Veer Bahadur Singh Purvanchal University, Jaunpur

(A State University- Government of Uttar Pradesh; Accredited A^+ by NAAC)

Ordinance and Syllabus for

Bachelor of Science (Honours) Environmental Science

B. Sc. (Hons.) Environmental Science

Three-years (Six semesters) undergraduate degree programme

Faculty of Science

Under Choice Based Credit System (CBCS)

As per the guidelines of NEP-2020

w.e.f. 2024-25(Academic Session)

Ordinance governing three-years (Six semesters) undergraduate degree programme

Bachelor of Science (Honours) Environmental Science

B. Sc. (Hons.) Environmental Science

Under Choice Based Credit System (CBCS)

w.e.f. 2024-25 (Academic Session)

The following ordinances have been framed governing the admission, course structure, examination and other allied matters relating to the three years (Six semesters) under graduate degree programme B.Sc. (Hons.) Environmental Science is being offered by Veer Bahadur Singh Purvanchal University.

1. ADMISSION AND EXIT

1.1. All matters relating to admission to B.Sc. (Hons.) Environmental Science programme shall be dealt by the Admission Committee constituted by the University.

1.2. The B.Sc. (Hons.) Environmental Science is open to candidate passed 10+2 (class XII) Examination or its equivalent from a recognized Board with any of the three subjects of Physics, Chemistry and Biology or any other science subject with 50% or equivalent grade (for SC/ ST candidates passing percentage marks of eligibility will be 45% or equivalent grade).

1.3. In case of candidates who are studying in Board/Schools in any of the foreign countries the eligibility/Qualifying marks will be the same as recognized/equivalent to 10+2 with 50% marks or equivalent grade (for SC/ ST candidates, eligibility will be 45% marks or equivalent grade).

1.4. The candidate who has appeared in the qualifying examination but whose result has so far not been declared can also apply but their eligibility for the entrance test will be purely provisional subject to the condition that they have to produce a passing certificate scoring at least the minimum percentage of marks as prescribed for the qualifying examination on the day and the specified time of counseling.

1.5. Admission in B.Sc. (Hons.) Environmental Science will be based on the entrance test or merit of the qualifying examination as per the rules of the university.

1.6. The intake of candidates in B.Sc. (Hons.) Environmental Science programme shall be fixed by Veer Bahadur Singh Purvanchal University. The admission to B.Sc. (Hons.) Environmental Science programme shall be made through a merit based on written test conducted by Veer Bahadur Singh Purvanchal University Combined Admission Test (PUCAT). The reservation norms for admission in B.Sc. (Hons.) Environmental Science programme shall be as per the Uttar Pradesh State Government/ University policy notified from time to time.

1.7. On selection, the candidates shall deposit the fees prescribed for the purpose to get their admission confirmed within the stipulated time period by the Admission Committee of the Department. If the candidate fails to do so their admission shall be automatically liable to be cancelled and the seat falling vacant shall be offered to other candidates as per the merit/category. There is no provision of fee concession/exemption under any

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circumstances except the case related to social welfare department, Uttar Pradesh government. Fee refund policy shall be applicable as per the University norms.

1.8. Admission to B. Sc. (Hons.) Environmental Science programme cannot be claimed by any candidate as a matter of right. The Admission Committee B.Sc. (Hons.) Environmental Science shall have power to refuse, reject or cancel any admission if it possesses sufficient reasons to do so.

1.9. All the teachers of the department shall function as Student Mentor (Advisors). Every student will be assigned a mentor (advisor) with commencement of the academic session to support the students for their overall development in all possible ways related to their academics/co-curricular/extra-curricular/sports/personality development/soft skill/cultural activity and offer all possible students support services.

2. COURSES OF STUDY AND EXAMINATION

2.1. Undergraduate program B.Sc. (Hons.) Environmental Science will be based on CBCS (Choice Based Credit System) and semester system.

2.2. B. Sc. (Hons.) Environmental Science programme- **1st semester**

3 (three) theory papers of major/core courses (4 credits each)	= 12
3 (three) practical papers major/core courses (2 credits each)	= 6
1 minor elective from other faculty (4 credits)	= 4
1 minor vocational skill development course (3 credits)	= 3
1 minor co-curricular course (qualifying)	

1st semester there will be 25 credits.

B. Sc. (Hons.) Environmental Science programme- **2nd semester**

3 (three) theory papers of major/core courses (4 credits each)	= 12
3 (three) practical papers major/core courses (2 credits each)	= 6
1 minor vocational skill development course (3 credits)	= 3
1 minor co-curricular course (qualifying)	

2nd semester there will be 21 credits

Thus, 1st year of B.Sc. will be of 46 credits.

B. Sc. (Hons.) Environmental Science programme- **3rd semester**

3 (three) theory papers of major/core courses (4 credits each)	= 12
3 (three) practical papers major/core courses (2 credits each)	= 6
1 minor elective from other faculty (4 credits)	= 4
1 minor vocational skill development course (3 credits)	= 3
1 minor co-curricular course (qualifying)	

3rd semester there will be 25 credits

B. Sc. (Hons.) Environmental Science programme- **4th semester**

3 (three) theory papers of major/core courses (4 credits each)	= 12
3 (three) practical papers major/core courses (2 credits each)	= 6

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1 minor vocational skill development course (3 credits) = 3
1 minor co-curricular course (qualifying)

4th semester there will be 21 credits.

Thus, 2nd year of B.Sc. will be of 46 credits.

B. Sc. (Hons.) Environmental Science programme- **5th semester**

4 (four) theory papers of major/core courses (4 credits each) = 16
2 (two) practical papers major/core courses (2 credits each) = 4
1 minor co-curricular course (qualifying)

5th semester there will be 20 credits

B. Sc. (Hons.) Environmental Science programme- **6th semester**

4 (four) theory papers of major/core courses (4 credits each) = 16
2 (two) practical papers major/core courses (2 credits each) = 4
1 minor co-curricular course (qualifying)

6th semester there will be 20 credits

Thus, 3rd year of B.Sc. will be of 40 credits.

Hence, three years (6 semesters) B.Sc. (Hons.) Environmental Science programme is of 132 credits.

2.3. All theory major/core courses are compulsory in the first year (1st and 2nd semester) and second year (3rd and 4th semester) of own faculty (Science).

2.4. It will be mandatory for the student to take minor elective course of other faculty (one minor Course/per year) – first year (1st semester) and second year (3rd semester) of undergraduate programmed and fourth year (Bachelor's Degree with research). The university/college may offer the course of the minor elective. Minor elective paper will not be compulsory in third year undergraduate programme (5th and 6th semester).

2.5. Minor elective courses will be opted for amongst the courses conducted in the University/College. The classes for the opted minor course will be held along with the classes of the same course conducted in the faculty and their examination will also be held at the same time.

2.6. In the third year undergraduate programme (5th and 6th semester), the student can choose one course based on the elective course, according to their interest and on the basis of the resources available in the university /college.

2.7. The student will have to take only 1 minor elective course from any other faculty (a subject other than the own faculty). This course will be of at least 4 (four) or more credits and will not require any pre-requisite.

3. VOCATIONAL/SKILL DEVELOPMENT COURSE

3.1. Every student admitted in undergraduate programme will have to take a skill development course of 3 credits in each semester of the first 2 years (4 semesters) (4

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courses of 3x4 = 12 credits in total).

4. CO-CURRICULAR COURSES

4.1. It will be mandatory for students admitted in undergraduate programme will have to take one co-curricular/course in each semester of 3 years (6 semesters).

4.2. The student has to pass co-curricular/coursesas per the rules prescribed for passing criteria of Veer Bahadur Singh Purvanchal University. Grades based on their marks will be marked on the grade seat of the student, but they will not be included in the calculation of CGPA.

5. RESEARCH PROJECT

5.1. The students has to carry out a research project (qualifying) in 3rd year (5th and 6thsemesters).

5.2. This research project can also be in the form of internship/technical report/comprehensive review/online or field surveys work/training in industry or institute.

5.3. This research project may also be intra disciplinary.

5.4. The research project will be done under the direction of a teacher (supervisor), another supervisor can be opted from any industry/company/technical institution/research institute.

5.5. The student will submit a joint dissertation report for the research project carried out in 3rd year (5th and 6th semesters) will be evaluated at the end of the year, which will be assessed jointly out of 100 marks by the respective supervisor and the external examiner nominated by the University or as per the directive of the university.

6. CREDIT AND CREDIT ASSESSMENT

6.1. One credit paper of Theory will consist of one hour/week teaching assignment, i.e. 15 hours of teaching assignments in 15 weeks of a semester.

6.2. One credit paper of Practical/Internship/Field Work etc. will consist of two hours / per week teaching work i.e. 30 hours of practical / internship/field work etc. will be done in 15weeks of a semester. In computing the workload of the teacher, the workload of 1 hour of theory/practical/internship/field work etc. will be equal to the workload of 2 hours.

6.3. All credit related work will be done through University/State government rule or state level "Academic Bank of Credit".

6.4. A student can take a one-year certificate on earning a minimum of 46 credits, a two-year diploma after earning a minimum of 92 credits, and a three-year bachelor's degree with a minimum of 132 credits.

6.5. After using the credits once, the student will not be able to use the credits for those courses again. For example, if a student obtains a certificate after one year using 46 credits, then their credits will be treated as expenses. If the student wants to take diploma after some years, they will either surrender their original certificate to the University and re-credit the 46 credits into the account or re-credit the new 46 credits

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and on the basis of which one can take diploma by earning 92 credits (46 + 46) credits in the second year (actual third year). Similar arrangements will be made for the coming years also. If the student studies continuously and does not take the certificate/diploma, then they can take the degree on the basis of 132 credits.

6.6. If a student (fast learner) will get the required credits for the degree in a short time, then there will be a gap facility on getting the minimum credits, but the degree will be available only after completion of three years. During the interval they will be free to any assignment in industry of as per their interest.

6.7. In three years, the student will get a degree in the same faculty in which the student will get at least 60 percent of the total credits of the three main subjects.

6.8. If a qualified student re-credits their credit by taking certificate/diploma and fails in the upcoming examination, then they can get the certificate/diploma again by using the recredited credit.

6.9. The grades based on the marks obtained in the research project will be marked on the grade sheet of the undergraduate programme but they will not be included in the calculation of CGPA.

7. ATTENDANCE AND CREDIT ASSESSMENT

7.1. It will be necessary to take the exam for credit validation. Credits will be incomplete without examination.

7.2. 75 percent attendance will be mandatory as per earlier rules to take the examination.

7.3. A candidate admitted to the B.Sc. (Hons.) Environmental Science programme shall pursue aregular course of study in all the semesters of the programme and attend a minimum of 75% of the classes held to be eligible to appear in the semester examinations.

7.4. If a student fails to attend requisite classes in a semester due to medical ground, they may be given relaxation of 15% attendance (5% at the level of Head of Department and 10% at the level of Vice-Chancellor) on production of medical certificate.

7.5. Semester examinations of the B.Sc. (Hons.) Environmental Science programme shall be conducted by way of theory papers, practical and industrial training/surveys/research project. Each theory major/core and elective courses will be of 100 marks out of which 75 marks shall be allocated for end semester examination and 25 marks for Continuous internal Evaluation. Continuous Internal Evaluation (CIE) is an integral part of the courses and is compulsory for all students. The academic performance of a student is evaluated by assessing day to day performance, attendance, assignments, periodic tests, seminar presentation, subject's quiz, class discussion, etc. There shall be no mid-term examination of CIE will be held rather a teacher assess the student along with the class teaching.

The 25 Marks of CIE shall be allocated as given below:
10marksfor Test/Subject' quiz,
10marksforpresentationalongwithassignment
05 marks for Class interactions, discussion, performance, attendance.

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7.6. The responsibility of evaluating the internal assessment is vested on the teacher(s) who teaches the course.

7.7. If a student qualifies for the examination on the basis of attendance in the class but is not able to give the examination due to any reason, then they can take the qualifying examination in the next time as per university rules. they won't need to take classes again

8. RESULTS, PROMOTION AND IMPROVEMENT

8.1. If a student wants to leave after passing the first year of graduation by earning a minimum of 46 credits, then he will be awarded a Certificate in Environmental Science

8.2. If a student wants to leave after passing the Second year of graduation by earning a minimum of 92 credits, then he will be awarded a Diploma in Environmental Science

8.3. If a student wants to leave after passing the Third year of graduation by earning a minimum of 132 credits, then he will be awarded a Bachelor of Science (Hons) in Environmental Science

8.4. The declaration of results, promotion, improvement and passing criteria of B.Sc.(Hons.) Biotechnology semester examination shall be declared pass as per the rules of Veer Bahadur Singh Purvanchal University undergraduate programme.

8.5. Those who failed in any course of the semester examination shall not be assigned any rank while declaring the final result of the Bachelor of Science (Hons.) Environmental Science programme.

8.6. If required, before the declaration of result for each semester a moderation committee shall be formed by the Vice chancellor on recommendations of the Convener. The moderation committee shall have the course convener as its convener and the name of the other shall be proposed by the course convener for the approval of the Vice chancellor.

8.7. Matters pertaining to the syllabi and conduct of examination shall be dealt with by the Board of Studies (BoS) constituted by the Vice-Chancellor.

8.8. The BoS shall recommend the panel of paper setters/examiners to the Vice-Chancellor. After getting approval from the Vice-Chancellor, the appointment letters shall be issued to the concerned paper setters/examiners by the Registrar/Controller of Examination of University.

8.9. Question papers for theory examination in sealed envelope shall be handed over/sent by registered post to the Registrar/Controller of Examination by the Examiners. Controller of Examinations will ensure the printing of question papers and fair conduct of the examinations.

8.10. The Registrar/Controller of the Examinations, with the approval of the Vice-Chancellor shall associate one or two members of the BoS for the moderation of the papers. The moderated papers shall have to be printed by the Registrar/Controller of the Examinations well before commencement of the Examinations.

8.11. After printing the questions papers in sealed covers, shall be handed over to the Examination Superintendent who will ensure the smooth and fair conduct of the examinations.

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8.12. For appearing in the B.Sc. (Hons.) Environmental Science semester examination each student shall have to deposit a prescribed examination fee along with a copy of online filled examination form for online verification. Separate fees will also be charged for back and improvement papers as per University rules.

8.13. After the examinations, Controller of Examinations/Technical Cell for campus courses shall ensure the evaluation of the answer books and declaration of results of semester examinations within a reasonable time so as to enable the department to adhere to the Academic Calendar.

8.14. Practical examinations of B.Sc. (Hons.) Environmental Science semesters I, II, III, IV, V, and VI will be conducted by one internal and one external examiner nominated by the university.

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VEER BAHADUR SINGH PURVANCHAL UNIVERSITY, JAUNPUR- 222003

Syllabus

B. Sc. (Hons.) in Environmental Science

Designed as per Syllabus Development Guidelines of National Education Policy-2020 (NEP-2020)

Year	Se-mes-ter	Course code	Course Type	Paper title	Theory/ Practical	Cred-it
First Year	I	**BH150101T**	Major/core	Ecology and Ecosystems	Theory	4
		BH150102P	Major/core	Ecology and Ecosystems	Practical	2
		BH150103T	Major/core	Physics & Chemistry of Environment	Theory	4
		BH150104P	Major/core	Physics & Chemistry of Environment	Practical	2
		BH150105T	Major/core	Earth & Earth Surface Processes	Theory	4
		BH150106P	Major/core	Earth & Earth Surface Processes	Practical	2
			Minor (Elec-tive) (Other faculty)	Minor elective from other faculty		4
			Minor	Vocational Skill Development course		3
		Z010101T	Minor/Co-Curricular (Qualifying)	First Aid and Basic Health		
				Total credit Semester		**25**
	II	**BH150201T**	Major/core	Biodiversity & Conservational Biology	Theory	4
		BH150202P	Major/core	Biodiversity & Conservational Biology	Practical	2
		BH150203T	Major/core	Environmental Biotechnology	Theory	4
		BH150204P	Major/core	Environmental Biotechnology	Practical	2
		BH150205T	Major/core	Environmental Health and Toxicology	Theory	4
		BH150206P	Major/core	Environmental Health and Toxicology	Practical	2
			Minor	Vocational Skill Development course		3
		Z020201T	Minor/Co-Curricular (Qualifying)	Food Nutrition and Hygiene	Theory	
				Total credit Semester		**21**
				Total credit in year (Semester I + Semester II) = 46		
Second Year	III	**BH150301T**	Major/core	Water and Water Resources Manage-ment	Theory	4
		BH150302P	Major/core	Water and Water Resources Manage-ment	Practical	2
		BH150303T	Major/core	Land management and soil conserva-tion	Theory	4
		BH150304P	Major/core	Land management and soil conserva-tion	Practical	2
		BH150305T	Major/core	Natural Resources Management & Sus-tainability	Theory	4
		BH150306P	Major/core	Natural Resources Management & Sus-tainability	Practical	2
			Minor (Other Fac-ulty)	Minor elective (other faculty)		4
			Minor	Vocational Skill Development course		3
		Z030301	Minor) Co-	Human Values and Environment studies	Theory	

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			curricular course (Qualifying)			
				Total credit in Semester		**25**
	IV	**BH150401T**	Major/core	Analytical methods, instrumentation and Measurement	Theory	4
		BH150402P	Major/core	Analytical methods, instrumentation and Measurement	Practical	2
		BH150403T	Major/core	Green Technologies	Theory	4
		BH150404P	Major/core	Green Technologies	Practical	2
		BH150405T	Major/core	Energy & Environment	Theory	4
		BH150406P	Major/core	Energy & Environment	Practical	2
			Minor	Vocational		3
			Minor) Co-curricular course (Qualifying)	Co-Curricular course (Qualifying)		
				Total credit in Semester		**21**
					Total credit in year (Semester III+ Semester IV)=46	
Third Year	**V**	**BH150501T**	Major/core	Environmental Pollution and Human Health	Theory	4
		BH150502P	Major/core	Environmental Pollution and Human Health	Practical	2
		BH150503T	Major/core	Atmosphere & Global Climate	Theory	4
		BH150504P	Major/core	Atmosphere & Global Climate	Practical	2
		BH150505T	Major/core	Environmental Legislation & Policy	Theory	4
		BH150506R	Major/core	Industrial Training/Surveys/Research Project (Qualifying)	Project	
		BH150507T	Major/elective	Organismal & Evolutionary Biology	Theory	4
		BH150508T	Major/elective	Urban Ecosystems	Theory	4
		Z050501T	Minor/Co-Curricular (Qualifying)	Analytical Ability and Digital Awareness		
				Total credit in Semester		**20**
	VI	**BH150601T**	Major/core	Environment Impact & Risk Assessment	Theory	4
		BH150602P	Major/core	Environment Impact & Risk Assessment	Practical	2
		BH150603T	Major/core	Remote Sensing, Geographic Information System & Modeling	Theory	4
		BH150604P	Major/core	Remote Sensing, Geographic Information System & Modeling	Practical	2
		BH150605T	Major/core	Natural Hazards & Disaster Management	Theory	4
		BH150606R	Major/core	Industrial Training/Surveys/Research Project (Qualifying)	Project	-
		BH150607T	Major/elective	*Elective paper* Wildlife Management	Theory	4
		BH150608T	Major/elective	*Elective paper* Systematic & Biogeography	Theory	4
				Total credit in Semester		**20**
				Total credit in year (Semester V + Semester VI) = 40		
				Total credit of B.Sc. Environmental Science Hons = 132		

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Program Educational Objectives (PEOs)

The **B. Sc. honors degree Environmental Sciences** program illustrates the scientific understanding to the graduate's students and strengthens the diverse emerging research to manage environmental issues. The course provides the opportunities to build the career in the field of academic / R & D / Industries / consultancy/Government and non government sectors.

PEO1	The students could get employment opportunities in Central Pollution Control Board (CPCB) and State Pollution Control Board (SPCB), Research Institutions, Colleges, Universities and Non-governmental organizations. Students could get opportunities for higher research (Ph. D) and scientific activities across the globe.
PEO2	After successful completion of the course, the students could get job opportunities in urban and rural environmental mitigation and awareness including social forestry programs, bio-fertilizer and bio-pesticide industries, waste management and organic farming divisions funded by National, International and Regional agencies.
PEO3	The students could get employment perspectives in R & D laboratories of waste water treatment plants, metal, chemical and textile effluent treatment plants, municipal solid waste management units and waste management in biomedical industries and hospitals
PEO4	The students could find employment opportunities in agro industries, forest departments, water harvesting and watershed management sectors, bio-resource utilization and biodiversity conservation organizations, food and feed Industries, environment friendly and integrated livestock management sectors.
PEO5	Students also having the immense opportunities to pursue higher studies in various research fields such as environmental pollution, environmental chemistry, waste management and bioremediation, environmental microbiology, waste water treatment, recycle, reuse and management, sustainable environmental food security, bio-resource utilization and biodiversity conservation, functional and ecosystem ecology, environmental toxicology, agro-waste ecosystem, non-biodegradable synthetic chemicals and polymers in environment, occupational health and industrial safety, environment analytical techniques, environmental impact assessment, remote sensing and geographical information system, environmental biotechnology, carbon sequestration, natural disaster management and mitigation, climate change, marine pollution and resources utilization, restoration of different ecosystems, renewable and green energy and environmental law, policies and auditing.

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PROGRAMME SPECIFIC OUTCOMES (PSOs)s	
	CERTIFICATE IN ENVIRONMENTAL SCIENCE
B. Sc. First Year	The aim is to build conceptual and fundamental understanding among students to exposing the basic principles behind various environmental processes (Abiotic and Biotic). To introduce students to the concepts of ecology, Environmental Chemistry, Instrumentation and Environmental Microbiology & Biotechnology for deep analysis of mystery of environment and issue related to environment. They also are able to understand the good laboratory practices and to know the strategies for sustainable management and carrying capacity Educate the students on source, classification, and impact of air, water and soil pollution.
	DIPLOMA IN ENERGY & ENVIRONMENT
B. Sc. Second Year	The students will also recognize the various control measures of pollution problems. Understand the solid waste pollution, noise pollution, radioactive and thermal pollution and related consequences. To enrich the knowledge on biodiversity its value and various approach for conservations. Make students aware of biodiversity of India, bio-geographic zones and role of local communities and traditional knowledge in conservation. Environment provisions in constitution, power and functions of government agencies for pollution control.
	DEGREE IN BACHELOR OF ENVIRONMENTAL SCIENCE (HONS)
B. Sc. Third Year	In addition also get the knowledge of sustainable management of wastes. To introduce students to the general environmental awareness, current environmental priorities in India and basic of statistics and instrumentations. To develop the understanding on natural resources and their significance and to know the strategies for sustainable management. Understand the basic principles and application of remote sensing and GIS techniques. Impart knowledge on microbial diversity and recent advancement methods in the analysis of microbial diversity. Provide in-depth knowledge of role of beneficial and pathogenic microorganisms in environment. Understand the application of microbes for production of different eco-friendly products. Impart knowledge in molecular biotechnology and its applications in Environmental management and conservation. Make students aware about EIA, Bioethics, bio-safety and IPR. To Understand the basic laws, act, treaty, public policies and PIL.

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The Award of the Certificate/Diploma/Degree will be as per the below criteria

CERTIFICATE IN ENVIRONMENTAL SCIENCE

-After completion of One year (Semester first+ Semester second)

DIPLOMA IN ENERGY & ENVIRONMENT

-After completion of Two years (Semester first+ Semester second Semester third +Semester four)

(Hons.) DEGREE IN ENVIRONMENTAL SCIENCE

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Programme /Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** First (1)	**Semester:** First (I)
Subject: Environmental Science		
Course Code: BH150101T	**Course Title: ECOLOGY AND ECOSYSTEMS**	

Course Outcomes (COs)

CO1 Strengthen the knowledge about ecosystem
CO2 To build the fundamental concept of Environment
CO3 To understand the basic principles of energy subsidies
CO4 To understand the model of ecology
CO5 To aware fundamental knowledge of ecological productivity.

Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	Topics	No. of Lectures
I	Basic concepts and definitions: ecology, landscape, habitat, ecozones, biosphere, ecosystems, ecosystem stability, resistance and resilience; autecology; synecology; major terrestrial biomes.	12
II	Population Ecology : Concept of population; characteristics of population: density, dispersion, natality, mortality, life tables, survivorship curves, age structure; population growth: geometric, exponential, logistic, density dependent; limits to population growth.	12
III	Community: Community structure and organization: physiognomy, sociability, species associations, periodicity, biomass, stability, keystone species, ecotone and edge effect; species interactions: mutualism, symbiotic relationships, commensalism, amensalism, protocooperation, predation, competition, parasitism, mimicry, herbivory; ecological succession: primary and secondary successions, models and types of successions, and meta-population; r- and Kselection, climax community concepts, examples of succession, rudreal, competitive and stress-tolerance strategies	12
IV	Types of ecosystem: forest, grassland, lentic, lotic, estuarine, marine, desert, wetlands; ecosystem structure and function; abiotic and biotic components of ecosystem; ecosystem boundary; ecosystem. function; ecosystem metabolism; primary production and models of energy flow; secondary production and trophic efficiency; ecosystem connections: food chain, food web; detritus pathway of energy flow and decomposition processes; ecological efficiencies; ecological pyramids: pyramids of number, biomass, and energy.	12
V	Biogeochemical cycles and nutrient cycling: 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.	12

Suggested Reading

Suggested Books:

1. Fundamentals of Ecology — E.P. Odum
2. Essentials of Ecology — John L. Harper and Michael Begon
3. Environmental Sciences — Robert M Shaoh
4. Environmental Communication (Lab to Land) — Mishra & Upadhyay
5. Environmental Science — Andrew RW & Julie M Jackson
6. Ecology and The Environment — Russell K Manson
7. Silent Spring — Rachel Carson
8. Ecosystem — PD Sharma
9. From the past to future — Richard HW Bradshaw & Martin T Sykes

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Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** First (1)	**Semester:** First (I)
Subject: Environmental Science		
Course Code: BH150102P	**Course Title: ECOLOGY AND ECOSYSTEMS LAB**	
Credits: 2	**Core Compulsory**	
Maximum Marks:50	**Minimum Passing Marks:** As per University norms	

	Topics	**No. of Lectures**
	1. Estimation of weed status, with emphasis on compatibility within/among the weeds. **2.** Determine the minimum size of quadrate by species area curve method. **3.** To study the community by quadrate method by determining Frequency, Density and Abundance of different species present at sampling area. **4.** Field study in ecology using both qualitative and quantitative studies (Check-list/Quadrat /Transect) from any one of the following bio-geographical area (coastal/ forest/ Hills/National Park) with **report submission.** .	15

Programme/Class: Certificate /B. Sc. (Hons)	**Year:** First (1)	**Semester:** First (I)
Subject: Environmental Science		
Course Code: BH150103T	**Course Title:** **PHYSICS AND CHEMISTRY OF ENVIRONMENT**	

Course Outcomes (COs)

On successful completion of this course, student will be able:

CO1 To Strengthen the knowledge about physical and chemical Environment

CO2 To build the fundamental concept of organic chemistry and Atmospheric chemistry

CO3 To understand the basic principles of chemical reactions

CO4 To understand about Atmospheric photochemical reactions

CO5 To aware fundamental knowledge environmental physics

Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

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Unit	Topics	No. of Lectures
I	**Fundamentals of environmental physics** **Part A:** Basic concepts of light and matter; spectroscopic concepts: Introduction to the concept of absorption and transmission of light, Beer-Lambert law; scattering of light, Rayleigh and Mia scattering. **Part B:** Basic concepts of pressure, force, work and energy; types of forces and their relation (pressure gradient, viscous, Coriolis, gravitational, centripetal, and centrifugal force); concept of heat transfer, conduction, convection; concept of temperature, lapse rate (dry and moist adiabatic); laws of thermodynamics.	12
II	**Fundamentals of environmental chemistry** **Part A:** Atomic structure, electronic configuration, periodic properties of elements (ionization potential, electron affinity and electronegativity), types of chemical bonds (ionic, covalent, coordinate and hydrogen bonds); mole concept, molarity and normality, quantitative volumetric analysis. **Part B:** Types of chemical reactions; acids, bases and salts, concept of chemical equilibrium, solubility products; solutes and solvents; redox reactions, concepts of pH and pE. **Part C:** Basic concepts of organic chemistry, hydrocarbons, aliphatic and aromatic compounds, organic functional groups, polarity of the functional groups, colloid chemistry and Synthetic organic pollutant.	12
III	**Atmospheric chemistry:**Composition of atmosphere; photochemical reactions in atmosphere; smog formation, types of smog (sulphur smog and photochemical smog), aerosols; chemistry of acid rain, reactions of NOX and SOX; free radicals and ozone layer depletion.	12
IV	Water chemistry **:** Structure of water, factors responsible for conversion of water chemistry, Gases in water, Henry's Law, alkalinity and acidity of water, hardness of water, total hardness; solubility of metals, complex formation and chelation.	12
V	Soil chemistry: Soil composition; relation between organic carbon and organic matter, inorganic and organic components in soil; soil humus; cation and anion exchange reactions in soil; nitrogen, phosphorus and potassium in soil.	12

Suggested Reading

1. Environmental Chemistry — James E. Girrard
2. Environmental Chemistry — Stanly.e.manchen
3. Environmental Chemistry — A.K. De

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** First (1)	**Semester:** First (I)
Subject: Environmental Science		
Course Code: BH150104P	**Course Title: PHYSICS AND CHEMISTRY OF ENVIRONMENT LAB**	
Credits: 1	**Core Compulsory**	
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms	

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	Topics	No. of Lectures
	1. Determine the total hardness of given water sample. 2. Determine the alkalinity of given water sample. 3. Determine the free CO_2 content in given water sample. 4. Estimate the chloride content in given water sample. 5. Determine the acidity of water sample. 6. Stress determination on plant, fungi and bacteria. 7. Estimation of chlorophyll content of different plant leaves under stress	15

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** First (1)	**Semester:** First (I)
Subject: Environmental Science		
Course Code: BH150105T	**Course Title:** **EARTH & EARTH SURFACE PROCESSES**	

Course Outcomes (COs)

CO1 Strengthen the knowledge about earth
CO2 To build the fundamental concept of earth surface processes
CO3 To understand the principles of evolution of earth's atmosphere and composition
CO4 To understand about Continental collision
CO5 To aware fundamental knowledge of evolution of monsoon in Indian subcontinent

Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	Topics	No. of Lectures
I	History of Earth: Formation of the Earth: formation and composition of core, mantle, crust, atmosphere and hydrosphere; chemical composition of Earth; geological time scale and major changes on the Earth's surface.	12
II	**Earth system processes** Movement of lithosphere plates; mantle convection and plate tectonics, major plates and hotspots, plate boundaries; sea floor spreading; earthquakes; volcanic activities; gravitational and magnetic fields of the earth; continental drift theory .	12
III	**Rocks, weathering and minerals:** Minerals and important rock forming minerals; rock cycle and roc formation, rock structure, igneous, sedimentary and metamorphic rocks; weathering: physical, biogeochemical processes; erosion: physical processes of erosion, factors affecting roc erosion.	12
IV	**Earth atmosphere** Atmosphere: evolution of earth's atmosphere and composition, physical and optical properties, circulation; interfaces: atmosphere-ocean interface, atmosphere-land interface, ocean-land interface.	12
V	**Mountain and river systems of India:** Continental collision and mountain formation; Formation of Peninsular Indian mountain systems - Western and Eastern Ghats, Vindhyas, Aravallis, etc.; Formation of the Himalaya; perennial river systems and evolution of monsoon in Indian subcontinent; formation of Indo-Gangetic Plains.	12

Suggested Reading

Suggested Books:

1. Environmental Science — Andrew RW & Julie M Jackson
2. Environmental Sciences — Robert M Shaoh
3. Earth and intimate history — Richard Fortey
4. Environmental Geosciences — Savindra Singh
5. Green House and Earth — Annika Nilsson

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6. Ozone in the Free Atmosphere Robert C. Whitten & Sheos Prasad
7. The Atmosphere:
8. An Introduction to Meteorology Frederick K Lutgens & Edwrd J Tarbuck

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** First (1)	**Semester:** First (I)

Subject: Environmental Science

Course Code: BENM150106P	**Course Title:** **EARTH & EARTH SURFACE PROCESSES LAB**
Credits: 2	**Core Compulsory**
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms

	Topics	**No. of Lectures**
	Identification of rocks & minerals (Hand Specimen) a) Rocks- Granite, Basalt, Dolerite, Shale, Sandstone, Limestone, Slate, Marble, Quartzite, Gneiss b) Minerals- Talc, Bauxite, Mica, Quartz, Hematite, Galena 2. Topological sheet interpretation for geomorphology.	15

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** First (1)	**Semester:** First (I)

Subject: Environmental Science

Course Code: to be provided by other faculty	**Course Title: Minor (Other Faculty)**
Minor Other Faculty: 1(one) minor elective paper from any other faculty (a subject other than the	
Credits: 4	**Minor elective (Optional)**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

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Vocational		
Co-Curricular		
Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** First (1)	**Semester:** Second (II)
Subject: Environmental Science		
Course Code: BH150201T	**Course Title: BIODIVERSITY & CONSERVATIONAL BIOLOGY**	

Course Outcomes (COs)

CO1 Strengthen the knowledge about biodiversity
CO2 To build the fundamental concept of biodiversity Conservation
CO3 To understand the principles of Biodiversity patterns
CO4 To understand about Continental collision
CO5 To aware fundamental knowledge about Threats of biodiversity

Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	Topics	No. of Lectures
I	**Biodiversity patterns and estimation:** Definition; Types; Spatial and temporal variation patterns of biodiversity, seasonal fluctuations in biodiversity patterns. Sampling strategies and surveys of biodiversity, qualitative and quantitative methods of biodiversity: scoring, habitat assessment, richness, density, frequency, abundance, evenness, diversity, biomass estimation; community diversity estimation: alpha, beta and gamma diversity.	**12**
II	**Unit 2: Importance of biodiversity:** Economic values - medicinal plants, drugs, fisheries and livelihoods; ecological services - primary productivity, role in hydrological cycle, biogeochemical cycling; ecosystem services - purification of water and air, nutrient cycling, climate control, pest control, pollination, and formation and protection of soil; social, aesthetic, consumptive, and ethical values of biodiversity.	**12**
III	**Unit 3: Threats to biodiversity:** Natural and anthropogenic disturbances; habitat loss, habitat degradation, and habitat fragmentation; climate change; pollution; hunting; over-exploitation; deforestation; hydropower development; invasive species; land use changes; overgrazing; man wildlife conflicts; consequences of biodiversity loss; Intermediate Disturbance Hypothesis.	**12**
IV	**Unit 4: Conservation of biodiversity:** Importance of biodiversity patterns in conservation; In-situ conservation (Biosphere Reserves, National Parks, Wildlife Sanctuaries); Ex-situ conservation (botanical gardens, zoological gardens, gene banks, seed and seedling banks, pollen culture, tissue culture and DNA banks), role of local communities and traditional knowledge in conservation; biodiversity hotspots; IUCN Red List categorization - guidelines, practice and application; Red Data book; ecological restoration; aforestation; social forestry; agro forestry; joint forest management; role of remote sensing in management of natural resources.	**12**
V	**Unit 5: Biodiversity in India:** India as a mega diversity nation; phytogeographic and zoogeographic zones of the country; National Biodiversity Action Plan.	**12**

Suggested Reading

1. The Biodiversity of India — Erach Bharucha
2. An advance text book of biodiversity,

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3. Principles and Practices — K.V. Krishnamurthy
4. Hand book of sustainable development — Giles Atkinson, Eric Neumayer
5. Environmental sciences — Ginger smith
6. Green House and Earth — Annika Nilsson
7. Groom.B.&Jenkins.M.2000.GlobalBiodiversityEarth'sLivingResourcesinthe21stCent

a. Pandit,M.K.&GrumbineR.E.2012.Ongoingandproposedhydropowerdevelopmentinthe Himalaya and its impact on terrestrial biodiversity Conservation Biology 26: 1061- 1071.

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** First (1)	**Semester:** Second (II)
Subject: Environmental Science		
Course Code: BH150202P	**Course Title:** **BIODIVERSITY & CONSERVATIONAL BIOLOGY LAB**	
Credits: 2	**Core Compulsory**	
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms	

	Topics	**No. of Lectures**
	1. Estimation of vegetation through analysis of Frequency of species. **2.** Estimation of vegetation through analysis of density of species. **3.** Estimation of vegetation through analysis of abundance, relative density of species. **4.** Analysis of indices (Shannon wiener diversity index, Simpson's index, Simpson's index of diversity, evenness index) in studied area.	15

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** First (1)	**Semester:** Second (II)
Subject: Environmental Science		
Course Code: BENM15203T	**Course Title:** **ENVIRONMENTAL BIOTECHNOLOGY**	

Course Outcomes (COs)

CO1 To aware fundamental knowledge of microbiology and Biotechnology
CO2 Students buildup the application of biotechnological means to save our environment.
CO3 To know about relevant biotechnological tools and techniques
CO4 To develop the molecular understanding of genetic material and Proteins
CO5 To aware about microbiological and Biotechnological tools is benefited than

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Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	Topics	No. of Lectures
I	Basic Concepts of Microbiology: Classification of microorganisms, different factors for microbial growth, staining techniques. The Structure, type, synthesis and Function of DNA, RNA and Protein. Extremophyles. Microbe identification and characterization.	12
II	Recombinant DNA Technology: Chronological development in origin Recombinant DNA Technology, toolkit of enzymes for manipulation of DNA: restriction enzymes, polymerases (DNA/RNA polymerases, transferase, reverse transcriptase), other DNA modifying enzymes (nucleases, ligase, phosphatases, polynucleotide kinase); genomic and cDNA libraries, cloning and expression vectors	12
III	Biotechnology of Solid waste management: Wastewater treatment: anaerobic, aerobic process, methanogenesis, bioreactors, cell and protein (enzyme) immobilization techniques, degradation; solid waste treatment: sources and management (composting, vermiculture and methane production, landfill. hazardous waste treatment); specific bioremediation technologies for xenobiotic compounds.	12
IV	Ecologically safe products and processes PGPM: biofertilizers, microbial insecticides and pesticides, bio-control of plant pathogen, Integrated pest management; development of stress tolerant plants, biofuel; microbe based bioremeadiation	12
V	GMs and GMOs: Concept of GM and GMOs, case studies, biosafety protocol.	12

Suggested Reading

1. Environmental Microbiology — P. Gebra
2. A Text Book of microbiology — RC Dubey
3. Environmental Biotechnology — S.N. Jogdand
4. Environmental Biotechnology — Alans Scragg
5. Environmental Science — Andrew R.W & Julie M Jackson
6. Microbiology — Prescott
7. Environmental Microbiology — Pradipta K Mohapatra
8. Microbiology — HG Slegal
9. Microbiology — Jaicklene G Black
10. Microbiology — Pelczar

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** First (1)	**Semester:** Second (II)

Subject: Environmental Science

Course Code: BH150204 P	**Course Title: ENVIRONMENTAL BIOTECHNOLOGY**
Credits: 2	**Core Compulsory**
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms

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	Topics	No. of Lectures
	1. Gram Staining, 2. Total Coliform 3. count (MPN), 4. Preparation of Microbial Growth media 5. ABO Blood grouping. 6. Review paper preparation/ presentation on topics related to Environmental Biotechnology.	15

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** First (1)	**Semester:**Second (II)
Subject: Environmental Science		
Course Code: BH150205T	**Course Title:** **ENVIRONMENTAL HEALTH AND TOXICOLOGY**	

Course Outcomes (COs)

Upon completion of this course, the students will be able to:
CO1 Aware fundamental knowledge about Basic Concept of Toxicology
CO2 Students aware about diseases which is based on pollution
CO3 Students buildup the Concept of Immunology
CO4 To buildup the concept of communication for health education
CO5 To aware about toxicant and route exposure.

Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	Topics	No. of Lectures
I	**Epidemiology and Health:** Concept of Health and Disease, principles of epidemiology and epidemiological methods, aims of epidemiology, measurement of mortality, measurement of morbidity.	12
II	**Concept of Disease:** Concept of screening the diseases, some communicable diseases like small pox, cholera, acute diarrheal disease, viral hepatitis, water borne pathogens, vector borne diseases, diseases caused by contaminated food and water, soil borne infections, insect borne diseases.	12
III	**Concept of Immunology:** Elementary idea about antigens and antibody, hyper sensitivity, allergic reactions, pollens and their allergens. Immunological techniques.	12
IV	**Community and Health:** Communication for health education, health care of the country.	12
V	**Basic Concept of Toxicology:** Different types of toxicant, toxicity test, toxicity by different factors, exposure effect relationship, different route of exposure, synergistic and antagonistic effect, Bioaccumulation and Biomagnification. Detoxification, toxicodynamics.	12

Suggested Reading

1. Fundamentals of Toxicology — Casserette & Doulls
2. Fundamentals of Toxicology — Shukla, Pandey & Trivedi
3. Environmental Toxicology — Crutis Dklaassel
4. Environmental Biology & Toxicology — P D Sharma

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Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows.

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** First (1)	**Semester:** Second (II)
Subject: Environmental Science		
Course Code: BH150206P	**Course Title: ENVIRONMENTAL HEALTH AND TOXICOLOGY**	
Credits: 2	**Core Compulsory**	
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms	

	Topics	No. of Lectures
	1. LC 50 calculation by probit analysis with data provided. 2. Determination of stress related heat, pH, temperature 3. Study of abnormalities in the erythrocytes of fish 4. Study of abnormalities in root tip of Allium cepa	15

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Second (II)	**Semester: Third** (III)
Subject: Environmental Science		
Course Code: BH150301T	**Course Title: WATER RESOURCE MANAGEMENT**	

Course Outcomes (COs)

CO1 To aware fundamental knowledge of water sources and it types
CO2 Students aware about Physical, Chemical, Biological Properties of water
CO3 Students buildup the concept of ground water
CO4 To buildup the concept of Wetlands
CO5 To aware about the Water resource in India.

Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	Topics	No. of Lectures
I	**Water resource:** Sources and types of water; hydrological cycle; precipitation, runoff, infiltration, evaporation, evapotranspiration; classification of water resources (oceans, rivers, lakes and wetlands).	12
II	**Properties of water:** Physical, chemical and biological properties of water, water quality index, role of hydrogen bond in water molecule, conditions responsible for solubility of gases in water, DO, COD, BOD, electrical conductivity, microbiological status in water.	12
III	Surface and Groundwater: Introduction to surface and ground water; water table; vertical	12

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	distribution of water; formation and properties of aquifers; hydraulic potential, Darcy's equation, types of flow, turbulence, techniques for ground water recharge; watershed and drainage basins; importance of watershed and watershed management	
IV	**Wetlands and their management:** Definition of a wetland; types of wetlands (fresh water and marine); ecological and hydrological functions of wetlands.	12
V	**Water resource in India and Water sharing conflicts:** Demand for water (agriculture, industrial, domestic); overuse and 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.	12

Suggested Reading

1. Water Pollution V.K. Kudesia & Emminual Pulmen
2. Aquatic Pollution Edward A –laws
3. Surface water pollution and its control K V Ellis
4. A Text Book of water pollution and water quality indicators Kugamoorthy & Belauthamorthy (Lambert Academic Publisher)

Other ccourse books published in Hindi must be prescribed by the University/College

Suggested Continuous Internal Evaluation (CIE) methods

Total marks: 25
10 marks for Test
10 marks for presentation along with assignment
05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Second (II)	**Semester:** Third (III)
Subject: Environmental Science		
Course Code: Course Code: BH150302P	**Course Title: WATER AND WATER RESOURCES MANAGEMENT LAB**	
Credits: 2	**Core Compulsory**	
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms	

	Topics	**No. of Lectures**
	1. Determine the alkalinity, pH, Electrical conductivity, Salinity of given water sample. 2. Determine the alkalinity of given soil sample (through Chloride Estimation). 3. Determine the Dissolved oxygen, TSS, TDS, Iron of given soil sample 4. Determine the TSS, TDS, Iron of given soil sample 5. Determine the Iron of given soil sample 6. Determine the TSS, TDS, Iron of given soil sample	15

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Second (II)	**Semester:** Third (III)
Subject: Environmental Science		
Course Code: BH150303T	**Course Title: Land management and soil conservation**	
Course Outcomes (COs)		
After completion of the course the student should be able to:		

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CO1 To aware fundamental knowledge of Land Resource
CO2 To buildup the concept of soil science
CO3 Students aware about Soil resistance and resilience
CO4 Students buildup the concept of Land use pattern
CO5 To aware about the Land deterioration and management

Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	Topics	No. of Lectures
I	**Introduction to Land Resource:** Land as a resource, types and evaluation, soil health; ecological and economic importance of soil; types and causes of soil degradation; impact of soil loss and soil degradation on agriculture and food security; need for soil conservation and restoration of soil fertility.	12
II	**Fundamentals of soil science** Soil formation; classification of soil; soil architecture; physical properties of soil; soil texture; soil profile; soil water holding capacity; soil temperature; soil colloids; soil acidity and alkalinity; soil salinity and sodicity; soil organic matter; micronutrients of soil; nitrogen, sulphur, potassium and phosphorus economy of soil; soil biodiversity; soil taxonomy maps.	12
III	**Soil degradation and conservation:** Soil resistance and resilience; nature and types of soil erosion; non-erosive and erosive soil degradation; losses of soil moisture and its regulation; nutrient depletion; soil pollution due to mining and mineral extraction, industrial and urban development, toxic organic chemicals, and organic contaminants in soils; fertilizers and fertilizer management; recycling of soil nutrients.	12
IV	**Land use changes** Land use pattern, drivers of land use and land cover change in major geographic zones and biodiverse regions with particular reference to the Himalaya and the Western Ghats.	12
V	**Land degradation and management:** Land degradation: biological and physical phenomena; visual indicators of land degradation; drivers of land degradation - deforestation, desertification; habitat loss, loss of biodiversity; range land degradation; land salinization; human population pressure, poverty, socio-economic and institutional factors, Economic valuation of land degradation; onsite and offsite costs of land degradation; loss of ecosystem services; effects on farming communities; effects on food security; effects on nutrient cycles; future effects of soil degradation; emerging threats of land degradation to developing countries. Sustainable land use planning; role of databases and data analysis in landuse planning control and management; land tenure and land policy; legal, institutional and sociological factors; participatory land degradation assessment; integrating land degradation assessment into conservation.	12

Suggested Reading

1. **Suggested Books:**
2. Soil Sciences — N .C Breede
3. Hand Book of Soil Science — Malcolm E Sumner
4. Agriculture and soil pollution — James B Livingston
5. Soil and Water Contamination — Marcel Van Derperk
6. Soil Pollution — Armeando Duarte, Anabela Cachada

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows.
Total marks: 25
10 marks for Test

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10 marks for presentation along with assignment 05 marks for Class interactions		
Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Second (II)	**Semester:** Third (III)
Subject: Environmental Science		
Course Code: BH150304P	**Course Title: LAND MANAGEMENT AND SOIL CONSERVATION LAB**	
Credits: 2	**Core Compulsory**	
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms	

Topics	No. of Lectures
1. Estimation of Soil Organic Carbon, 2. Estimation of Water Holding Capacity, 3. Estimation of buffering capacity of soil 4. Estimation of pH of soil 5. Estimation of Determination of Soil carbonate and Bicarbonate 6. Estimation of Available NPK of Soil 7. Bulk density particle density water holding capacity	15

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Second (II)	**Semester:** Third (III)
Subject: Environmental Science		
Course Code: BH150305T	**Course Title: NATURAL RESOURCES MANAGEMENT AND SUSTAINABILITY**	
Course Outcomes (COs)		
CO1 To aware fundamental knowledge of natural resources **CO2** To buildup the concept of conservation of natural resources **CO3** Students aware about mineral resources **CO4** Students buildup the energy conservation **CO5** To aware about the Sustainable energy strategy		
Credits: 4	**Core Compulsory**	
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms	

Unit	Topics	No. of Lectures
I	**Introduction** Resource and reserves; classification of natural resources; renewable and non-renewable resources; resource degradation; resource conservation; resource availability and factors influencing its availability; land resources; water resources; fisheries and other marine resources; energy resources; mineral resources; human impact on natural resources; ecological, social and economic dimension of resource management.	12
II	**Natural resources and conservation** Forest resources: economic and ecological importance of forests, forest management strategies, sustainable forestry; water resources: supply, renewal, and use of water resources, freshwater shortages, strategies of water conservation; soil resources conservation.	12

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III	**Mineral resources:** Mineral resources and the rock cycle; identified resources; undiscovered resources; reserves; types of mining: surface, subsurface, open-pit, dredging, strip; reserve-to-production ratio; global consumption patterns of mineral resources techniques to increase mineral resource supplies; ocean mining for mineral resources; environmental effects of extracting and using mineral resources.	12
IV	**Energy resources** Resource and conservation-Oil and natural gas formation, exploration, extraction and processing. Energy efficiency; life cycle cost; cogeneration; solar energy: technology, advantages, passive and active solar heating system, solar thermal systems, solar cells. Resource and conservation-wind energy, hydropower energy, nuclear energy ,ocean thermal energy conversion (OTEC); geothermal energy, bio energy and tidal energy.	12
V	Sustainable energy strategy: Sustainable energy strategy; principles of energy conservation; Indian renewable energy programme.	12

Suggested Reading

1. Introduction to forestry and Natural Resources — Donald L Grebner, Pete Bettinger i. Jacek P. Siry
2. Energy and the Environment — Robert A Ristinen, Jack P. i. Kraushaar
3. Introduction to energy,
4. The environment and sustainability — Paul Gannon
5. Natural resources and Environmental Justice — Rakuten Kobo
6. Sustainable Utilization of Natural Resources — AK Dalai
7. The environmental &
8. Natural Resources Economics — Jonathan M Harris and Brian

1. Roach

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows.

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Second (II)	**Semester:** Third (III)

Subject: Environmental Science

Course Code: BH150306P	**Course Title: NATURAL RESOURCES MANAGEMENT AND SUSTAINABILITY LAB**
Credits: 2	**Core Compulsory**
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms

Topics	No. of Lectures
1. Survey of natural agricultural resource for Energ 2. Use and over-utilisation of surface and ground water, floods, drought, conflicts over water, dams – benefits and problems 3. Use of Alternate energy sources, Case studies 4. Non-renewable resources in India 5. Renewable resources in India 6. Natural resources Harnessing Methods and classification	15

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	Minor elective from other faculty	
	Vocational	
	Co-Curricular	

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Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Second (2)	**Semester:** Fourth (IV)
Subject: Environmental Science		
Course Code: BH150401T	**Course Title:** **ANALYTICAL METHODS, INSTRUMENTATION AND MEASUREMENT**	
Course Outcomes (COs)		
CO1 To aware fundamental knowledge Sampling **CO2** To buildup the concept of Spectrophotometry **CO3**Students aware about Electrophoresis **CO4** Students buildup the concept of Microscopy **CO5** To aware about the data analysis		
Credits: 4	**Core Compulsory**	
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University Norms	

Unit	Topics	No. of Lectures
I	**Sampling** Sampling, preservation, storage techniques; Principles and applications of titrimetry (Acidimetry, Alkalimetry, Complexometry, Argentometry, Iodometry) gravimetry, potentiometry, conductimetry.	12
II	**Principles and application of Spectrophotometry** Principles and application of UV-VIS Spectrophotometry, Atomic absorbtion spectrophometry flame photometry	12
III	**Electrophoresis** Electrophoresis gel electrophoresis, SDS-PAGE , Chromatography, X-Ray fluorescence	12
IV	**Microscopy**- Microscopy Properties, Types and applications.	12
V	**Date Information-** Knowledge Wisdom Loop, data analysis, errors in data representation.	12

Suggested Reading

1. Standard Methodology of Biochemical Analysis SK Thimmayiah
2. Practical Biochemistry K Willson & John Walker
3. Labraor manual P.M.Swami

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Second (2)	**Semester:** Fourth (IV)
Subject: Environmental Science		
Course Code: BENM150402P	**Course Title:** **ANALYTICAL METHODS, INSTRUMENTATION AND MEASUREMENT LAB**	

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Credits: 2	**Core Compulsory**	
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms	

	Topics	**No. of Lectures**
	1. Separation of chlorophyll pigment by paper chromatography. 2. Separation of protein by paper chromatography. 3. Separation of amino acid by thin-layer chromatography. 4. Protein profiling by SDS-PAGE. 5. Measurement of light intensity. 6. Agarose-Gel electrophoresis. Obtained data from field by Sampling, preservation, tabulation and analysis	15

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Second (2)	**Semester:** Fourth (IV)

Subject: Environmental Science

Course Code: BH150403T	**Course Title:** **GREEN TECHNOLOGIES**

Course Outcomes (COs)

CO1 To aware fundamental knowledge and Concept of green technology
CO2 To buildup the concept of application green technology
CO3 To buildup the concept of application green chemistry
CO4 Students buildup the concept of sustainable green chemistry
CO5 To aware about the Innovation of Green technology

Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	**Topics**	**No. of Lectures**
I	**Green infrastructure, planning and economy** Concept of green technology, Chronological development of green technology, green belts.	**12**
II	**Applications of green technologies** Introduction to green chemistry; principles and recognition of green criteria in chemistry; bio- degradable and bio-accumulative products in environment, photodegradable plastic bags	**12**
III	**Green chemistry** Introduction to green chemistry; principles and recognition of green criteria in chemistry; bio- degradable and bio-accumulative products in environment; green nanotechnology; reagents, reactions and technologies that should be and realistically could be replaced by green alternatives; photodegradable plastic bags.	**12**
IV	**Green future** Agenda of green development; reduction of ecological footprint; role of green technologies towards a sustainable future; major challenges and their resolution for implementation of green technologies; green practices to conserve natural resources	**12**

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	(organic agriculture, agro forestry, reducing paper usage and consumption, etc.); emphasis on waste reduction instead of recycling.	
V	**Innovation of Green technology** Emphasis on innovation for green future; role of advancement in science in developing environmental friendly technologies.	**12**

Suggested Reading

1. Conservation of Natural Resources. Prentice Hall Publication Klee, G.A. 1991.
2. Anastas,
3. Green Chemistry: Theary & Practice. Oxford University Press P.T. & Warner,J.C. 1998.
4. Boeker,E.&Grondelle,R.2011.EnvironmentalPhysics:SustainableEnergyandClimateC hange.Wile
5. Renewable Energy: Power for Sustainable Future. Oxford University Press. Boyle G., 2004.

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Second (2)	**Semester:** Fourth (IV)
Subject: Environmental Science		
Course Code: BH150404P	**Course Title:** **GREEN TECHNOLOGIES LAB**	
Credits: 2	**Core Compulsory**	
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms	

	Topics	**No. of Lectures**
	1. Analysis of stability of vermi-compost by compost respiration method. 2. Analysis of rainwater harvesting potential in urban/rural catchments 3. Developed green practices to conserve natural resources (organic agriculture, agro forestry, reducing paper usage and consumption) **4.** Developed green practices for photodegradable plastic bags	15

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Second (2)	**Semester:** Fourth (IV)
Subject: Environmental Science		
Course Code: BENM150405T	**Course Title: ENERGY AND ENVIRONMENT**	

Course Outcomes (COs)

CO1 To aware fundamental knowledge of Global energy resources
CO2 To buildup the concept of energy demand
CO3 To buildup the concept of Energy for environment and society
CO4 Students buildup the concept of sustainable energy resources
CO5 To aware about the Energy impact and issues

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Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	Topics	No. of Lectures
I	**Energy resources** Defining energy; forms and importance; Global energy resources; renewable and non-renewable resources: distribution and availability; sources and sinks of energy; past, present, and future technologies for capturing and integrating these resources into our energy infrastructure.	12
II	**Energy demand** Global energy demand: historical and current perspective; energy demand and use in domestic, industrial, agriculture and transportation sector; generation and utilization in rural and urban environments; changes in demand in major world economies; energy subsidies; environmental costs.	12
III	**Energy, environment and society** Energy production as driver of environmental change; nature, scope and analysis of local and global impacts of energy use on the environment; fossil fuel burning and related issues of air pollution, nuclear energy and related issues such as radioactive waste, spent fuel; energy production	12
IV	**Our energy future** Current and future energy use patterns in the world and in India; evolution of energy use over time; alternative sources as green energy (biofuels, wind energy, solar energy, geothermal energy; tidal energy, ocean energy; nuclear energy); need for energy efficiency; energy conservation and sustainability; action strategies for sustainable energy management from a future perspective	12
V	**Energy impact and issues** Energy transformation and utilization associated environmental impacts (Chernobyl and Fukushima nuclear accidents, construction of dams, environmental pollution); energy over-consumption and its impact on the environment, economy, and global change; social inequalities related to energy production, distribution, and use; energy conservation.	12

Suggested Reading

1. Anastas, P.T. & Warner,J.C. 1998. Green Chemistry: Theary & Practice. Oxford University Press
2. Boeker,E.&Grondelle,R.2011.EnvironmentalPhysics:SustainableEnergyandClimateC hange.Wile
3. Boyle G., 2004. Renewable Energy: Power for Sustainable Future. Oxford University Press.
4. Renewable Energy: Power for Sustainable Future. Oxford University Press. Boyle G., 2004.

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Second (2)	**Semester:** Fourth (IV)
Subject: Environmental Science		
Course Code: BH150406P	**Course Title: ENERGY AND ENVIRONMENT**	
Credits: 2	**Core Compulsory**	

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Maximum Marks: 50	**Minimum Passing Marks:** As per University norms	
	Topics	**No. of Lectures**
	1. Calculation of energy efficiency from given data. 2. Preparation of energy audit of a domestic unit and report submission. 3. Submit a report on Green energy development (biofuels, wind energy, solar energy, geothermal energy, tidal energy, ocean energy, nuclear energy) in Indian contest	15
Vocational		
Co-Curricular		
Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Fifth (V)
Subject: Environmental Science		
Course Code: BH150501T	**Environmental Pollution and Human Health**	
Course Outcomes (COs)		
CO1 To aware fundamental knowledge of Pollutants **CO2** To buildup the concept of Ambient air quality and noise **CO3** To buildup the concept of water pollution **CO4** Students buildup the concept of soil pollution **CO5** To aware about the pollution management		
Credits: 4	**Core Compulsory**	
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms	

Unit	Topics	No. of Lectures
I	**Introduction** Definition of pollution; pollutants; classification of pollutants.	12
II	**Air & Noise pollution** Ambient air quality: monitoring and standards (National Ambient Air Quality Standards of India); air quality index; sources and types of pollutants (primary and secondary); indoor air pollution: sources and effects on human health. Noise pollution-sources; frequency, intensity and permissible ambient noise levels; effect on communication, impacts on life forms and humans - working efficiency, physical and mental health; control measures.	12
III	**Water pollution** Sources of surface and ground water pollution; water quality parameters and standards; organic waste and water pollution; eutrophication; COD, BOD, DO; effect of water contaminants on human health (nitrate, fluoride, arsenic, chlorine, cadmium, mercury, pesticides); water borne diseases; concept and working of effluent treatment plants (ETPs). Marine resources and their importance; sources of marine pollution; oil spill and its effects; coral reefs and their demise; coastal area management; existing challenges and management techniques (planning, construction, environmental monitoring of coastal zones).	12
IV	**Soil pollution** Causes of soil pollution and degradation; affect of soil pollution on environment, vegetation and other life forms; control strategies. Radioactive material and sources of radioactive pollution; effect of radiation on human health (somatic and genetic effects); thermal pollution and its effects.	12
V	**Pollution** Pollution control mechanism of air, water, soil and noise. Activated Sludge Process (ASP) - Trickling Filters - oxidation ponds, fluidized bed reactors, membrane	12

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	bioreactor neutralization, ETP sludge management; digesters, up flow anaerobic sludge blanket reactor, fixed film reactors, sequencing batch reactors, hybrid reactors, bioscrubbers, biotrickling filters; regulatory framework for pollution monitoring and control; case study: Ganga Action Plan; Yamuna Action Plan; implementation of CNG in NCT of Delhi.	

Suggested Reading

1. The Atmosphere: An Introduction to Meteorology- Frederick K Lutgens & Edwrd J
2. Green House and Earth Annika Nilsson
3. Environmental sciences Denial d chiras
4. Environmental sciences Ginger smith
5. Ozone in the Free Atmosphere Robert C. Whitten & Sheos Prasad
6. Water Pollution V.K. Kudesia & Emminual Pulmen
7. Aquatic Pollution Edward A –laws
8. Surface water pollution and its control K V Ellis
9. A Text Book of water pollution and water quality indicators Kugamoorthy & Belauthamorthy (Lambert Academic Publisher)

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows.

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Fifth (V)
Subject: Environmental Science		
Course Code: BH150502P	**Course Title: ENVIRONMENTAL POLLUTION AND HUMAN HEALTH LAB**	
Credits: 2	**Core Compulsory**	
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms	

	Topics	**No. of Lectures**
	1. Estimation of BOD, COD of Gomati river water 2. Estimation of Noise level (dB (A) in Jaunpur city 3. Estimation of SPM, RSPM of air 4. Estimation of Dust fall rate of road side vegetation 5. Soil pollution	15

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Fifth (V)
Subject: Environmental Science		
Course Code: BH150503T	**Course Title: ATMOSPHERE AND GLOBAL**	

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	CLIMATE CHANGE

Course Outcomes (COs)

CO1 To aware fundamental knowledge Earth's energy balance
CO2 To buildup the concept of Atmospheric circulation
CO3 To buildup the concept of Meteorological parameters
CO4 Students buildup the concept and trends of global warming and climate change
CO5 To aware about the ozone layer depletion

Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	Topics	No. of Lectures
I	**Global energy balance** Earth's energy balance; energy transfers in atmosphere; Earth's radiation budget; green house gases (GHGs); greenhouse effect; global conveyor belt.	12
II	**Atmospheric circulation** Movement of air masses; atmosphere and climate; air and sea interaction; southern oscillation; western disturbances; EI Nina and La Nina; tropical cyclone; Indian monsoon and its development, effect of urbanization on micro climate; Asian brown clouds.	12
III	**Meteorology and atmospheric stability** Meteorological parameters (temperature, relative humidity, wind speed and direction, precipitation); atmospheric stability and mixing heights; temperature inversion; plume behavior; Gaussian plume model.	12
IV	**Global warming and climate change** Earth's climate through ages; trends of global warming and climate change; drivers of global warming and the potential of different green house gases (GHGs) causing the climate change; atmospheric windows; impact of climate change on atmosphere, weather patterns, sea level rise, agricultural productivity and biological responses - range shift of species, CO_2 fertilization and agriculture; impact on economy and spread of human diseases. Environmental policy debate; International agreements; Kyoto protocol 1997; Convention on Climate Change; carbon credit and carbon trading; clean development mechanism.	12
V	**Ozone layer depletion** Ozone layer or ozone shield; importance of ozone layer; ozone layer depletion and causes; Chapman cycle; process of spring time ozone depletion over Antarctica; ozone depleting substances (ODS); effects of ozone depletion; mitigation measures and international protocols - Montreal protocol 1987.	12

Suggested readings

1. The Atmosphere: An Introduction to Meteorology
2. Frederick K Lutgens & Edwrd J Tarbuck
3. Green House and Earth Annika Nilsson
4. Ozone in the Free Atmosphere Robert C. Whitten & Sheos Prasad
5. Environmental sciences Denial D Chiras
6. Environmental sciences Ginger smith

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Further Suggestions: None

Programme/Class:	**Year:** Third (III)	**Semester:** Fifth (V)

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Certificate /B. Sc. (Hons) **Environmental Science**		
Subject: Environmental Science		
Course Code: BENM150504P	**Course Title: ATMOSPHERE AND GLOBAL CLIMATE CHANGE LAB**	
Credits: 2	**Core Compulsory**	
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms	

	Topics	**No. of Lectures**
	1. Estimation of atmospheric pressure, 2. Estimation of relative humidity, 3. Estimation of rainfall, 4. Estimation of insolation, 5. Calculate the wind speed, 6. Estimation of light intensity (Lux meter) 7. Prepare a summary report of weather with the help of one month data	15

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Fifth (V)
Subject: Environmental Science		
Course Code: BH150505T	**Course Title: ENVIRONMENTAL LEGISLATION AND POLICY**	

Course Outcomes (COs)

CO1 To aware fundamental knowledge of Constitution of India related to environment
CO2 To determine the concept of policy
CO3 To buildup the concept of Environmental legislation
CO4 to develop concept and trends of National Environmental policy and act
CO5 To aware about the International laws and policy of Environment

Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	**Topics**	**No. of Lectures**
I	**Introduction** Constitution of India; fundamental rights; fundamental duties; Union of India; union list, state list, concurrent list; legislature; state assemblies; judiciary; panchayats and municipal bodies.	12
II	**History of environmental legislation and policy** Provision of Environmental Conservation - British India: Indian Penal Code 1860, Forest Act 1865, Fisheries Act 1897; Independent India: Van Mahotsava 1950, National Forest Policy 1952, National Forest Policy 1988.	12
III	**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 Water (Prevention and Control of Pollution) Act 1974; The Water	12

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	(Prevention and Control of Pollution) Cess Act 1977; The Forests (Conservation) Act 1980; The Air (Prevention and Control of Pollution) Act 1981; The Environment (Protection) Act 1986; Motor Vehicle Act 1988; The Public Liability Insurance Act 1991; Noise Pollution (Regulation and Control) Rules 2000; The Biological Diversity Act 2002; The Schedule Tribes and other Traditional Dwellers (Recognition of Forests Rights) Act 2006; The National Green Tribunal Act 2010; scheme and labeling of environment friendly products, Ecomarks.	
IV	**Role of Government institutions and National Policies** 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; National Green Tribunal; National Environment Policy, 2006.	12
V	**International laws and policy** Stockholm Conference 1972; United Nations Conference on Environment and Development 1992; Rio de Janeiro (Rio Declaration, Agenda 21); Montreal Protocol 1987; Kyoto Protocol 1997; Copenhagen and Paris summits; Ramsar convention.	12

Suggested Reading

1. Management Planning for Nature Conservation Axeander Mike
2. Inside ISO 1400 The competitive advantage
3. of Environmental Management Don Sayre
4. Introduction to Environmental Management Mary K Theodore
5. International Environmental Law Philippe Sands
6. Law relating to Intellectual Properties Dr BL Wadehra
7. Hand Book of Environmental Laws,
8. Acts, Guidelines, Compliances and standards Dr RK Trivedy

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Suggested Continuous Internal Evaluation (CIE) methods

Total marks: 25
10 marks for Test
10 marks for presentation along with assignment
05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Fifth (V)

Subject: Environmental Science

Course Code: BH150506R	**Course Title: Industrial Training/Surveys/Research Project**
Credits: As per University norms	**Core Compulsory**
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Fifth (V)

Subject: Environmental Science

Course Code: BH150507T	**Course Title: ORGANISMAL AND EVOLUTIONARY BIOLOGY**

Course Outcomes (COs)

CO1 To aware fundamental knowledge of life on Earth
CO2 To buildup the concept of Evolution of unicellular life

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CO3 To buildup the concept of Geography of evolution
CO4 Students buildup the concept of Molecular evolution
CO5 To aware about the Fundamentals of population genetics

Credits: 4	**Elective**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	Topics	No. of Lectures
I	**History of life on Earth** **Part-A : Paleontology and evolutionary History;** Evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale; stages in primate evolution including Homo. **Part B: Lamarck's concept of evolution;** Darwin's Evolutionary Theory: variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutations; The Evolutionary Synthesis.	12
II	**Evolution of unicellular life** Origin of cells and unicellular evolution and basic biological molecules; abiotic synthesis of organic monomers and polymers; Oparin-Haldane hypothesis; study of Miller; the first cell.	12
III	**Geography of evolution** Biogeographic evidence of evolution; patterns of distribution**.**	12
IV	**Molecular evolution** Introduction to biomolecules: Protein, Lipids, Carbohydrates (General characteristics and classification) Neutral evolution; molecular divergence and molecular clocks; molecular tools in phylogeny, classification and identification; protein and nucleotide sequence analysis.	12
V	**Fundamentals of population genetics** Concepts of populations, gene pool, gene frequency; concepts and rate of change in gene frequency through natural selection, migration and genetic drift; adaptive radiation; isolating mechanisms; speciation (allopatric, sympatric, peripatric and parapatric); convergent evolution; sexual selection; coevolution; Hardy-Weinberg Law.	12

Suggested Reading

1. Nei, M. 1987. Molecular Evolutionary Genetics. Columbia University press.
2. Bawa K.S., Primack R.B, Oommen M.A. 2004. Conservation Biology: A Primer for South Asia. University Press.

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25
10 marks for Test
10 marks for presentation along with assignment
05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Fifth (V)

Subject: Environmental Science

Course Code: BH150508T	**Course Title: URBAN ECOSYSTEMS**

Course Outcomes (COs)

To aware fundamental knowledge of urban ecosystem
CO2 To buildup the concept of urban habitat growth
CO3 To buildup the concept of City ecosystem
CO4 Students buildup the concept of city planning and environmental management

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CO5 To aware about the Fundamentals of urban environmental management		
Credits: 4	**Elective**	
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms	

Unit	Topics	No. of Lectures
I	**Environment in an urban setting** Man as the driver of urban ecosystem; co modification of nature; economic and ecological perspectives of urban development.	12
II	Urban Sprawl; 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.	12
III	**Urban interface with the environment** Definition and concepts: green technology, green energy, green infrastructure, green economy, and, green chemistry; sustainable consumption of resources; individual and community level participation such as small-scale composting pits for biodegradable waste, energy conservation.	12
IV	**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.	12
V	**Planning and environmental management** Green buildings; history of green buildings, need and relevance of green buildings over conventional buildings.	12

Suggested Reading

1. Freeman, A.M. 2003. Millennium Ecosystem Assessment: Conceptual Framework. Island Press.
2. Loreau, M. &Inchausti, P. 2002. Biodiversity and Ecosystem functioning: Synthesis and Perspectives. Oxford University Press, Oxford, UK.
3. Fundamentals of Ecology E.P. Odum
4. Essentials of Ecology John L. Harper and Michael Begon
5. Ecology and The Environment Russell K Manson
6. Silent Spring Rachel Carson
7. Ecosystem dynamics From the past to future-Richard HW Bradshaw & Martin T Sykesf

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Sixth (VI)
Subject: Environmental Science		
Course Code: BH150601T	**Course Title: ENVIRONMENTAL IMPACT AND RISK ASSESSMENT**	

Course Outcomes (COs)

On completion of this course, students should be able to:

CO1 To aware fundamental knowledge of Environmental impact assessment

CO2 To buildup the concept of EIA module

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CO3 To buildup the concept of EIA regulation
CO4 Students buildup the concept of EIA risk assessment
CO5 To aware about the Fundamentals of ISO

Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	Topics	No. of Lectures
I	**Environmental impact assessment (EIA):** Definitions, introduction and concepts; rationale and historical development of EIA; scope and methodologies of EIA; role of project proponents, project developers and consultants; Terms of Reference; impact identification and prediction; baseline data collection; Environmental Impact Statement (EIS), Environmental Management Plan (EMP)	12
II	**Environmental impact assessment module** Rapid EIA; Strategic Environmental Assessment; Social Impact Assessment; Cost-Benefit analysis; Life cycle assessment; environmental appraisal; environmental management - principles, problems and strategies; environmental planning; environmental audit;	12
III	**Environmental impact assessment regulation** EIA regulations in India; status of EIA in India; current issues in EIA; case study of hydropower projects thermal projects.	12
IV	**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.	12
V	**ISO Certification** Introduction to ISO 9000 and ISO 14000, certification; sustainable development.	12

Suggested Reading

1. Management Planning for Nature Conservation Axeander Mike
2. Inside ISO 1400 The competitive advantage
3. of Environmental Management Don Sayre
4. Introduction to Environmental Management Mary K Theodore
5. International Environmental Law Philippe Sands
6. Law relating to Intellectual Properties Dr BL Wadehra
7. Hand Book of Environmental Laws, Acts, Guidelines, Compliances and standards-Dr RK Trivedy

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test
10 marks for presentation along with assignment
05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Sixth (VI)
Subject: Environmental Science		
Course Code: BH150602P	**Course Title: ENVIRONMENTAL IMPACT AND RISK ASSESSMENT**	
Credits: 2	**Core compulsory**	
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms	

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	Topics	No. of Lectures
	1. Industrial Case study 2. Preparation and submission of report	30

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Sixth (VI)

Subject: Environmental Science

Course Code: BH150603T	**Course Title: *REMOTE SENSING, GEOGRAPHIC INFORMATION SYSTEM & MODELLING***

Course Outcomes (COs)

CO1 To aware fundamental knowledge of Remote Sensing
CO2 To buildup the concept of GIS
CO3 To buildup the concept of environmental management system
CO4 strengthen the knowledge of GPS survey and software
CO5 To aware about the Fundamentals of GIS application

Credits: 4	**Core compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	Topics	No. of Lectures
I	**Remote Sensing:** Definitions and principles; Electromagnetic (EME) spectrum; interaction of EMR with Earth's surface; spectral signature; satellites and sensors; aerial photography and image interpretation.	12
II	**Geographical Information Systems:** Definitions and components; spatial and non-spatial data; raster and vector data; database generation;	12
III	**Management** Database management system; land use! land cover mapping; overview of GIS	12
IV	**Software packages** GPS survey, data import, processing, and mapping.	12
V	**Applications and case studies of remote sensing and GIS in geosciences;** Water resource management, lands use planning, forest resources, agriculture, marine and atmospheric studies.	12

Suggested Reading

1. Guha, P.K. 2013. Remote Sensing for the Beginner (3rd ed.), Affiliated East West Press.
2. Jenson J.R. 2003. Remote Sensing of the Environment: An Earth Resource Perspective. Pearson.
1. Lillesand T.M. and Kiefer R.W., 2011. Remote Sensing and Image Interpretation (6th ed.). Wiely.

Suggested Continuous Internal Evaluation (CIE) methods

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

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05 marks for Class interactions		
Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Sixth (VI)
Subject: Environmental Science		
Course Code: BH150604P	**Course Title:** ***REMOTE SENSING, GEOGRAPHIC INFORMATION SYSTEM & MODELLING*** **Lab**	
Credits: 2	**Core compulsory**	
Maximum Marks: 50	**Minimum Passing Marks:** As per University norms	

	Topics	**No. of Lectures**
	1. ArC GIS online study for Mapping 2. Q GIS online study for Mapping 3. Analysis of Mapper and imaging	15

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Sixth (VI)
Subject: Environmental Science		
Course Code: BENH15605T	**Course Title: NATURAL HAZARDS AND DISASTER MANAGEMENT**	
Course Outcomes (COs)		
CO1 Strengthen the knowledge about ecosystem **CO2** To build the fundamental concept of Environment **CO3** To understand the basic principles of energy subsidies **CO4** To understand the model of ecology **CO5** To aware fundamental knowledge of ecological productivity.		
Credits: 4	**Core Compulsory**	
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms	

Unit	**Topics**	**No. of Lectures**
I	**Introduction** Definition of hazard; natural, technological, and context hazards; concept of risk and vulnerability; reasons of vulnerability - rapid population growth, urban expansion, environmental pollution, epidemics, industrial accidents, inadequate government policies.	12
II	**Natural hazards:** Natural hazards: hydrological, atmospheric & geological hazards; earthquake: seismic waves, epicenter; volcanoes: causes of volcanism, geographic distribution; floods: types and nature, frequency of flooding; landslides: causes and types of landslides, landslide analysis; drought: types of droughtmeteorological, agricultural, hydrological, and famine; Glacial Lake Outburst Floods (GLOF); tornadoes, cyclone & hurricanes; tsunamis: causes and location of tsunamis; coastal erosion, sea level changes	12

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	and its impact on coastal areas and coastal zone management.	
III	**Anthropogenic hazards** Impacts of anthropogenic activities such as rapid urbanization, injudicious ground water extraction, sand mining from river bank, deforestation, mangroves destruction; role of construction along river banks in elevating flood hazard; disturbing flood plains. Deforestation and landslide hazards associated with it; large scale developmental projects, like dams and nuclear reactors in hazard prone zones; nature and impact of accidents, wildfires and biophysical hazards. Case studies of Bhopal, Minamata and Chernobyl disaster. role of space technology in disaster management. role of government bodies such as NDMC and IMD; role of armed forces	12
IV	**Risk and vulnerability assessment** Two components of risk: likelihood and consequences, qualitative likelihood measurement index; categories of consequences (direct losses, indirect losses, tangible losses, and intangible losses); application of geoinformatics in hazard, risk & vulnerability assessment.	12
V	**Mitigation and preparedness** Concept of mitigation; types of mitigation: structural and non-structural mitigation, use of technologies in mitigations such as barrier, deflection and retention systems; concept of preparedness; importance of planning, exercise, and training in preparedness; role of public, education and media in hazard preparedness.	12

Suggested Reading

Suggested Readings:

1. Coppola D.P. 2007. Introduction to International Disaster Management. Butterworth Heinemann.
2. Craig, J.R., Vaughan. D.J. &Skinner. B.l. 1996. Resources of the Earth: Origin, Use, and Environmental Impacts(2 nd edition). Prentice Hall, New Jersey.
3. Critchfield, H.J. 2012. General Climatology (4th & Indian edition), PHI.
4. Cutter, S.L. 2012.Hazards Vulnerability and Environmental Justice. Earth Scan, Routledge Press.

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows

Total marks: 25

10 marks for Test

10 marks for presentation along with assignment

05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Sixth (VI)
Subject: Environmental Science		
Course Code: BENH15606R	**Course Title: Industrial Training/Surveys/Research Project Credits**	
Credits: As per University norms	**Core Compulsory**	

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Sixth (VI)
Subject: Environmental Science		
Course Code: BH150607T	**Course Title:** **WILDLIFE MANAGEMENT**	

Course Outcomes (COs)

On successful completion of this course, student will be able:

CO1 To learn basic knowledge of wildlife

CO2 To buildup the strategy of wildlife Conservation

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CO3 To aware about concept and practices of wildlife management
CO4 Develop skill of Analysis of wild life management
CO5 To Develop skill through Fundamentals technique of wild life management

Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	Topics	No. of Lectures
I	**Need of** wildlife **management** Role of stakeholders in managing wildlife. Journey of mankind from predator to conservator; prehistoric association between wildlife and humans: records from Bhimbetka wall paintings	12
II	**Conservation of** wildlife In the reign of king Ashoka: excerpts from rock edicts; understanding wildlife management, conservation and policies regarding protected areas in 21st century; positive values provided by wildlife conservation (monetary, recreational, scientific and ecological benefits).	12
III	**Practices of** wildlife **management** Principles and practices of wildlife management, Course and fine filter approaches for wildlife Management.	12
IV	**Analysis and management** Analysis of wild life management problems. Species conservation projects in India (Tiger, Rhino, Lion)	12
V	Capture and handling techniques, Identification and marking techniques, Measuring animal abundance, radio telemetry	12

Suggested Reading

1. Wildlife Ecology, Conservation, and Management, (3rd Edition), John M. Fryxell, Anthony R. E. Sinclair, Graeme Caughley 2014 Wiley Blackwell

Suggested Continuous Internal Evaluation (CIE) methods

Continuous Internal Evaluation shall be based on Class test, presentation along with assignment and class interactions. Marks shall be as follows
Total marks: 25
10 marks for Test
10 marks for presentation along with assignment
05 marks for Class interactions

Programme/Class: Certificate /B. Sc. (Hons) **Environmental Science**	**Year:** Third (III)	**Semester:** Sixth (VI)

Subject: Environmental Science

Course Code: BH150608T	**Course Title:** **SYSTEMATICS AND BIOGEOGRAPHY**

Course Outcomes (COs)

CO1 To learn basic concept of biogeography
CO2 To buildup the concept of Nomenclature
CO3 To aware about concept and practices of Bio-geographical rules
CO4 Enhance the knowledge of Biogeography and its types
CO5 learn about Speciation and extinction

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Credits: 4	**Core Compulsory**
Maximum Marks: 100 (75(ESE)+25(CIE))	**Minimum Passing Marks:** As per University norms

Unit	**Topics**	**No. of Lectures**
I	**Concept and systematic approaches** Definition of taxonomy, taxonomic identification keys/tools for systematic biogeography. Concept of species and taxonomic hierarchy	12
II	**Nomenclature and systems of classification** Principles and rules (International Code of Botanical and Zoological Nomenclature); ranks and names.	12
III	**Biogeography** Biogeographical rules-Gloger's rule, Bergmann's rule, Allen's rule, Geist rule; biogeographical realms and their fauna; endemic, rare, exotic and cosmopolitan species.	12
IV	**Types of Biogeography** **Part-A: Historical Biogeography** Earth's history; paleo-records of diversity and diversification; continental drift and plate tectonics and their role in biogeographic patterns **Part-B: Ecological Biogeography** Species, habitats; environment and niche concepts; biotic and abiotic determinants of communities **Part-C: Conservation Biogeography** Application of biogeographical rules in design of protected area and biosphere reserves; use of remote sensing in conservational planning.	12
V	**Speciation and extinction Types and processes of speciation -** Allopatric, parapatric, sympatric; ecological diversification; adaptive radiation, convergent and parallel evolution; dispersal and immigration; means of dispersal and barriers to dispersal; extinction.	12

Suggested Reading

Suggested Readings:

1. Williams, D.M., Ebach, M.C. 2008.FaundatiansafSystematics and Biogeography. Springer. 158.
2. Ecology and Biogeography in India. Dr. WJunk Publishers., TheHague Mani, M.S. 1974.

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