aptitude Test; Group Discussion; Quiz (General/Technical); Presentations by the students; Team building Exercises

Unit 2: (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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Syllabi (5th Semester)

BSEN-501C Environmental Monitoring and Techniques

External Marks: 60	**L T P**
Internal Marks: 40	**2 0 0**
Total Marks: 100	

Unit 1: Environmental Monitoring:

Concept and objectives of environmental monitoring; Global Environmental monitoring system (GEMS); National environmental monitoring programs; Bio-indicators and biological monitoring, Instrumentation, equipment and facilities for environmental sampling and analysis.

Unit 2: Sampling Techniques:

Sampling of water and wastewater; Flow measurement and composite sampling; Ambient air quality monitoring; Stack monitoring; Tail pipe emissions monitoring, Noise monitoring; On-line monitoring, Environmental laboratories; Standards procedures for the sampling and analytical techniques; Preservation, storage and transportation of environmental samples.

Unit 3: Analytical Techniques:

Gravimetry, titrimetry, potentiometry (including ion analyzers), turbidimetry, conductimetry, and colorimetry (UV-visible spectrometry); preparation (digestion, extraction,etc.) environmental samples for analysis; Flame photometry, AAS; Chromatography, high volume samplers, Flue gas analyzers.

References:

1. Shukla SK and Srivastava PR, Methodology for Environmental Monitoring and Assessment, IK Publishers (1992)
2. Wiersma G, Environmental Monitoring, CRC Press (2004)
3. Standard Methods for Examination of Water and Wastewater: APHA-AWWA-WEF; Boston (1989)
4. Skoog DA, Holler FL and Nieman TA, Principles of Instrumental Analysis, Harcourt CollegePublishers (1997)

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BSEN-502C Instrumentation Techniques Lab

	L	T	P
External Marks: 20			
Internal Marks: 30	**0**	**0**	**2**
Total Marks: 50			

List of Experiments

1. Principle, working and handling of pH meter.
2. Principle, working and handling of Turbidity meter.
3. Principle, working and handling of Conductivity meter.
4. Principle, working and handling of DO meter.
5. Principle, working and handling UV-Vis Spectrophotometer.
6. Principle, working and handling of IR spectrophotometer.
7. Principle, working and handling of Gas Chromatograph.
8. Principle, working and handling of HPLC.

References:

1. Eugene WR, Rodger BB, Andrew DE, Lenore SC (editors), Standard Methods for Examinationof Water and Wastewater: APHA-AWWA-WEF; Boston(2012).
2. Pradyot P, Handbook of Environmental Analysis Chemical Pollutants in Air, Water, Soil and solidwastes, CRC Press (2017).
3. Skoog DA, Holler FL and Crouch, Principles of Instrumental Analysis, Cengage Publishers(2018).
4. Gunzler H and Williams A, Handbook of Analytical Techniques, Wiley-VCH (2002).

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Elective-I

BSEN-511C Sustainable Development Goals (SDG's)

External Marks: 60	**L T P**
Internal Marks: 40	**3 1 0**
Total Marks: 100	

Unit 1: Development and Environment: Sustainable Development Goals

Introduction to Millennium Development Goals (MDGs), Strategies and Framework for Sustainable Development, The 2030 Agenda for Sustainable Development, UN Sustainable Development Knowledge Platform, COPs, Sustainable Development Goals, Criticisms in Sustainability: Women and Gender Equality, Education, Public Engagement and Sustainable Development

Unit 2: Environmental Conservation and Sustainability

Technical Skills in Environment and Sustainability**,** Environmental Governance and Sustainability**,** Environmental Economics and Sustainability**,** Circular Economy, Water Conservation and Sustainable Development**,** Urbanization and Sustainable Cities**,** Challenges in Energy, Food, Forest and Agriculture

Unit 3: New Developments in Sustainability

Appropriate Technology and Sustainability Science, Sustainable Transport, Sustainability Assessment of Food and Agriculture (SAFA), Corporate Sustainability, Sustainability Metrics and Indices, Ecological and Carbon Footprint for Sustainability Measurement, Sustainability Measurement and Reporting Tools, Life Cycle Assessment, Green credit

Unit 4: Indian Efforts on Sustainable development Goals

Planning of Niti Ayog on SDG's, Planning at State and District level for implementation of SDG's, Net zero emission by 2070

References:

1. Fulekar MH, Pathak B, Kale RK, Environment and Sustainable Development, Springer Nature (2013).
2. Mishra A, Dahiya V, Tandon K, Sustainable Development in Digital Era, JSR Publishing House LLP, (2019).
3. Jeffrey D Sachs and Ban Ki moon, The Age of Sustainable Development Columbia University Press (2015).
4. Kalam APJ, Singh SP, Target 3 Billion: Innovative Solutions Towards Sustainable Development Penguin India (2011).
5. Goel S, Management of Resources for Sustainable Development, The Orient Blackswan (2016)

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Elective-I

BSEN-512C Environmental Ethics and Human Values

External Marks: 60	**L T P**
Internal Marks: 4 0	**3 1 0**
Total Marks: 100	

Unit- 1: Environmental Ethics

Definition and concept of environmental ethics, Resource consumption patterns and need for equitable utilization, Anthropocentrism, stewardship, biocentrism, ecocentrism, cosmocentrism, Conservation ethics, traditional value system in India.

Unit-2: Introduction to Human Values

Values, Characteristics, Types, Developing Value system in Indian Organizations, Values in Business Management, Value based Organization, Trans-Cultural Human values in Management. Swami Vivekananda's philosophy of Character building, Gandhi Concept of Seven sins, APJ Abdul Kalam view on role of parents and Teachers

Unit- 3: Principals of Ethics

Secular and Spiritual values, Levels of value Implementation. Features of spiritual values, Corporate Social Responsibility (CSR)- nature, Levels, Phases ad Models of CSR, Corporate Governance. CSR and Modern Business Tycoons Ratan Tata, Azim Prem ji and Bill Gates

Unit-4: Human Values and Present Practices

Issues: Corruption and Bribe, Privacy Policy in Web, and social media, Cyber threats, Online Shopping. Remedies Introduction to sustainable policies and Practices in Indian Economy

Reference Books:

1. Gaur RR, Sangal R, A foundation course in Human Values and Professional Ethics, Excel Books(2010).
2. Justice: What's the Right Thig to do? Michael J. Sandel, penguin UK (2008).
3. Tripathi AN, Human Values, New Age International (2006).
4. https://www.un.org/sustainabledevelopmemt/sustainable-development-goals/
5. https://www.india.gov.in/my-government/schemes
6. Nagendra M, A Review of Handbook of Human values and Professional Ethics, Notion Press (2020).
7. Mark R, Human Value, Environmental Ethics and sustainability The Precautionary HealthPrinciple, Rowman and Littlefield (2016).

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Elective-I

BSEN-513C Hazard and RiskAssessment

External Marks: 60	**L T P**
Internal Marks: 40	**3 1 0**
Total Marks: 100	

Unit 1: Natural Hazards:

Earthquakes, tsunami, volcanoes, floods, landslides, avalanche, cyclone, drought, fire – causes, perception, mitigation and management.

Unit 2: Man-made hazards:

Hazards due to dams and reservoirs, nuclear power plants, industrial hazards, occupational hazards, mitigation measures.

Unit 3: Environmental health hazard and risk assessment:

Biological, chemical, physical and psychological health hazard; health risk assessment and management.

Unit 4: Risk assessment:

Introduction and Scope, Project Planning, Exposure Assessment, Toxicity, assessment, Hazard Identification and Assessment, Risk Characterization, Risk Communication, Environmental Monitoring, Community Involvement, Legal and Regulatory Framework, Human and Ecological Risk Assessment.

Unit 5: Hazard Mitigation:

Identification of hazard prone belts, hazard zonation and risk assessment; risk reduction in vulnerable areas, developing warning systems, forecasting, emergency preparedness, education and training activities, planning for rescue and relief works.

References:

1. Calow P, Handbook of environmental risk assessment and management. Oxford: Blackwell Science(1997).
2. Kushy TM, Geological Hazards A Source Book on Hazards and Disasters, Green wood Press,Westport, Conn, London (2003).
3. Gupta and Harsh, Disaster Management, Universities Press (India) Pvt Ltd (2003).
4. Louis Theodore, Ryan DR, Environmental Health and Hazard Risk Assessment: Principles andCalculations, CRC press (2012).

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Elective-I Lab

BSEN-517C Sustainable Development Goals (SDG's) Lab

External Marks: 40	**L T P**
Internal Marks: 6 0	**0 0 3**
Total Marks: 100	

List of Experiments:

1. Preparation of documentary on sustainability practices of an organization agency or village area
2. Studies on measurements of sustainable farming practices
3. Questionnaire survey on sustainability based on online platforms and analysis
4. Measurement of carbon footprint and ecological footprints by using online software
5. Use of Open LCA software with case study as a sustainability measurement tool
6. Application of CropWat (FAO) software for crop water requirements and irrigation requirements based on soil, climate and crop data
7. Preparation of sustainability report: Study of any Business venture/start-up

References:

1. Fulekar MH, Pathak B, Kale RK, Environment and Sustainable Development, Springer Nature(2013).
2. Mishra A, Dahiya V, Tandon K, Sustainable Development in Digital Era, JSR Publishing House LLP, (2019).
3. Jeffrey D Sachs and Ban Ki moon, The Age of Sustainable Development Columbia University Press (2015).
4. Kalam APJ, Singh SP, Target 3 Billion: Innovative Solutions Towards Sustainable Development Penguin India (2011).
5. Goel S, Management of Resources for Sustainable Development, The Orient Blackswan (2016).

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Elective-I Lab

BSEN-518C Environmental Ethics Report Writing

	L	T	P
External Marks: 40			
Internal Marks: 60	**0**	**0**	**3**
Total Marks: 100			

1. Report writing on different Environmental issues: Climate Change, Land Degradation, Deforestation, Pollution, Desertification, Biodiversity Conservation, Human and Wildlife Conflicts
2. Report writing on Plagiarism
3. Discussion on Conflicts of thought process on different Environment ethical values
4. Case studies and Group Discussion
5. Seminars
6. Expert Lectures

References:

1. Gaur RR, Sangal R, A foundation course in Human Values and Professional Ethics, Excel Books(2010).
2. Justice: What's the Right Thig to do? Michael J. Sandel, penguin UK (2008).
3. Tripathi AN, Human Values, New Age International (2006).
4. https://www.un.org/sustainabledevelopmemt/sustainable-development-goals/
5. https://www.india.gov.in/my-government/schemes
6. Nagendra M, A Review of Handbook of Human values and Professional Ethics, Notion Press (2020).
7. Mark R, Human Value, Environmental Ethics and sustainability The Precautionary Health Principle, Rowman and Littlefield (2016).

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Elective-I Lab

BSEN-519C Hazard and Risk Assessment Lab

	L	T	P
External Marks: 40			
Internal Marks: 60	**0**	**0**	**3**
Total Marks: 100			

List of Experiments:

1. Identification of landslide: Landslide Prone Zone and Slope stability using GPR and Resistivity Images.
2. Risk assessment of Hazard and Vulnerability mapping are to be studied through map or imagery andsubmission of report in the form of Record.
3. Preparation of digital map of disaster-prone areas
4. Report on various preparatory models for rehabilitation

References:

1. Calow P, Handbook of environmental risk assessment and management. Oxford: Blackwell Science (1997).
2. Kushy TM, Geological Hazards A Source Book on Hazards and Disasters, Green wood Press, Westport, Conn, London (2003).
3. Gupta and Harsh, Disaster Management, Universities Press (India) Pvt Ltd (2003).
4. Louis Theodore, Ryan DR, Environmental Health and Hazard Risk Assessment: Principles and Calculations, CRC press (2012).

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Elective-II

BSEN-514C Agriculture and Environment

	L	T	P
External Marks: 60			
Internal Marks: 40	**3**	**1**	**0**
Total Marks: 100			

Unit I: Soils:
Cultivation; Major problems associated with the soils (Loss of soil fertility, Soil erosion, Salinity and sodicity, Soil structural decline, Soil acidification, and Buildup of chemical residues); Impacts on soil organic carbon and soil biotic community; soil conservation measures.

Unit 2: Crops and cropping patterns:
Food, fodder, energy and fiber crops; Impacts on biodiversity, Water logging; Salinization; agricultural drainage and pollution of water bodies and ground water pollution; Irrigation by treated effluent; drip irrigation; sprinkler systems of irrigation.

Unit 4: **Chemicals in agriculture:**
Pesticides and inorganic fertilizers; Integrated pest control; biofertilizers and biopesticides; Organic farming; composting and vermicomposting; Ecological farming; Limited till and Zero tillage farming, Nature Farming, Integrated Nutrient Management

Unit 5: Agricultural residues and wastes:
Integrated agricultural systems; Biomass fuels (anaerobic digestion, biodiesel); fiber source, Agricultural waste management; stubble burning

Unit 6: Sustainable Agriculture:
Green revolution and its impact; Impact of climate change on agriculture; unsustainable features of different agricultural practices, impact of intensive agriculture; Nature and importance of sustainable agriculture; Sustainability concepts for the management soil, water, plants and animals, and for the control of weeds, pests and diseases; Examples of farming practices that are economically viable, environmentally sound and socially responsible, vertical farming, Urban agriculture, Agroforestry and its types.

References:

1. Mason J, Sustainable Agriculture, 2nd ed, Land links, (2003).
2. Vandermeer JH, The Ecology of Agroecosystems, Jones and Bartlett (2011).

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Elective-II

BSEN-515C Climatology

External Marks: 60	**L T P**
Internal Marks: 40	**3 1 0**
Total Marks: 100	

Unit I: Introduction to Climatology:
Definition, brief history and scope of Climatology, Atmospheric variables, Standard atmosphere, Vertical structure of the Earth's atmosphere.

Unit 2: Physical and Dynamic Climatology:
The energy balance: Nature of radiation, solar source, solarradiation and planetary energy budget, Atmospheric temperature: Seasons, weather, daily temperature changes, vertical distribution of temperature, factor influencing horizontal distribution of temperature, Moisture in atmosphere: Hydrological cycle, relative humidity, evaporation, transpiration, condensation, fog, clouds and precipitation

Unit 3: Regional Climatology:
Definition, microclimate and meso-climate scale, Climate and distribution of vegetation, Mid-latitude climate, Polar and high land climate, Motion in the atmosphere: Atmospheric pressure, wind, Corrolis effect, Global circulation of the atmosphere, Oceans and international variations in climate (El Nino, ENSO, La Nina), Natural and atmospheric extreme events: Tropical cyclone, thunder storms, tornadoes, flood, cloud burst, drought.

Unit 4: **Applied Climatology:**
Human response to climate, Agriculture and Industry, Global Environmental changes and atmospheric chemistry: Acid precipitation, Ozone layer depletion, Natural causes of climate change, Warming of the planet Earth and its consequences. International efforts to arrest Climate Change

References:

1. Hardy JT, Climate Change: Causes, Effects and Solutions. John Wiley & Sons (2003).
2. Harvey D, Climate and Global Climate Change. Prentice Hall (2000).
3. Barry RG, Atmosphere, Weather and Climate. Routledge Press, UK (2003).
4. Maslin M, Climate Change: A Very Short Introduction. Oxford Publications (2014).
5. Mathez EA, Climate Change: The Science of Global Warming and our Energy. Future. ColumbiaUniversity Press (2009).
6. Mitra AP, Sharma S, Bhattacharya S, Garg A, Devotta S, & Sen K, Climate Change and India,Universities Press, India (2004).
7. Philander SG, Encyclopedia of Global Warming and Climate Change (2nd edition). Sage Publications(2012).

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Elective-II

BSEN-516C Environment and Society

External Marks: 60	**L T P**
Internal Marks: 40	**3 1 0**
Total Marks: 100	

Unit 1: Introduction:

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:

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; interface between environment and society.

Development-Environment Conflict: Developmental issues and related impacts such as ecological degradation; environmental pollution; development-induced displacement, resettlement, and rehabilitation: problems, concerns, and compensative mechanisms; discussion on Project Affected People (PAPs).

Unit 3: Urbanization and environment:

Production and consumption-oriented approaches to environmental issues in Indian as well as global context; impact of industry and technology on environment;urban sprawl, traffic congestion and social-economic problems; conflict between economic and environmental interests. Environment and social inequalities**:** Inequalities of race, class, gender, region, andnation- state in access to healthy and safe environments; history and politics surrounding environmental, ecological and social justice; environmental ethics, issues and possible solutions.

Unit 4: Community participation:

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); corporate responsibility movement; appropriate technology movement; environmental groups and movements, citizen groups; role played by NGOs; environmental education and awareness.

References:

1. Chokkan KB, Pandya H & Raghunathan H, Understanding Environment.Sagar PublicationIndia Pvt Ltd, New Delhi (2004).
2. Elliot D, Energy, Society and Environment, Technology for a Sustainable Future, Routledge Press (2003).
3. Guha R, 1989, Ecological change and peasant resistance in the Himalaya, Unquiet Woods, Oxford University Press, Delhi (1989).
4. Pandit MK, Chipko: Failure of a Successful Conservation Movement. In: Sodhi NS, Gibson L, & Raven PH, Conservation Biology: Voices from the Tropics, pp. 126-127. Wiley-Blackwell,

Oxford, UK (2013)

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Elective-II Lab

BSEN-520C Agriculture and Environment Lab

	L	T	P
External Marks: 40			
Internal Marks: 60	**0**	**0**	**3**
Total Marks: 100			

List of Experiments:

1. Study of soil profile.
2. Study of soil forming rocks and minerals.
3. Study of soil texture.
4. Determination of organic matter content in the soil.
5. Analysis of soil pH and soil conductivity.
6. Identification of Horticulture crops.
7. Preparation of seed bed, Nursery.
8. Sexual and asexual methods of propagation including micropropagation.
9. Training and pruning of fruits trees.
10. Methods of herbicides and fertilizer applications in different crops.
11. Seed germination and viability test.
12. Preparation of Vermicompost.

References:

1. Mason J, Sustainable Agriculture, 2nd ed, Land links, (2003).
2. Vandermeer JH, The Ecology of Agro-ecosystems, Jones and Bartlett (2011).

BSEN-521C Climatology Lab

External Marks: 40	**L T P**
Internal Marks: 60	**0 0 3**
Total Marks: 100	

1. Analysis of surface meteorological data from IMD; temperature, pressure, wind speed, rainfall
2. Analysis of upper air data; using radiosondes, ozonesondes
3. Analysis of clouds vertical profiles using satellite sensors, MODIS, CloudSat, CALIPSO
4. Analysis of cloud and precipitation characteristics using ground based instruments; Ceilometer, Disdrometer, raingauge
5. Analysis of surface and upper air weather charts for Monsoon
6. Analysis of surface and upper air weather charts for Western Disturbance
7. Analysis of surface and upper air weather charts for Tropical Cyclone
8. Analysis for vertical time and space section

References:

1. Hardy JT, Climate Change: Causes, Effects and Solutions. John Wiley & Sons (2003).
2. Harvey D, Climate and Global Climate Change. Prentice Hall (2000).
3. Barry RG, Atmosphere, Weather and Climate. Routledge Press, UK (2003).
4. Maslin M, Climate Change: A Very Short Introduction. Oxford Publications (2014).
5. Mathez EA, Climate Change: The Science of Global Warming and our Energy. Future. Columbia University Press (2009).
6. Mitra AP, Sharma S, Bhattacharya S, Garg A, Devotta S, & Sen K, Climate Change and India, Universities Press, India (2004).
7. Philander SG, Encyclopedia of Global Warming and Climate Change (2nd edition). Sage Publications (2012).

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BSEN-522C Environment and Society Lab

	L	T	P
External Marks: 40			
Internal Marks: 60	**0**	**0**	**3**
Total Marks: 100			

Project Report Preparation on:

1. Personal Ecological Footprint Calculation
2. Water Footprint Calculation
3. Carbon Footprint Calculation
4. Sustainable approaches in Rural areas
5. Sustainable approaches in Urban areas
6. Food Cultural Alternatives
7. 3D evaluation of Environmental Problems
8. Role of Society in Environment Protection
9. Role of youth/Common man in Environment protection

References:

1. Chokkan KB, Pandya H & Raghunathan H, Understanding Environment.Sagar PublicationIndia Pvt Ltd, New Delhi (2004).
2. Elliot D, Energy, Society and Environment, Technology for a Sustainable Future, Routledge Press (2003).
3. Guha R, 1989, Ecological change and peasant resistance in the Himalaya, Unquiet Woods,Oxford University Press, Delhi (1989).
4. Pandit MK, Chipko: Failure of a Successful Conservation Movement. In: Sodhi NS, Gibson L, & Raven PH, Conservation Biology: Voices from the Tropics, pp. 126-127. Wiley-Blackwell, Oxford, UK (2013).

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BMPD-501C Mentoring and Professional Development

	L	T	P
External Marks: -			
Internal Marks: 25	**0**	**0**	**2**
Total Marks: 25			

Guidelines regarding Mentoring and Professional DevelopmentThe objective of mentoring will be development of:

1. Overall Personality
2. Aptitude (Technical and General)
3. General Awareness (Current Affairs and GK)
4. Communication Skills
5. 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 maintainproperrecord student wise of each activity conducted and the same shall be submitted to the department.

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BSEN-503C Minor Project & Seminar

	L	T	P
External Marks: 40			
Internal Marks: 60	**0**	**0**	**6**
Total Marks: 100			

The objective of the Minor Project is to test the ability of the student to judge his basic knowledge in the field of Environmental Sciences.

Each student will have to perform literature survey and plan the course of action for the Major Project and submit a report and deliver a presentation based on the work done. The main aim is to develop an understanding of literature survey, its analysis and inculcate presentation skills in the students. Depending on his/her performance in the presentation he/she will be evaluated. The student will also have to appear in a Viva-voce Examination justifying the work being carried out.

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Syllabi (6th Semester)

BSEN-601C Eco-Restoration and Development

	L	T	P
External Marks: 60			
Internal Marks: 40	**2**	**0**	**0**
Total Marks: 100			

Unit I: Introduction:

Concept of Ecological Restoration and Development, Historical development, Role in stewardship and Future needs.

Unit 2: Ecological Concepts:

Ecological Succession: concepts of ecological succession, general process of succession, types of succession, structural and functional changes in succession; Ecosystem degradation and restoration - factors/threats of ecosystem, restoration of ecosystem, Reference conditions.

Unit 3: Restoration Process:

Step in the Process, Understanding Limitations: Biological Limitations, Physical Limitations, Chemical Limitations; Overcoming Limitations (a few examples): Revegetation, Mulching, Phytoremediation, Collaborative Restoration

Unit 4: Restoration in Various Settings:

Restoration of Wetlands, Rivers, Wildlife, Temperate Forests, Grasslands, Tropical Forests, Case studies

References:

1. Prakash G, Restoration of Nature, Ecological Society (2007).
2. Jelte VA and James A, Restoration Ecology the New Frontier, Wiley-Blackwell Publication (2012).
3. Stuart KA, Ecological Restoration and Environmental Change- Reviewing Damaged Ecosystems, Taylor & Francis Ltd (2014).
4. Donald AF, Margaret P, Joy Z, Richard JH, Foundations of Restoration Ecology (The Science and Practice of Ecological Restoration Series), Island Press (2016).
5. Kakade BK, Watershed Manual (BAIF and LEAD India Publication (2005).
6. Athavale RN, Water Harvesting and Sustainable Supply in India, Centre for Environment Education Rawat Publications (2003).

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BSEN-602C Environmental Biotechnology Techniques Lab

External Marks: 20	**L T P**
Internal Marks: 30	**0 0 2**
Total Marks: 50	

1. Sampling and enumeration techniques for microbes.
2. Determination of total microbial count in a water sample.
3. Determination of total count (MPN) of coliform in a water sample.
4. To prepare the Nutrient agar medium for culturing bacteria present in our surroundings.
5. Isolation of bacteria by the Pour- plate method.
6. Isolation of bacteria by the Spread - plate method.
7. Isolation of bacteria by the Streak- plate method.
8. To prepare the differential medium (MacConky) so as to grow the enteric bacteria.
9. Isolation of fungi from the given sample of Water.
10. Isolation of the *Lactobacillus* bacteria from the given sample of curd.
11. Working principle of molecular technique–PCR.

References:

1. Evans GG & Furlong J, Environmental Biotechnology: Theory and Application (2nd edition).Wiley-Blackwell Publications (2000).
2. Jordening HJ and Winter J, Environmental Biotechnology: Concepts and Applications, JohnWiley and Sons (2005).
3. Lodish HF, Baltimore D, Berk A, Zipursky SL, Matsudiara P & Darnell J, Molecular CellBiology, Freeman WH (1995).
4. Nelson DL and Cox MM, Lehninger's Principles of Biochemistry, Freeman WH (2013).
5. Rittman BE and McCarty PL, Environmental Biotechnology. Principles andApplications.McGraw-Hill, New York (2001).
6. Scagg AH, Environmental Biotechnology, Oxford University Press (2005).
7. Wainwright M, An Introduction to Environmental Biotechnology, Springer (1999).

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Elective -III

BSEN-611C Environment Management System

External Marks: 60	**L T P**
Internal Marks: 4 0	**3 0 0**
Total Marks: 100	

Unit 1: Introduction to Environmental Management Systems (EMS):
Introduction to Environmental Management System basic definitions and terms, Framework for Environmental Management Systems, Approach for developing an Environmental Management System.

Unit 2: Introduction and Implementation of ISO 14001
The introduction and implementation of ISO 14001: environmental policy, planning, implementation and operation, checking, management review, EMS certification.

Unit 3: Applications of EMS
Applications EMS in terms of Process flow chart, effluent Generation, composition and treatment of effluentsfrom following industries – sugar, pulp and paper, electroplating, dairy, oil refineries.

Unit 4: Environmental Auditing
Introduction to Environmental Auditing, Category "A" & "B" types of projects. Procedures and Guidelines toconduct Environmental Audit.

References:

1. Kuhre WL, ISO 14001 Certification - Environmental Management Systems: A Practical Guide for Preparing Effective Environmental Management Systems, Prentice Hall, Management System Standards, Book 1(1995).
2. Rao MN, Waste Water Treatment, Oxford and IBH publishing Co. Pvt Ltd (2007).
3. Peavy HS, Rowe DR, & George T, Environmental Engineering, New York: McGraw Hill, (1987).
4. Christopher Sheldon and Mark Yoxon, Installing Environmental management Systems – a step bystep guide, Earthscan Publications Ltd, London (1999).
5. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organization for Standardization, (2004).
6. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing,Bureau of Indian Standards, New Delhi, (2002).
7. Paul L Bishop, Pollution Prevention: Fundamentals and Practice, McGraw- Hill international,Boston (2000).

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Elective -III

BSEN-612C Environmental Law

External Marks: 60	**L T P**
Internal Marks: 40	**3 0 0**
Total Marks: 100	

Unit 1: Introduction:
Constitution of India; fundamental rights; fundamental duties; Union of India; unionlist, state list, concurrent list; legislature; state assemblies; judiciary; panchayats and municipal bodies; National Green Tribunal. Role of Ministry of Environment, Forests & Climate Change in environmental law and policy making; role of central and state pollution control boards in environmental law and policy making.

Unit 2: Environmental legislation:
Legal definitions (environmental pollution, natural resource, biodiversity, forest, sustainable development); Article 48A (The protection and improvement of environment and safeguarding of forests and wildlife); Article 51 A (Fundamental duties). The Indian Forest Act 1927;; The Wildlife (Protection) Act 1972, The Forests (Conservation) Act 1980, The Biological Diversity Act 2002, The Schedule Tribes and other Traditional Dwellers (Recognition of Forests Rights) Act 2006; The National Green Tribunal Act 2010, Wetland conservation and management rules 2020, The Hazardous Waste Rules, 2016, Biomedical Waste Rules, 2016; Plastics Waste Management Rules, 2016; Noise Pollution Rules, 2016, Fly ash management Rules

Unit 3: Legislative Instruments: The Water (Prevention and Controlof Pollution) Act 1974; The Air (Prevention and Control of Pollution) Act 1981; The Environment (Protection) Act 1986; Motor Vehicle Act 1988 (Environment related Provisions); The Public Liability Insurance Act 1991; Noise Pollution (Regulation and Control) Rules 2000; scheme and labeling of environmentfriendly products; Ecomark scheme.

Unit 4: Case studies and International Laws: National Green Tribunal: Aditya N Prasad vs. Union of India & Others; Ganga Tanneries Case: M.C. Mehta vs. Union of India 1988; environmental education case: M.C. Mehta vs. Union of India, WP 860/1991. Stockholm Conference 1972; United Nations Conference on Environment and Development 1992; Rio Declaration Agenda 21; Vienna Convention, Montreal Protocol 1987; Kyoto Protocol 1997; Copenhagen and Paris summits; CITES. Ramsar Convention on wetlands, Convention on Biological Diversity (CBD) and Convention on Migratory Species (CMS).

References:

1. Agarwal VK, Environmental Laws in India: Challenges for Enforcement. Bulletin of the National Institute of Ecology 15: 227-238(2005).
2. Divan S and Rosencranz A, Environmental Law and Policy in India: Cases, Materials andStatues (2nd edition), Oxford University Press (2002).

3. Gupta KR, Environmental Legislation in India, Atlantic Publishers and Distributors (2006).
4. Leela krishnan P, Environmental Law in India (3rd edition), Lexis Nexis India (2008).
5. Naseem M, Environmental Law in India Mohammad, Kluwer Law International (2011).
6. Venkat A, Environmental Law and Policy, PHI Learning Private Ltd (2011).

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Elective -III

BSEN-613C Urban Ecosystem

	L	T	P
External Marks: 60			
Internal Marks: 40	**3**	**0**	**0**
Total Marks: 100			

Unit 1: Introduction:

Introduction to urbanization; urban sprawl and associated environmental issues; Environment in an urban setting: Man as the driver of urban ecosystem; commodification of nature; metros,cities and towns as sources and sinks of resources; resource consumption and its social, cultural, economic and ecological perspectives; urban transformation; increasing challenges posed by modernity for the environment; urban pollution (air, water, soil).

Unit 2: Urban dwelling:

Housing scenario across a range of large-medium-small cities; poverty and slums in an urban context; Town planning Acts and their environmental aspects; energy consumption and waste disposal as well as accumulation; environmental costs of urban infrastructure.

Unit 3: Urban interface with the environment:

Management of urban environment; alternative resources; policy and management decisions; urban settings as loci of sustainability; challenges associated with sustainability and urban future. Natural spaces in a city: Concept of 'controlled nature'; scope, importance and threats to nature in the city; organization and planning of green spaces such as parks, gardens and public spaces; concept of green belts; urban natural forest ecosystem as green lungs.

Unit 4: Planning and environmental management:

Urban planning and its environmental aspects from historical and contemporary perspectives; benefits of environmental management; introduction to green buildings; urban governance; political complexity of applying ecological science to urban policy and planning,smart cities.

References:

1. D'Monte Darryl, Industry versus Environment Temples or Tombs. Three Controversies, Delhi, CSE (1985).
2. Gaston KJ, Urban Ecology, Cambridge University Press, New York (2010). Grimm NB, Faeth SH, et al. Global Change and the Ecology of Cities. Science 319:756-760 (2008).
3. Hinchliffe S & Whatmore S, Living cities: Towards a politics of conviviality. Science asCulture15: 123–138(2006).
4. McIntyre NE, Urban ecology as an interdisciplinary field: differences in the use of 'urban' between the social and natural sciences. Urban Ecosystems 4: 5-24(2000).
5. Montgomery MR, Urban Transformation of the developing world. Science 319: 761-764 (2009).
6. Richter M & Weiland U. (ed.), Applied Urban Ecology. Wiley-Blackwell, UK (2012). Alesso Russo, Giuseppe T. Cirella, Urban Ecosystem services, MDPI (2021).

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Elective -III

BSEN-614C Disaster Management

	L	T	P
External Marks: 60			
Internal Marks: 40	**3**	**0**	**0**
Total Marks: 100			

Unit 1: Fundamentals of Disaster and Disaster Management:
Definition, types of disaster and need for disaster management. Natural disasters: Hydrological, wind related, geophysical and climate related Man-made disasters: Nuclear disaster, Industrial, Environmental (forest fire), rail, road, air and sea accidents

Unit 2: Disaster preparedness:
Concept, nature, plan and mitigation, Disaster response: Plan, communication, logistic management, stress and panic movement, integration of multiple stakeholders, Disaster medicine (Prevention, preparedness, response and recovery of health problems.

Unit 3: Post Disaster Management:
Relief camps, role of voluntary organizations and armed forces Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action.

Unit 4: Rehabilitation, Reconstruction and Recovery:
Reconstruction and rehabilitation as a means of development, Damage assessment, Role of various agencies in disaster management, Development of physical and economic infrastructure, Information management structure, Education and awareness, Constrain in monitoring and evaluation, Long term recovery and counter disaster planning.

References:

1. Schneid, TD and Collins L, Disaster Management and Preparedness. Lewis Publishers, NewYork, NY (2001).
2. Smith K, Environmental Hazards: Assessing Risk and Reducing Disaster, Routledge Press(2001).
3. Coppola DP, Introduction to International Disaster Management, Butterworth Heinemann (2007).
4. Cutter SL, Hazards Vulnerability and Environmental Justice, Earth Scan, Routledge Press (2012).
5. Keller EA, Introduction to Environmental Geology, Prentice Hall, Upper SaddleRiver, New Jersey(1996).
6. Pine JC, Natural Hazards Analysis: Reducing the Impact of Disasters, CRC Press, Taylor and Francis Group (2009).

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Elective –III Lab

BSEN-618C Environment Management System Lab

	L	T	P
External Marks: 40			
Internal Marks: 60	**0**	**0**	**3**
Total Marks: 100			

Project Report preparation on:

1. ISO 14001 and OHSAS 18001 and its comparison.
2. Guiding principles, Codes and Present scenario of Responsible Care
3. Carbon footprint
4. Various International Conventions
5. Methods and challenges involved in applying life cycle assessment.
6. Six steps methodology for Cleaner Production.
7. Sustainable Development Goals and status of India
8. Institutional Framework of Environmental Regulations in India
9. Comprehensive Environmental Pollution Index (CEPI)

References:

1 Kuhre WL, ISO 14001 Certification - Environmental Management Systems: A Practical Guide for Preparing Effective Environmental Management Systems, Prentice Hall, Management System Standards, Book 1(1995).

2. Rao MN, Waste Water Treatment, Oxford and IBH publishing Co. Pvt Ltd (2007).
3. Peavy HS, Rowe DR, & George T, Environmental Engineering, New York: McGraw Hill, (1987).
4. Christopher Sheldon and Mark Yoxon, Installing Environmental management Systems – a step by step guide, Earthscan Publications Ltd, London (1999).
5. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organization for Standardization, (2004).
6. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, (2002).
7. Paul L Bishop, Pollution Prevention: Fundamentals and Practice, McGraw-Hill International, Boston (2000).

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Elective –III Lab

BSEN-619C Environmental Law Report Writing

External Marks: 40 **L T P**

Internal Marks: 60 **0 0 3**

Total Marks: 100

Report writing on

1. Emergence of Environmental Law
2. Provisions under Water (Prevention and Control of Pollution) Act, 1974
3. Provisions under Air (Prevention and Control of Pollution) Act, 1981
4. Provisions under Environmental Protection Act, 1986
5. Provisions under The Hazardous Waste (Management and Handling) Rules, 2016
6. Provisions under The Biomedical Waste (Management and Handling) Rules, 2016
7. Provisions under The Plastics Waste Management Rules, 2016
8. Provisions under The Noise Pollution (Regulation and Control) Rules, 2016
9. Provisions under Coastal Regulation Zone, 2019
10. Case Studies on recent environmental court cases

References:

1. Agarwal VK, Environmental Laws in India: Challenges for Enforcement. Bulletin of theNational Institute of Ecology 15: 227-238(2005).
2. Divan S and Rosencranz A, Environmental Law and Policy in India: Cases, Materials and Statues (2nd edition), Oxford University Press (2002).
3. Gupta KR, Environmental Legislation in India, Atlantic Publishers and Distributors (2006).
4. Leela krishnan P, Environmental Law in India (3rd edition), Lexis Nexis India (2008).
7. Naseem M, Environmental Law in India Mohammad, Kluwer Law International (2011).
8. Venkat A, Environmental Law and Policy, PHI Learning Private Ltd (2011).

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Elective –III Lab

BSEN-620C Urban Ecosystem Lab

External Marks: 40	**L T P**
Internal Marks: 6 0	**0 0 3**
Total Marks: 100	

1. Integrated plan for urban region, including 2 weeks field survey.
2. Theories and principles of urban development plan and preparation for survey and data collection.
3. Field survey of the study area.
4. Analysis of data and information
5. Planning for urban area and its region (structure plan / Development plan) with emphasis on:
6. Land use and transportation network
7. Infrastructure plan
8. Action area programs and urban renewal plan
9. Capital budget and financing
10. Administrative and management backup for implementation

References:

1. D'Monte Darryl, Industry versus Environment Temples or Tombs. Three Controversies, Delhi,CSE (1985).
2. Gaston KJ, Urban Ecology, Cambridge University Press, New York (2010).
3. Grimm NB, Faeth SH, et al. Global Change and the Ecology of Cities. Science 319:756-760(2008).
4. Hinchliffe S & Whatmore S, Living cities: Towards a politics of conviviality. Science asCulture15: 123–138(2006).
5. McIntyre NE, Urban ecology as an interdisciplinary field: differences in the use of 'urban'between the social and natural sciences. Urban Ecosystems 4: 5-24(2000).
6. Montgomery MR, Urban Transformation of the developing world. Science 319: 761-764 (2009).
7. Richter M & Weiland U. (ed.), Applied Urban Ecology. Wiley-Blackwell, UK (2012).
8. Alesso Russo, Giuseppe T. Cirella, Urban Ecosystem services, MDPI (2021).

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Elective –III Lab

BSEN-621C Disaster Management Lab

External Marks: 40 **L T P**

Internal Marks: 6 0 **0 0 3**

Total Marks: 100

Preparation of project report based on field and case studies:

(i) Flood & Water logging

(ii) Cyclone

(iii) Earthquake

(iv) Fire hazards

(v) Industrial accidents

References:

1. Schneid, TD and Collins L, Disaster Management and Preparedness. Lewis Publishers, New York, NY (2001).
2. Smith K, Environmental Hazards: Assessing Risk and Reducing Disaster, Routledge Press (2001).
3. Coppola DP, Introduction to International Disaster Management, ButterworthHeinemann (2007).
4. Cutter SL, Hazards Vulnerability and Environmental Justice, Earth Scan,Routledge Press (2012).
5. Keller EA, Introduction to Environmental Geology, Prentice Hall, Upper SaddleRiver, New Jersey (1996).
6. Pine JC, Natural Hazards Analysis: Reducing the Impact of Disasters, CRC Press,Taylor andFrancis Group (2009).

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Elective –IV

BSEN-615C Remote Sensing and GIS

	L	T	P
External Marks: 60			
Internal Marks: 40	**3**	**0**	**0**
Total Marks: 100			

Unit I: Fundamentals of Remote Sensing:

Principles and Process of Remote Sensing, Electromagnetic Radiations (EMR) and Electromagnetic Spectrum, Interaction between Matter and EMR, Types of Remote Sensing Sensors, Types of Remote Sensing Platforms, Types of Resolution, Remote sensing data acquisition mechanism, Aerial survey, Microwave and LiDAR remote sensing, Thermal and Hyperspectral Remote sensing.

Unit 2: Image Analysis:

Digital Image processing, Image Preprocessing, Enhancement, Image Classification, Visual Interpretation, Image Fusion and change detection, Microwave and LiDAR data Processing, Applications of Remote Sensing in the field of Agriculture, Forestry, Geology, Hydrology, Sea Ice Land Cover Mapping, Oceans and Coastal.

Unit 3: Introduction to GIS:

Definition, Components, Functions and advantages of GIS Process of GIS, Spatial data analysis, Integration of spatial and non-spatial data.

Unit 4: Geospatial Analysis:

Introduction, Geospatial data analysis methods, Database query Geospatial measurements, Overlay Operations, Network Analysis, Surface Analysis, Geo-visualization, Multi-criteria analysis, Map composition, Geo-web services.

Unit 4: Modern Trends of GIS:

Integration of GIS and Remote Sensing, Integration of GIS and Multimedia, Mobile GIS, Collaborative GIS (CGIS).

References:

1. Anji Reddy M, Textbook of Remote Sensing and Geographical Information Systems ThirdEdition (2008)
2. Norman K, Lucas LFJ, Gerrit CH, Principles of Remote Sensing An Introductory Textbook.ITC Educational Textbook Series (2004).
3. Bhatta B, Remote Sensing and GIS, Oxford University (2008).
4. Lillesand TM and Keifer, RW, Remote Sensing and Image Interpretation, John Willey andSons, New York (1990).
5. Joseph G, Fundamentals of Remote Sensing, Universities Press, Hyderabad (2003).
6. Heywood, Sarah C, Steve C, An Introduction to Geographical Information Systems, Pearson,(2011).

7. Chang, Kang-Taung, Introduction to Geographic Information Systems, Tata-McGraw-Hill(2002).
8. Burroughs PA, Principles of Geographical Information Systems for Land Resource Assessment, Oxford University Press (1986).
9. Gupta RP, Remote Sensing Geology, Springer, New York (2003).
10. Barrett EC and Curtis LF, Introduction to Environmental Remote Sensing (1999)

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Elective –IV

BSEN-616C Environmental Geology

External Marks: 60	**L T P**
Internal Marks: 40	**3 0 0**
Total Marks: 100	

Unit 1: Fundamentals of Environmental Geology and Earth System:
Fundamental concepts of environmental geosciences, its scope and necessity, Origin and geological evolution of Earth, Physiography, drainage, climate, soils and natural resources of India.

Unit 2: Formation and structure of the Earth:
Plate tectonics, rocks and their classification, Brief account of relationship among various geospheres-lithosphere, hydrosphere and biosphere, Energy budget of the Earth, Earth's thermal environment and seasons

Unit 3: Earth's Processes and Geological Hazards:
Earth's processes: Concept of residence time and rates of natural cycles, catastrophic geological hazards. Study of floods, landslides, earthquakes, volcanism and avalanche, Tsunami, ice sheets and fluctuations of sea levels, marine pollution by toxic wastes, Prediction and perception of the hazards and adjustments to hazardousactivities

Unit 4: Environmental Geochemistry and Land use Planning:
Concept of major, trace and REE(Rare Earth Elements), Classification of trace elements, mobility of trace elements, Human use, trace elements and health, possible effects of some trace elements, Weathering and soil formation, soil profile, soil classification, soils of India, Landuse planning: Soil surveys in relation to land use planning, methods of site selection and evaluation

References:

1. Barbar WM et al., Environmental Geology, John Wiley & Sons, New York (1996).
2. Edward AL, Introduction to Environmental Geology, Pearson Education publisher (2011).
3. Valdiya KS, Environmental Geology, McGraw-Hill Education (India) (2013)
4. Collins Larry R and Schneid Thomas D, Disaster Management and Preparedness, Taylor and Francis(2000).
5. Goel SL and Kumar Ram, Disaster Management, Deep and Deep Publications (2001).

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Elective –IV

BSEN-617C Water Resource Management

External Marks: 60	**L T P**
Internal Marks: 4 0	**3 0 0**
Total Marks: 100	

Unit 1: Introduction:

Sources and types of water; hydrological cycle; precipitation, runoff, infiltration, evaporation, evapo- transpiration; classification of water resources (oceans, rivers, lakes and wetlands). ***Properties of water:*** Physical: temperature, colour, odour, total dissolved solids and total suspended solids; Chemical:major inorganic and organic constituents, dissolved gases, DO, COD, BOD, acidity and alkalinity, electrical conductivity, sodium adsorption ratio; Biological: phytoplankton, phytobenthos,zooplankton, macro-invertebrates and microbes.

Unit 2: Surface and subsurface water:

Introduction to surface and ground water; surface and ground water pollution; water table; vertical distribution of water; formation and properties of aquifers; techniques for ground water recharge; river structure and patterns; watershed and drainage basins; importance of watershed and watershed management; rain water harvesting in urban settings.

Unit 3: Wetlands and their management:

Definition of a wetland; types of wetlands (fresh water and marine); ecological significance of wetlands; threats to wetlands; wetland conservation and management; Ramsar Convention, 1971; major wetlands of Punjab.

Marine resource management: Marine resources; commercial use of marine resources; threats to marine ecosystems and resources; marine ecosystem and resource management (planning approach, construction techniques and monitoring of coastal zones.

Unit 4: Water resource in India and Conflicts: Demand for water (agriculture, industrial, domestic); overuseand depletion of surface and ground water resources; water quality standards in India; hot spots of surface water; role of state in water resources management. Water resources and sharing problems, case studies on Kaveri and Krishna river water disputes; Multi-purpose river valley projects in India and their environmental and social impacts; case studies of dams-Narmada and Tehri dam – social and ecological losses versus economic benefits; International conflicts on water sharing between India and her neighbours; agreements to resolve these conflicts. Indus water treaty; Ganges water treaty; Teesta water treaty; National River linking plan: ecological and economic impacts.

References:

1. Bansil PC, Water Management in India. Concept Publishing Company, India (2004).
2. Brebbia CA, Water Resources Management VII. WIT Press (2013).
3. CEA, Water Resources and Power Maps of India. Central Board of Irrigation & Power (2011).
4. Grumbine, RE and Pandit MK, Threats from India's Himalaya dams. Science 339: 36-37(2013).
5. Loucks DP, Stedinger JR and Haith DA, Water Resource Systems Planning andAnalysis.Englewood Cliffs, NJ, Prentice Hall (1981).
6. Mays LW, Water Resources Sustainability, The McGraw-Hill Publications (2006).
7. Schward and Zhang, Fundamentals of Groundwater, John Willey and Sons (2003).
8. Souvorov AV, Marine Ecologonomics: The Ecology and Economics of Marine NaturalResource Management, Elsevier Publications (1999).
9. Vickers A, Handbook of Water Use and Conservation, Water Plow Press (2001).

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Elective –IV Lab

BSEN-622C Remote Sensing and GIS Lab

	L	T	P
External Marks: 40			
Internal Marks: 60	**0**	**0**	**3**
Total Marks: 100			

List of Experiments:

1. GPS handling and acquisition of data
2. Rectification and Georeferencing using toposheet/satellite image/GPS
3. Subsetting and masking to get required image from whole image
4. Image Classification and Post Classification Processing
5. Spectral Signature Collection using Spectro-radiometer and Spectral Analysis
6. Visual analysis and interpretation of satellite data (preparation spatial data: Point, line, polygon)
7. Preparation of multi-thematic layers i.e. land use/land cover, forest types, wetlands, ground water prospects map, wastelands, agriculture and horticulture cropped area mapping and Creation of Geodatabase
8. Ground truthing using GPS & DGPS: field visit
9. Analysis of Google Earth for environmental sciences
10. Map Composition

References:

1. Anji Reddy M, Textbook of Remote Sensing and Geographical Information Systems ThirdEdition (2008).
2. Norman K, Lucas LFJ, Gerrit CH, Principles of Remote Sensing An IntroductoryTextbook. ITC Educational Textbook Series (2004).
3. Bhatta B, Remote Sensing and GIS, Oxford University (2008).
4. Lillesand TM and Keifer, RW, Remote Sensing and Image Interpretation,John Willey andSons, New York (1990).
5. Joseph G, Fundamentals of Remote Sensing, Universities Press, Hyderabad (2003).
6. Heywood, Sarah C, Steve C, An Introduction to Geographical Information Systems,Pearson (2011).
7. Chang, Kang-Taung, Introduction to Geographic Information Systems, Tata McGraw-Hill (2002).
8. Burroughs PA, Principles of Geographical Information Systems for Land Resource Assessment, Oxford University Press (1986).
9. Gupta RP, Remote Sensing Geology, Springer, New York (2003).
10. Barrett EC and Curtis LF, Introduction to Environmental Remote Sensing (1999).

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Elective –IV Lab

BSEN-623C Environmental Geology Lab

External Marks: 40	**L T P**
Internal Marks: 60	**0 0 3**
Total Marks: 100	

List of experiments:

1. Study of natural resource map of India.
2. Physiographic divisions of India.
3. Study of distribution of major climatic regimes of India on map.
4. Study of major geomorphic features.
5. Distribution of major wind patterns on the world map.
6. Preparation of paleogeographic maps (distribution of land and sea) of India during specific geological time intervals.
7. Plate tectonics map
8. Preparation of Hazard zonation maps for India and the World eg; Earthquake, landslides,cyclones and other natural disasters
9. Types of geochemical data analysis and interpretation of common geochemical plots.
10. Geochemical variation diagrams, rare earth elements (REE), and spider diagrams and their interpretations
11. Soil Map of India and specific regions in detail.

References:

1. Barbar WM et al., Environmental Geology, John Wiley & Sons, New York (1996).
2. Edward AL, Introduction to Environmental Geology, Pearson Education publisher (2011).
3. Valdiya KS, Environmental Geology, McGraw-Hill Education (India) (2013)
4. Collins Larry R and Schneid Thomas D, Disaster Management and Preparedness, Taylor and Francis(2000).
5. Graham T and Jon T, Earth Science and the Environment, Thomson and Brooks/cole (2007).
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Elective –IV Lab

BSEN-624C Water Resource Management Lab

External Marks: 40	**L T P**
Internal Marks: 60	**0 0 3**
Total Marks: 100	

List of Experiments:

1. Analysis of Chloride in water.
2. Measurement of nitrate in water.
3. Report on water conservation techniques.
4. Visit of a nearby Sewage/waste water treatment plant.
5. Hydrological properties of water bearing strata
6. Different treatment technologies for groundwater treatment and restoration
7. Case study related to the groundwater pollution problems in India.
8. Case study of restoration of a River Kali Bein
9. Report on restoration of nearby Pond of Punjab

References:

1. Bansil PC, Water Management in India. Concept Publishing Company, India (2004).
2. Brebbia CA, Water Resources Management VII. WIT Press (2013).
3. CEA, Water Resources and Power Maps of India. Central Board of Irrigation & Power (2011).
4. Grumbine, RE and Pandit MK, Threats from India's Himalaya dams. Science 339: 36-37(2013).
5. Loucks DP, Stedinger JR and Haith DA, Water Resource Systems Planning andAnalysis.Englewood Cliffs, NJ, Prentice Hall (1981).
6. Mays LW, Water Resources Sustainability, The McGraw-Hill Publications (2006).
7. Schward and Zhang, Fundamentals of Groundwater, John Willey and Sons (2003).
8. Souvorov AV, Marine Ecologonomics: The Ecology and Economics of Marine NaturalResource Management, Elsevier Publications (1999).
9. Vickers A, Handbook of Water Use and Conservation, Water Plow Press (2001).

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BSEN-603C Major Project

	L	T	P
External Marks: 40			
Internal Marks: 60	**0**	**0**	**10**
Total Marks: 100			

The objective of the Major Project is to test the ability of the student to judge his knowledge in the field of Environmental Sciences, originality and capacity for application of laboratory data and to determine the level of his/her proficiency at the end of the course.

The Project Paper is composed of
a) Identification of Problem
b) Review of Literature
c) Methodology
d) Analysis
e) Findings
f) Presentation and Viva-Voce.

Submission of Project will carry 60 marks (Internal Assessment) and Power point Presentation and Viva-voce (External Assessment) will carry 40 marks. Viva will be conducted through on the topic in the presence of external and internal examiners. The student may choose any on one Unit/Topic given in the syllabus relevant to Environmental Sciences as his/her Project. Where topic is not given in the syllabus, the concerned teachers will choose any one of the Unit/Topic of study may select as project for the students.

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BMPD-601C Mentoring and Professional Development

External Marks: -	**L T P**
Internal Marks: 25	**0 0 2**
Total Marks: 25	

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 activitiesto 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.