SCHEME OF EXAMINATION
and
SYLLABUS
of

BACHELOR OF SCIENCE
ENVIRONMENTAL SCIENCE (4 YEARS)
(BASED ON NEP-2020*, CBCS# and LOCF$)

(Programme Code: 324)

From

Effective from Academic Session 2024 onwards

(Scheme and Syllabus Approved by the BOS and Academic Council Sub-Committee)

GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY

Sector 16C, Dwarka, Delhi - 110078

(*National Education Policy – 2020; #Choice Based Credit System;
$ LOCF (Learning Outcome Based Curriculum Framework)

Programme Code: 0324

Title of the Programme: Bachelor of Science in Environmental Science

Approval of APC meeting on: 7th APC of 2023 on dated 1.12.2023

Approval of SRC meeting on: 18th SRC of 2023 on dated 1.12.2023

Approval of BOS meeting on: 14.12.2023

Sub-Committee Academic Council's Approval: 15.12.2023

Academic Council's Approval: ……...

University School of Studies of the Programme: University School of EnvironmentManagement (USEM)

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w.e.f. Academic Session 2024

GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY

University School of Environment Management

B.Sc. Environmental Science

Programme Outcomes (POs)

To create biodiversity professionals equipped with in-depth knowledge and understanding of contemporary issues in environmental sciences, sustainable development and conservation of biodiversity.
To provide in-depth theoretical and hands-on practical knowledge on subjects ranging from various disciplines of environment, development, biodiversity, pollution, restoration, ecology, molecular biology, phylogenetics to statistics, GIS, remote sensing and communication tools.
To appreciate the role of ethics, values and societal norms in producing culturally attuned and effective conservation interventions

Programme Specific Outcomes (PSOs)

Critically engage with concepts and theory in various frontiers of environment, ecology, biodiversity, science and management from interdisciplinary perspectives.
Critically assess the modes through which inclusive and sustainable development concept builds and extends power and describe in detail the factors that explain the emergence and performance of different types of governance.
Evaluate the implications of emergent technologies for the future of environmental science and sustainability.

Preamble

The course curriculum for undergraduate students under choice-based credit system (CBCS) for B.Sc. in Environmental Science (Basic/Hons.) is framed in this document. This exercise is undertaken as part of the nationwide curriculum restructuring initiative by the National Education Policy-2020. As enshrined in the National Education Policy-2020 vision of introducing course curriculum for undergraduate studies under Choice Based Credit System (CBCS), the main objective of framing this curriculum of B.Sc. (Basic/Hons.) in Environmental Science is to impart the students a holistic understanding of the subject giving substantial weightage to the core contents, skill, value-based and ability enhancement. The syllabus will give due importance on the main streams of the body of knowledge on 'Environment' with due recognition of its wide spectrum. The ultimate goal of the syllabus is to enable the students to have an in-depth knowledge on the subject and enhance their scope of employment at every level of exit. Adequate emphasis will be given on the new and emerging techniques and understanding of the subject under the changing regime and global context. There is also an additional emphasis in providing opportunities to understand the integration of modern disciplines such as environmental modelling, geographical information systems and remote sensing, environmental sustainability and climate change, EIA, conservation strategies, corporate governance and their applications to environmental sciences. Students will be encouraged to go beyond the classroom and conduct active action-research, research projects, technology-based learning and internships in industry/ private/government/manufacture and service sectors based on suitability. Lectures and classroom sessions will be accompanied with field visits, industrial visits, seminars, laboratory experiments and in-plant training. Educational visits are an integral part of teaching Environmental Science. These interventions are compulsory and essential aspects of the curriculum. There are optional subjects that can be chosen by the students as per their desire and their professional choices.

Introduction

The B.Sc. Environmental Science Programme provides international and national perspectives to address environmental issues and sciences-based solutions and critical thinking to balance nature and its sustainability in an interactive conducive classroom environment. Deep conceptual theoretical frameworks, principles and application-based engagement in the domain of environmental science, where sustainability component in prioritized. The programme comprises classroom discussion, seminars, field excursion, case studies, industry internships, live projects and most modern pedagogical delivery aimed for enriched interaction with faculty, practical hands-on training and curiosity among students.

Further, students can pursue post-graduate course in three important fields- M.Sc. Environment Management, M.Sc. Biodiversity Conservation and M.Sc. Natural Resource Management. USEM also have a very acclaimed Ph.D. Programme in Environmental Science for the past 20 years. B.Sc. in environmental science prepares students for a wide range of

employment opportunities in the field of Environmental Monitoring and Assessment, Natural Resource Management and Environmental Education. Students are also prepared to continue their education in post graduate and Ph.D. programmes in various subjects.

Program Education Objectives: - (PEO)

PEO_1: - To create biodiversity professionals equipped with in-depth knowledge and understanding of contemporary issues in environmental sciences, sustainable development and conservation of biodiversity.

PEO_2: - To provide in-depth theoretical and hands-on practical knowledge on subjects ranging from various disciplines of environment, development, biodiversity, pollution, restoration, ecology, molecular biology, phylogenetics to statistics, GIS, remote sensing and communication tools.

PEO_3: - To appreciate the role of ethics, values and societal norms in producing culturally attuned and effective conservation interventions.

Program Specific Objectives: - (PSO)

PSO_1: - Critically engage with concepts and theory in various frontiers of environment, ecology, biodiversity, science and management from interdisciplinary perspectives.

PSO_2:- Critically assess the modes through which inclusive and sustainable development concept builds and extends power and describe in detail the factors that explain the emergence and performance of different types of governance.

PSO_3: - Evaluate the implications of emergent technologies for the future of environmental science and sustainability.

Model Curriculum

Name of the Degree Programme: B.Sc. (Basic/Hons./Research)
Discipline Core: Environmental Science
Total Credits for the Programme: 170
Starting year of implementation: 2024

The course curriculum presented in the following table confirms to the general Guidelines of NEP-2020 scheme, semester schedule, evaluation criteria and course credit structure of B.Sc. Environmental Science (Basic/Hons./Research) Programme, like all other undergraduate courses and comprises of 170 credits spread over the following papers to be completed in four years/eight semesters.

S. No		No. Of Courses	Credits		
			Per Course	3rd Year	4th Year
1	**Major Core Courses**	22	4	64	80
2	**Minor Courses including Electives**	8 (out of 9 courses)	4	24	32
3	**Field Trip (Minor Projects) + Term Paper**	2	2	4	4
4	**Inter-disciplinary Course**	3	3	9	9
5	**Ability Enhancement Courses (AEC)**	4	2	9	9
6	**Skill Enhancement Courses (SEC)**	3	3/4	11	11
7	**Value Addition Courses (VAC)**	4	2/3	9	9
8	**Summer Internship**	1	4	4	4
9	**Dissertation (For Research Student)**	1	12	-	12
10	**Specialization Courses (For Honours Student)**	3	4	-	
			Total	**130**	**170**

Courses of Undergraduate Programme

The undergraduate programme shall contain the following course components:

- **Core Course:** This is a course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in Environmental Science. Each of the Core Courses shall contain two components: Theory and Practical/Tutorial.
- **Elective Course:** Generally, an elective course is a course which can be chosen from a pool of courses which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill.

An elective course may be three types:

- **Discipline Specific Elective (DSE) Course:** Elective courses offered by the main discipline/subject of study are referred to as Discipline Specific Elective Courses. This course is to advance knowledge and skill in the core domain. Each of the DSE courses shall contain two components: Theory and Practical/Tutorial.
- **Dissertation/Project/Internship**: An elective course designed to acquire special/advanced knowledge is termed as dissertation/project. This is considered as a special course involving application of knowledge in solving/ analysing/ exploring a real life situation/ difficult problem. Dissertation/Project Work/Internship is optional and it may be offered in lieu of a discipline specific elective paper in 8th Semester.

- **Generic Elective Course (GEC):** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek a wide exposure is called a Generic Elective. A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective. Each of the GEC Courses shall contain two components: Theory and Practical/Tutorial.
- **Ability Enhancement Course:** The Ability Enhancement Course may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). AECC courses are the courses based upon the content that leads to Knowledge enhancement: (i) Environmental Science and (i) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc. These may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge. Each of the AECC and SEC courses shall carry Credits.
- **Value Addition Courses (VAC):** These are courses that will help develop all capacities of human beings-intellectual, aesthetic, social, physical, emotional, and moral in an integrated manner. It includes subjects like Yoga, Sports, Health Care, NCC, NSS, Ethics, Culture etc. VAC courses may be chosen from a pool of courses. Each VAC course shall carry Credits.

Exit Options and Credit Requirements

Progressive Certificate in Science, Diploma in Science, Bachelor of Science Degree or Bachelor of Science Degree with Honours in Environmental Science is awarded at the completion of every progressive year.

Exit with	Credit requirements
CERTIFICATE IN ENVIRONMENTAL SCIENCE at the successful completion of First year (Two Semesters) of the Four Years Multidisciplinary Undergraduate Degree Programme.	45 credits
DIPLOMA IN ENVIRONMENTAL SCIENCE at the successful completion of Second year (Four Semesters) of the Four Years Multidisciplinary Undergraduate Degree Programme.	90 credits
BACHELOR OF ENVIRONMENTAL SCIENCE DEGREE at the successful completion of Three year (Six Semesters) of the Four Years Multidisciplinary Undergraduate Degree Programme.	130 credits
BACHELOR OF SCIENCE DEGREE WITH HONOURS IN ENVIRONMENTAL SCIENCE at the successful completion of Four year (Eight Semesters) of the Four Years Multidisciplinary Undergraduate Degree Programme.	170 credits

A student will be allowed to enter/re-enter only at the ODD semester and can only exit after EVEN semester. Re-entry at various as lateral entrants in academic programmes based on the above mentioned earned credits and proficiency test records.

The validity of the earned credit will be for a maximum period of seven years or as specified by the Academic Bank of Credits (ABC). Emphasis is given on Continuous Internal Assessment (CIA) with Higher order thinking skills (40%:60% - 40% CIA and 60% End Semester Examination) for theory course and 50%:50% - End Semester Examination and CIA for Laboratory work, Field works, Project, Internship and Educational visits.

TEACHING METHODOLOGY AND SYSTEM OF A S S E S S M E N T

Pedagogy to be followed

1. Lectures
2. Individual Assignments/ Group Assignments
3. Field/ Industry/ Internet-Based Project
4. Case Studies
5. Quizzes
6. Video Lessons

System of Internal Assessments:

End Term Examination		**- 60 Marks**
Continuous evaluation		
1.	Attendance/Class Participation/Participation in School Activities	- 10 Marks - 20 Marks
2.	Mid-Term Examination	
3.	Assignment/Quiz/Presentation	- 10 Marks

Total Marks for Internal Evaluations – **40 Marks**

Student will have to secure passing marks in the language courses (English/German/French and Hindi).

Bachelor of Environmental Science

SCHEME OF EXAMINATION

Bachelor of Science (Environmental Science)

COURSE STRUCTURE: B.Sc. major in Environmental Science (minor in Environment Management (EM)/minor in Biodiversity and Conservation (B&C)/minor in Natural Resource Management (NRM)

First Semester

Paper Code	Paper Title	L	T	P	Credits
Theory Papers					
BSCES – 101 (Major Course)	Fundamentals of Ecology and Environmental Science	3			3
BSCES – 103 (Major Course)	Basics of Earth Science	3			3
BSCES – 105 (Minor Course)	Environmental Physics and Chemistry	4			4
BSCES – 107 (Inter-Disciplinary Course)	Sustainable Development	3			3
BAENG– 107/111/113 (AEC)	English/German/French	2			2
BSCES – 111 (SEC)	Air and Water Quality Analysis	1			1
BSCES – 113 (VAC: Vocational/Education & Training)	AI in Environment	2			2
Practical/Lab					
BSCES – 151	Fundamentals of Ecology and Environmental Science			2	1
BSCES – 153	Basics of Earth Science			2	1
BSCES – 155	Air and Water Quality Analysis			4	2
BSCES – 157 (VAC)	AI in Environment			2	1
NCC/ NSS/* Yoga Education/ University Srijan Club Activity (VAC)					2
	Total				**25**

*NUES: Comprehensive evaluation by the teacher out of hundred, no term end examination shall be held. As per norms of NCC/NSS, credits will be earned by the student after completion of 6th semester.

Second Semester

Paper Code	Paper Title	L	T	P	Credits
Theory Papers					
BSCES – 102 (Major Course)	Environmental Pollution	3			3
BSCES – 104 (Major Course)	Biodiversity Conservation	3			3
BSCES – 106 (Minor Course)	Life Sciences	3			3
BSCES – 108 (AEC)	Environmental History	2			2
BSCES – 110 (SEC)	Quantitative Skill And Data Analysis	3			3
BSCES – 112* (VAC)	Extension Activity				2
Practical/Lab					
BSCES – 152	Environmental Pollution			2	1
BSCES – 154	Biodiversity Conservation			2	1
BSCES – 156	Life Sciences			2	1
BSCES – 158	Quantitative Skill And Data Analysis			2	1
	Total				**20**

*In addition, students who wish to exit after the first two semesters will undergo a four credits **vocational course work** based learning/internship during the summer term in order to get a **UG certificate**.
*NUES

Third Semester

Paper Code	Paper Title	L	T	P	Credits
Theory Papers					
BSCES – 201 (Major Course)	Environmental Microbiology	3			3
BSCES – 203 (Major Course)	Natural Resource Management	3			3
Minor electives (to choose any three)					
BSCES – 205 (Minor Course)	Introduction to Marine Science	4			12
BSCES – 207 (Minor Course)	Urban Ecology and Urban Planning	4			
BSCES – 209 (Minor Course)	Water and Wastewater Treatment	4			
BSCES – 211 (Minor Course)	Solid Waste Management	4			
BSCES – 213 (AEC)	Hindi Language	2			2
UHV – 201 (VAC)	Universal Human Values : Understanding Harmony	2			2
Practical/Lab					
BSCES – 251	Environmental Microbiology			2	1
BSCES – 253	Natural Resource Management			2	1
	Total				**24**

Fourth Semester

Paper Code	Paper Title	L	T	P	Credits
Theory Papers					
BSCES – 202 (Major Course)	Basics of Geoinformatics	3			3
BSCES – 204 (Major Course)	Environmental Legislation and Policy	4			4
BSCES – 206 (Major Course)	Environmental Geology	3			3
BSCES – 208 (Inter-Disciplinary Course)	Environmental Health	3			3
BSCES – 210 (Inter-Disciplinary Course)	Inclusive Development: Gender and Social Issues in Environment	3			3
BJ(JMS-MDC)- 107 (AEC)	Communication Skills	3			3
Practical/Lab					
BSCES – 252	Basics of Geoinformatics			2	1
BSCES – 254	Environmental Geology			2	1
	Total				**21**

*In addition, students who wish to exit after the first four semesters will undergo a four credits **vocational course work** based learning/internship during the summer term in order to get a **UG Diploma certificate**.

Fifth Semester

Paper Code	Paper Title	L	T	P	Credits
Theory Papers					
BSCES – 301 (Major Course)	Wildlife and Habitat Management	3			3
BSCES – 303 (Major Course)	Atmosphere and Climate Change	4			4
BSCES – 305 (Major Course)	Geospatial Technological Application in Environment	3			3
BSCES – 307 (SEC)	Instrumentation and Analytical Techniques in Environment	3			3
Practical/Lab					
BSCES – 351	Wildlife and Habitat Management			2	1
BSCES – 353	Geospatial Technological Application in Environment			2	1
BSCES – 355	Instrumentation and Analytical Techniques in Environment			2	1
BSCES – 357* (SEC)	Summer Internship				4
	Total				**20**

*NUES

Sixth Semester

Paper Code	Paper Title	L	T	P	Credits
Theory Papers					
BSCES – 302 (Major Course)	Natural Hazard and Disaster Management	4			4
BSCES – 304 (Major Course)	EIA, Auditing and ESG	4			4
BSCES – 306 (Major Course)	Biosystematics and Biogeography	3			3
BSCES – 308 (Major Course)	Energy and Environment	3			3
BSCES-310 (Minor Course)	Environmental Economics and Green Marketing	4			4
Practical/Lab					
BSCES – 352	Biosystematics and Biogeography			2	1
BSCES – 354	Energy and Environment			2	1
	Total				**20**

***Student who wishes to exit after the first six semesters will get a Bachelor Degree.**

Seventh Semester

Paper Code	Paper Title	L	T	P	Credits
Theory Papers					
BSCES – 401 (Minor Course)	Environmental Molecular Biology	4			4
BSCES – 403 (Minor Course)	Conservation of Wetland and Aquatic Ecosystem	4			4
BSCES – 405 (Major Course)	Society and Sustainable Livelihood	3			3
BSCES – 407 (Major Course)	Eco-technology: Restoration of Degraded Ecosystem	3			3
Practical/Lab					
BSCES – 451	Environmental Molecular Biology			2	1
BSCES – 453	Conservation of Wetland and Aquatic Ecosystem			2	1
BSCES – 455*	Educational Field Trip (Minor Project)				2
BSCES – 457*	Term Paper				2
	Total				**20**

*NUES

Eighth Semester

Paper Code	Paper Title	L	T	P	Credits
Theory Papers					
BSCES – 402 (Major Course)	Research Methodology and IPR	4			4
BSCES – 404 (Major Course)	Environmental Project Management: Formulation and Implementation	4			4
B.Sc. Hons. Without Research/Project (Any one area of the Minor Discipline)*					
Environment Management Course – BSCES – 406, BSCES-408, BSCES-410					
BSCES – 406 (Minor Course - EM)	Environmental Biotechnology	4			4
BSCES – 408 (Minor Course - EM)	Environmental modelling	4			4
BSCES – 410 (Minor Course - EM)	Watershed Management	4			4
Biodiversity & Conservation Course – BSCES – 412, BSCES – 414, BSCES – 416					
BSCES – 412 (Minor Course – B&C)	Landscape Ecology	4			4
BSCES – 414 (Minor Course – B&C)	Biodiversity Conservation in Anthropocene	4			4
BSCES – 416 (Minor Course – B&C)	Population and Conservation Genetics	4			4
Natural Resource Management Course – BSCES-418, BSCES-420, BSCES-422					
BSCES – 418 (Minor Course – NRM)	Forest Ecology, Forest Resources and its Utilization	4			4
BSCES – 420 (Minor Course – NRM)	Land Management, Agro-ecosystem and Agroforestry	4			4
BSCES – 422 (Minor Course – NRM)	Collaborative Resource Management	4			4
BCSES – 424	Dissertation Research Project				12
	Total				**20**

*For obtaining B.Sc. Hon. Without Research/Project degree, student have to select three minor courses from either grouped courses of EM/B&C/NRM.

Job Opportunities

Exit option with Certificate in Environmental Science

- Job opportunities for the Exit option with Certificate
- Sampling Assistant in wastewater treatment plants
- Analytical Assistant/Intern analyst in water testing laboratories
- Laboratory instructor in in educational institutions
- Field Technician in mobile environmental laboratories
- Field Technician in Research institutions/NGOs involved in environmental monitoring/carbon credit establishment/productivity studies.
- Sampling and execution assistant in environmental auditing
- Garden/nursery Supervisor/Entrepreneurship
- NGOs/Consultancy firms
- Self-employment

Job Opportunities for the **Diploma in Environmental Science**

- Procurement of Medicinal Plants - Marketing/Entrepreneurship
- Procurement, processing, value addition and Marketing of NTFPs - Executive/Entrepreneurship
- Lab assistant in educational institutions
- Wildlife and Ecotourism guides
- Public Health/Waste Management Assistants in Municipalities
- Incinerator operators in small establishments
- NGOs/Consultancy firms
- Self-employment

Job opportunities for the **B.Sc. Degree in Environmental Science**

- ESG Analysist
- Environmental Impact Consultant
- Biodiversity Analyst
- Forestry Consultant
- Natural Resource Assessment Professional
- Assistants in Central and State Pollution Control Boards
- Environmental Health and Safety Analyst in industries
- Occupational Health and Safety Analyst in industries/theme parks
- CSR Consultant
- Sustainable Development Policy and Governance Analyst
- Wastewater Treatment Plant Managers
- Environmental/Production Quality Assurance Executive - Junior
- Environmental Analyst (Validation)
- R&D Lab Assistant
- Water testing labs or chemical suppliers/ Entrepreneurship

- Watershed Management Consultant
- Mineral/Energy Resource Exploration Assistant
- Solar energy/alternate energy Executives
- Micro irrigation Executives
- Organic Farming Executives/Entrepreneurship
- NGOs/Consultancy firms
- Teachers in Schools
- Self-employment

Job opportunities for the **B.Sc. (Hons.) Degree in Environmental Science**

- Urban Landscape Planning
- ESG Analysist
- Environmental Impact Consultant
- Biodiversity Analyst
- Forestry Consultant
- Scientific Assistant in Research institutions
- Scientists in Central and State Pollution Control Boards
- Environment Health and Safety Officer in industries
- Environmental auditor I/Auditor II
- Environmental/Production Quality Assurance Officer
- Wastewater Treatment Plant Managers
- Sanitary landfill and Hazardous Waste Handling Experts
- Forensic Scientist
- Quality Control Executive Regulatory Affairs/Liaison Officer
- NGOs/Consultancy firms Project and Planning and Development Departments
- Watershed Management Professional
- Teachers in Schools
- Self-employment