

UNIVERSITY OF THE PUNJAB

NOTIFICATION

It is hereby notified that the Syndicate at its meeting held on 01-01-2026 has approved the recommendations of the Academic Council made at its meeting dated 16-12-2025 regarding approval of the Revised Syllabi and Courses of Reading for BS in Environmental Sciences Programs w.e.f the Academic Session, Fall, 2025 to onward.

The Revised Syllabi and Courses of Reading for BS in Environmental Sciences Programs is attached herewith as Annexure-A.

**Admin. Block,
Quaid-i-Azam Campus,
Lahore.**

No. D/ 6111 Acad.

**Sd/-
Dr. Ahmad Islam
Registrar**

Dated: 25-09 /2026.

Copy of the above is forwarded to the following for information and further necessary action: -

1. Dean, Faculty of Geo- Sciences
2. Principal, College of Earth and Environmental Sciences
3. Controller of Examinations.
4. Director, IT Centre *(for uploading on website).*
5. Additional Registrar (Affiliation) for circulation among Colleges
6. Secretary to the Vice-Chancellor
7. Secretary to Registrar
8. Assistant Registrar (Statutes)
9. A.R. Syllabus (W.F)


Assistant Registrar (Academic)
for Registrar



College of Earth and Environmental Sciences University of the Punjab, Lahore



Revised Syllabi and Courses of Reading for BS Environmental Sciences (04 Year) Degree Program

Program Title: BS Environmental Science
Department: College of Earth and Environmental Sciences
Faculty: Geosciences

1. Department Mission

The mission of the College is to groom the students into responsible and honest citizens and skilled professionals trained in their respective fields to serve the nation. Character building and moral training is an integral component of student-teacher relationship. student life in the College provides the students with all possible opportunities to acquire the most dynamic personalities with leadership qualities. Academically excellent and experienced faculty members are involved in teaching and research in the CEES. Classes are regularly held, well supplemented with laboratory work and observations in the field.

2. Introduction

College is presently offering multidisciplinary degree program i.e. BS, MS, M.Phil. and Ph.D. degree programs in the disciplines of Environmental Sciences, Applied Hydrology, Tourism & Hospitality Management, Geomatics and Occupational Health and Safety Management. The purpose of these courses is to produce graduates in these emerging disciplines with the insight and knowledge to serve the nation for attaining environmentally sustainable development in the country. Environmental changes, like desertification, silting of dam reservoirs, water logging, salinity and contamination of land as well as surface and groundwater, have created problems related to tourism. Over exploitation of resources has adversely impacted the tourism destinations and we are facing the danger of degradation and destruction of ecological infrastructure that is essential for sustainable tourism. In Pakistan, as elsewhere in developing countries, environmental degradation is occurring due to heavy industrialization concentrated in narrow zones, especially hospitality industry.

Keeping in view the importance and the growing demands for training manpower in the emerging discipline, the College of Earth and Environmental Sciences has been established in the University of

the Punjab in 2005. The new building of the College was completed in November 2008, featuring spacious rooms, moderately equipped laboratories, a library and large grounds.

3. Program Description

College of Earth and Environmental Sciences provides a learning educational environment to students with the opportunities to acquire knowledge and skill to build a successful career and become an integral part of the community. The program of BS Environmental Science is structured in accordance with the HEC Undergraduate Education Policy V 1.1 (2023) and subsequent notifications, to provide comprehensive understanding of the complex interactions between human societies and the natural environment. Throughout the program, students will be able to study and understand the diverse interdisciplinary themes to develop a holistic perspective on environmental issues. The program will equip students with the knowledge and skills to address pressing environmental challenges such as climate change, pollution, biodiversity loss, resource depletion etc. By exploring fundamental, contemporary and advanced courses, students will learn to analyze environmental problems, develop sustainable solutions, and make informed decisions to promote environmental conservation and stewardship. As a policy requirement, the program also provides students with an opportunity to engage in a capstone where they apply their interdisciplinary knowledge and research skills to tackle real-world environmental problems or conduct original research. This capstone will allow students to integrate concepts from multiple courses, demonstrate critical thinking and problem-solving abilities, and contribute to the advancement of environmental science.

The main goal of this program is to prepare students for diverse career paths in environmental research, consulting, advocacy, policy making, and education having deep understanding of environmental issues, strong analytical and research skills, and a commitment to creating positive environmental change in their communities and beyond.

4. Standard Nomenclature

The scheme of study prescribed for the four-year undergraduate degree in Environmental Science is based on a total of 7 electives. Where these courses are opted from the general pool of electives, the degree will be titled Bachelor of Science in Environmental Science in its generic form and without any specialization. Whereas, if all the electives are opted from within a single specialization domain, the degree will be titled Bachelor of Science in Environmental Science with the name of specialization in parenthesis in accordance with the National Qualifications Framework (2015).

5. Program Learning Outcomes

By the completion of Bachelor of Science in Environmental Science, the graduates will be able to:

1. Understand and explain the concepts, theories and empirical aspects within the discipline of environmental sciences.
2. Apply interdisciplinary knowledge to analyze and address environmental issues effectively.
3. Demonstrate adequate ability to utilize tools and techniques as applied in the field of environmental sciences.
4. Understand the impact of human activities on environment and natural resources.
5. Develop sustainable solutions to promote environmental conservation and stewardship

6. Program Objectives

In order for our program to remain preeminent our key goals are to:

1. To impart advanced knowledge about major areas of Environmental Sciences.
2. To enable the students to learn data collection, organization and statistical analyses.
3. To augment the capabilities of the students to use various practical techniques of planning and management of resources.
4. To train students to plan and execute studies on local environmental issues.
5. To develop abilities and keen interest in students to seek higher education in areas relevant to environmental sciences.
6. To equip students with professional skills to be demonstrated in teaching, research and environmental management.
7. To enable the students to review published literature critically.

7. Market Need / Rationale of the Program

The scope of environmental science is increasing day by day with growing environmental concerns. In the public sector, the jobs have been created at federal, provincial and local government levels. In the Pakistan with the 18th constitutional amendments, the subject of environment has been devolved to provinces and provincial institutions have been setup. With the establishment of local bodies system, the opportunities for environmental graduates will further increase as most of the tasks related to environment have been mandated to local bodies. Currently, all provinces, AJK and Gilgat Baltistan have environmental institutions at district level. In the private sector, all multinational companies have jobs related to environment and now local companies are also hiring environmental graduates. There are opportunities in environmental consulting services, where consultancy services are well rewarded. The UN organizations, World Bank, Asian Development Bank have established environment sections. Non-governmental organizations in the development and conservation sectors are also hiring environmental graduates.

Generally speaking, environmental issues are considered as cleanliness, planting trees, abating pollution etc., but in reality, the scope of environment is much beyond that. It encompasses the ecological, economic, social, cultural, political and commercial dimensions of consumptions and degradation of environmental resources and at the same time includes the technical, technological, legal, moral and ethical approaches to deal with such inter-sectoral issues at local and global level.

Technically speaking environment provides the essential life support services to the planet through dynamic interaction of its resources. The human interventions with the environmental resource dynamics for socio-economic development have created complex problems at local and global level. The knowledge to understand such problems and find different approaches to their solution has also developed. Hence, developing human resources capable of understanding the complex science of life support system is also of vital importance to make the development process environmentally sustainable. Therefore, the discipline of Environmental Science has come up as one of the emerging sciences in the new millennium and there is dire need to generate human resource in this emerging field of increasing significance to fulfil the market need. The core philosophy of Environmental sciences education is to provide management and vocational education and training combined with academic learning and hands-on training.

8. Admission Eligibility Criteria

A student holding HSSC (F.Sc. Pre-Engg. & Pre-Medical or equivalent) or 12 Years education marks from any recognized institute of Pakistan. Admissions to which will be on Merit (Marks obtained in previous examination), entry test or interview or the criteria decided by the respective bodies of the university as per rules in vogue.

9. Duration of the Program

Total duration of the program will be 04 year and number of courses taught in BS degree in Environmental Sciences will be 137 credit hours total with 08 semesters varied by 15-19 credit hrs in each semester. There shall be following 4 categories of courses offered to the students according to HEC standardized format/Scheme of studies.

10. NOC from Professional Councils (if applicable)

Not Applicable

11. Faculty Strength

Degree	Name of Faculty Member	Area / Specialization	Total
PhD	1. Prof. Dr. Irfan Ahmad Shaikh	Water and Wastewater Treatment	17
	2. Prof. Dr. Sajid Rashid Ahmad	Earth and Environmental Sciences, Climate Change, Remote Sensing & GIS	
	3. Prof. Dr. Nadia Jamil	Analytical / Environmental Chemistry	
	4. Prof. Dr. Abdul Qadir	Environmental Biology	
	5. Prof. Dr. Yumna Sadeef	Environmental Sciences	
	6. Dr. Muhammad Kamran	Environmental Tourism	
	7. Dr. Azhar Ali	Water and Wastewater Treatment, Health & Safety	
	8. Dr. Sana Ashraf	Biotechnology Bioremediation and Env. Microbiology	
	9. Dr. Naeem Akhtar Abbasi	Environmental Toxicology	
	10. Dr. Muhammad Bilal Shakoor	Water and Wastewater Treatment and Quality Assessment	
	11. Dr. Mehwish Mumtaz	Environmental Engineering / Toxicology	
	12. Dr. Rizwan Aziz	Hydrology and Water Resources Management	
	13. Dr. Muhammad Awais	Hydrology and Water Resources Management	
	14. Dr. Muhammad Waqar	Hydrology and Water Resources Management	
	15. Dr. Muhammad Asif Javed	GIS and Remote Sensing	
	16. Dr. Nayab Alam	GIS and Remote Sensing	
	17. Dr. Anum Tariq	Urban Ecology, Environmental Sciences	
MS / M.Phil.	18. Mr. Muhammad Dastgeer	Environmental Tourism	02
	19. Ms. Zahra Majid	Hydrology and Water Resources Management	
TOTAL FACULTY:			19

12. PROGRAM STRUCTURE

The Bachelor of Science (BS) in Environmental Science is structured in accordance with the provisions of the HEC Undergraduate Education Policy V 1.1. and comprises of 137-credit hours spread over eight (08) regular semesters. Universities may offer courses up-to maximum of 144 credit hours provided that the total number of credit hours are reasonably set to achieve the Program Learning Objectives (PLOs) without putting undue burden on students.

Minimum Credit Hours		135
General Education		34 Credit hours (15 courses)
Major	a). Compulsory	58 credit hours (20 courses)
	b). Mandatory Electives	21 credit hours (07 courses)
	Total Major Requirements	79 credit hours (27 courses)
Interdisciplinary Courses		16 credit hours (06 courses)
Internship		03 credit hours
Capstone Project		03 credit hours
Program Duration		Minimum: 04 Years Maximum: 06 Years
Semester Duration:		16-19 weeks for regular semester (1-2 weeks for examination) 8-9 weeks for summer semester (1 week for examination)
Course Load (Per semester)		15-19 credit hours for regular semester
3 Credit Hours (Theory)	3 classes (1 hour each) OR 2 classes (1.5 hour each) OR 1 class (3 hours) per week throughout the semester	
1 Credit Hour (Lab/Equivalent)	Practical / lab / field work of 1 credit hour requires 3 hours per week throughout the semester	

The standard scheme of studies for the program of BS Environmental Science (irrespective of the area of specialization) is given as under:

SEMESTER I				
S.N.	COURSE CODE	COURSE	CREDIT HOURS	CATEGORY
1	ENSC-101	Introduction to Environmental Science	3 (3-0)	Major
2	ENSC-102	Principles of Biology	3 (2-1)	Interdisciplinary
3	GQR-101	Quantitative Reasoning – I *	3 (3-0)	General Education
4	GNS-101	Natural Sciences ** (Physical Geography)	3 (2-1)	General Education
5	GISL-101	Islamic Studies * (Religious Edu / Ethics for non-Muslim students)	2 (2-0)	General Education
6	GICT-101	Applications of Information & Communication Technologies *	3 (2-1)	General Education
7	HQ-01	Understanding of Holy Quran / Fahm-e-Quran– I	01 (0-1)	Compulsory
Total Credits Hours = 18				
SEMESTER II				
S.N.	COURSE CODE	COURSE	CREDIT HOURS	CATEGORY
1	ENSC-103	Fundamentals of Ecology	3 (3-0)	Major
2	ENSC-104	Basic Chemistry	3 (2-1)	Interdisciplinary
3	GQR-102	Quantitative Reasoning – II *	3 (3-0)	General Education
4	GSS-102	Social Sciences *** (Anthropology)	2 (2-0)	General Education
5	GENG-101	Functional English *	3 (3-0)	General Education
6	GSPS-101	Pakistan Studies *	2 (2-0)	General Education
7	GAH-101	Arts & Humanities **** (Language i.e. French)	2 (2-0)	General Education
8	HQ-02	Understanding of Holy Quran / Fahm-e-Quran– II	01 (0-1)	Compulsory
Total Credits Hours = 19				
SEMESTER III				
S.N.	COURSE CODE	COURSE	CREDIT HOURS	CATEGORY
1	ENSC-201	Environmental Chemistry	3 (2-1)	Major
2	ENSC-202	Environmental Physics	3 (2-1)	Major
3	ENSC-203	Mineral Resources	3 (3-0)	Major
4	ENSC-204	Introduction to Earth Sciences	2 (2-0)	Interdisciplinary
5	GENG-201	Expository Writing *	3 (3-0)	General Education
6	GCCE-201	Civics & Community Engagement *	2 (2-0)	General Education
7	GICP-201	Ideology & Constitution of Pakistan *	2 (2-0)	General Education
Total Credit Hours = 18				

SEMESTER IV				
S.N.	COURSE CODE	COURSE	CREDIT HOURS	CATEGORY
1	ENSC-205	Environmental Toxicology	3 (3-0)	Major
2	ENSC-206	Environmental Pollution	3 (3-0)	Major
3	ENSC-207	Applied Ecology	3 (2-1)	Major
4	ENSC-208	Environmental Microbiology	3 (2-1)	Major
5	ENSC-209	Water and Wastewater Treatment	3 (2-1)	Major
6	ENSC-210	Environmental Economics	2 (2-0)	Interdisciplinary
Total Credit Hours = 17				
SEMESTER V				
S.N.	COURSE CODE	COURSE	CREDIT HOURS	CATEGORY
1	ENSC-301	Analytical Techniques in Environmental Science	3 (2-1)	Major
2	ENSC-302	Research Methods in Environmental Science	3 (3-0)	Major
3	ENSC-303	Geographical Information Systems and Remote Sensing	3 (2-1)	Major
4	ENSC-304	Environmental Governance Policy & Law	2 (2-0)	Major
5	ENSC-305	Internship	3 (3-0)	Major
6	ENSC-306	Elective – I *****	3 (3-0)	Major
Total Credit Hours = 17				
SEMESTER VI				
S.N.	COURSE CODE	COURSE	CREDIT HOURS	CATEGORY
1	ENSC-307	Disaster Risk Management	3 (3-0)	Major
2	ENSC-308	Solid Waste Management	3 (3-0)	Major
3	ENSC-309	Environmental Management Systems	3 (3-0)	Major
4	ENSC-310	Elective – II *****	3 (3-0)	Major
5	ENSC-311	Elective – III *****	3 (3-0)	Major
Total Credit Hours = 15				
SEMESTER VII				
S.N.	COURSE CODE	COURSE	CREDIT HOURS	CATEGORY
1	ENSC-401	Biodiversity & Conservation	3 (2-1)	Major
2	ENSC-402	Artificial Intelligent (AI) and Emerging Technologies in Environmental Science	3 (3-0)	Major
3	ENSC-403	Health, Safety and Environment	3 (2-1)	Interdisciplinary
4	GENT-401	Entrepreneurship*	2 (2-0)	General Education
5	ENSC-404	Elective – IV*****	3 (3-0)	Major
6	ENSC-405	Climate Change	2 (2-0)	Major
Total Credit Hours = 16				

SEMESTER VIII				
S.N.	COURSE CODE	COURSE	CREDIT HOURS	CATEGORY
1	ENSC-406	Sustainable Development	3 (3-0)	Interdisciplinary
2	ENSC-407	Elective – V *****	3 (3-0)	Major
3	ENSC-408	Elective – VI *****	3 (3-0)	Major
4	ENSC-409	Elective – VII *****	3 (3-0)	Major
5	ENSC-410	Capstone Project	3 (3-0)	Capstone
Total Credit Hours = 15				
Total Program Credit Hours = 135				

*HEC designed model courses for general education may be used by the university.

**The university / concerned department may offer any course in the broader category of “Natural Sciences” which should have relevance to the purpose of the degree program.

***The university / concerned department may offer any course in the broader category of “Social Sciences” including but not limited to a course of Sociology, Social Work, Anthropology, Psychology, Education etc.

****The university / concerned department may offer any course in the broader category of “Arts & Humanities” including but not limited to a course of regional or international language such as Chinese, Arabic, French, Spanish etc. or any other course such as Philosophy, History etc.

*****Read in conjunction with guidance given on “Standard Nomenclature” in this document, the university / concerned department may offer any 7 advanced courses from either the general pool or from within one of the specializations as electives keeping in view its available academic, human and infrastructural resources. Credit combination may be arranged in accordance with the nature of the course.

Degree Award Requirements

The following minimum requirements are prescribed for the award of BS Environmental Science:

- All courses in the General Education category with titles and credit hours as prescribed in HEC Undergraduate Education Policy V 1.1. including the courses of “Pakistan Studies”, “Understanding of Holy Quran – I” and “Understanding of Holy Quran – II” must be completed.
- A minimum of 135 credit hours as prescribed in this document must be completed.
- A capstone of 3 credit hours must be completed in accordance with HEC Undergraduate Education Policy V 1.1. This requirement cannot be substituted with additional coursework or internship / field experience.
- A supervised internship of 3 credit hours must be completed in accordance with HEC Undergraduate Education Policy V 1.1. This requirement cannot be substituted with additional coursework, capstone or project work.
- CGPA must not be below 2.00/4.00 at the time of completion of the degree program. The university may, however, set a higher standard in this regard.
- The minimum duration to complete the degree is 8 regular semesters spread over 4 years whereas the maximum duration is 12 regular semesters spread over 6 years. The maximum duration may further be extended to 2 more semesters (OR) 1 year, in extraordinary circumstances subject to approval of the university’s relevant statutory body. Summer semester is not considered as a regular semester.

12. Course Outlines separately for each course.

1ST YEAR, SEMESTER I			
Code	COURSE	CREDIT HOURS	CATEGORY
ENSC-101	Introduction to Environmental Science	3 (3-0)	Major
ENSC-102	Principles of Biology	3 (2-1)	Interdisciplinary
GQR-101	Quantitative Reasoning – I *	3 (3-0)	General Education
GNS-101	Natural Science ** (Physical Geography)	3 (2-1)	General Education
GISL-101	Islamic Studies * (Religious Edu / Ethics for non-Muslim students)	2 (2-0)	General Education
GICT-101	Applications of Information & Communication Technologies *	3 (2-1)	General Education
HQ-01	Understanding of Holy Quran / Fahm-e-Quran– I	1 (0-1)	General Education
Total Credit hrs Semester-I		18	

Program	BS Environmental Sciences	Course Code	ENSC-101	Credit hours	03
Course Title	INTRODUCTION TO ENVIRONMENTAL SCIENCE				
COURSE INTRODUCTION					
This course offers a foundational understanding of environmental science, exploring the relationships between humans and the natural environment. Students will study the basic principles of ecology, earth systems, biodiversity, energy flow, and natural resource management. The course also examines contemporary environmental issues such as climate change, pollution, deforestation, and sustainability. Emphasis is placed on scientific methods, critical thinking, and the role of environmental policy and ethics in addressing ecological challenges. Through lectures, discussions, and practical activities, students will gain the knowledge and tools needed to make informed decisions and take responsible actions concerning the environment.					
LEARNING OUTCOMES					
By the end of this course the students will learn:					
1 The importance of Environmental Science as an academic discipline					
2 About natural renewable and non-renewable resources of earth					
3 To understand the basic components and processes of environment, analyze human and environment interactions					
4 To evaluate the sources and consequences of water, air, land and soil pollution and their preventive measures					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Importance of environmental science and different aspects of environment		Environmental Science: A global Concern by Cunningham, W. P. /		
	Introduction to Environmental Science		Assignment 1: Write a short report on the evolution and importance of		
	History and evolution of Environmental Science		Environmental Science (2–3 pages)		
WEEK-2	Nature and scope of Environmental Science		Environmental Science: A Global Concern by Cunningham, W. P. /		
	Contribution of Environmental Science to society		Quiz 1: Basic concepts of		
	Physical aspects of environment		Environmental Science		
WEEK-3	Ecological aspects of environment		Environmental Science: A Global Concern by Cunningham, W. P. /		
	Socio-economic aspects of environment		Assignment 2: Prepare a concept map showing interactions among		
	Ethical and philosophical aspects of environment		environmental components.		
WEEK-4	Human environment and environmental problems		Environmental Sciences (17 th Edition) by Miller G.T. /		
	Global, national, and regional environmental issues		Quiz 2/ Assignment 4: Essay on		
	Unit-II: Types of environmental pollution		environmental ethics and human		
	Environmental pollution – concepts and types		responsibility toward nature.		
WEEK-5	Sources and effects of pollution		Environmental Sciences (17 th Edition) by Miller G.T. /		
	Air pollution – outdoor sources and effects		Assignment 6: Survey indoor air quality issues in homes or workplaces and		
	Indoor air pollution and control measures		suggest control measures.		
WEEK-6	Global warming – causes and impacts		Environmental Sciences (17 th Edition) by Miller G.T. /		
	Ozone depletion, acid rain, and mitigation strategies		Quiz 3 / Assignment 7: Prepare a presentation on causes and impacts of		
	Water pollution – rivers and lakes		ozone depletion and acid rain		
WEEK-7	Groundwater pollution and control measures		Environmental Sciences (17 th Edition) by Miller G.T. /		
	Water use and management – conservation techniques		Quiz 4		
	Soil pollution – causes and effects				

	Fertilizers and pesticides – environmental impacts	Assignment 7: Prepare a presentation on causes and impacts of ozone depletion and acid rain
	Pest control methods and sustainable solutions	
WEEK-8	Solid waste – sources and management	Environment: The science behind the stories (17 th Ed.) by Withgott, J/ Quiz 5
	Hazardous waste and disposal techniques	
	Noise and noise pollution – sources and effects	
MID TERM EXAMINATION		
WEEK-9	Urban environment and environmental problems of cities	Environmental Sciences (17 th Edition) by Miller G.T. / Assignment 9: Develop a household solid waste management plan.
	Light pollution and visual pollution	
	Deforestation – causes, impacts, and solutions	
WEEK-10	Loss of biodiversity and conservation strategies	Environmental Sciences (17 th Edition) by Miller G.T. / Assignment 10: Conduct a noise level survey in different campus/locality locations and interpret results.
	Unit-III: Environmental education and sustainable development Mangroves – importance and causes of disappearance	
	Environmental education – concept and objectives	
WEEK-11	Role of environmental education in society	Quiz 6
	Sustainable development – principles and goals	Environment: The science behind the stories (17 th Ed.) by Withgott, J/ Assignment 11: Report on biodiversity conservation strategies in Pakistan.
	Environmental challenges to sustainable development	
WEEK-12	Population dynamics – concepts and factors	Environment: The science behind the stories (17 th Ed.) by Withgott, J/ Assignment 12: Design an environmental awareness campaign for university students
	Population control and future population trends	
	Industrial development and environmental impacts	
WEEK-13	Agricultural development and sustainability	Environment: The science behind the stories (17 th Ed.) by Withgott, J/ Assignment 13: Analyze environmental impacts of urbanization in a selected city.
	Urbanization – environmental and social impacts	
	Poverty, resource depletion, and environmental degradation	
WEEK-14	Unit-1V: Food and alternate energy sources Food resources and global food security	Environment: The science behind the stories (17 th Ed.) by Withgott, J/ Quiz 7
	World hunger – causes and solutions	
	WEEK-15	Energy concepts in the environment
Fossil fuels – use and environmental impacts		
Renewable and alternate energy sources		
WEEK-16	Environmental benefits and challenges of alternate energy	Assignment 15: Comparative study of renewable and non-renewable energy resources in Pakistan.
	Nuclear energy – principles and applications	
	Nuclear energy and environmental issues	
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Cunningham, W. P., Cunningham, M. A., O'Reilly, C. M., & Winsett, K. E. (2024). <i>Environmental science: A global concern</i> (16th ed.). McGraw-Hill Education. 2. Miller, G. T., & Spoolman, S. E. (2024). <i>Environmental science</i> (17th ed.). Cengage Learning. 3. Withgott, J., & Laposata, M. (2024). <i>Environment: The science behind the stories</i> (7th ed.). Pearson Education 4. McKinney, M. L., Schoch, R. M., Yonavjak, L., & Mincy, G. (2017). <i>Environmental Science: Systems and Solutions: Systems and Solutions</i>. Jones & Bartlett Learning. 5. Miller, G. T., & Spoolman, S. (2015). <i>Living in the environment: concepts, connections, and solutions</i>. Brooks/Cole.		

6. Miller, G. T., & Spoolman, S. (2015). *Environmental science*. Cengage Learning.
 7. Botkin, D.B. (2014). *Environmental Science: Earth as a Living Planet*. John Wiley & Sons.
- Further Reading:** As suggested by the Instructor.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-102	Credit hours	02
Course Title	PRINCIPLES OF BIOLOGY (THEORY)				
COURSE INTRODUCTION					
This theoretical course provides a comprehensive introduction to the fundamental principles of biology. It covers key topics including cell structure and function, biomolecules, genetics, evolution, and the diversity of life. Students will explore biological systems at the molecular, cellular, and organismal levels, gaining an understanding of processes such as metabolism, cell division, gene expression, and heredity. The course also introduces the basics of ecology and the evolutionary relationships among organisms. Emphasis is placed on scientific reasoning, biological terminology, and the foundational concepts that support advanced study in the life sciences.					
LEARNING OUTCOMES					
By the end of this course the students will learn:					
1. understand the scope of biology and biological organization and speciation and process of evolution 2. Learn the systematics and classification of organisms from early life to modern primates 3. Describe the basic concepts of genetics and inheritance and applications of biotechnology in environmental science					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-1: An introduction to Biology		Mader Biology 14th Ed. Chapter 1: A View of Life / Biology: The Study of Life (pp. 1–18 or similar)		
	Definitions and basic concepts in field of biology				
	Organization from sub atomic particles to biomes				
WEEK-2	Species, population, communities, ecosystem and biodiversity		Raven Biology (2022 / Mason et al. editions). Chapter 1: The Science of Biology.		
	Significance of Biology in modern days				
WEEK-3	Unit- 2: Speciation and concept of Evolution		Campbell 12th Global Mechanisms of Evolution (Chapters 22–25 approx.)		
	The Biological Species Concept and reproductive isolation				
	Speciation and Environmental Change				
WEEK-4	Concept and Processes of evolution		Mason et al. 11th: Similar to Raven – evolution section (Chapters ~20–24)		
	Theories of evolution Natural selection				
WEEK-5	Unit- III: Phylogeny and the Tree of Life		Campbell 12th: Chapter 26: Phylogeny and the Tree of Life.		
	Phylogeny and Classification				
	Nomenclature and five kingdom system of classification				
WEEK-6	Unit- IV: Diversity of primitive organism		Campbell 12th: Chapter on Viruses; Prokaryotes; early eukaryotic evolution.		
	Viruses and Prions etc				
	Prokaryotic Cell Structure and Diversity				
WEEK-7	Human viral and Bacterial Disease		Campbell 12th: Chapter on Viruses; Prokaryotes; early eukaryotic evolution.		
	Eukaryotic Origins and primary and secondary Endosymbiosis				
WEEK-8	Unit- V: Plants and Fungi Diversity		Campbell 12th: Plant Diversity I & II (Chapters 29–30); Fungi (Chapter 31).		
	Origin of Land Plants and Alternation of Generation				
	Classification and Ecology of Fungi				
MID TERM EXAMINATION					
WEEK-9	The Evolution of Seed Plants		Campbell 12th: Plant Diversity I & II (Chapters 29–30); Fungi (Chapter 31).		
	Spermatophytes (Gymnosperms and Angiosperms)				
WEEK-10	Unit- VI: Animal Diversity		Campbell 12th. General features and body plans of animals.		
	General Features of Animals and Body Plans				
	Evolution of animals				
WEEK-11	Parazoa, Eumetazoa and bilateria		Campbell. Parazoa, Eumetazoa, Protostomes and Deuterostomes		
	Protostomes and Deuterostomes				

WEEK-12	Chordates Features and classification	Campbell. Chordates, Fishes to Mammals, Evolution of Primates.	
	Fishes, Amphibians Reptiles		
	Birds and Mammals		
	Evolution of the Primates		
WEEK-13	Unit- VII: Genetics and inheritance	Campbell Biology, Chapters on Mendelian Genetics and Inheritance.	
	Concepts of genes, alleles and inheritances		
	Laws and theories of inheritance		
WEEK-14	Unit- VII: DNA and Biotechnology	Campbell. DNA structure, sequencing, cloning and biotechnology.	
	DNA sequencing, cloning and Amplification		
	Expressing Cloned DNA in Eukaryotic Genes		
WEEK-15	Cloning and Stem Cells techniques	Campbell + Mader. Stem cells, cloning techniques and applications.	
	Applications of biotechnology		
WEEK-16	Bioremediation and conservation biology	Bioremediation, Conservation Biology and One Health concept (supplementary readings).	
	One Health concept (linking human, animal, and ecosystem health)		
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Mader D., Sylvia S. (2024). <i>Biology</i> 14th Edition, McGraw-Hill Higher Education 2. Neil A. Campbell, Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky and Jane B. Reece (2021). <i>Biology: A Global Approach</i>, 12th Global Edition, Pearson 3. Raven, Peter H.; Johnson, George B.; Mason, Kenneth A.; Losos, Jonathan; Duncan, Tod, (2022). <i>Biology</i>. McGraw-Hill. 4. Mason, K. A., Losos, J. B., Singer S. R. (2017). <i>Biology</i>, 11th Edition, McGraw-Hill Education. 5. Starr, C.; Taggart, R.; Evers, C; Starr, L (2015). <i>Biology: The Unity and Diversity of Life - Standalone Book</i> 14th Edition, Cengage Learning Further Reading:As suggested by the Instructor.			
TEACHING – LEARNING STRATEGIES			
Lecture based examination Presentation/seminars Class discussion Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: classroom participation, attendance, assignments and presentation, homework attitude and behavior, hands-on-activities, short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-102	Credit hours	01
Course Title	PRINCIPLES OF BIOLOGY (PRACTICAL)				
COURSE INTRODUCTION					
This laboratory course is designed to complement the theoretical concepts covered in <i>Principles of Biology (Theory)</i> by providing hands-on experience in biological investigation and experimentation. Students will engage in practical exercises that explore cell biology, microscopy, biochemical testing, genetics, and the diversity of life. Emphasis is placed on developing scientific observation, data collection, analytical skills, and the proper use of laboratory equipment and techniques. The course fosters a deeper understanding of biological principles through experimentation, critical thinking, and scientific reporting.					
LEARNING OUTCOMES					
By the end of this course the students will learn:					
1. Learn about use the microscope for microorganism’s study and Identification of different plants and animals 2. Examine of animal and plant tissues through thin sections, develop the understanding about tissues and organs of living organisms 3. Learn the basic concepts of genetics and inheritance and applications					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit- I: Constructing a phylogenic tree Study and construct of phylogenetic tree			Construct phylogenetic tree (Campbell / Mader lab manual).	
WEEK-2	Convert a Venn diagram of shared traits into a cladogram, or vice versa.			Convert Venn diagram to cladogram (practical exercise from lab manual).	
WEEK-3	Unit- II: Identification to Microscopic organisms			Microscope use, study of Prokaryotes, Protista and Fungi (prepared slides + fresh specimens).	
	Significance of the use of microscope in biology				
WEEK-4	Study of representatives of kingdom prokaryotae,				
WEEK -5	Kingdom protista and kingdom fungi with prepared slides and fresh specimens.				
WEEK-6	Unit- III: Plants and animals Survey.			Plant survey in botanical garden and animal survey in zoological museum.	
	Study of different plants in botanical garden				
WEEK -7	Animal survey in zoological museum				
WEEK -8	Examination of thin sections of plants and animals’ tissues			Examination of thin sections of plant and animal tissues.	
MID TERM EXAMINATION					
WEEK-9	Unit- IV: Inheritance and Genetics			Mendelian inheritance with Drosophila, Pedigree analysis.	
	Study of Mendelian inheritance: monohybrid and dihybrid Cross using <i>Drosophila melanogaster</i>				
WEEK-10	Pedigree Analysis and Inheritance Patterns: Analyze human pedigrees for autosomal dominant, recessive, and sex-linked traits				
WEEK-11	DNA Extraction (from blood, bacteria, or plant tissue)				

WEEK-12	DNA fragments separation by size using Gel Electrophoresis	<i>DNA extraction, Gel Electrophoresis, observation of mitosis/meiosis.</i>	
WEEK-13	Microscopic observation of chromosomes and cell division (mitosis/meiosis)		
WEEK-14	Virtual lab on DNA cloning and PCR amplification	<i>Virtual lab on cloning/PCR, Punnett squares and genetics problems.</i>	
WEEK-15	Solving Mendelian genetics problems and Punnett squares		
WEEK-16	Review of all practical exercises conducted throughout the semester	<i>Review and report writing.</i>	
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Mader D., Sylvia S. (2024). <i>Biology</i> 14th Edition, McGraw-Hill Higher Education 2. Neil A. Campbell, Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky and Jane B. Reece (2021). <i>Biology: A Global Approach</i>, 12th Global Edition, Pearson 3. Mackean, D.G and Hayward., D (2018) Cambridge IGCSE Biology. Third Edition, Hodder Education 4. Reece, J. B., Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Jackson, R. B. (2014). <i>Campbell biology</i> (No. s 1309). Boston: Pearson. 5. Morgan, J. G. Carter, M.E.B. (2014), Investigating Biology, Laboratory Manual, Eighth Edition, 6. Lewis, B., Cassimeris, L., Lingappa, V. R., Plopper, G. Jones (2007). Cells, and Bartlett Publishers. Canada, 7. Morgan, S. (2002). Advanced Level Practical Work for Biology (Advanced Level Practical Work Series). S. Hodder & Stoughton. Further Reading: As suggested by the Instructor.			
TEACHING – LEARNING STRATEGIES			
Lecture based examination Presentation/seminars Class discussion Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: classroom participation, attendance, assignments and presentation, homework attitude and behavior, hands-on-activities, short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GQR-101	Credit hours	03
Course Title	QUANTITATIVE REASONING-I				
COURSE INTRODUCTION					
Quantitative Reasoning (I) is an introductory-level undergraduate course that focuses on the fundamentals related to the quantitative concepts and analysis. The course is designed to familiarize students with the basic concepts of mathematics and statistics and to develop students’ abilities to analyze and interpret quantitative information. Through a combination theoretical concepts and practical exercises, this course will also enable students cultivate their quantitative literacy and problem-solving skills while effectively expanding their academic horizon and breadth of knowledge of their specific major / field of study.					
LEARNING OUTCOMES					
By the end of this course the students will learn: 1. Fundamental numerical literacy to enable them work with numbers, understand their meaning and present data accurately. 2. Understanding of fundamental mathematical and statistical concepts. 3. Basic ability to interpret data presented in various formats including but not limited to tables, graphs, charts, and equations etc. 4. To build foundational mathematical and analytical skills for understanding and solving real-world problems using quantitative methods.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	UNIT I: Introduction to Numerical Literacy & Course Overview Number System – Types of Numbers		DeTemple et al., Ch. 3 ("Numeration Systems Past and Present" & Computation), pp. 151–195. Practice Set 1: Applying arithmetic properties to environmental datasets.		
	Basic Arithmetic Operations & BODMAS				
	Properties of Numbers & Arithmetic (commutative, associative, distributive)				
WEEK-2	Units & Conversions – Length, Mass, Time		DeTemple et al., Ch. 10 ("Measurement"). Sec 10.1 (Measurement Process) & 10.2 (Area & Perimeter), pp. 516–552; Sec 10.4 & 10.5 (Volume & Surface Area), pp. 561–578.		
	Area and Perimeter of 2D Shapes		Worksheet 1: Dimensional analysis and volume calculations of 3D solids.		
	Volumes and Surface Areas of 3D Solids				
WEEK-3	Mixed Practice Problems (Units, Area, Volume)		DeTemple et al., Ch. 6 ("Fractions and Rational Numbers"), pp. 289–348 & Ch. 7 (Proportional Reasoning & Percents), pp. 349–402.		
	Ratios & Proportions		Problem Set 1: Calculating percentage increase/decrease in resource loss.		
	Percentages – Increase/Decrease, Profit & Loss				
WEEK-4	Rates – Speed, Distance, Time; Work Problems		DeTemple et al., Ch. 7 (Proportional Reasoning), pp. 349–402 & Ch. 13 ("Statistics: The Interpretation of Data"), pp. 694–710.		
	Mixed Applications of Ratios & Percentages		Analytical Assignment: Differentiating primary vs. secondary data sources.		
	Types & Sources of Data				

WEEK-5	Measurement Scales: Nominal, Ordinal, Interval, Ratio	DeTemple et al., Ch. 13 ("Statistics: The Interpretation of Data"), pp. 694–739.
	Tabular & Graphical Data Presentation	Quiz 1 & Submission of Unit I Graphical Revision Portfolio.
	Quantitative Reasoning Exercises (Unit I Revision)	
WEEK-6	UNIT II: Fundamental Mathematical Concepts Quantitative Reasoning Using Number Knowledge	DeTemple et al., Ch. 9 ("Geometric Figures"). Sec 9.1 (Figures in the Plane) & 9.2 (Curves and Polygons), pp. 451–489.
	Geometry Basics – Points, Lines, Angles	Homework Set 2: Angle properties and geometric proofs in field marking.
	Triangles and Quadrilaterals – Properties	
WEEK-7	Circles – Chords, Tangents, Arcs	DeTemple et al., Ch. 8.3 (Circles), pp. 434–444; Ch. 9.2 (Polygons), pp. 471–489; Ch. 10.2 (Area of a Circle), pp. 531–552.
	Polygons – Types & Properties	Geometry Workshop Presentation: Area mapping of irregular polygons.
	Geometry Problem-Solving Workshop	
WEEK-8	Sets – Definitions & Types	Rosen, Ch. 2.1 ("Sets"), pp. 121–132 & Ch. 2.2 ("Set Operations"), pp. 133–146; <i>Alternative:</i> Epp, Ch. 6.1 & 6.2 ("Set Theory"), pp. 384–405.
	Set Operations – Union, Intersection, Complement	Venn Diagram Problem Sheet: Application to ecosystem distribution.
	Venn Diagrams & Applications	
MID TERM EXAMINATION		
WEEK-9	Relations & Functions – Definitions, Domain, Range	DeTemple et al., Ch. 8.1 ("Variables, Algebraic Expressions, and Functions"), pp. 406–418; Rosen, Ch. 2.3 ("Functions"), pp. 147–164.
	Types of Functions & Their Graphs	Graphing Exercise: Plotting linear and exponential models.
	Exponents – Laws & Applications	
WEEK-10	Factorization Techniques	DeTemple et al., Ch. 8.1 (Solving Equations) & 8.2 ("Graphing Points, Lines, and Elementary Functions"), pp. 406–433.
	Simplifying Algebraic Expressions	Algebraic Simplification & Linear Equation Problem Set.
	Linear Equations – Algebraic & Graphical Solutions	
WEEK-11	Quadratic Equations – Factorization, Formula	DeTemple et al., Ch. 8.2 (Nonlinear Functions), pp. 419–433.
	Inequalities – Solving & Graphing	Quiz 2 & Submission of Unit II Algebraic Revision Exercises.
	Quantitative Reasoning Exercises (Unit II Revision)	
WEEK-12	UNIT III: Fundamental Statistical Concepts Introduction to Statistics & Quantitative Reasoning	DeTemple et al., Ch. 13 ("Statistics: The Interpretation of Data" - Core Concepts), pp. 694–710.
	Population vs. Sample	Mini-Project: Design a sampling technique for a local environmental assessment.
WEEK-13	Graphical Presentation – Histograms, Polygons, Boxplots	DeTemple et al., Ch. 13 ("Statistics: The Interpretation of Data" - Distributions & Means), pp. 710–739.

	Measures of Central Tendency – Mean, Median, Mode	Lab Report: Calculating Mean, Median, SD, and Variance for air quality indices.
	Measures of Dispersion – Range, Variance, SD	
WEEK-14	Applications of Measures of Central Tendency & Dispersion	Rosen, Ch. 6.1 ("The Basics of Counting"), pp. 405–419 & Ch. 6.3 ("Permutations and Combinations"), pp. 428–436.
	Rules of Counting – Multiplicative Principle	Homework Set 3: Permutations and multiplicative counting principles.
	Permutations	
WEEK-15	Combinations	Rosen, Ch. 6.3 ("Permutations and Combinations"), pp. 428–436 & Ch. 7 ("Discrete Probability"), pp. 469–496.
	Counting Applications Workshop	Problem Set: Applying combinations to probability in risk assessment.
	Basic Probability Concepts	
WEEK-16	A Priori & Relative Frequency Probability	Rosen, Ch. 7 ("Discrete Probability" continued), pp. 469–500. Final Revision
	Probability Problem-Solving Workshop	
	Quantitative Reasoning Exercises (Unit III Revision & Course Wrap-Up)	
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Akar, Gülseren Karagöz, et al., eds. <i>Quantitative reasoning in mathematics and science education</i>. Springer, 2023. 2. Akar, Gülseren Karagöz, et al., eds. <i>Quantitative reasoning in mathematics and science education</i>. Springer International Publishing, 2022. 3. Zaslow, Eric. <i>Quantitative Reasoning: Thinking in Numbers</i>. Cambridge: Cambridge University Press, 2020. Prin 4. Discrete, Kenneth H. Rosen. "Mathematics and its Applications" McGraw-Hill Education. 2019. 5. Bennett, J. O., Briggs, W.L., & Badalamentiu, A. Using and Understanding Mathematics “A Quantitative Reasoning Approach” Pearson Education. 2016. 6. Attali, Yigal. "Calculator Use on the GRE® revised General Test Quantitative Reasoning Measure." <i>ETS Research Report Series</i> 2014.2 (2014): 1-8. https://ztcprep.com/userfiles/aad79eb9.pdf 7. Sevilla, Alicia, and Kay Somers. <i>Quantitative Reasoning: Tools for Today's Informed Citizen</i>. John Wiley & Sons, 2012.		
TEACHING – LEARNING STRATEGIES		
● Lecture based examination ● Presentation/seminars ● Class discussion ● Quizzes		
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR		
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: ● classroom participation, ● attendance, assignments and presentation, ● homework ● attitude and behavior, ● hands-on-activities, ● short tests, quizzes etc.		

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GNS-101	Credit hours	02
Course Title	NATURAL SCIENCES - PHYSICAL GEOGRAPHY (THEORY)				
COURSE INTRODUCTION					
This course examines the concepts and processes of physical geography that govern the function of the atmosphere, lithosphere, hydrosphere, and biosphere using an earth-systems approach.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Explain physical geography processes and concepts in all four major spheres of the Earth using an earth-systems approach. 2. Demonstrate foundational knowledge in physical geography in preparation for upper level and advanced topics in Geography and other subjects. 3. Evaluate the impact of human activities on the physical environment and how physical geography can be applied to address real world issues.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Introduction to Physical Geography			Introducing Physical Geography (Chapter 1, Page 1–25)	
	Introductory concepts of physical geography: spheres, scales, systems and cycles			Geosystems: An Introduction to Physical Geography (Page 02-30)	
	The Earth as a rotating planet: shape, rotation and its geographic consequences				
WEEK-2	Weather and climate system: definitions, elements and global patterns			Weather & Energy System (Page 60-95)	
	The global energy system: solar radiation, energy balance and heat transfer			A Landscape Appreciation (Page 90-120)	
WEEK-3	Earth history and geological time scale: major eras and events			Geosystems: An Introduction to Physical Geography (Ch#02 Page -250-290)	
	Earth materials: minerals, rocks and the cycle of rock change				
WEEK-4	The structure of the Earth: crust, mantle, core and their properties			Geosystems: An Introduction to Physical Geography (Ch#02 Page -250-290)	
	The lithosphere and tectonic systems: plate boundaries and plate movement				
WEEK-5	The Earth-Atmosphere Interface			Geosystems: An Introduction to Physical Geography (Ch#11 Page 330-370)	
	Volcanic activity: types, causes, products and environmental impacts			Introducing Physical Geography (Page 200–230)	
	Earthquakes: causes, measurement, distribution and hazards				
WEEK-6	The global scope of climate: climate zones, controls and classification			Geosystems: An Introduction to Physical Geography (Ch#06 Page -150-190)	
	Weather systems: air masses, fronts, cyclones and anticyclones				
	Global Climate and Weather				

WEEK-7	Formation of climate and classification of climatic regions: Koppen system	Geosystems: An Introduction to Physical Geography (Ch#14 Page -220-250)
	Climate change: natural and anthropogenic drivers and evidence	Introducing Physical Geography (Page 300–330)
WEEK-8	Global warming and the greenhouse effect: mechanisms, gases and projections	Geosystems: An Introduction to Physical Geography (Ch#14 Page -420-450)
	Human impacts on climate: deforestation, urbanization and industrialization	
MID TERM EXAMINATION		
WEEK-9	Systems of Landform Evolution	Geosystems: An Introduction to Physical Geography (Ch#12 Page -360-400)
	Weathering and mass wasting: physical, chemical and biological weathering	
	River systems and fluvial landscapes: erosion, transportation and deposition	Introducing Physical Geography (Ch# 14 Page 420–450)
WEEK-10	Aeolian landforms: wind erosion and deposition, dunes and desert landscapes	Geosystems: An Introduction to Physical Geography (Ch#12 Page -360-400)
	Karst topography: limestone dissolution, caves and karst landforms	McKnight’s Physical Geography: A Landscape Appreciation (Chapter Page 380–410))
WEEK-11	Glacier systems and ice ages: glacial erosion, deposition and landforms	Geosystems: An Introduction to Physical Geography (Ch#13 Page -400-420)
	Coastal landforms: wave action, erosion, deposition and coastal management	McKnight’s Physical Geography: A Landscape Appreciation (Chapter Page 380–410)
WEEK-12	Configuration of ocean floor, marine deposits, composition and temperature	Essentials of Oceanography (Ch# 03 & 05 60–110)
	Salinity of oceanic water: distribution, causes and variation	
WEEK-13	Movement of oceanic water: waves, ocean currents and tides	Geosystems: An Introduction to Physical Geography (Ch#15 Page -450-480)
	Freshwater systems: lakes, wetlands and groundwater resources	
WEEK-14	Hydrosphere, Soil and Biosphere	Geosystems: An Introduction to Physical Geography (Ch#18 Page -540-580)
	Soil development: pedogenesis, soil horizons and global soil classification	
	Energy flow in ecosystems and biogeochemical cycles in the biosphere	Introducing Physical Geography (Page 400–430)
WEEK-15	Global ecosystems and biomes: distribution, characteristics and threats	Geosystems: An Introduction to Physical Geography (Ch#19 Page -580-620)
	Human impacts on ecosystems: biodiversity loss, land use change and conservation	McKnight’s Physical Geography: A Landscape Appreciation (Chapter Page 380–410)

WEEK-16	Review of core concepts: earth systems, climate, landforms, hydrosphere and biosphere	Review all highlighted chapters	
	climate, landforms, hydrosphere and biosphere	Integrated report (Climate–Landform–Hydrology linkages)	
FINAL TERM EXAMINATION			
TEACHING – LEARNING STRATEGIES			
• Lecture based examination • Presentation/seminars • Class discussion • Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:			
• classroom participation, • attendance, assignments and presentation, • homework • attitude and behavior, • hands-on-activities, • short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly
TEXT BOOKS AND READING MATERIAL			
1. Strahler, A. H., & Archibold, O. W. (2021). Introducing Physical Geography (6th ed.). Wiley.			
2. McKnight's Physical Geography: A Landscape Appreciation (13th ed.). Hess, D., Finch, R., & Tasa, D. G. (2021).			
3. Christopherson, R. W. et al. (2020). Geosystems: An Introduction to Physical Geography (9th ed.). Pearson.			
4. Strahler, A. (2013). Introduction to Physical Geography. John Wiley & Sons, New Jersey.			
5. Thurman, H. V. & Trujillo, A. P. (2013). Essentials of Oceanography. Prentice-Hall, New York.			

Program	BS Environmental Sciences	Course Code	ENSC-104	Credit hours	01
Course Title	NATURAL SCIENCES - PHYSICAL GEOGRAPHY (PRACTICAL)				
COURSE INTRODUCTION					
This laboratory course provides hands-on practical experience in the concepts and processes of physical geography, covering map reading, rock and mineral identification, remote sensing, weather observation and oceanographic mapping through an earth-systems approach.					
LEARNING OUTCOMES					
By the end of this course the students will be able to:					
1. Explain physical geography processes and concepts in all four major spheres of the Earth using an earth-systems approach. 2. Demonstrate foundational knowledge in physical geography in preparation for upper level and advanced topics in Geography and other subjects. 3. Evaluate the impact of human activities on the physical environment and how physical geography can be applied to address real world issues.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Comprehension of atlases, map reading skills, location of places and features		Hess (2021), Physical Geography Laboratory Manual, Ex. 2 & 29, pp. 15-28, 301-314.		
WEEK-2	Methods of finding direction: compass, bearings and orientation techniques		Hess (2021), Ex. 2, pp. 15-28; Ex. 29, pp. 301-314.		
WEEK-3	Types of scale: representative fraction, linear scale and statement of scale		Hess (2021), Ex. 4, pp. 41-54.		
WEEK-4	Work on contour lines: drawing valley profiles and calculation of gradient		Hess (2021), Ex. 28 & 30, pp. 287-300, 315-326.		
WEEK-5	Distance calculation and area measurement on maps: symbolization and legend reading		Hess (2021), Ex. 4 & 29, pp. 41-54, 301-314.		
WEEK-6	Identification of soil, rocks and minerals and their types in the field and lab		Hess (2021), Ex. 27 & 33, pp. 275-286, 347-360; Huggett & Shuttleworth (2023), Ch. 2, pp. 25-54.		
WEEK-7	Geomorphic profiles: drawing and interpreting cross-sections of landforms		Hess (2021), Ex. 30, pp. 315-326; Huggett & Shuttleworth (2023), Ch. 1-2, pp. 1-54.		
WEEK-8	Use of remote sensing techniques for interpretation of landforms and geomorphic features		Hess (2021), Ex. 8 & 32, pp. 83-102, 333-346.		
MID TERM EXAMINATION					
WEEK-9	Study and identification of landforms using satellite imageries and topographic sheets		Hess (2021), Ex. 8, 29, 32, pp. 83-102, 301-314, 333-346.		
WEEK-10	Weather map interpretation and analysis: pressure systems, fronts and isobars		Hess (2021), Ex. 18-20, pp. 189-224; Appx. 3, Weather Map Symbols.		
WEEK-11	Observation of weather elements: temperature, humidity, rainfall and wind speed		Hess (2021), Ex. 12, 14, 15, pp. 125-136, 149-172.		

WEEK-12	Methods of showing relief on maps: contours, hachures, shading and spot heights	Hess (2021), Ex. 6, 28-30, pp. 65-82, 287-326.
WEEK-13	Observation and recording of weather data from a mini weather station	Hess (2021), Ex. 12-15 & 19, pp. 125-172, 211-224.
WEEK-14	Drawing features of the ocean floor: ridges, trenches, continental shelf and abyssal plains	Holden (2022), Ch. 3 & 5, pp. 96-111, 160-175; Hess (2021), Appx. 5, Color Maps and Images.
WEEK-15	Mapping of ocean currents, tides and associated phenomena	Holden (2022), Ch. 3, pp. 96-111; Hess (2021), Ex. 19 & Appx. 5, pp. 211-224.
WEEK-16	Overview and review of practical concepts covered throughout the semester	Review: Hess (2021), selected Ex. 2, 4, 6, 8, 19, 27-32, pp. 15-102, 211-346.

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Hess, D. (2021). Physical Geography Laboratory Manual (13th ed.). Pearson Education.
 2. Holden, J. (2022). Physical Geography: The Basics (2nd ed.). Routledge.
 3. Huggett, R., & Shuttleworth, E. (2023). Fundamentals of Geomorphology (5th ed.). Routledge.
 4. Holden, J. (Ed.). (2021). Water Resources: An Integrated Approach (2nd ed.). Routledge.
 5. France, D., Haigh, M., Fryirs, K., & Waldron, S. (Eds.). (2025). Teaching Fieldwork in Geography, Earth and Environmental Sciences. Edward Elgar.
- Note: Page ranges are aligned with print editions; eText pagination may vary slightly.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GISL-101	Credit hours	02
Course Title	ISLAMIC STUDIES				
COURSE INTRODUCTION					
This course is designed to provide students with a comprehensive overview of the fundamentals aspects of Islam, its benefits, practices, history and influence on society. It will further familiarize the students with a solid foundation in understanding Islam from an academic and cultural perspective. Through this course, students will have an enhanced understanding of Islam’s multifaceted dimensions which will enable them to navigate complex discussions about Islam’s historical and contemporary role, fostering empathy, respect, and informed dialogue.					
LEARNING OUTCOMES					
By the end of this course, students will be able to:					
1. Demonstrate enhanced knowledge of Islamic foundational beliefs, practices, historical development, fundamental sources of Shiarah, spiritual values and ethical principles.					
2. Describe basic sources of Islamic law and their application in daily life.					
3. Identify and discuss contemporary issues being faced by the Muslim world including social challenges, gender roles and interfaith interactions.					
COURSE CONTENTS					Assignments / Readings
2. عَنْ عُمَرَ بْنِ عَبْدِ الرَّحْمَنِ - اللَّهُ عَنْهُ عَنِ النَّبِيِّ ﷺ قَالَ: "يُخَوَّرُ كُفْرٌ مَنِ تَعَلَّمَ الْقُرْآنَ وَعَلَّمَهُ." (صحيح البخاري، 502)					
3. عَنْ مَالِكِ بْنِ سُلَيْمٍ - اللَّهُ عَنْهُ قَالَ: قَالَ رَسُولُ اللَّهِ ﷺ: "تَرَكَتُ فِيكُمْ لِمُؤْمِنِينَ أَنْ يَقُولُوا: آمَنَّا بِمَا كُتِبَ لِلنَّبِيِّ ﷺ رُسُودُهُ (رواه مالك في الموطأ مرسلًا)					
4. عَنْ عَبْدِ اللَّهِ بْنِ عَمْرٍو - اللَّهُ عَنْهُ مَا قَالَ: قَالَ رَسُولُ اللَّهِ ﷺ: "لَا يُسْلَمُ عَنْ جَسَدٍ شَهِادَتَانِ لِرَأْسِهِمَا اللَّهُ وَنَافِثَتُهُمَا أَهْلُ بَيْتِهِ وَآلُ قَوْمِهِ" (صحيح مسلم، 113)					
5. وَعَنِ النَّعْمَانِ بْنِ بَشِيرٍ - اللَّهُ عَنْهُ قَالَ: قَالَ رَسُولُ اللَّهِ ﷺ: "تَرَى الْمُؤْمِنِينَ فِي تَرَاتُجِهِمْ وَتَوَاضُعِهِمْ وَتَعَلُّقِهِمْ بِكَمَلِ جَسَدِ رَأْسِهِمْ" عَنْهُ وَقَدْ أَخْبَرَنِي أَبُو بَكْرٍ بْنُ أَبِي شَيْبَةَ عَنْ أَبِي هُرَيْرَةَ (متفق عليه، البخاري، 6011)					
6. عَنْ يَزِيدَ بْنِ أَبِي حَبِيٍّ - اللَّهُ عَنْهُ قَالَ: قَالَ رَسُولُ اللَّهِ ﷺ: "أَقَارُونُ مَا الْمَغْضُوبُ: قَالُوا: الْمَغْضُوبُ فِي مَا تَمَنَّى لَأَوْ هَمَلَهُ لَا مَنَاقِعَ فَقَالَ: بَيْنَ الْمَغْضُوبِ وَالْمَغْضُوبِ مَنْ لَمْ يَكُنْ يَوْمَ الْقِيَامَةِ بِمَلَاؤِ صَدْرِهِمْ وَكَانُوا قَوِيًّا. قَالَ: شَرُّ هَذَا أَوْ قَلْبٌ هَذَا أَوْ مَالٌ هَذَا أَوْ فَكٌ هَذَا أَوْ رِبٌّ هَذَا أَوْ قِيَامٌ هَذَا أَوْ مَنْ حَمَلَتْهُ قَيْنٌ فَيُنْفِثُ حَمْلَ نِسَائِهِ قَالِي: أَنْ يَهْجُو مَا عَلَيْهِمْ وَأَنْ يَخُذَ مِنْ خَطِّ أَيْدِيهِمْ فَطَرَحَتْ عَلَيْهِمْ طَرَحِي الْقَلْبَ. (رواه مسلم، كتاب البر، 6579)					
7. عَنْ يَزِيدَ بْنِ أَبِي حَبِيٍّ - اللَّهُ عَنْهُ قَالَ: كَانَ رَسُولُ اللَّهِ ﷺ يَقُولُ: "اللَّهُمَّ! إِنِّي أَعُوذُكَ مِنَ الْإِرْبَاعِ وَمِنْ عِلْمٍ لَا يَنْفَعُ وَمِنْ دُعَاءٍ لَا يُجِبُ وَمِنْ قَلْبٍ لَا يَضْمَعُ وَمِنْ نَفْسٍ لَا تَهْتَبُ." (رواه مسلم وأحمد وابن ماجه، 250)					
5. عَنْ أَبِي هُرَيْرَةَ - قَالَ: قَالَ رَسُولُ اللَّهِ ﷺ: "كَانَتْ تَبُولُ إِلَى اللَّهِ وَهُدُ الرُّجِيَاءُ كُلُّ مَا هَلَكَتْ بَيْنِي خَلْقَةُ نَفْسِي وَرَأَيْتُ لَا يَكُنْ بَعْدِي خَلْقَاءُ فَيَكْفُرُونَ" (صحيح البخاري، 3455)					
8. عَنْ عَبْدِ اللَّهِ بْنِ عَمْرٍو - اللَّهُ عَنْهُ مَا قَالَ: قَالَ رَسُولُ اللَّهِ ﷺ: "الرَّكْبُ كُفْرٌ رَاجِعٌ وَكُلُّ كُفْرٍ مِمَّنْ يُكْفَرُ عَنْ رِعَايَتِهِ فَلَا رَمْلَ الْأَعْظَمِ الَّذِي عَلَى الْعَاسِ وَأَعْوَالُ عَنْ رِعَايَتِهِ وَالْوَلِيُّ رَاجِعٌ بِيَدِهِ وَهُوَ مِمَّنْ يُكْفَرُ عَنْ رِعَايَتِهِ وَالْمَرْأَةُ رَاجِعَةٌ عَلَى بَيْتِهَا وَوَلَدُهَا وَهُوَ مِمَّنْ يُكْفَرُ عَنْ رِعَايَتِهِ وَعَبْدُ الرَّجُلِ رَاجِعٌ عَلَى مِلَّةِ خَدَمِهِ وَهُوَ مِمَّنْ يُكْفَرُ عَنْ رِعَايَتِهِ كُلُّ كُفْرٍ رَاجِعٌ وَكُلُّ كُفْرٍ مِمَّنْ يُكْفَرُ عَنْ رِعَايَتِهِ" (ترمذي، 1705)					

17. عَنْ جَابِرِ بْنِ عَبْدِ اللَّهِ عَنِ النَّبِيِّ - اللَّهُ عَنْهُ قُلْتُ: خَطَمْتُ رَسْمِي بِخَطِّكَ وَسَمَّيْتُهِ الْعَرَبِيَّةَ الْوَدَاعَ فَقَالَ: يَا أَيُّهَا الْكَلْبُ إِنَّ رَبَّكَ وَاحِدٌ وَإِنَّ أَبَاكَ وَاحِدٌ لَا تَفْضُلَ لِعَبْدٍ عَلَى عَمَلٍ وَلَا لِعَجَمِيٍّ عَلَى عَرَبِيٍّ وَلَا لِمَنْ سَمَّى عَلَى مَنْ سَمَّى وَلَا لِمَنْ دَعَى عَلَى مَنْ دَعَى وَلَا بِالْقُدْوَى إِنَّ أَكْرَمَكُمْ عِنْدَ اللَّهِ أَتْقَاهُ أَلَمْ تَفْعَلْ؟ فَقَالُوا لَا يَا رَسُولَ اللَّهِ قُلْ: فَلْيَبْلُغِ الشَّاهِدُ الْغَائِبَ فَلْيَبْلُغِ الشَّاهِدُ الْغَائِبَ. (البيهقي، شعب الإيمان، باب في حفظ اللسان، فصل في حفظ اللسان عن الفحشاء والبذاءة)

3۔ ایمانیات و عبادات: تعارف اور مختصر۔

4۔ سیرت نبوی صلی اللہ علیہ وآلہ وسلم

1۔ رسول اللہ صلی اللہ علیہ وآلہ وسلم کی حیات طیبہ (حالات زندگی قبل از بعثت، اعلان نبوت، ہجرت مدینہ، غزوات، صلح حدیبیہ، خطبہ حجۃ الوداع)

2۔ رسول اللہ ﷺ کی مختلف حیثیات: (i) بحیثیت معلم (ii) بحیثیت پیغمبر امن

5۔ خلافت راشدہ

1۔ خلفائے راشدین (حضرت ابو بکر صدیقؓ، حضرت عمر فاروقؓ، حضرت عثمان غنیؓ، حضرت علی المرتضیٰؓ) کے شخصی احوال

2۔ عہد خلافت راشدہ کے اہم خصائص

6۔ فقہ اسلامی

1۔ فقہ اسلامی کے مکتبہ (حنبل، شافعی، مالکی، حنبلی، حنفی، قیاس، اجتہاد)

2۔ ائمہ اربعہ کا تعارف (امام ابو حنیفہؒ، امام مالکؒ، امام شافعیؒ، امام احمد بن حنبلؒ)

7۔ اسلام کی سماجی تعلیمات

1۔ خاندان کا تعارف و اہمیت

2۔ اسلام میں عورت کا مقام

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GICT-101	Credit Hours	02
Course Title	APPLICATIONS OF INFORMATION AND COMMUNICATION TECHNOLOGIES (THEORY)				
COURSE INTRODUCTION					
This course is designed to provide students with an exploration of the practical applications of Information and Communication Technologies (ICT) and software tools in various domains. Students will gain hands-on experience with a range of software applications, learning how to leverage ICT to solve daily life problems, enhance productivity and innovate in different fields.					
LEARNING OUTCOMES					
By the end of this course, students will be able to:					
1. Explain the fundamental concepts, components, and scope of information and communication technologies (ICT). 2. Identify uses of various ICT platforms and tools for different purposes. 3. Apply ICT platforms and tools to address basic needs in daily, academic, and professional life. 4. Understand the ethical and legal considerations in the use of ICT platforms and tools.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Introduction to Information and Communication Technologies			Discovering Computers (CH # 01, Page 1-40)	
	Components of ICT: hardware, software, networks, local and cloud data storage			Computing Essentials (CH # 01, Page 1-30)	
	Scope of ICT: use in education, business, governance, healthcare and digital media				
WEEK-2	Emerging technologies and future trends in ICT			Technology in Action (CH # 01, Page 1-35)	
	Digital transformation: how ICT is reshaping industries and society			Discovering Computers (CH # 02, Page 60-90)	
WEEK-3	Effective use of popular search engines (Google, Bing) to explore the World Wide Web			Discovering Computers (CH # 02, Page 70-120)	
	Formal communication tools and etiquettes: Gmail and Microsoft Outlook			Technology in Action (CH # 02, Page 50-80)	
WEEK-4	Microsoft Office Suites: Word, Excel and PowerPoint — features and applications			GO! With Microsoft Office (CH # 01 Word, Page 01-40)	
	Google Workspace: Google Docs, Sheets and Slides for collaborative work			GO! With Microsoft Office (CH # 01 Excel, Page 01-35)	
WEEK-5	Basic ICT Productivity Tools — Cloud Storage and Collaboration			Discovering Computers (CH # 0, Page 80-100)	
	Cloud storage and file sharing: Dropbox, Google Drive and Microsoft OneDrive			Technology in Action (CH # 04, Page 140-170)	
	Note-taking and organization: Evernote and Microsoft OneNote				
WEEK-6	Video conferencing tools: Google Meet, Microsoft Teams and Zoom			Technology in Action (CH # 02, Page 60-90)	
	Project management and team collaboration platforms: Trello, Asana and Slack			Computing Essentials (CH # 03, Page 90-110)	

WEEK-7	Unit III: ICT in Education	Technology in Action (CH # 02, Page 20-50)
	Learning management systems: Moodle, Canvas and Google Classroom	Computing Essentials (CH # 01)
	Sources of online education: Coursera, edX, Udemy and Khan Academy	
WEEK-8	Interactive multimedia, virtual classrooms and e-learning best practices	Discovering Computers (CH # 03, Page 120-150)
	Digital literacy skills for academic research and online information evaluation	Technology in Action (Page 100-120)
MID TERM EXAMINATION		
WEEK-9	ICT in Health, Well-being and Personal Finance	Discovering Computers (CH # 13, Page 500-530)
	Health and fitness tracking devices and applications: Google Fit, Samsung Health, Apple Health	Technology in Action (CH # Page 420-450)
	Telemedicine and online health consultations: OLADOC, Sehat Kahani and Marham	
WEEK-10	Online banking and financial management tools: JazzCash, Easypaisa and 1Link	Discovering Computers (Page 100-120)
	E-commerce and online shopping: platforms, security and consumer rights in Pakistan	Technology in Action (Page 70-95)
WEEK-11	Digital identity and online reputation management	Computing Essentials (CH # 10, Page 350-380)
	Netiquette: respectful and professional online communication	Technology in Action (CH # 10 Page 380-410)
WEEK-12	Cyberbullying, online harassment and strategies for prevention	Discovering Computers (CH # 08, Page 300-340)
	Online privacy: data protection, cookies, tracking and personal security	Computing Essentials (Page 360-390)
WEEK-13	Intellectual property and copyright issues in the digital environment	Technology in Action (CH # 10 , Page 390-420)
	Ensuring originality: avoiding plagiarism and unauthorized use of information sources	Computing Essentials (Page 370-400)
WEEK-14	Digital Citizenship and Unit VI: Ethical Considerations in ICT	Discovering Computers (CH # 08 , Page 310-350)
	Content accuracy and integrity: misinformation, fake news and digital manipulation	Technology in Action (Page 400-430)
	Cybersecurity fundamentals: threats, safe practices and protecting digital assets	
WEEK-15	ICT and environmental sustainability: e-waste and carbon footprint of digital technologies	Technology in Action (Page 440-460)
	Social media: responsible use, influence on society and digital well-being	Discovering Computers (Page 520-550)
WEEK-16	Future of ICT: artificial intelligence, machine learning and their impact on daily life and professions	Technology in Action (Page 460-490)
	ICT for sustainable development: smart cities, green technology and digital solutions for environmental challenges	Discovering Computers (Latest edition pages)
FINAL TERM EXAMINATION		

TEXT BOOKS AND READING MATERIAL

1. "Discovering Computers" by Vermaat, Shaffer, and Freund.
2. "GO! With Microsoft Office" Series by Gaskin, Vargas, and McLellan.
3. "Exploring Microsoft Office" Series by Grauer and Poatsy.
4. "Computing Essentials" by Morley and Parker.
5. "Technology in Action" by Evans, Martin and Patsy.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GICT-101	Credit hours	01
Course Title	APPLICATIONS OF INFORMATION AND COMMUNICATION TECHNOLOGIES (PRACTICAL)				
COURSE INTRODUCTION					
This course is designed to provide students with an exploration of the practical applications of Information and Communication Technologies (ICT) and software tools in various domains. Students will gain hands-on experience with a range of software applications, learning how to leverage ICT to solve daily life problems, enhance productivity and innovate in different fields. Through individual and interactive exercises and discussions, students will develop proficiency in utilizing software for communication, creativity, and more.					
LEARNING OUTCOMES					
By the end of this course, students will be able to:					
1. Explain the fundamental concepts, components, and scope of information and communication Technologies (ICT) 2. Identify uses of various ICT platforms and tools for different purposes. 3. Apply ICT platforms and tools for different purposes to address basic needs in different domains of daily, academic, and professional life. 4. Understand and ethical and legal considerations in use of ICT platforms and tools.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Guided tutorials and exercises to ensure that students are proficient in commonly used software applications such as word processing software (e.g., Microsoft Word),		Create a formatted document in MS Word including: Heading, subheadings, bullet points Insert table and image Save in .docx and PDF format		
WEEK-2	Presentation software, (e.g., Microsoft PowerPoint), spreadsheet software (e.g., Microsoft Excel) among such other tools		Create a PowerPoint presentation (8–10 slides) on: “Role of ICT in Environmental Sciences” Prepare an Excel sheet: Student marks dataset Apply SUM, AVERAGE, and basic formatting		
WEEK-3	Creating, managing, and organizing files and folders on both local and cloud storage systems.		Create folder structure: Semester-Course-Assignments Organize files properly Take screenshots and submit report		
WEEK-4	File naming conventions, creating directories, and using cloud storage solutions (e.g., Google Drive, OneDrive).		Apply proper file naming conventions: e.g., CourseCode_Assignment1_Name_2026 Upload files to Google Drive / OneDrive Share link with instructor		
WEEK-5	Introduction to Google Drive		Create Google Drive account (if not already) Upload: Word, Excel, PPT files Create shared folder and assign permissions		
WEEK-6	Introduction to OneDrive		Upload files to OneDrive Sync files between local system and cloud Submit screenshot of synced folders		
WEEK-7	Uploading, sharing and collaborating on documents		Share a document with classmates Collaboratively edit a Google Doc Track changes and comments		
WEEK-8	File naming conventions for academic and research work		Prepare standard file naming guidelines for: Assignments Research work Submit as 1-page document		

MID TERM EXAMINATION		
WEEK-9	The use of online learning management systems (LMS)	Log in to LMS (Moodle/Google Classroom) Join a class using code Submit dummy assignment
WEEK-10	Navigating Moodle/Google Classroom; Submitting assignments, joining virtual classes, discussion board	Participate in discussion forum Upload assignment and comment on 2 peers' posts Join a virtual class session
WEEK-11	Communication & Collaboration Tools Setting up and using professional email (Gmail/Outlook); Email etiquette for academic and professional communication	Create professional email ID Write: Formal email to teacher Email with attachment Follow proper email etiquette
WEEK-12	Video Conferencing Tools; Hands-on practice with Zoom/Google Meet/Microsoft Teams; Scheduling meetings, screen sharing, and collaborative tools	Host a meeting on Zoom/Google Meet Perform: Screen sharing Invite participants Submit meeting screenshot/report
WEEK-13	Reference Management Tools; Introduction to Zotero/Mendeley for managing references; Creating bibliographies and in-text citations automatically	Install Zotero or Mendeley Add 5 research articles Generate: Bibliography In-text citations
WEEK-14	AI & Productivity Tools Responsible use of AI tools (ChatGPT, Gemini) in academic work	Use AI tools (e.g., ChatGPT or Google Gemini)
WEEK-15	Digital Citizenship & Online Safety Managing digital identity and privacy settings	Review privacy settings of: Google / Social media account Identify risks and suggest improvements Submit short report
WEEK-16	Recognizing fake news and misinformation - practical exercises	Identify fake vs real news: Analyze 2 online articles Use fact-checking tools Submit comparison report
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. "Discovering Computers" by Vermaat, Shaffer, and Freund. 2. "GO! With Microsoft Office" Series by Gaskin, Vargas, and McLellan. 3. "Exploring Microsoft Office" Series by Grauer and Poatsy. 4. "Computing Essentials" by Morley and Parker. 5. "Technology in Action" by Evans, Martin and Patsy.		
TEACHING – LEARNING STRATEGIES		
• Lecture based examination • Presentation/seminars • Class discussion • Quizzes		
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR		
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: • classroom participation, • attendance, assignments and presentation, • homework • attitude and behavior, • hands-on-activities, • short tests, quizzes etc.		

ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	HQ-01	Credit hours	01
Course Title	UNDERSTANDING OF HOLY QURAN / FAHM-E-QURAN - I				
COURSE INTRODUCTION					
Understanding of Holy Quran / Fahm-e-Quran – II is a compulsory 1-credit-hour HEC course for Muslim students enrolled in undergraduate and graduate degree programs in Pakistan. It is the second part of the Fehm-e-Quran sequence and builds upon the concepts introduced in <i>Understanding of Holy Quran / Fahm-e-Quran - I</i>. The course aims to deepen students' understanding of the meanings, themes, and practical guidance of the Holy Quran, enabling them to apply its teachings in their personal, social, and professional lives. It emphasizes reflection (<i>Tadabbur</i>), moral development, ethical conduct, and the relevance of Quranic guidance to contemporary issues.					
LEARNING OUTCOMES					
By the end of this course, students will be able to:					
1. Develop the ability to understand basic words of the Quran, phrases and sentences that do not contain verbs (unit 1 to 5 of Muallim ul Quran Book) and then sentences having present tense (first half of unit 6 of Muallim ul Quran Book). 2. Acquire a strong foundation for understanding long verses of the Quran with clarity. 3. Comprehend Quranic vocabulary, particles (operative & non operative particles), compounds (Adjective & Possessive compound), pronouns (singular & plural) and types of plural through hundreds of Quranic sentences. 4. Recognize and understand different styles of Quranic sentences, including nominal sentence, emphatic sentence, double emphatic sentence, negative sentence, interrogative sentence, oath –based sentences. 5. Strengthen understanding of fundamental Quranic linguistic styles, expressions and idioms. 6. Understand at least 30 to 40 % of each page of the holy Quran.					
COURSE CONTENTS					
Weeks	Lectures (1.5 hrs)	Units	Lessons	Assignments/Home Task	Linguistic Rules
1.	1.	1	1-6	Writing the meaning of Quranic words Lesson 1-8	Proper Noun Masculine & Feminine
	2.	1	9-14	Writing the meaning of Quranic words 9-14	Two kinds of plural Concept of (و) "And" Common Noun
2.	1.	1	15-17	Writing the meaning of Quranic words, phrases & translation of Sentences 15-17	Demonstrative Noun (This & That for Masculine (هَذَا هَذِهِ) Demonstrative Noun (This & That for Feminine) (ذَلِكَ ذَلِكَ)
	2.	1	18-19 & Revision (Unit 1)	Writing the meaning of Quranic words , phrases & translation of Sentences 17-19 Quiz	Laam for emphasis (لَا التَّكْوِيدِ) Superlative Degree like أَكْبَرُ Revision of all Quranic Sentences

3.	1.	Unit 2	1-3	Writing the meaning of Quranic words, phrases & translation of Sentences 1-3	Emphatic Particle إن (اللام) Preposition "For" (في) Preposition (في)
	2.	2	4-6	Writing the meaning of Quranic words, phrases & translation of Sentences 4-6	Preposition (على- من- إلى)
4.	1.	2	7- 9	Writing the meaning of Quranic words & translation of Sentences 7-9	Preposition (إلى) Absolute Negation Particle لا النافية (لا النافية) Exceptive Particle (إلا) (ما النافية) (للتجنس)
	2.	2	10-13 & Revision (Unit 2)	Writing the meaning of Quranic words, phrases & translation of Sentences 10-13 Quiz	Subordinating Conjunction (أن), Was (كان), Vocative Particle (هرف النداء)

5.	1.	Unit 3	1+2	Writing the meaning of Quranic phrases 1+2	Quranic Adjective Compounds (صفة وموصوف) (صفة وموصوف)
	2.	3	3+5	Writing the meaning of Quranic phrases & translation of sentences 3+5	Quranic Possessive Construction (مضاف ومضاف إليه) (مضاف ومضاف إليه)
6.	1.	3	6+7	Writing the meaning of Quranic phrase translation of sentences 6+7	Quranic Possessive Construction (مضاف ومضاف إليه) (مضاف ومضاف إليه)
	2.	3	8+10 & Revision (Unit 3)	Writing the meaning of Quranic phrase & translation of sentences 8+10 Quiz	Active Participle (اسم الفاعل), Passive Participle (اسم المفعول), Dual (مثنى)
7.	1.	Unit 4	1+2	Writing the meaning of Quranic phrase & translation of sentences 1+2	Personal Pronoun He (هو) (المتصل) Possessive Pronoun His (له) (المتصل)
	2.	4	3+4	Writing the meaning of Quranic phrase & translation of sentences 3+4	Possessive Pronoun with prepositions في بيته like Pronoun "His" with prepositions like لله، منه، فيه
8.	1.	4	5+8	Writing the meaning of Quranic sentences 5+8	Personal Pronoun You (أنت) (المتصل) Possessive Pronoun Your (لك) (المتصل) Possessive Pronoun with prepositions في بيتك like Pronoun "your" with prepositions like للك، منك، قبك
	2.	Mid Term			

9.	1.	4	9-12	Writing the meaning of Quranic phrases & sentences 9-12	Personal Pronoun She(هي المتصل) Possessive Pronoun Her ها المتصل) Possessive Pronoun with prepositions like في بيتها Pronoun "Her" with prepositions like لها
	2.	4	13-16	Writing the meaning of Quranic phrases & sentences 13-16	Personal Pronoun I (أنا المتصل) Possessive Pronoun Her هي المتصل) Possessive Pronoun with prepositions like في بيتي Pronoun "My" with prepositions like لي
10.	1.	4	17 & Revision Unit 4	Revision of all Quranic sentences of Unit 4 Quiz	Adverb (حال)
	2.	Unit 5	1-2	Writing the meaning of Quranic phrases & sentences 1-2	Masculine Plural جمع المذكر السالم و جمع المذكر السالم المسبوق بعرف الجر
11.	1.	5	3-4	Writing the meaning of Quranic phrases & sentences 3-4	Possessive Construction with Plurals جمع المذكر السالم المسبوق بالإضافة
	2.	5	5-6	Writing the meaning of Quranic phrases, sentences & verses 5-6	Personal Pronoun They (هم المتصل) Possessive Pronoun Their هم المتصل)
12.	1.	5	7-8	Writing the meaning of Quranic phrases, sentences & verses 7-8	Possessive Pronoun with prepositions like في بيتهم Pronoun "Their" with prepositions like لهم
	2.	5	9-11	Writing the meaning of Quranic phrases, sentences & verses 9-11	Personal Pronoun You (أنتم المتصل) Possessive Pronoun Your كم المتصل) Possessive Pronoun with prepositions

					في بيتكم like
3.	1.	5	12-14	Writing the meaning of Quranic phrases & sentences & verses 12-14	Pronoun "Your" with prepositions like لكم Personal Pronoun We (نحن المتصل) Possessive Pronoun Our (نا المتصل)
	2.	5	15-16	Writing the meaning of Quranic sentences & verses 15-16	Possessive Pronoun with prepositions like في بيتنا Pronoun "Our" with prepositions like لنا
4.	1.	5	17-18	Writing the meaning of Quranic sentences & Verses 17-18	Demonstrative Pronoun These, Those (هؤلاء أولئك)
	2.	5	19-23	Writing the meaning of Quranic sentences & Verses 19-23	ما / إلا، إن / إلا، إنما، ليس، ما ، (ألم، أن، بل، كل (ألا، ليس، اليوم، يومئذ، سبحانه، ما بينهما، قل، إذن، بل، نعم، كلا، ما أترأوه، حسب، أعلم به، معصير، مرهف، تبتل/تعيير)
5.	1.	5	Revision Unit 5	Quiz	
	2.	5	1-3 (till Page 16)	Writing the meaning of Quranic Verbs & Translation of Quranic Sentences & Verses (1-3)	Introduction of Present Tense (فعل مضارع) & Verbal Sentence (جملة فعلية) Present Tense الفعل المضارع صيغة المفرد يعلم
6.	1.	6	3 (From Page 17) & 4-5	Translation of Quranic Sentences & Verses 3-5	Present Tense الفعل المضارع صيغة المفرد يعلم
	2.	6	6	Translation of Quranic Sentences & Verses	Present Tense الفعل المضارع صيغة الجمع يعلمون

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Paper book: All volumes are available in printed book form.
2. Tutorial videos: Teaching video of each lesson available on YouTube.
3. Confirmation Videos: A complete series of confirmation videos of all lessons is available in which the student can confirm his answers.
4. A flipbook: A flipbook edition is also accessible.
5. Helping material: Helping material for the teachers like quizzes, question papers and images is available on website.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

1ST YEAR, SEMESTER II			
Code	COURSE	CREDIT HOURS	CATEGORY
ENSC-103	Fundamentals of Ecology	3 (3-0)	Major
ENSC-104	Basic Chemistry	3 (2-1)	Interdisciplinary
GQR-102	Quantitative Reasoning – II *	3 (3-0)	General Education
GSS-102	Social Sciences *** (Anthropology)	2 (2-0)	General Education
GENG-101	Functional English *	3 (3-0)	General Education
GSPS-101	Pakistan Studies *	2 (2-0)	General Education
GAH-101	Arts & Humanities ***** (Language i.e. French)	2 (2-0)	General Education
HQ-02	Understanding of Holy Quran / Fahm-e-Quran– II	1 (0-1)	General Education
Total Credit hrs Semester-II		19	

Program	BS Environmental Sciences	Course Code	ENSC-103	Credit hours	03
Course Title	FUNDAMENTALS OF ECOLOGY				
COURSE INTRODUCTION					
The current course is designed to introduce the fundamentals of ecology and ecological principles to the participants. The course shall encompass the thorough study of climate and world major terrestrial and aquatic biomes including coral reefs and coastline mangroves. The dynamics of population and community ecology will be the core of this course. Interactions of plants with other organisms will also be taught. Finally, concepts of restoration of ecosystems and modern challenges of restoration shall also be encompassed in this course.					
LEARNING OUTCOMES					
By the end of this course, students will be able to: 1. Understand the basic concepts of ecology and fundamental ecological principles. 2. Learn climate and biomes of the world and interactions of plants with the environment. 3. Explain the dynamics of population and community ecology. 4. Describe restoration of ecosystems and the challenges involved.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to Ecology and Ecological Principles A brief history of life on Earth: origin, evolution and major biological transitions			Begon et al. Essentials of Ecology, Chapter 1. History and levels of organization.	
	Definition and types of ecology: organismal, population, community, ecosystem and landscape ecology				
	Levels of biological organization: from individuals to the biosphere				
WEEK-2	Abiotic and biotic components of the ecosystem and their interactions			Begon, Chapter on energy flow and biogeochemical cycles	
	Concept of energy flow through ecosystems: trophic levels and energy transfer efficiency				
	Recycling of nutrients: major biogeochemical cycles — carbon, nitrogen and phosphorus				
WEEK-3	Ecological niches: fundamental vs realized niche, niche breadth and overlap			Keddy Plant Ecology or Begon. Niches, productivity.	
	Habitat, microhabitat and ecosystem types: an overview				
	Ecosystem productivity: gross and net primary production and limiting factors				
WEEK-4	Unit-II: Climate and Biomes Understanding climatic patterns of the world: temperature, precipitation and seasonality			Begon / Holl. Climate, terrestrial & aquatic biomes, coral reefs, mangroves.	
	Major terrestrial biomes: tropical forest, savanna, grassland, desert, taiga and tundra				
	Major aquatic biomes: freshwater lakes, rivers, wetlands and marine ecosystems				
WEEK-5	Coral reefs: structure, biodiversity, threats and conservation				
	Estuaries, coastline ecosystems and mangroves: ecological roles and threats				
	Climate change impacts on biomes and ecosystem distribution				
WEEK-6	Unit-III: Population Ecology Explaining species and populations: definitions, boundaries and characteristics			Begon. Population ecology, growth models, community interactions.	
	Concept of subpopulations, metapopulations and satellite populations				

	Population demography: birth rate, death rate, age structure and sex ratio	
WEEK-7	Population growth models: exponential and logistic growth, carrying capacity	
	Survivorship curves: Types I, II and III and their ecological significance	
	Population decline and threats: habitat loss, overexploitation and fragmentation	
WEEK-8	Unit-IV: Community and Ecosystem Ecology Speciation, evolution, dispersal, natural and artificial selection	
	Intraspecific and interspecific interactions and their ecological consequences	
	Understanding community structure: species richness, diversity and dominance	
MID TERM EXAMINATION		
WEEK-9	Concept of food chain, food web, food pyramid and feeding guilds	
	Predation, competition, mutualism and parasitism: mechanisms and examples	
	Concept of home range and territories: ecological functions and measurement	
WEEK-10	Unit-V: Interactions Among Plants and Other Organisms Mycorrhiza: types, functions and importance in plant nutrition and ecosystem health	Plant interactions (mycorrhiza, nitrogen fixation, pollination) – Keddy & Begon.
	Nitrogen fixation: biological nitrogen fixation, key organisms and ecological significance	
	Pathogens and endophytes: plant-microbe interactions and ecological roles	
WEEK-11	Parasites, saprophytes and carnivorous plants: adaptations and ecological roles	
	Plant-pollinator interactions: mutualism, co-evolution and conservation	
	Allelopathy and plant-plant chemical interactions in communities	
WEEK-12	Introduction to restoration ecology: definitions, goals and principles	
	Difference between afforestation, reforestation and forest restoration	
	Ecological succession: primary, secondary succession and climax communities	
WEEK-13	Unit-VI: Restoration Ecology — Disturbance, Tools and Communities Types and intensity of disturbances in natural ecosystems: natural vs anthropogenic	Holl Foundations of Restoration Ecology. Succession, disturbance, restoration tools.
	Disturbance ecology: the intermediate disturbance hypothesis and ecosystem resilience	
	Restoration planning: site assessment, goal setting and species selection	
WEEK-14	Emerging tools in restoration: drones, remote sensing and GIS-based monitoring	
	AI-based ecosystem monitoring and predictive modelling for restoration outcomes	
	Indicators of restoration success: biodiversity, soil health and ecosystem function	
WEEK-15	Unit-VII: Community Engagement and Future of Ecology	
	Role of indigenous and local communities in ecosystem restoration and conservation	
	Traditional ecological knowledge: its value and integration with modern science	
	International frameworks for restoration: UN Decade on Ecosystem Restoration 2021-2030	Case studies, UN Decade on Restoration, Anthropocene challenges.

WEEK-16	Global ecological challenges: biodiversity crisis, climate change and planetary boundaries		
	Ecology in the Anthropocene: human-dominated ecosystems and pathways to sustainability		
	Case studies in ecological success: lessons from rewilding, species recovery and landscape restoration projects		
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Singh, V. (2024). Textbook of Environment and Ecology (pp. 217-224). Springer, Singapore. 2. Keddy, P. A. (2017). Plant Ecology. Cambridge University Press. 3. Rubenstein, D. I., & Wrangham, R. W. (2016). Ecological Aspects of Social Evolution. Princeton University Press. 4. Holl, K. (2016). Foundations of Restoration Ecology. Island Press. 2. Applied Population and Community Ecology: The Case of Feral Pigs in Australia. John Wiley & Sons. 3. Begon, M., Howarth, R. W., & Townsend, C. R. (2014). Essentials of Ecology (4th ed.). Wiley. 4. Rana, S. V. S. (2013). Essentials of Ecology and Environmental Science. PHI Learning Pvt. Ltd.			
TEACHING – LEARNING STRATEGIES			
Lecture based examination Presentation/seminars Class discussion Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: classroom participation, attendance, assignments and presentation, homework attitude and behavior, hands-on-activities, short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-104	Credit hours	02
Course Title	BASIC CHEMISTRY (THEORY)				
COURSE INTRODUCTION					
This course provides an introduction to the fundamental principles of chemistry, focusing on the structure, properties, and transformations of matter. Students will explore core topics including atomic structure, the periodic table, chemical bonding, chemical reactions, stoichiometry, states of matter, solutions, acids and bases, and basic thermochemistry.					
LEARNING OUTCOMES					
By the end of this course the students will learn: 1. to have an understanding of periodic laws and atomic properties. 2. to learn basic concepts of chemical bonding and strength of acids and bases. 3. To have an understanding of buffers application in industries and environment. 4. The students will learn chemistry of functional groups in organic compounds and their role in environment.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-1: Introduction to Periodic Table Periodic Law — History & Development (Mendeleev, Modern Periodic Table)			Reading: Review Chapter 1 of Petrucci on periodic table history; list 5 key differences between Mendeleev’s and the modern periodic table.	
	Metals — Properties, Classification, Examples				
WEEK-2	Non-metals — Properties, Classification, Metalloids			Assignment: Compare electronegativity trends across Period 2 and Group 17 using data from your textbook.	
	Periodic Trends: Electronegativity & Electropositivity				
WEEK-3	Periodic Trends: Ionization Potential			Reading: Read about ionization energy trends; explain in 5 sentences why IE generally increases across a period.	
	Periodic Trends: Electron Affinity				
WEEK-4	Unit-II: Chemical Bonding			Assignment: Draw Lewis structures for NaCl and H ₂ O; identify the bond type in each compound.	
	Ionic Bonding — Formation, Properties, Examples				
	Covalent Bonding — Types, Lewis Structures, Properties				
WEEK-5	Coordinate Covalent Bonding — Concept & Examples			Reading: Review coordinate covalent bonding; find two real-world examples not given in your textbook.	
	Lattice Energy — Born-Haber Cycle, Trends				
WEEK-6	Unit-III: Acid and Base strengths			Assignment: Calculate the pH of 0.1 M HCl and 0.1 M acetic acid solutions; compare the two results.	
	Strong & Weak Acids — Dissociation, K _a , Examples				
	Strong & Weak Bases — K _b , Conjugate Pairs				
Week-7	pH — Calculations, pOH, pH Scale, Neutralization			Reading: Read the Henderson-Hasselbalch equation derivation; solve two buffer pH practice problems.	
	Buffers — Henderson-Hasselbalch, How Buffers Work				
WEEK-8	Buffer Applications — Pharmaceutical & Environmental			Assignment: Research one industrial application of buffers and write a brief half-page summary.	
	Water Hardness — Temporary/Permanent, Softening Methods				
MID TERM EXAMINATION					

WEEK-9	Unit-IV: Organic Chemistry	Reading: Review the overview of functional groups; list the environmental significance of at least three groups.
	Introduction to Functional Groups — Overview & Environmental Role	
	Alcohols — Structure, Properties, Reactions, Environmental Relevance	
WEEK-10	Carbonyls — Aldehydes & Ketones, Properties	Assignment: Draw structural formulas of ethanol and acetaldehyde; identify the functional group in each.
	Esters — Formation, Hydrolysis, Applications	
WEEK-11	Carboxylic Acids — Structure, Acidity, Examples	Reading: Read about carboxylic acids in the environment; give two examples of environmentally relevant compounds.
	Amines — Classification, Basicity, Environmental Pollutants	
WEEK-12	Aromatic Compounds Benzene	Assignment: Draw the structure of benzene and explain the concept of resonance
	Polyaromatic Hydrocarbons (PAHs) and resonance	
WEEK-13	Ethers Structure	Reading: Review ether properties; identify one industrial use and one environmental concern associated with ethers. Assignment: Identify the peptide bond in a simple dipeptide and explain its formation in your own words.
	Properties, Industrial Uses of Ethers	
WEEK-14	Amino Acids & Proteins	Reading: Read about causes of protein denaturation; list three environmental factors that can cause it.
	Structure, Peptide Bonds, Significance	
WEEK-15	Protein Denaturation	Reading: Review ether properties; identify one industrial use and one environmental concern associated with ethers. Assignment: Identify the peptide bond in a simple dipeptide and explain its formation in your own words.
	Environmental Implications of protein denaturation	
WEEK-16	Carbohydrates Monosaccharides	Reading: Read about causes of protein denaturation; list three environmental factors that can cause it.
	Polysaccharides, functions of carbohydrates	
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Hanif, M. A., Nadeem, F., Bhatti, I. A., Tauqeer, H. M. (2020). Environmental Chemistry: A Comprehensive Approach. United Kingdom: Wiley. 2. Organic and Inorganic Chemistry. (2022). United States: Larsen and Keller Education. 3. Boyle, R. (2020). The Sceptical Chymist. (n.p.): Outlook Verlag. 4. Petrucci, R. H. (2017). <i>General chemistry: principles and modern applications</i>. Pearson. 5. Schwarzenbach, R. P., Gschwend, P. M., & Imboden, D. M. (2016). <i>Environmental organic chemistry</i>. John Wiley & Sons. 6. Ucko, D. A. (2013). <i>Basics for chemistry</i>. Elsevier. 7. Silberberg, M. (2012). <i>Principles of general chemistry</i>. McGraw-Hill Education.		

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

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- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-109	Credit hours	01
Course Title	BASIC CHEMISTRY (PRACTICAL)				
COURSE INTRODUCTION					
This course provides an introduction to the fundamental principles of chemistry, focusing on the structure, properties, and transformations of matter. Through a combination of theoretical instruction and practical laboratory work, students will develop problem-solving skills and a scientific mindset. Emphasis is placed on the application of chemical concepts to real-world situations, everyday life, and environmental issues. This course lays a strong foundation for further study in science, medicine, engineering, and related fields.					
LEARNING OUTCOMES					
By the end of this course the students will learn: 1. To have an understanding of basic concepts of volumetric analysis 2. Learn about gravimetric analysis 3. To learn about Complexometric titrations					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-1: Acid Base Titration Introduction to Laboratory Safety, Glassware, and Volumetric Equipment — Preparation of Standard Solutions			Reading: Review standard laboratory safety rules; list 5 precautions specific to volumetric analysis.	
WEEK-2	Determination of Acidity in a Sample using Strong Acid-Strong Base Titration (HCl vs NaOH)			Assignment: Write a pre-lab report for the HCl vs NaOH titration including the expected balanced equation.	
WEEK-3	Determination of Alkalinity using Weak Acid-Strong Base Titration (Acetic acid vs NaOH) — Use of Indicators			Reading: Read about common acid-base indicators; explain the color change mechanism for phenolphthalein.	
WEEK-4	Introduction to Redox Titrations. Preparation of KMnO ₄ Solution & Standardization			Assignment: Write the balanced equation for KMnO ₄ standardization with oxalic acid.	
WEEK-5	Determination of Iron (Fe ²⁺) Content in a Sample using Permanganometry			Reading: Review permanganometry principles; explain why HCl should not be used as the acidifying agent.	
WEEK-6	Determination of Vitamin C (Ascorbic Acid) using Iodometric Titration			Assignment: Write a concise step-by-step procedure for the iodometric determination of Vitamin C.	
WEEK-7	Introduction to Complexometric Titrations — Preparation of EDTA Solution & Indicators (Eriochrome Black T)			Reading: Review the structure of EDTA; explain in simple terms how it forms chelates with metal ions.	
WEEK-8	Determination of Total Hardness of Water using EDTA Titration			Assignment: Calculate the volume of 0.01 M EDTA needed to titrate 50 mL of 0.01 M Ca ²⁺ solution.	
MID TERM EXAMINATION					

WEEK-9	Determination of Calcium and Magnesium Hardness Separately using EDTA	Reading: Review the calculation differences between total hardness, calcium hardness, and magnesium hardness.
WEEK-10	Unit-IV: Argentometric Titrations Introduction to Argentometric Titrations. Preparation & Standardization of AgNO ₃ Solution	Assignment: Write the reaction between AgNO ₃ and NaCl; name the precipitate and state its color.
WEEK-11	Determination of Chloride Content in Water using Mohr's Method	Reading: Read about Mohr's method; explain the role and color change of potassium chromate indicator.
WEEK-12	Determination of Chloride Content using Volhard's Method	Reading: Compare Mohr's and Volhard's methods; note one practical advantage of each.
WEEK-13	UNIT V: Gravimetric Analysis Introduction to Gravimetric Analysis. Precipitation, Filtration & Drying Techniques; Determination of Sulfate in a Sample	Assignment: Write a short note on the steps of precipitation, filtration, and drying in gravimetric analysis.
WEEK-14	Determination of Total Dissolved Solids (TDS) in a Water Sample: Environmental Application	Assignment: Design a simple flowchart for the determination of Total Dissolved Solids (TDS) in a water sample.
WEEK-15	Comprehensive Review of All Titration Methods	Reading: Review all four titration types studied; prepare a brief comparison table of methods and applications.
WEEK-16	Lab Report Submission	Assignment: Submit a complete formatted lab report for one experiment conducted during the semester.

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Hanif, M. A., Nadeem, F., Bhatti, I. A., Tauqeer, H. M. (2020). Environmental Chemistry: A Comprehensive Approach. United Kingdom: Wiley.
2. Organic and Inorganic Chemistry. (2022). United States: Larsen and Keller Education.
3. Boyle, R. (2020). The Sceptical Chymist. (n.p.): Outlook Verlag.
4. Petrucci, R. H. (2017). *General chemistry: principles and modern applications*. Pearson.
5. Schwarzenbach, R. P., Gschwend, P. M., & Imboden, D. M. (2016). *Environmental organic chemistry*. John Wiley & Sons.
6. Ucko, D. A. (2013). *Basics for chemistry*. Elsevier.
7. Silberberg, M. (2012). *Principles of general chemistry*. McGraw-Hill Education.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GQR-102	Credit hours	03
Course Title	QUANTITATIVE REASONING II				
COURSE INTRODUCTION					
Quantitative Reasoning (I) is an introductory-level undergraduate course that focuses on the fundamentals related to quantitative concepts and analysis. The course is designed to familiarize students with the basic concepts of mathematics and statistics and to develop their abilities to analyze and interpret quantitative information. Through a combination of theoretical concepts and practical exercises, this course will enable students to cultivate their quantitative literacy and problem-solving skills while expanding their academic horizon in their specific field of study.					
LEARNING OUTCOMES					
By the end of this course, students will be able to: 1. Demonstrate fundamental numerical literacy to work with numbers, understand their meaning and present data accurately. 2. Apply fundamental mathematical and statistical concepts in problem-solving contexts. 3. Interpret data presented in various formats including tables, graphs, charts and equations. 4. Build foundational mathematical and analytical skills for understanding and solving real-world problems using quantitative methods.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Logic, Logical and Critical Reasoning		Bennett & Briggs, Ch. 1A (Living in the Media Age) & Ch. 1B (Propositions and Truth Values), pp. 4–24. Practice Set 1: Identifying fallacies and constructing basic conditional statements.		
	Introduction to Logic				
	Argument, Fallacy, Types of Logic				
	Logical Connectors, Inverse				
WEEK-2	Conditionals, Converse		Bennett & Briggs, Ch. 1B (Propositions and Truth Values) & Ch. 1D (Analyzing Arguments), pp. 41–54. Worksheet 1: Constructing truth tables and proving logical equivalences.		
	Contrapositive, Biconditionals				
	Tautology and contingency				
WEEK-3	Truth Tables and Logical Equivalences		Bennett & Briggs, Ch. 1C (Sets and Venn Diagrams), pp. 25–40; Brief Review (Sets of Numbers), p. 28. Problem Set 1: Defining set operations (union, intersection, complement) for numeric systems.		
	Number systems, Sets				
	Set Operations				
WEEK-4	Unit-II (continued): Mathematical Modeling and Analyses		Bennett & Briggs, Ch. 1C (Venn Diagrams), pp. 25–40; Blitzer, Sec 1.4 (Linear Functions) & Sec 2.1 (Basics of Functions), pp. 202–217, 222–234. Graphical Assignment: Creating Venn diagrams and plotting deterministic linear models.		
	Subsets, Relation Between sets				
	Venn Diagrams				
	Predicates and quantifiers				
WEEK-5	Deterministic models		Blitzer, Sec 8.1 (Systems of Linear Equations in Two Variables), pp. 796–810. Quiz 1 & Mathematical Modeling Problem Set: Solving systems of equations via substitution and elimination.		
	Linear Functions				
	System of linear equations				

WEEK-6	Unit-III: Fundamental Mathematical Concepts	Blitzer, Sec 11.3 (The Derivative), pp. 1083–1094. Calculus Worksheet 1: Calculating average and instantaneous rates of change graphically.
	System of Eqs Examples	
	Modeling with the system of Linear Eq.	
	Graphical Representation	
WEEK-7	Introduction to Derivatives	Blitzer, Sec 11.3 (The Derivative - continued), pp. 1095–1100. Calculus Worksheet 2: Applying basic derivative rules (power, constant multiple, sum/difference).
	Rules of Derivatives	
	Rules of Derivatives Continue	
WEEK-8	Unit-IV: Mathematical Modeling and Analyses	Blitzer, Sec 4.5 (Exponential Growth and Decay; Modeling Data), pp. 495–510. Mid-Term Revision & Modeling linear vs. exponential population decay.
	Derivatives in mathematical modeling	
	Linear Model	
	Exponential Model	
MID TERM EXAMINATION		
WEEK-9	Growth Model	Blitzer, Sec 10.7 (Probability), pp. 1123–1135; Bennett & Briggs, Ch. 7A (Fundamentals of Probability), pp. 410–424. Probability Set 1: Determining sample spaces and calculating theoretical probability for independent events.
	Decay Model	
	Some Real-World Application of Mathematical Models	
WEEK-10	Unit-V: Statistical Modeling and Analyses	Bennett & Briggs, Ch. 7B (Combining Probabilities), pp. 425–436; Blitzer, Sec 10.5 (The Binomial Theorem), pp. 1102–1110. Assignment: Distinguishing between continuous and discrete variables in data samples.
	Introduction to probability	
	Sample Spaces and Events	
	Probability Axioms and Basic Rules	
WEEK-11	Discrete vs. Continuous Random Variables	Bennett & Briggs, Ch. 6C (The Normal Distribution), pp. 383–395. Statistical Application Worksheet: Real-world modeling using binomial distributions.
	Introduction to the Binomial Distribution	
	Binomial Distribution: Mean and Variance	
WEEK-12	Applications of Binomial Models in Real Life	Bennett & Briggs, Ch. 6C (The Normal Distribution), pp. 383–395. Quiz 2 & Problem Set: Calculating Z-scores and interpreting standard normal curve areas.
	Introduction to the Normal Distribution	
	The Standard Normal Curve (Z-scores)	
WEEK-13	Unit-V (continued): Statistical Modeling and Analyses	Bennett & Briggs, Ch. 5E (Correlation and Causality), pp. 342–353. Data Visualization Project: Constructing scatter plots and calculating Pearson correlation for bivariate datasets.
	Simple Applications of Normal Distribution	
	Introduction to Bivariate Data	
	Constructing and Interpreting Scatter Plots	
WEEK-14	Introduction to Pearson Correlation	Bennett & Briggs, Ch. 6 (Putting Statistics to Work), pp. 396–405.
	Coefficient of Determination	

	Concept of Statistical Inference	Hypothesis Testing Worksheet: Formulating null and alternative hypotheses.
WEEK-15	Hypothesis Testing	Bennett & Briggs, Reference Appendix / Class Handouts on Chi-Square. Problem Set: Setting up Chi-Square tables and calculating degrees of freedom.
	Understanding P-values	
	Chi-Square Test	
WEEK-16	Degrees of Freedom	Bennett & Briggs, Reference Appendix / Class Handouts on Hypothesis Testing. Final Revision
	Critical Values	
	Interpreting Chi-Square	

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Akar, G. K., et al. (Eds.). (2023). Quantitative Reasoning in Mathematics and Science Education. Springer.
2. Zaslow, E. (2020). Quantitative Reasoning: Thinking in Numbers. Cambridge University Press.
3. Rosen, K. H. (2019). Discrete Mathematics and its Applications. McGraw-Hill Education.
4. Bennett, J. O., Briggs, W. L., & Badalamente, A. (2016). Using and Understanding Mathematics: A Quantitative Reasoning Approach. Pearson Education.
5. Attali, Y. (2014). Calculator Use on the GRE Revised General Test Quantitative Reasoning Measure. ETS Research Report Series.
6. Sevilla, A., & Somers, K. (2012). Quantitative Reasoning: Tools for Today's Informed Citizen. John Wiley & Sons.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GNS-101	Credit hours	02
Course Title	SOCIAL SCIENCES – ANTHROPOLOGY				
COURSE INTRODUCTION					
Environmental anthropology explores the interface between human populations and their environmental surroundings, viewing how culture, politics and human behavior influence the natural environment. It explores how the human/environment relationship varies cross-culturally, geographically, and economically over time, in different sociopolitical contexts. With the current environmental crises and race for more natural resources has been triggered the degradation of the global environmental Integrity.					
LEARNING OUTCOMES					
By the end of this course the students will learn:					
1. Identify key contributions, ideas, and concepts in environmental anthropology					
2. Use analytic tools in environmental anthropology to pursue independent inquiry into problems in environment and society					
3. Investigate environmental issues like climate change and resource distribution using ethnographic methods					
4. Understand and explain different cultural perspectives on nature, ecology, and the environment					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction			Kottak Anthropology Pg 4-9	
	Introduction - Anthropology				
	Basic Terminologies of Anthropology				
WEEK-2	Branches of Anthropology			Kottak Anthropology Pg 9-15	
	Scope of Anthropology				
WEEK-3	History of Anthropology			Assignment 1	
	Geographical Distribution of Humans				
WEEK-4	Unit-II: Human and Cultural Evolution			Kottak Anthropology Pg 44-49	
	Biological Evolution of Humans				
	Human Ancestors and Primates				
WEEK-5	Human Biological Variations			Kottak Anthropology Pg 49-54	
	Evolution of Brain				
WEEK-6	Unit-II: Cultural Anthropology			Kottak Anthropology Pg 26-s42	
	Cultural Evolution & Adaptation				
	Cultural characteristic & Terminologies				
Week-7	Cultural Evaluation			Quiz 1	
	Social Stratification, class, ethnicity & Racism				
WEEK-8	Unit IV: Communication and Language			Kottak Anthropology Pg. 65-76	
	Origins of language				
	Process of linguistic divergence				
MID TERM EXAMINATION					
WEEK-9	Relationship between language and culture			Kottak Anthropology Pg. 98-114	
	Social and Cultural Settings				

WEEK-10	Unit V: Human Population, Food and Agriculture	Kottak Anthropology Pg. 98-105
	Evolution of agriculture	
	Agricultural Practices	
WEEK-11	Agriculture and Pesticides	Kottak Anthropology Pg. 106-114
	Organic Farming	
WEEK-12	Genetically modified organisms	Assignment 2
	Traditional ecological knowledge	
WEEK-13	Tragedy of the commons	Kottak Anthropology Pg. 98-105
	Rare ecological habitats of humans	
WEEK-14	Unit VI: Environmental Anthropology	Kottak Anthropology Pg. 106-114
	Globalization -Intro	
	Problems and Opportunities	
WEEK-15	Climate change, resilience	Quiz 3
	Nature, biodiversity and urban landscapes	
WEEK-16	Ethnobotany, medicinal plants	Assignment 3
	Intellectual property rights	
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Kottak, C. P. (2021). <i>Anthropology: Appreciating Human Diversity</i> (19th ed.). McGraw-Hill. 2. Scupin, Raymond and DeCorse, Christopher (2020). <i>Anthropology A Global Perspective</i> Ninth Edition, Sage Press: 3. Scupin, R. (2019). <i>Cultural anthropology: A global perspective</i>. SAGE Publications. 4. Stensrud, A. B., & Eriksen, T. H. (Eds.). (2019). <i>Climate, Capitalism and Communities: An Anthropology of Environmental Overheating</i>. PlutoPress. 5. Eller, J. D. (2016). <i>Cultural Anthropology Global Forces, Local Lives</i> Third edition, Routledge, New York 6. Singer, M. (2016). <i>A companion to the anthropology of environmental health</i>. John Wiley & Sons, Chichester, UK 7. Kopnina, H., & Shoreman-Ouimet, E. (2016). <i>Routledge handbook of environmental anthropology</i>; Routledge, New York. 8. Carol R. E., Melvin E., & Peter N. (2015). <i>Human Evolution and Culture Highlights of Anthropology 8th Edition</i>. Pearson. 9. Haviland, W. A. Harald E. L. Prins, B. McBride, D. Walrath (2014). <i>Cultural Anthropology: The Human Challenge</i>, Fourteenth Edition, Wadsworth Belmont, USA		
TEACHING – LEARNING STRATEGIES		
• Lecture based examination • Presentation/seminars • Class discussion • Quizzes		
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR		
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: • classroom participation, • attendance, assignments and presentation, • homework • attitude and behavior, • hands-on-activities, short tests, quizzes etc.		

ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GENG-101	Credit hours	03
Course Title	FUNCTIONAL ENGLISH				
COURSE INTRODUCTION					
This course is designed to equip students with essential language skills for effective communication in diverse real-world scenarios. It focuses on developing proficiency in English language usage: word choices, grammar and sentence structure. In addition, the course will enable students to grasp nuanced messages and tailor their communication effectively through application of comprehension and analytical skills in listening and reading. Moreover, the course encompasses a range of practical communication aspects including professional writing, public speaking, and everyday conversation, ensuring that students are equipped for both academic and professional spheres. An integral part of the course is fostering a deeper understanding of the impact of language on diverse audiences. Students will learn to communicate inclusively and display a strong commitment to cultural awareness in their language use. Additionally, the course will enable them to navigate the globalized world with ease and efficacy, making a positive impact in their functional interactions.					
LEARNING OUTCOMES					
By the end of this course, students will be able to: 1. Apply enhanced English communication skills through effective use of word choices, grammar and sentence structure. 2. Comprehend a variety of literary / non-literary written and spoken texts in English. 3. Effectively express information, ideas and opinions in written and spoken English. 4. Recognize inter-cultural variations in the use of English language and to effectively adapt their communication style and content based on diverse cultural and social contexts.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Foundations of Functional English: Foundations of Functional English, Vocabulary Building, Contextual usage.		Observe one day of communication around you and identify five situations where functional English is used effectively		
	Idiomatic expressions, Synonyms, Antonyms		Read newspaper article, find 5 new words and their one synonym and antonym and make sentences of each.		
	Communicative Grammar (subject-verb agreement)		Find 2 incorrect sentences from daily usage and correct the subject-verb agreement error		
WEEK-2	Sentence Structure (simple, compound, complex)		Assignment: Combine simple sentences into compound and complex ones.		
	Verb Tenses, Fragments and Run-ons		Reading from book Functional English (Medicose series 3rd edition) pg 9-13		
	Examples of sentence structures		Reading from book Functional English (Medicose series 3rd edition) pg 24-25		
WEEK-3	Word formation, affixation, compounding.		Collect 15 modern English words from social media, and identify the process of word formation used in each		
	Clipping, back formation		Assignment: Write five pairs of words showing affixation or compounding.		
	Articles and Modifiers		Reading from book Functional English (Medicose series 3rd edition) pg 22-23		

WEEK-4	Word Classes (nouns, verbs)	Reading from book Functional English (Medicose series 3rd edition) pg 16-21
	Adjectives, adverbs, prepositions, etc.	Record a 1-minute audio of yourself reading a short paragraph aloud, focusing on correct pronunciation.
	Pronunciation and Sound Production	Reading from book Functional English (Medicose series 3rd edition) pg 25-27
WEEK-5	Unit-II: Comprehension and Analysis: Context of comprehension and analysis	Reading from book Functional English (Medicose series 3rd edition) pg 32-34
	Reading strategies (skimming, scanning, SQ4R)	Reading from book Functional English (Medicose series 3rd edition) pg 42-47
	Tone, bias, assumptions	Reading from book Functional English (Medicose series 3 rd edition) pg 35-41
WEEK-6	Critical reading practice	Read a short article provided by the instructor. Write a 150-word summary identifying the author's purpose, audience and tone
	Inference and interpretation	Bring a short newspaper article and identify three inferred meanings that are not directly stated.
	Active Listening	Reading from book Functional English (Medicose series 3rd edition) pg 47-48
WEEK-7	Listening Barriers	Reading from book Functional English (Medicose series 3rd edition) pg 49
	Overcoming listening barriers	Reading from book Functional English (Medicose series 3rd edition) pg 50
	Focused Listening	Listen to a short audio and write one key idea and a question for the speaker
WEEK-8	Unit-III: Effective Communication: Principles of communication	Reading from book Functional English (Medicose series 3rd edition) pg 53-56
	Clarity, coherence, conciseness	Find a poorly written message and improve it using communication principles
	Foundations of Functional English, Vocabulary Building, Contextual usage.	Revisions
MID TERM EXAMINATION		
WEEK-9	Structuring Documents	Reading from book Functional English (Medicose series 3rd edition) pg 59
	Introduction, Body, Conclusion	Assignment: Write one introductory paragraph having all key elements
	Formatting	Redesign the given poorly formatted and punctuated paragraph
WEEK-10	Unit-IV: Inclusive and Cross-Cultural Communication Inclusivity in Language	Reading from book Functional English (Medicose series 3rd edition) pg 62-65
	Gender-neutral language, stereotypes	Assignment: Rewrite five sentences to make them gender-neutral or culturally inclusive.

	Cross-cultural use	Reading from book Functional English (Medicose series 3rd edition) pg 65-68
WEEK-11	Public Speaking	Reading from book Functional English (Medicose series 3rd edition) pg 68-71
	Stage fright, voice modulation, body language	Prepare a 2-3 minute speech on any topic.
	Preparation Stage (topic, audience, venue)	Reading from book Functional English (Medicose series 3rd edition) pg 71-78
WEEK-12	Presentation Skills Presentation Stage (AV aids, engagement etc.)	Create PowerPoint slides on your speech topic.
	Q&A sessions in presentation	Reading from book Functional English (Medicose series 3rd edition) pg 81-83
	Evaluation Stage (organization, visual aids, engagement)	Reading from book Functional English (Medicose series 3rd edition) pg 83-87
WEEK-13	Informal Communication: Small talk, networking, conversation starters	Reading from book Functional English (Medicose series 3rd edition) pg 89-93
	Effective Writing Skills	Reading from book Functional English (Medicose series 3rd edition) pg 93-95
	Professional Writing (Business emails, memos, formal letters)	Assignment: Write an email to your course instructor requesting an extension on an assignment due to illness.
WEEK-14	Unit-V: Academic and Creative Writing Essay / Creative Writing	Reading from book Functional English (Medicose series 3rd edition) pg 57-61
	Kinds of essays: Descriptive, Narrative.	Write a descriptive essay using sensory details.
	Transition from creative to academic writing	Take a short blogpost and rewrite it in a formal academic style
WEEK-15	Kinds of essays: Argumentative, Expository, Persuasive.	Reading from book Functional English (Medicose series 3rd edition) pg 91-100
	Essay Writing (Structure, thesis statement)	Reading from book Functional English (Medicose series 3rd edition) pg 100-105
	Essay Writing (body paragraphs, arguments with supporting evidence, analysis)	Assignment: Essay writing on contemporary topics given by instructor
WEEK-16	Essay Writing (organization, transitions, referencing of sources)	Essay Writing Practice
	Essay Writing: avoiding plagiarism, integrating sources and citation styles (APA, MLA)	Revisions
	Peer review and feedback: evaluating and improving written work collaboratively	Revisions
FINAL TERM EXAMINATION		
PRACTICAL REQUIREMENTS		
As part of the overall learning requirements, students will also be exposed to relevant simulations, role-plays and real-life scenarios and will be required to apply skills acquired throughout the course in the form of a final project.		
TEXT BOOKS AND READING MATERIAL		
1. "Understanding and Using English Grammar" by Betty Schramper Azar. 2. "English Grammar in Use" by Raymond Murphy. 3. "The Blue Book of Grammar and Punctuation" by Jane Straus.		

4. English for Specific Purposes: A Learning-Centered Approach” by Tom Hutchinson and Alan Waters.
5. “Cambridge English for Job-hunting” by Colm Downes.
6. “Practical English Usage” by Michael Swan.
7. “Reading Literature and Writing Argument” by Missy James and Alan P. Merickel.
8. “Improving Reading: Strategies, Resources, and Common Core Connections” by Jerry Johns and Susan Lenski.
9. “Comprehension: A Paradigm for Cognition” by Walter Kintsch.
10. “Communication Skills for Business Professionals” by J.P. Verma and Meenakshi Raman.
11. “Medicose Functional English” by Rawal Rafiq Leghari.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
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ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

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- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GPS-101	Credit hours	02
Course Title	PAKISTAN STUDIES				
COURSE INTRODUCTION					
This course offers a comprehensive overview of the historical, cultural, political, geographical, and constitutional development of Pakistan. It explores the ideological foundations of the country, the Pakistan Movement, and key events leading to its creation in 1947. The course also examines Pakistan's geography, governance structure, economic challenges, foreign relations, and social issues.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Know the historical perspective about the creation of Pakistan. 2. Discuss the Government of Pakistan and its policies. 3. Understand the current issues of Pakistan.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Historical Perspective		Reading: Read the relevant chapters in Rabbani (2017), Pakistan Affairs, covering the ideological rationale for Pakistan and the contributions of Sir Syed Ahmed Khan, Allama Iqbal and Quaid-e-Azam.		
	Ideological rationale: contribution of Sir Syed Ahmed Khan to Muslim awakening				
	Ideological contributions of Allama Iqbal and Quaid-e-Azam Muhammad Ali Jinnah				
WEEK-2	Factors leading to Muslim separatism: Hindu-Muslim tensions and political exclusion		Assignment: Prepare a one-page note comparing the factors of Muslim separatism with the key milestones of the Pakistan Movement, using Rabbani (2017) as the primary source.		
	Key events in the Pakistan Movement: Lahore Resolution 1940 and road to independence				
WEEK-3	Early problems of Pakistan: administrative, economic and refugee challenges		Reading: Study the sections of Rabbani (2017) dealing with the early administrative and economic problems of Pakistan (1947-58) and the steps taken toward nation-building.		
	Solutions to early challenges: nation-building and institutional development 1947-58				
WEEK-4	1947-58: Constitutional struggle — Objectives Resolution and the 1956 Constitution		Assignment: Draft a short timeline of Pakistan's constitutional development from the Objectives Resolution to the 1962 Constitution, citing Rabbani (2017).		
	1958-69: Ayub Khan's era — military rule, Basic Democracies and the 1962 Constitution				
WEEK-5	Unit-II: Government and Politics in Pakistan		Reading: Review Rabbani (2017) on the events of 1971 and the 1973 Constitution, supplemented by Burki (1980), State and Society in Pakistan, for the Bhutto era.		
	1971: Fall of Dhaka — causes, events and lessons for Pakistani nationalism				
	1971-77: Bhutto's era — 1973 Constitution, nationalization and political legacy				
WEEK-6	1977-88: Zia ul Haq's era — military rule, Islamization policy and socio-political effects		Assignment: Write a critical summary of the Zia ul Haq era and the 1988-99 democratic transition, drawing on Rabbani (2017) and Waseem (1987), Pakistan Under Martial Law.		
	1988-99: PPP and PML governments — democratic transition and governance challenges				
WEEK-7	Unit-II (continued): Recent Political History		Reading: Read about the Musharraf era and post-2008 political developments in Rabbani (2017).		
	1999-2008: Pervez Musharraf's era — military government, devolution and post-9/11 policies				

	2008 till date: democratic consolidation, political parties and current political scenario	
WEEK-8	Pakistan's constitutional evolution: key amendments and their significance	Assignment: Prepare a comparative table of Pakistan's constitutional amendments and their significance, referring to Rabbani (2017) and Hussain (2011), The Judicial System of Pakistan.
	Role of judiciary, military and civil society in Pakistani politics	
MID TERM EXAMINATION		
WEEK-9	Unit-III: Contemporary Pakistan	Reading: Study CPEC and the National Action Plan in Rabbani (2017), noting their economic and security significance.
	China-Pakistan Economic Corridor (CPEC): objectives, projects and regional significance	
	National Action Plan (NAP): counter-terrorism strategy and implementation challenges	
WEEK-10	Baluchistan issue: historical background, grievances and government responses	Assignment: Write a short policy brief on the Baluchistan issue and the 18th/21st Amendments, using Rabbani (2017) and Khan (2000), Economy, Society and the State in Pakistan.
	18th and 21st Amendments: devolution of power, provincial autonomy and after effects	
WEEK-11	Foreign policy of Pakistan: principles, key relationships and strategic interests	Reading: Review Pakistan's foreign policy and Pakistan-India relations in Rabbani (2017) and Ahmed (2010), Military and the Foreign Policy of Pakistan.
	Pakistan-India relations: Kashmir dispute, trade and peace prospects	
WEEK-12	Pakistan-China and Pakistan-USA relations: strategic partnerships and bilateral tensions	Assignment: Prepare a case study comparing Pakistan-China and Pakistan-USA relations, and Pakistan's role in SAARC/OIC/UN, using Rabbani (2017).
	Pakistan's role in regional and international organizations: SAARC, OIC, UN	
WEEK-13	PANAMA Papers and their effects on Pakistani politics and accountability	Reading: Read about the Panama Papers and Pakistan's economic challenges (debt, inflation, energy crisis) in Rabbani (2017).
	Economic challenges of Pakistan: debt, inflation, energy crisis and development gaps	
WEEK-14	Unit-III (continued): Social Issues and Development	Assignment: Write a short reflective essay on social and environmental issues in Pakistan (poverty, education, gender inequality, water scarcity), citing Afzal (2015), Education and Attitudes in Pakistan, and Bhatti & Farooq (2014), Politics of Water in Pakistan.
	Social issues in Pakistan: poverty, education, gender inequality and healthcare	
	Environmental challenges: water scarcity, deforestation and climate vulnerability	
WEEK-15	Pakistan's water politics: Indus Waters Treaty, interprovincial disputes and water security	Reading: Review Pakistan's water politics and the Indus Waters Treaty in Bhatti & Farooq (2014), along with the role of youth and media in Rabbani (2017).
	Youth, media and civil society: their growing role in Pakistan's democratic development	
WEEK-16	Pakistan's future: pathways to political stability, economic growth and sustainable development	Assignment: Submit a concluding review paper on pathways to political stability and sustainable development in Pakistan, drawing on Rabbani (2017), Aziz (1976), Party Politics in Pakistan, and Afzal & Rafique (1998), Political Parties in Pakistan.
	Review of key themes: history, governance, contemporary challenges and Pakistan's role in the world	
FINAL TERM EXAMINATION		

TEXT BOOKS AND READING MATERIAL

1. Rabbani, M. I. (2017). Pakistan Affairs. Caravan Book House.
2. Afzal, M. (2015). Education and Attitudes in Pakistan. United States Institute of Peace.
3. Bhatti, M. N., & Farooq, M. (2014). Politics of water in Pakistan. Pakistan Journal of Social Sciences, 34(1), 205-216.
4. Hussain, F. (2011). The Judicial System of Pakistan. Supreme Court of Pakistan.
5. Ahmed, N. (2010). Military and the foreign policy of Pakistan. South Asian Survey, 17(2), 313-330.
6. Khan, T. A. (2000). Economy, society and the state in Pakistan. Contemporary South Asia, 9(2), 181-195.
7. Afzal and Rafique, M. (1998). Political Parties in Pakistan. Vol. I, II and III. NIHCR, Islamabad.
8. Safdar, M. (1994). Pakistan Political Roots and Development. Lahore.
9. Waseem, M. (1987). Pakistan Under Martial Law. Vanguard, Lahore.
12. Burki, S. J. (1980). State and Society in Pakistan. The MacMillan Press Ltd.
13. Aziz, K. K. (1976). Party Politics in Pakistan. NIHCR, Islamabad.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GAH-101	Credit hours	02
Course Title	ARTS & HUMANITIES – FOREIGN LANGUAGE (FRENCH)				
COURSE INTRODUCTION					
This course introduces students to the French language with no prior knowledge required. It covers basic communicative tools useful for everyday interaction, teaching not only the linguistic system but also strategies and techniques that facilitate the language learning process. Students will develop foundational skills in speaking, listening, reading and writing in French.					
LEARNING OUTCOMES					
On the completion of the course, the students will be able to:					
1. Form affirmative, negative and interrogative sentences in French. 2. Use and comprehend the present tense of common French verbs. 3. Introduce basic vocabulary and grammatical structures to communicate in everyday situations. 4. Develop communication skills for typical everyday situations such as shopping, travel and social interaction. 5. Develop an insight into French-speaking life, culture and society.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Premiers Pas — First Steps		Reading: Carpenter, C. (1992). Beginner's French, Ch. 1: Greetings & Introductions. Assignment: Write 5 sentences introducing yourself in French.		
	Introduction to course; self-introduction: name, age, profession, nationality and place				
	Greetings and farewells; basic French sounds: ou, i, a and pronunciation practice				
WEEK-2	Definite articles (le, la, les); days of the week and months of the year		Reading: Kendris, C. (2010). French: The Easy Way, Ch. 2: Articles & Numbers. Assignment: Fill in definite articles (le/la/les) for 10 nouns.		
	Numbers 0-10; greetings in context and polite expressions				
WEEK-3	Self-introduction revisited: forming complete sentences about oneself		Reading: Miquel, C. Vite et Bien 1, Unit 1: Se Presenter. Assignment: Write a short paragraph (5-6 sentences) introducing yourself using question words.		
	Numbers 0-20; question words: Comment, Quel, Quelle, Où; fruits vocabulary				
WEEK-4	Indefinite articles (un, une, des); verbs être and avoir: meaning and conjugation		Reading: Carpenter, C. (1992). Beginner's French, Ch. 3: Verbs être & avoir. Assignment: Conjugate être and avoir for all subject pronouns; write 6 sentences using indefinite articles.		
	Subject pronouns: je, tu, il, elle, nous, vous, ils, elles				
WEEK-5	Unit-II: Grammaire de Base — Basic Grammar		Reading: Kendris, C. (2010). French: The Easy Way, Ch. 4: Regular -ER Verbs. Assignment: Conjugate parler, manger, and habiter; write 6 sentences using present tense -ER verbs.		
	Present tense of être and avoir: full conjugation and practice exercises				
	Present tense of regular -ER verbs: parler, manger, habiter, travailler				
WEEK-6	Numbers 21-50; using numbers in context: age, addresses and telephone numbers		Reading: Miquel, C. Vite et Bien 1, Unit 2: Les Chiffres. Assignment: Write your address and phone number in French; form 5 negative sentences using ne...pas.		
	Negation: ne...pas — forming negative sentences in the present tense.				

WEEK-7	Unit-III: La Vie Quotidienne — Daily Life	Reading: Carpenter, C. (1992). Beginner's French, Ch. 5: Dates & Colours. Assignment: Write today's date and describe 5 objects using colour adjectives with correct agreement.
	Telling the date: le + number + month + year; asking Quelle est la date?	
	Colours: names, agreement with nouns; describing favourite colours	
WEEK-8	Family members vocabulary: la famille; describing your family	Reading: Kendris, C. (2010). French: The Easy Way, Ch. 6: Family Vocabulary. Assignment: Draw and label your family tree in French; revise vocabulary from Weeks 1–7.
	Revision and consolidation: grammar and vocabulary from weeks 1-7	
MID TERM EXAMINATION		
WEEK-9	Unit-IV: Interactions et Société — Interactions and Society	Reading: Miquel, C. Vite et Bien 1, Unit 3: Aller & Le Temps. Assignment: Write 5 sentences using verb aller; describe the weather in your city for each season.
	Verb aller (to go): conjugation, usage and common expressions	
	Weather and seasons: Il fait beau, Il pleut, Il neige; les quatre saisons	
WEEK-10	Telling the time: 12-hour and 24-hour formats; Quelle heure est-il?	Reading: Carpenter, C. (1992). Beginner's French, Ch. 8: Telling the Time. Assignment: Write out 10 times in French (both 12-hour and 24-hour); describe your daily routine.
	Daily routine vocabulary; linking time expressions to activities	
WEEK-11	Interrogation: direct questions and est-ce que constructions	Reading: Kendris, C. (2010). French: The Easy Way, Ch. 9: Questions & Family. Assignment: Write 5 direct questions and 5 est-ce que questions; describe two family members using avoir and être.
	Ma famille et moi: describing family relationships using avoir and être	
WEEK-12	Reservation of a ticket and taxi: practical dialogues and useful phrases	Reading: Miquel, C. Vite et Bien 1, Unit 4: Voyages & Nationalités. Assignment: Write a dialogue for reserving a taxi/ticket; list 10 countries with their nationalities in French.
	Different countries and their nationalities: masculine and feminine forms	
WEEK-13	Shop names and their products: la boulangerie, la pharmacie, le marché	Reading: Carpenter, C. (1992). Beginner's French, Ch. 11: Shopping & Markets. Assignment: Write a shopping dialogue at a boulangerie; list prices for 5 items using French numbers.
	How to buy: asking for prices, quantities and making purchases in a shop	
WEEK-14	Unit-V: Vocabulaire Pratique — Practical Vocabulary	Reading: Kendris, C. (2010). French: The Easy Way, Ch. 12: Numbers & Clothing. Assignment: Practice counting 0–60; describe what you are wearing today using clothing vocabulary and colour adjectives.
	Counting 0-60: numbers in context; prices, quantities and time expressions	
	Les vêtements: clothing vocabulary, colours and describing what someone wears	
WEEK-15	Vocabulary at the hotel: checking in, room types and asking for services	Reading: Miquel, C. Vite et Bien 1, Unit 5: Hôtel & Aéroport. Assignment: Write a hotel check-in dialogue; write 5 sentences about travel directions at an airport.
	Vocabulary at the airport: check-in, directions and essential travel phrases	
WEEK-16	Common French mistakes	Reading: Ultimate French: Beginner-Intermediate (2004), Ch. 16: Review. Assignment: Complete a revision worksheet covering all grammar, vocabulary and communicative expressions from the course.
	Comprehensive revision: grammar, vocabulary and communicative expressions covered throughout the course	

FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Lodge, R., Shelton, J., Ellis, Y., & Armstrong, N. (2016). <i>Exploring the French language</i>. Routledge. 2. Kendris, C. (2010). French: The Easy Way. Barron's Educational Series. 3. Whitmarsh, W. F. H. (1982). More Rapid French: Book 1. Longman, England. 4. Ultimate French: Beginner-Intermediate. (2004). Living Language. 5. Carpenter, C. (1992). Beginner's French. Hodder & Stoughton. 6. Miquel, C. Vite et Bien 1 (A1-A2). CLE International.			
TEACHING – LEARNING STRATEGIES			
• Lecture based examination • Presentation/seminars • Class discussion • Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: • classroom participation, • attendance, assignments and presentation, • homework • attitude and behavior, • hands-on-activities, • short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	HQ-02	Credit hours	01
Course Title	UNDERSTANDING OF HOLY QURAN / FAHM-E-QURAN - II				
COURSE INTRODUCTION					
Understanding of Holy Quran / Fahm-e-Quran – II is a compulsory course introduced by the Higher Education Commission (HEC), Pakistan for Muslim students enrolled in undergraduate and graduate degree programs. The course is a continuation of <i>Fahm-e-Quran – I</i> and aims to develop a deeper understanding of the Holy Quran through the study of selected Surahs, Quranic vocabulary, themes, messages, and practical application of Quranic teachings in personal and social life.					
LEARNING OUTCOMES					
By the end of this course, students will be able to:					
1. Directly comprehend hundreds of Quranic sentences & verses. 2. Understand at least 80 to 85 % of each page of the holy Quran. 3. Understand common verses across different Quranic topics. 4. Achieve proficiency in the basic and advance linguistic aspects of the Arabic language. 5. Understand the difference between Quranic verbs in various forms, such as present, past and imperative. 6. Develop the ability to understand long verses of the holy Quran independently and then comprehend their interpretation.					
COURSE CONTENTS					
Weeks	Lectures	Units	Lessons	Assignments/Home Task	
1.	1.	6	6	Understanding & Translation of Verses	Present Tense صيغة جمع مذكر غائب مثل يعبدون
	2.	6	7-8	Understanding & Translation of Verses	Present Tense صيغة جمع مذكر غائب مثل يعبدون
2.	1.	6	9-10	Understanding & Translation of Verses	Present Tense صيغة مفرد مذكر مخاطب (تعبد) وجمع مذكر مخاطب (تعبدون)
	2.	6	11-12	Understanding & Translation of Verses	Present Tense صيغة جمع مذكر مخاطب (تعبدون)
3.	1.	6	13	Understanding & Translation of Verses	صيغة المتكلم (أعبد) Present Tense صيغة جمع المتكلم (نعبد)
	2.	6	14-15	Understanding & Translation of Verses	Negative Imperative صيغة المفرد وصيغة الجمع , لا تعبد، لا تعبدوا
4.	1.	6	16-17	Understanding & Translation of Verses	Conditional Sentences & masdar moawal (مصدر مؤول)
	2.	6	18-19	Understanding & Translation of Verses	Laam uttaleel (لام التعليل) & Laam ul jhood(لام الجحود)
5.	1.	6	20-21	Understanding & Translation of Verses	Present with object pronouns & Passive Voice
	2.	6	Revision (Unit 6)	Quiz	

6.	1.	Unit 7	1 (sec 1-3)	Understanding & Translation of Verses	Past Tense صيغة المفرد للغائب
	2.	6	1 (Sec 4-5)	Understanding & Translation of Verses	Past Tense صيغة المفرد للغائب
7.	1.	6	1 (Sec 5-6)	Understanding & Translation of Verses	Past Tense صيغة المفرد للغائب
	2.	6	1 (Sec 7-9)	Understanding & Translation of Verses	Past Tense صيغة المفرد للغائب
8.	1.	7	Revision	Understanding & Translation of Verses QUIZ	Past Tense صيغة المفرد للغائب
	2.	MID TERM			
9.	1.	7	2 (sec 1-2)	Understanding & Translation of Verses	Past Tense صيغة الجمع للغائب عهدوا
	2.	7	2 (sec 3)	Understanding & Translation of Verses	Past Tense صيغة الجمع للغائب عهدوا
10.	1.	7	2 (sec 4-5)	Understanding & Translation of Verses	Past Tense صيغة الجمع للغائب عهدوا
	2.	7	2 (sec 6-7)	Understanding & Translation of Verses	Past Tense صيغة الجمع للغائب عهدوا
11.	1.	7	3 (sec 1-2)	Understanding & Translation of Verses	Past Tense صيغة الجمع للمتكلم عهدنا
	2.	7	3 (sec 2-3)	Understanding & Translation of Verses	Past Tense صيغة الجمع للمتكلم عهدنا
12.	1.	7	3 (sec 3-4)	Understanding & Translation of Verses	Past Tense صيغة الجمع للمتكلم عهدنا
	2.	7	3 (sec 4-5)	Understanding & Translation of Verses	Past Tense صيغة الجمع للمتكلم عهدنا
13.	1.	7	4 (sec 1-2-3)	Understanding & Translation of Verses	Past Tense صيغة الجمع للمخاطب عهدتم
	2.	7	4 (sec 4-5)	Understanding & Translation of Verses	Past Tense صيغة الجمع للمخاطب عهدتم
14.	1.	7	5-6	Understanding & Translation of Verses Quiz	Past Tense صيغة المتكلم والمخاطب عهدت ، عهدت
	2.	7	7	Understanding & Translation of Verses	Past Tense صيغة المؤنث للغائب عهدت
15.	1.	7	8	Understanding & Translation of Verses	Passive Voice (Past Tense) فعل مجهول للمفرد
	2.	7	9	Understanding & Translation of Verses	Passive Voice (Past Tense) فعل مجهول للجمع
16.	1.	8	1-4	Understanding & Translation of Verses	Imperative Verb for singular فعل الأمر للمفرد
	2.	7	5-8	Understanding & Translation of Verses	Imperative Verb for plural فعل الأمر للجمع

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Paper book: All volumes are available in printed book form.
2. Tutorial videos: Teaching video of each lesson available on YouTube.
3. Confirmation Videos: A complete series of confirmation videos of all lessons is available in which the student can confirm his answers.
4. A flipbook: A flipbook edition is also accessible.
5. Helping material: Helping material for the teachers like quizzes, question papers and images is available on website.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

SECOND YEAR, SEMESTER III			
Code	COURSE	CREDIT HOURS	CATEGORY
ENSC-201	Environmental Chemistry	3 (2-1)	Major
ENSC-202	Environmental Physics	3 (2-1)	Major
ENSC-203	Mineral Resources	3 (3-0)	Major
ENSC-204	Introduction to Earth Sciences	2 (2-0)	Interdisciplinary
GENG-201	Expository Writing *	3 (3-0)	General Education
GCCE-201	Civics & Community Engagement *	2 (2-0)	General Education
GICP-201	Ideology & Constitution of Pakistan *	2 (2-0)	General Education
Total Credit hrs Semester-III		18	

Program	BS Environmental Sciences	Course Code	ENSC-201	Credit hours	02
Course Title	ENVIRONMENTAL CHEMISTRY (THEORY)				
COURSE INTRODUCTION					
This course explores the chemical processes occurring in the environment and examines how natural and human-induced activities influence these processes. It focuses on the chemistry of air, water, soil, and living systems, with an emphasis on understanding pollution, its sources, and its impact on ecosystems and human health. Key topics include atmospheric chemistry (including ozone depletion and greenhouse gases), water and wastewater chemistry, soil contamination, toxicology, and sustainable practices.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
• Demonstrate knowledge of chemical and biochemical principles of fundamental environmental processes in air, water, and soil. • Recognize different types of toxic substances & responses and analyze toxicological information. • Apply basic chemical concepts to analyze chemical processes involved in different environmental problems (air, water & soil)					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-1: Chemistry of Troposphere			Environmental Chemistry by Colin Baird Page 66-69	
	Toxic gases				
	Oxides of Carbon their sources and effect				
WEEK-2	Oxides of sulfur their sources and effect			Environmental Chemistry By Tayyagi Page 115-165	
	Oxides of Nitrogen their sources and effect				
WEEK-3	Tropospheric ozone			Environmental Chemistry by Colin Baird Page 111-117	
	Smog and its types				
WEEK-4	Sulfurous smog			Environmental Chemistry by Colin Baird Page 73-78 & 83-85	
	Photochemical smog				
WEEK-5	Acid Rain and its impact on different ecosystems			Environmental Chemistry by Colin Baird Page 7-10 & 19-21	
	Unit-II: Stratospheric chemistry				
	Introduction to stratosphere				
WEEK-6	Ozone layer and its chemical depletion			Environmental Chemistry by Colin Baird Page 36-42	
	Polar stratospheric clouds and Polar vortex.				
WEEK-7	Unit-III: Green House Effect and Global warming			Principles of Environmental Chemistry by James Girard Page 94-95	
	The Greenhouse Effect and Global Warming				
	Greenhouse gases,				
WEEK-8	Earth energy emission and greenhouse effect.			Principles of Environmental Chemistry by James Girard Page 97-101, 102-108	
	Chemical reactions				
MID TERM EXAMINATION					
WEEK-9	Unit-IV: Chemistry of water bodies			Principles of Environmental Chemistry by James Girard Page 212-230	
	Dissolved Oxygen				
	Biological oxygen Demand				
WEEK-10	Chemical Oxygen demand			Principles of Environmental Chemistry by James Girard Page 234-235	
WEEK-11	Unit-V: Indoor Pollutants			Environmental Chemistry by Colin Baird Page 127-135	
	Radon Gas				
	Volatile organic compounds				
WEEK-12	Tabaco smoke			Environmental Chemistry by Colin Baird Page 130-131, 132-134	
	Pesticides				

WEEK-13	Biological indoor pollutants	Environmental Chemistry by Colin Baird Page 134-136
	Molds, Mycotoxins, and Endotoxins.	
WEEK-14	Unit-VI: Soil Chemistry and Contamination	Principles of Environmental Chemistry by James Girard Page 40-56 & 453-454
	Soil composition and chemical properties	
	Ion exchange capacity and soil pH	
WEEK-15	Bioaccumulation and Biomagnification of pollutants	Principles of Environmental Chemistry by James Girard Page 40-56 & 453-454
	Case studies on chemical environmental disasters	
WEEK-16	Integration of Air, Water, and Soil Chemistry	Principles of Environmental Chemistry by James Girard Page 413-416
	Green chemistry principles and real-world applications	

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Sonwani, S. and Shukla, A. (2021). *Air borne Particulate Matter, Source, Chemistry and Health*. Springer Singapore
2. Overway, K.S. (2017). *Environmental Chemistry*. An Analytical approach. John Wiley and Sons.
3. Stanley M. (2017). *Environmental Chemistry*. CRC Press
4. Schwarzenbach, R. P., Gschwend, P. M., & Imboden, D. M. (2016). *Environmental organic chemistry*. John Wiley & Sons.
5. Principles of Environmental Chemistry (2012). 5th Edition, By James E. Girard, published by W. H. Freeman Publishers
6. Principles of Environmental Chemistry: 3rd Edition (2010). By James E. Girard. About this book. Published by Jones & Bartlett Publishers
7. A Textbook of Environmental Chemistry (2002). O.D. Tyagi and M. Mehta, Anmol Publications Pvt Ltd

Further Reading: As suggested by the Instructor.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-201	Credit hours	01
Course Title	ENVIRONMENTAL CHEMISTRY (PRACTICAL)				
COURSE INTRODUCTION					
This practical course complements the theoretical study of Environmental Chemistry by providing hands-on experience with techniques used to analyze environmental samples. Students will perform laboratory experiments focusing on the chemical analysis of air, water and soil pollutants, including water quality testing (pH, BOD COD, hardness and heavy metals), air pollutant detection (PM, SO ₂) and soil analysis (pH, salinity and organic content).					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Demonstrate the application of chemical and biochemical principles of fundamental environmental processes in air, water and soil. 2. Recognize different types of toxic substances and analyze toxicological information. 3. Apply basic chemical concepts to analyze chemical processes involved in different environmental problems.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Dissolved oxygen — concept, importance and measurement principles			Lab Manual Practical #1	
WEEK-2	DO determination: Winkler titration method — demonstration and calculations			Samples Collection as per Lab. Manual	
WEEK-3	Chemical oxygen demand (COD) — concept, significance and dichromate method overview			Handout Notes	
WEEK-4	Unit-II: COD determination — dichromate open reflux method demonstration and data analysis			Sample Collection from field for original samples	
WEEK-5	Biological oxygen demand (BOD ₅) — concept, ecological significance and 5-day test procedure			Lab Manual Practical #2	
WEEK-6	BOD ₅ determination — incubation method demonstration and result interpretation			Advance Practical Chemistry Page 35	
WEEK-7	Unit-III: Total dissolved solids and total suspended solids — concepts and environmental relevance			Lab Manual Practical #3	
WEEK-8	TDS and TSS determination — gravimetric method demonstration and comparison of results			Lab Manual Practical #4	
MID TERM EXAMINATION					
WEEK-9	Unit-IV: Electrical conductivity — concept, relation to TDS and instrument calibration			Handout Notes	
WEEK-10	Conductivity and pH measurements — demonstration using conductivity meter and pH electrode			Handout Notes	
WEEK-11	Hardness of water — concept, types (temporary/permanent) and EDTA titration overview			Lab Manual Practical #5	
WEEK-12	Hardness determination — EDTA titrimetric method demonstration and calculations			Lab Manual Practical #6	
WEEK-13	Particulate matter (PM) in air — concept, health effects and high-volume sampler principles			Visit to EPA Lahore to see their Air Quality Laboratory	

WEEK-14	PM estimation — high-volume sampler demonstration, filter weighing and concentration calculation	Latest article on the topic	
WEEK-15	Soil analysis — concepts of pH, salinity and organic matter and their environmental significance	Lab Manual Practical #7	
WEEK-16	Soil pH, salinity and organic matter determination — demonstration and lab report writing	Lab Manual Practical #8	
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Sonwani, S. and Shukla, A. (2021). <i>Air borne Particulate Matter, Source, Chemistry and Health</i>. Springer Singapore 2. Overway, K.S. (2017). <i>Environmental Chemistry</i>. An Analytical approach. John Wiley and Sons. 3. Stanley M. (2017). <i>Environmental Chemistry</i>. CRC Press 4. Schwarzenbach, R. P., Gschwend, P. M., & Imboden, D. M. (2016). <i>Environmental organic chemistry</i>. John Wiley & Sons. 5. Principles of Environmental Chemistry (2012). 5th Edition, By James E. Girard, published by W. H. Freeman Publishers 6. Principles of Environmental Chemistry: 3rd Edition (2010). By James E. Girard. About this book. Published by Jones & Bartlett Publishers 7. A Textbook of Environmental Chemistry (2002). O.D. Tyagi and M. Mehta, Anmol Publications Pvt Ltd Further Reading: As suggested by the Instructor.			
TEACHING – LEARNING STRATEGIES			
Lecture based examination Presentation/seminars Class discussion Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: classroom participation, attendance, assignments and presentation, homework attitude and behavior, hands-on-activities, short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-202	Credit hours	02
Course Title	ENVIRONMENTAL PHYSICS (THEORY)				
COURSE INTRODUCTION					
Environmental Physics is an interdisciplinary course that applies the principles of physics to understand and analyze environmental processes and challenges. The course explores the physical laws governing energy flow, climate systems, radiation, atmospheric dynamics, water cycles and environmental pollution. Special emphasis is placed on the interaction between human activities and the environment, including energy production, resource consumption and climate change.					
LEARNING OUTCOMES					
At the end of this course a student is expected to have learnt: 1. Understanding of fundamental laws of Newtonian Mechanics. 2. Application of fundamental laws of Thermodynamics. 3. Apply mathematical and conceptual techniques to analyze physical systems. 4. Interpret physical laws and apply them to new situations. 5. Understand the principles behind natural phenomena and energy interactions. 6. Use equations and data to describe and predict physical behavior.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Mechanics		Reading: Study Chapter 1 in <i>Boeker & Van Grondelle (2001)</i> exploring the scale of environmental physics and fundamental environmental forces.		
	Definitions and basic concepts of physics and its relation with the environment				
	Basic concept of force; fundamental forces in nature and their environmental relevance				
WEEK-2	Newton's Laws of Motion: first, second and third law — statements and explanations		Assignment: Solve the introductory particle dynamics problems in Chapter 5 of Halliday, Resnick, & Walker (2013), modeling force vectors on land masses.		
	Applications of Newton's Laws of Motion to real-world and environmental problems				
WEEK-3	Particle in equilibrium and application of the second law of motion		Reading: Read Chapter 5 in Serway, Jewett, & Peroomian (2014) regarding static and kinetic friction coefficients in natural sediment transport.		
	Dynamics of particles and frictional forces: types of friction and their applications				
WEEK-4	Work, power and energy: definitions, units and interrelationships		Assignment: Calculate the potential energy stored in variable alpine water basins and its conversion to kinetic runoff energy using formulas from Young, Freedman, & Ford (2006).		
	Types of energy: kinetic energy, potential energy and their environmental significance				
WEEK-5	Unit-I (continued): Energy and Forces		Reading: Study Chapter 7 in <i>Walker (2017)</i> focusing on mechanical energy conservation versus non-conservative atmospheric drag losses.		
	Work and energy with varying forces: work done by variable forces				
	Conservative and non-conservative forces: definitions, examples and energy implications				
WEEK-6	Gravitational potential energy: concept, calculation and environmental applications		Assignment: Draft a 2-page assessment comparing the mechanical energy		

	Renewable energy resources: solar, wind, hydro and biomass energy overview	conversion limits of a hydroelectric plant vs. wind turbine arrays using <i>Boeker & Van Grondelle (2001)</i> .
WEEK-7	Unit-I (continued): Fluid Dynamics and Applications	Reading: Study Chapter 14 in Halliday, Resnick, & Walker (2013) on fluid continuity equations, alongside solid-state physics frameworks in Weinberg (2021).
	Introduction to fluid dynamics: types of fluid flow, viscosity and Bernoulli's principle	
	Working of solar/photovoltaic cells: principles, efficiency and environmental impact	
WEEK-8	Understanding of dynamics of particles: momentum, impulse and conservation laws	Assignment: Complete the fluid mechanics problem set calculating particulate settling velocities using Stoke's Law equations found in <i>Ames (2017)</i> .
	Introduction to fluid dynamics and particle equilibrium: applied problems	
MID TERM EXAMINATION		
WEEK-9	Unit-II: Heat and Thermodynamics	Reading: Read Chapters 2 and 3 in <i>Guyot (1998)</i> on solar geometry, solar constants, and the baseline radiative energy budget of the Earth's surface.
	Overview of the universe: galaxies, solar system and Earth as a planet	
	Sun as a source of energy: solar radiation, energy budget and heat transfer to Earth	
WEEK-10	Transfer of heat through conduction, convection and radiation: mechanisms and examples	Assignment: Construct a heat-flux model evaluating the convective upwelling rates required for cloud formation using equations in Seinfeld & Pandis (2006).
	Weather changes and cloud formation: atmospheric thermodynamics in the environment	
WEEK-11	Definitions and basic concepts of thermodynamics: state, systems and thermodynamic processes	Reading: Study Chapter 19 in Serway, Jewett, & Peroomian (2014) checking the physical parameters of macroscopic state variables and closed system boundaries.
	Laws of thermodynamics: zeroth, first, second and third law — statements and applications	
WEEK-12	Internal energy theorem: first law applications, heat and work interactions	Assignment: Apply the First and Second Laws of Thermodynamics to compute entropy generation (ΔS_{gen}) during spontaneous urban heat island expansions via Hens (2023).
	Entropy and enthalpy: definitions, physical meaning and environmental relevance	
WEEK-13	Concept of ideal and real gases: differences, assumptions and behaviour	Reading: Read Chapter 18 in Young, Freedman, & Ford (2006) focusing on the kinetic theory of gases and ideal gas deviation boundaries.
	Equation of state and ideal gas equation: derivation, applications and limitations	
WEEK-14	Unit-II (continued): Advanced Thermodynamics and Energy	Assignment: Solve real-gas expansion problems using the Van der Waals equation to adjust for molecular volume and intermolecular forces under Routledge (2001) rules
	The Van der Waals equation: corrections for real gas behaviour and environmental significance	
	Relation between the sun as a source of energy and thermodynamic laws	
WEEK-15	Nuclear energy: principles of fission and fusion, nuclear reactors and environmental impact	Reading: Study Chapter 5 in <i>Boeker & Van Grondelle (2001)</i> evaluating the thermal efficiency limitations and cooling tower footprints of commercial nuclear stations.
	Application of laws of thermodynamics in the universe and comparison with renewable energy	

WEEK-16	Comprehensive review: mechanics, thermodynamics	Assignment: Draft a comprehensive portfolio review contrasting technical thermodynamic constraints against behavioural transformation goals outlined in Rishi (2022).	
	Fluid dynamics, energy and sustainable future		
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Hens, H. S. L. (2023). Building Physics: Heat, Air and Moisture Fundamentals. Wiley. 2. Rishi, P. (2022). Managing Climate Change and Sustainability Through Behavioral Transformation. Springer Nature Singapore. 3. Weinberg, S. (2021). Foundations of Modern Physics. Cambridge University Press. 4. Walker, J. S. (2017). Physics (5th ed.). Pearson, UK. 5. Ames, J. S. (2017). Text Book of General Physics. Amer. Bk. Co. 7. Serway, R. A., Jewett, J. W., & Peroomian, V. (2014). Physics for Scientists and Engineers, Volume 1. Cengage Learning. 8. Halliday, D., Resnick, R., & Walker, J. (2013). Fundamentals of Physics. Wiley. 9. Seinfeld, J. H. & Pandis, S. N. (2006). Atmospheric Chemistry and Physics. John Wiley and Sons. 10. Young, H. D., Freedman, R. A., & Ford, A. L. (2006). Sears and Zemansky's University Physics. Pearson. 11. Boeker, E. & Van Grondelle, R. (2001). Introductory Environmental Physics. John Wiley and Sons. 12. Routledge, S. C. (2001). Environmental Physics. Kentucky, USA. 13. Guyot, G. (1998). Physics of the Environment and Climate. Praxis Publishing, UK.			
TEACHING – LEARNING STRATEGIES			
Lecture based examination Presentation/seminars Class discussion Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: classroom participation, attendance, assignments and presentation, homework attitude and behavior, hands-on-activities, short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-202	Credit hours	01
Course Title	ENVIRONMENTAL PHYSICS (PRACTICAL)				
COURSE INTRODUCTION					
This practical course is designed to provide hands-on experience in applying physics-based methods to study and analyze environmental phenomena. Through laboratory experiments and field measurements, students will investigate the physical properties of air, water, soil, and energy systems. Key focus areas include measurements of solar radiation, temperature, humidity, wind speed, thermal conductivity, noise levels, and light intensity, as well as the operation and calibration of environmental sensors and instruments.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. fundamental laws of Newtonian Mechanics 2. Fundamental laws of Thermodynamics.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-1: Mechanics		Reading: Study Chapter 1 in <i>Boeker & Van Grondelle (2001)</i> on the precision limits and calibration fundamentals of environmental sensor arrays.		
	Using Newton’s Law of Motion				
WEEK-2	Particle in Equilibrium, Using Second Law of Motion		Assignment: Submit Laboratory Report 1 calculating error margins on resultant static force vectors using formulas in Ames (2017).		
WEEK-3	Dynamics of Particle, Frictional Forces		Reading: Read Chapter 5 in <i>Walker (2017)</i> reviewing friction coefficients, normal forces, and incline slip thresholds.		
WEEK-4	Work and Kinetic Energy		Assignment: Complete data charts plotting kinetic energy ($K = 1/2m^2$) variations against measured physical displacements via Walker (2017).		
WEEK-5	Work and Energy with Varying Forces		Reading: Study Chapter 6 in Young, Freedman, & Ford (2006) regarding integral definitions of work done by non-constant linear forces.		
WEEK-6	Power, Gravitational Potential Energy, Conservative and Non-conservative forces		Assignment: Submit Laboratory Report 2 calculating total friction energy dissipation (W_{nc}) over a sliding system using Young, Freedman, & Ford (2006).		
WEEK-7	Force and Potential Energy		Reading: Study the conservative energy boundary systems and potential energy function derivatives in Chapter 7 of Walker (2017)		
WEEK-8	Sun as a source of energy, Earth as a planet		Assignment: Graph diurnal local solar radiation fluxes and calculate solar attenuation curves based on equations in Guyot (1998).		
MID TERM EXAMINATION					

WEEK-9	Unit-II: Heat and Thermodynamics Weather Changes, Cloud Formation,	Reading: Read Chapters 2 and 3 in Seinfeld & Pandis (2006) exploring cloud condensation nuclei (CCN) mechanics and atmospheric moisture phases.
WEEK-10	Entropy, Equation of State	Assignment: Submit Laboratory Report 3 calculating formal entropy changes during spontaneous hot and cold fluid mixtures via Routledge (2001).
WEEK-11	The Ideal Gas Equation	Reading: Study Chapter 18 in Young, Freedman, & Ford (2006) regarding the kinetic molecular theory assumptions of low-pressure ideal gases.
WEEK-12	The Van der Waals Equation & Real Gases	Assignment: Solve problem sets calculating specific volume corrections and internal pressure modifiers using Ames (2017).
WEEK-13	Zeroth, First, and Second Laws of Thermodynamics	Reading: Read Chapters 19 and 20 in Walker (2017) detailing net thermal efficiency formulas and cyclical heat transfer processes.
WEEK-14	Biomass, wind, and hydroelectric energy	Assignment: Submit a comparative technical brief calculating energy capture variations of solar panels under modified tilts using Boeker & Van Grondelle (2001).
WEEK-15	Physics behind energy conversion and efficiency	Reading: Study Chapter 4 in Guyot (1998) on thermal conductivity matrices (\$k\$), convective energy patterns, and radiative surface emissions.
WEEK-16	Nuclear fission and fusion	Assignment: Plot an isotope exponential radioactive attenuation curve and finalize the laboratory portfolio summary using Boeker & Van Grondelle (2001).
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Ames, J. S. (2017). Text Book of General Physics. Amer. Bk. Co 1904. 2. Walker, J. S. (2017). Physics 5th Edition, Pearson, UK. 3. Young, H. D., Freedman, R. A., & Ford, A. L. (2006). Sears and Zemansky's university physics (Vol. 1). Pearson education. 4. Seinfeld, J. H. and Pandis, S. N. (2006). Atmospheric Chemistry and Physics: From Air Pollution to Climate Change. John Wiley and Sons Inc. USA. 5. Boeker, E. and Van Grondelle, R. (2001). Introductory Environmental Physics. John Wiley and Sons Inc. New York, USA. 6. Routledge, S. C. (2001). Environmental Physics. Kentucky, USA. 7. Guyot, G. (1998). <i>Physics of the Environment and Climate</i>. Praxis publishing. UK. Further Reading: As suggested by the Instructor.		

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-203	Credit hours	03
Course Title	MINERAL RESOURCES				
COURSE INTRODUCTION					
This course provides a comprehensive overview of the mineral wealth of Pakistan, exploring the distribution, formation, and economic significance of various mineral resources found within the country. Students will study the geology and geography of major mineral deposits including metallic minerals (such as copper, gold, and chromite), non-metallic minerals (such as gypsum, salt, and limestone), and energy minerals (such as coal, oil, and natural gas).					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. This course will provide an introduction to the minerals and different mineral groups to the students. 2. The students will learn about the physical and chemical properties of common rock forming minerals. 3. They will have the knowledge about the classification of minerals on basis of structure and composition. 3. The students will learn about selected mineral commodities and their industrial uses and environmental impacts.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	UNIT I: Minerals		Reading: Study the definition, chemical composition and crystalline nature of minerals in Kesler & Simon (2024), Mineral Resources, Economics and the Environment.		
	What is Mineral				
	Chemical Composition of Minerals				
	Crystalline Nature of Minerals				
WEEK-2	Physical Properties of Minerals		Assignment: Prepare a short classification chart of silicate minerals based on their physical properties, citing Evans (2013), Ore Geology and Industrial Minerals.		
	Mineral Classification				
	Silicate Minerals				
WEEK-3	Rock Forming Minerals		Reading: Read about rock-forming and non-silicate industrial minerals in Evans (2013).		
	Other Important Non-Silicate Minerals				
	Industrial Minerals				
WEEK-4	UNIT II: Asbestos		Assignment: Prepare a fact sheet on the origin, occurrence and types of asbestos, drawing on Kogel (2006), Industrial Minerals & Rocks.		
	Introduction				
	Mode of Origin and Occurrence				
	Types of Asbestos and Associated Fibres				
WEEK-5	Industrial Application		Reading: Review the industrial applications, history and production of asbestos in Kogel (2006).		
	History				
	Production				
WEEK-6	UNIT III: Bentonite and Fuller's Earth		Assignment: Prepare a short note on the introduction and properties of bentonite and fuller's earth, citing Collins (2023), Applied Mineralogy.		
	Introduction				
	Properties				
	Industrial Applications				
WEEK-7	Types		Reading: Study the types, occurrence and environmental impacts of bentonite and fuller's earth in Collins (2023).		
	History and Natural Occurrence				
	Environmental Impacts				

WEEK-8	UNIT IV: Barytes	Assignment: Prepare a summary sheet on the introduction and properties of barytes, referring to Kesler & Simon (2024).
	Introduction	
	Properties	
	Industrial Application	
MID TERM EXAMINATION		
WEEK-9	Name and History of Barytes	Reading: Read about the history, mineral associations and uses of barytes in Kesler & Simon (2024).
	Mineral Association and Location	
	Uses	
WEEK-10	UNIT V: Lithium Minerals	Assignment: Prepare a short report on the introduction, types and properties of lithium minerals, citing Müller, Groves & Santosh (2024), Metallic Mineral Resources.
	Introduction	
	Types	
	Properties	
WEEK-11	Occurrence	Reading: Review the occurrence, history and chemistry of lithium minerals in Müller, Groves & Santosh (2024).
	History	
	Chemistry	
WEEK-12	Production	Assignment: Prepare a short note on lithium production, industrial application and safety precautions, citing Evans (2013).
	Industrial Application	
	Precaution	
WEEK-13	UNIT VI: Chromite	Reading: Study the introduction, properties and mode of occurrence of chromite in Kesler & Simon (2024).
	Introduction	
	Properties	
	Mode of Occurrence	
WEEK-14	Industrial Application	Assignment: Prepare a distribution map/summary of chromite deposits and their health and environmental impacts, citing Müller, Groves & Santosh (2024).
	Distribution of Deposits	
	Health and Environment Impacts	
WEEK-15	UNIT VII: China Clay (Kaolinite)	Reading: Read about the introduction and properties of China clay (kaolinite) in Kogel (2006).
	Introduction	
	Properties	
	Industrial Applications	
WEEK16	Names and Chemistry	Assignment: Submit a concluding fact sheet on the names, chemistry, occurrence and synthesis of kaolinite, drawing on all assigned texts, in preparation for the Final Term Examination.
	Occurrence	
	Synthesis and Genesis	
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Stephen Kesler and Adam C. Simon (2024) Mineral Resources, Economics and the Environment, 2nd Edition, pp.1-355. 2. Daniel Müller, David Ian Groves and M. Santosh (2024), Metallic Mineral Resources: The Critical Components for a Sustainable Earth, Elsevier, 1st Edition, pp.1-450. 3. Trinity Collins (2023) Applied Mineralogy: Applications in Industry, Syrawood Publishing House, 1st Edition, pp.1-261. 4. Anthony M. Evans (2013) Ore Geology and Industrial Minerals: An Introduction, Wiley-Blackwell, 3rd Edition, pp.1-400. 5. Jessica Elzea Kogel (2006) Industrial Minerals & Rocks, Nature, pp.1-1548		

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-204	Credit hours	02
Course Title	INTRODUCTION TO EARTH SCIENCES (THEORY)				
COURSE INTRODUCTION					
This foundational course introduces students to the broad field of Earth Sciences, covering the fundamental principles and concepts related to the structure, composition and dynamic processes of the Earth. Topics include the study of minerals and rocks, plate tectonics, earthquakes, volcanism, weathering, erosion, soil formation, and the Earth's atmosphere and hydrosphere. The course provides a comprehensive overview of the Earth as a system, emphasizing the interconnections between the lithosphere, atmosphere, hydrosphere and biosphere.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Provide an introduction to geology and the fundamental principles of Earth sciences. 2. Identify, classify and describe rocks and minerals and their formation processes. 3. Demonstrate knowledge of the occurrences and environmental importance of geological processes.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to Earth Sciences			Reading: Marshak Ch.1 - Introduction to Earth Sciences; Review geologic time scale diagram	
	Evolution of the geologic time scale: eons, eras, periods and epochs				
	Internal structure of the Earth: crust, mantle, outer and inner core				
WEEK-2	Earth's four spheres: lithosphere, atmosphere, hydrosphere and biosphere			Reading: Marshak Ch.2 - Earth's Spheres; Sketch diagram of Earth's four spheres	
	Magma: origin and types; plutonic and volcanic rocks				
WEEK-3	Formation and structure of igneous rocks: intrusive vs extrusive			Assignment: Classify 5 igneous rock samples using textural features (lab worksheet)	
	Textures and classification of igneous rocks				
WEEK-4	Weathering, erosion and transportation: definitions, agents and processes			Reading: Plummer Ch.4 - Weathering & Erosion; List 3 examples of mechanical weathering	
	Types of weathering; mechanical weathering: frost action, exfoliation and abrasion				
WEEK-5	Unit-II: Weathering, Soil and Sedimentary Rocks			Assignment: Compare mechanical vs chemical weathering with field examples from Pakistan	
	Chemical weathering: oxidation, hydrolysis and carbonation				
	Soil formation: parent material, climate, organisms, relief and time				
WEEK-6	Sediments and formation of sedimentary rocks: clastic, chemical and organic types			Reading: Marshak Ch.6 - Sedimentary Rocks; Draw and label a sedimentary environment diagram	
	Types, structures, textures and sedimentary environments of sedimentary rocks				
WEEK-7	Unit-III: Metamorphic Rocks			Reading: Fletcher Ch.7 - Metamorphism; Identify metamorphic rock types from provided images	
	Causes and consequences of metamorphism: temperature, pressure and fluids				
	Formation and types of metamorphic rocks				
WEEK-8	Structures and textures of metamorphic rocks: foliated and non-foliated			Assignment: Create a comparison table of foliated vs non-foliated metamorphic rocks	
	Grades of metamorphism and metamorphic facies				
MID TERM EXAMINATION					

WEEK-9	Unit-IV: Mass Wasting and Streams	Reading: Plummer Ch.10 - Mass Wasting; Find a local case study of mass wasting in Pakistan
	Definition of mass wasting, role of water and factors controlling mass wasting	
	Types of mass wasting; mass wasting triggered by earthquakes and volcanoes	
WEEK-10	Hydrological cycle; types and sources of streams; perennial and non-perennial streams	Assignment: Draw a labeled hydrological cycle diagram with all components
	Drainage basins; ability of streams to erode, transport and deposit sediments	
WEEK-11	Characteristics of streams, drainage patterns and stream crossings	Reading: Marshak Ch.11 - Streams & Deserts; Identify drainage patterns from map excerpts
	Desert types, etymology, weathering and erosional processes in desert environments	
WEEK-12	Alfred Wegener, rock magnetism, apparent polar wandering and sea floor spreading	Reading: Reynolds Ch.12 - Plate Tectonics; Write a one-page summary of Wegener's evidence
	Continental drift, plates and plate tectonics; divergent, convergent and transform boundaries	
WEEK-13	Anatomy of a plate, causes of plate motion and tectonic landforms	Assignment: Map plate boundaries and label tectonic landforms using provided base map
	Mountain building: deformation and rupture of rocks, the Andes and Himalayas	
WEEK-14	Unit-V: Glaciers, Deserts and Oceans	Reading: Fletcher Ch.14 - Glaciers; Compare ice age climatic conditions with present day
	Introduction to glaciers: types, formation, structure and movement	
	Glacial erosion, depositional landforms, ice ages and climate change	
WEEK-15	Desert landscape and desertification: physical, ecological and biogeographical dimensions	Assignment: Research desertification in Pakistan and submit a 500-word report
	Mountains: definition, geology, climate and plate tectonics in mountain building	
WEEK-16	Unit-VI: Oceans and Coastlines: origin of oceans, ocean currents, seawater properties	Reading: Marshak Ch.16 - Oceans; Quiz preparation: review ocean features and coastline types
	Continental margins, coastlines, mid-oceanic ridges and life in the sea	
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Reynolds, S. J. & Johnson, J. K. (2025). Exploring Geology. McGraw-Hill, USA. 2. Marshak, S. & Rauber, R. (2024). Earth Science (3rd ed.). W. W. Norton & Company. 3. Marshak, S. (2022). Essentials of Geology (7th ed.). W. W. Norton & Company. 4. Plummer, C. C., Carlson, D., & Hammersley, L. (2021). Physical Geology. McGraw-Hill, USA. 1. Fletcher, C. (2019). Physical Geology: The Science of Earth (3rd ed.). Wiley.		
TEACHING – LEARNING STRATEGIES		
Lecture based examination Presentation/seminars Class discussion Quizzes		

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GENG-201	Credit hours	03
Course Title	EXPOSITORY WRITING				
COURSE INTRODUCTION					
Expository Writing is a sequential undergraduate course aimed at refining writing skills in various contexts. Building upon the foundation of the pre-requisite course, Functional English, this course will enhance students’ abilities of producing clear, concise and coherent written texts in English. The course will also enable students to dissect intricate ideas, to amalgamate information and to express their views and opinions through well-organized essays. The students will further be able to refine their analytical skills to substantiate their viewpoints using credible sources while adhering to established ethical writing norms. Additionally, the course will highlight the significance of critical thinking enabling students to produce original and engaging written texts.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Understand the essential of the writing process integrating pre-writing, drafting, editing 2. and proof reading to produce well-structured essays. 3. Demonstrate mastery of diverse expository types to address different purposes and audiences. 4. Uphold ethical practices to maintain originality in expository writing.					
CONTENTS					
WEEK-1	Unit 1: Understanding Expository Writing			Reading: Zinsser, "Writing to Learn" Initial diagnostic writing prompt	
	Definition, types, purpose, and applications				
	Overview of Expository vs. Narrative/Persuasive forms				
	Identifying target audiences and core informative goals				
WEEK-2	Characteristics of Effective Expository Writing			Reading: Williams & Bizup, "Style: Lessons in Clarity and Grace"	
	Defining clarity and conciseness in informative prose				
	Establishing coherence through logical progression				
WEEK-3	Introduction to Paragraph Writing			Quiz 1: Core elements of a paragraph and expository traits	
	Anatomy of a paragraph: Topic sentences, unity, and concluding sentences				
	Structural patterns within single expository paragraphs				
WEEK-4	Pre-writing techniques: Brainstorming, free-writing, and mind-mapping			Reading: Axelrod & Cooper, "The St. Martin’s Guide to Writing"	
	Structuring information: Listing, questioning, and formal outlining				
	Introduction to the three-stage process of drafting techniques				
WEEK-5	Unit 2 Revising, Editing, and Proofreading			Reading: Strunk & White, "The Elements of Style" Quiz 2: Mechanics and Editing	
	Revising for macro-level clarity, structure, and coherence				
	Editing for micro-level grammar, syntax, mechanics, and conciseness				
	Proofreading techniques for fine-tuning the final draft				
WEEK-6	Peer Review and Feedback			Peer review workshop on initial essay drafts	
	Best practices for providing and receiving constructive critique				
	Implementing peer feedback into draft revisions				

WEEK-7	Unit 3: Essay Organization	Reading: Graff & Birkenstein, "They Say / I Say"
	Introduction, Hook, and Thesis	
	Strategies for engaging readers with an effective hook	
	Crafting a clear, focused, and central idea (Thesis Statement)	
WEEK-8	Developing body paragraphs with evidence and transitional devices	Reading: Rosenwasser & Stephen, "Writing Analytically"
	Selecting types of concluding paragraphs to leave an impact	
	Ensuring seamless connections and overall essay cohesion	
MID TERM EXAMINATION		
WEEK-9	Unit 4: Modes of Exposition -	Reading: Jonson-Sheehan & Paine, "Writing Today"
	Description and Illustration	
	Spatial, sensory, and objective description patterns	
	Using illustration and examples to clarify complex assertions	
WEEK-10	Principles of logical division and categorization (Classification)	Reading: Bullock et al., "The Norton Field Guide to Writing"
	Troubleshooting causal fallacies in expository analysis	
	Exploring causal relationships, immediate vs. remote causes, and outcomes	
WEEK-11	Comparative Analysis	Reading: Longknife & Sullivan, "The Art of Styling Sentences"
	Explaining step-by-step procedures clearly (Process Analysis)	
	Comparative analysis structures: Point-by-point vs. subject-by-subject	
WEEK-12	Writing for Academic Audiences	Reading: Graff & Birkenstein, "They Say / I Say"
	Shifting writing approaches to match specific purposes (inform vs. analyze)	
	Hallmarks of academic writing: Formality, objectivity, and academic conventions	
WEEK-13	Writing for Public Audiences and Adapting Tones	Reading: Faigley & Selzer, "Good Reasons with Contemporary Arguments"
	Translating academic jargon into engaging, informative public language	
	Tailoring tones, voices, and stylistic registers to specific settings	
WEEK-14	Unit 6: Ethical Considerations	Exercises using style manuals and documentation guidelines
	Credibility and Citations	
	Evaluating information and finding credible, peer-reviewed sources	
	Mechanics of proper citation and referencing styles (APA, MLA)	
WEEK-15	Source Integration and Avoiding Plagiarism	Quiz: Correct citation formats and paraphrase boundaries
	Mechanics of integrating evidence: Quoting, paraphrasing, and summarizing	
	Best practices for ethical text synthesis to prevent plagiarism	
WEEK-16	Capstone Project: Portfolio Presentation and Review	Portfolio Submission & Presentations Showcase of student writing
	Finalizing the Writing Portfolio containing a variety of expository texts	

	Portfolio evaluation, final reflections, and peer review wrap-up	portfolios showcasing proficiency	
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Sari, P. (2021). STUDENTS’EXPOSITORY WRITING: A CASE STUDY IN PARAGRAPH WRITING CLASS. <i>English Journal Literacy UTama</i>, 5(1), 374-380. 2. “The St. Martin’s Guide to Writing” by rise B. Axelrod and Charles R. Cooper. 3. “They Say / I Say: The Moves That Matter in Academic Writing” by Gerald Graff and Cathy Birkenstein. 4. “Writing Analytically” by David Rosenwasser and Jill Stephen. 5. “Style: Lessons in Clarity and Grace” by Joseph M. Williams and Joseph Bizup. 6. “The Elements of Style” by William Strunk Jr. and E.B. White. 7. “Good Reasons with Contemporary Arguments” by Lester Faigley and Jack Selzer. 8. “Writing to Learn; How to Write – and Think – Clearly About Any Subject at All” by William Zinsser. 9. “The Norton Field Guide to Writing” by Richard Bullock, Maureen Daly Goggin, and Francine Weinberg. 10. “The Art of Styling Sentences” by Ann Longknife and K.D. Sullivan. 11. “Writing Today” by Richard Jonson-Sheehan and Charles Paine.			
TEACHING – LEARNING STRATEGIES			
Lecture based examination Presentation/seminars Class discussion Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: classroom participation, attendance, assignments and presentation, homework attitude and behavior, hands-on-activities, short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GCCE-201	Credit hours	02
Course Title	CIVICS & COMMUNITY ENGAGEMENT				
COURSE INTRODUCTION					
This course is designed to provide students with fundamental knowledge about civics, citizenship, and community engagement. Students will learn about the essentials of civil society, government, civic responsibilities, inclusivity, and effective ways to participate in shaping the society which will help them apply theoretical knowledge to real-world situations to make a positive impact on their communities.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Demonstrate fundamental understanding of civics, government, citizenship and civil society. 2. Understand the concept of community and recognize the significance of community engagement for individuals and groups. 3. Recognize the importance of diversity and inclusivity for societal harmony and peaceful coexistence.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Introduction to Civics and Citizenship		Reading: Read Chapters 1 and 2 in <i>McGraw-Hill Education</i> , analyzing the foundational definitions of civic duty and historical evolutionary phases of participatory democracy.		
	Definition of civics, citizenship, and civic engagement				
	Historical evolution of civic participation across civilizations				
WEEK-2	Types of citizenship: active, participatory, global and digital citizenship		Assignment: Draft a 2-page synthesis paper mapping the ideological intersections where digital frameworks overlay global citizen dynamics based on paradigms in <i>Pike & Selby</i> .		
	The relationship between democracy, citizenship and governance				
WEEK-3	Civic identity and its role in shaping political culture and society		Reading: Study Chapter 3 in <i>Kymlicka & Norman</i> , detailing the preservation of distinct micro-civic identities within macro-political cultures.		
	Citizen rights and obligations in a constitutional democratic state				
WEEK-4	Levels of government and their interaction with citizens in Pakistan		Assignment: Construct an organizational flow chart tracking citizen petition trajectories from local union councils up to provincial state secretariats using <i>McGraw-Hill Education</i> templates.		
	Local government systems and community-level governance				
WEEK-5	Unit-II: Civil Society, State and Government		Reading: Review the operational separations of powers, legal checks, and balances outlined in Chapter 4 of <i>McGraw-Hill Education</i>		
	Structure and functions of government: executive, legislature and judiciary				
	The relationship between democracy, civil society and the state				
WEEK-6	Role of civil society organizations and non-governmental organizations (NGOs)		Assignment: Write a media-monitoring reflection essay detailing how institutional press freedom parameters act as an external accountability mechanism for state governance using <i>Clarke & Steckel</i> .		
	Media, freedom of press and its role in democratic governance				

WEEK-7	Unit-III: Rights and Responsibilities of Citizens	Reading: Study constitutional civil protections (Articles 8–28) alongside corresponding ethical codes of public conduct referenced in <i>Kymlicka & Norman</i> .
	Fundamental rights guaranteed under the Constitution of Pakistan 1973 (Articles 8-28)	
	Civic responsibilities, duties and ethical considerations in public life	
WEEK-8	Accountability, non-violence, peaceful dialogue and civility in civic life	Assignment: Prepare a presentation on the core legal obligations of voters, voter turnout fluctuations, and structural systemic barriers to representation using <i>Youniss & Levine</i> .
	Right to vote and importance of political participation and representation	
MID TERM EXAMINATION		
WEEK-9	Unit-IV: Community Engagement and Development	Reading: Read Chapters 1 and 2 in <i>Feldpausch & Omilian</i> , analyzing community sociological bonds and structural trust models.
	Concept, nature and characteristics of community in a social context	
	Community development, social cohesion and models of collective action	
WEEK-10	Approaches to effective community engagement and stakeholder participation	Assignment: Formulate a stakeholder engagement matrix plan for a localized development issue based on principles inside <i>Feldpausch & Omilian</i> .
	Case studies of successful community-driven initiatives in Pakistan	
WEEK-11	Volunteerism, civic service and youth leadership in community development	Reading: Study Chapter 5 in <i>Youniss & Levine</i> , focusing on longitudinal lifecycle impacts of early youth civic service and grassroots woman-led development.
	Role of women in community engagement and grassroots social change	
WEEK-12	Public discourse, public opinion formation and the role of media in civic life	Assignment: Draft a 3-page policy advocacy brief framework targeted at provincial lawmakers to address a localized structural crisis using <i>Clarke & Steckel</i> .
	Role of advocacy in addressing social, environmental and political issues in Pakistan	
WEEK-13	Social action movements: historical and contemporary examples from Pakistan and the world	Reading: Read Chapters 6 and 7 in <i>Clarke & Steckel</i> , analyzing historical dynamics, non-violent tactics, and strategic friction points within civic movements.
	Non-violent resistance, civil disobedience and democratic protest	
WEEK-14	Unit-VI: Digital Citizenship and Social Justice	Assignment: Complete the case assessment module on cyber-ethics liabilities, algorithms, and digital data privacy protections inside <i>Mattson</i> .
	Use of digital platforms for civic engagement and political participation	
	Cyber ethics, responsible use of social media and protection of digital rights	
WEEK-15	Understanding diversity: ethnic, cultural, economic and political dimensions in Pakistan	Reading: Study Chapters 4 and 8 in <i>Kymlicka & Norman</i> concerning structural pathways toward minority group representation and pluralistic harmony.
	Promoting inclusive citizenship, equal rights and interfaith harmony	
WEEK-16	Environmental citizenship	Assignment: Prepare a final portfolio mapping environmental stewardship responsibilities against local

	Role of active citizens in achieving Sustainable Development Goals (SDGs)	implementation benchmarks for global SDGs using <i>Pike & Selby</i> .	
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. "Civics Today: Citizenship, Economics, & You" by McGraw-Hill Education. 2. "Citizenship in Diverse Societies" by Will Kymlicka and Wayne Norman. 3. "Engaging Youth in Civic Life" by James Youniss and Peter Levine. 4. "Digital Citizenship in Action: Empowering Students to Engage in Online Communities" by Kristen Mattson. 5. "Globalization and Citizenship: In the Pursuit of a Cosmopolitan Education" by Graham Pike and David Selby. 6. "Community Engagement: Principles, Strategies, and Practices" by Becky J. Feldpausch and Susan M. Omilian. 7. "Creating Social Change: A Blueprint for a Better World" by Matthew Clarke and Marie-Monique Steckel.			
TEACHING – LEARNING STRATEGIES			
Lecture based examination Presentation/seminars Class discussion Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: classroom participation, attendance, assignments and presentation, homework attitude and behavior, hands-on-activities, short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GICP -201	Credit hours	02
Course Title	IDEOLOGY AND CONSTITUTION OF PAKISTAN				
COURSE INTRODUCTION					
This course is designed to provide students with a fundamental exploration of the ideology and the constitution of Pakistan. The course focuses on the underlying principles, beliefs, and aspirations that have been instrumental in shaping the creation and development of Pakistan as a sovereign state. Moreover, the course will enable students to understand the core provisions of the Constitution of the Islamic Republic of Pakistan concerning the fundamental rights and responsibilities of Pakistan citizens to enable them function in a socially responsible manner.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Demonstrate enhanced knowledge of the basis of the ideology of Pakistan with special reference to the contributions of the founding fathers of Pakistan.					
2. Demonstrate fundamental knowledge about the Constitution of Pakistan 1973 and its evolution with special reference to state structure.					
3. Explain about the guiding principles on rights and responsibilities of Pakistan citizens as enshrined in the Constitution of Pakistan 1973.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to the Ideology of Pakistan			Read Javed Iqbal, <i>Ideology of Pakistan</i> , Chapter 1	
	Definition and significance of ideology in the context of nation-building				
	Historical context: socio-political, religious and cultural dynamics of British India (1857-1947)				
WEEK-2	Contributions of Allama Muhammad Iqbal: philosophy of self and Muslim renaissance			M R Kazmi, A Concise History of Pakistan Chapter on Iqbal	
	Contributions of Muhammad Ali Jinnah: leadership, vision and role in the freedom movement			M R Kazmi, A Concise History of Pakistan Chapter on Jinnah	
WEEK-3	Role of women and students in the freedom movement for a separate Muslim homeland			The Idea of Pakistan" by Stephen P. Cohen, Preface and Chapter: 2	
	Other founding fathers and their contributions to the creation of Pakistan				
WEEK-4	Islamic ideology as the basis of Pakistani nationhood: Quaid's vision for Pakistan			Book Review of Jinnah of Pakistan, Stanley Wolpert	
	Socio-cultural identity of Muslims of British India and demand for self-determination				
WEEK-5	Unit-II: The Two-Nation Theory and the Pakistan Movement			Read Hamid Khan, <i>Constitutional and Political History of Pakistan</i> , Ch. 1	
	Evolution of the Two-Nation Theory: Urdu-Hindi controversy, Partition of Bengal, Simla Deputation 1906				

	Allama Iqbal's Presidential Address 1930 and Congress Ministries 1937	
WEEK-6	Lahore Resolution 1940 and the formal demand for Pakistan	Read Original Text of Lahore Resolution (1940)
	Key events, milestones and leaders of the Pakistan Movement (1940-1947)	
WEEK-7	Unit-III: Introduction to the Constitution of Pakistan	Research Article: What is a Constitution: Principles and Concepts, The International Institute for Democracy and Electoral Assistance
	Definition, importance and functions of a constitution in a democratic state	
	Objectives Resolution 1949: ideological foundations of Pakistan's constitution	Read Original Text of O.R. 1949
WEEK-8	Constitutional history: Constitutions of 1956, 1962 and reasons for their failure	Read Hamid Khan, Chapter
	Constitution of 1973: background, framing process, salient features and significance	Revision
MID TERM EXAMINATION		
WEEK-9	Unit-IV: Structure of Government under the Constitution of Pakistan	Read Article 41-47, 90-100 of the Constitution of Pakistan 1973
	The executive: President, Prime Minister, Federal Cabinet and their constitutional powers	
	The legislature: National Assembly, Senate, legislative procedure and parliamentary democracy	Read Article 50-80 of the Constitution of Pakistan 1973
WEEK-10	The judiciary: Supreme Court, High Courts, constitutional jurisdiction and independence	Read Article 175-212 of the Constitution of Pakistan 1973
	Distribution of powers between federal and provincial governments under the Constitution	
WEEK-11	18th Amendment: devolution of powers, provincial autonomy and its impact on federalism	Read Article 155-161 of the Constitution of Pakistan 1973 and Summary of Case Law on Cooperative Federalism by Lahore High Court
	Concurrent Legislative List and federal-provincial relations in Pakistan	
WEEK-12	Fundamental rights guaranteed to citizens (Articles 8-28) and permissible limitations	Read Magna Carta 1215, the Last Sermon of the HOLY Prophet (PBUH), and the UDHR 1948
	Principles of Policy (Articles 29-40) and directive principles for state governance	
WEEK-13	Responsibilities of Pakistan citizens (Article 5) and civic obligations under law	Read 10 Case Laws on Human Rights Provided in the Class from Pakistan Law Site
	Enforcement of fundamental rights through courts: writ jurisdiction and remedies	
WEEK-14	Unit-VI: Constitutional Amendments, Challenges and National Identity	Read Article 238-239, 175B of the Constitution of Pakistan 1973
	Procedures for amending the Constitution and notable amendments with their implications	
	Contemporary constitutional challenges and debates in Pakistan	

WEEK-15	National symbols, values and key institutions of Pakistan and their constitutional basis	
	Pakistan's foreign policy principles and international obligations as enshrined in the Constitution	
WEEK-16	Role of youth in upholding constitutional values	Comprehensive revision of all units and preparation for final examination.
	Role of youth in upholding civic responsibility and national development	
FINAL TERM EXAMINATION		
SUGGESTED PRACTICAL ACTIVITIES (OPTIONAL)		
As part of the overall learning requirements, the course may have one or a combination of the following practical activities:		
1. Community Storytelling: Students can collect and share stories from community members. This could be done through oral histories, interviews, or multimedia presentations that capture the lived experiences and perspectives of diverse individuals. 2. Community Event Planning: Students can organize a community event or workshop that addresses a specific issue or fosters community interaction. This could be a health fair, environmental cleanup, cultural festival, or educational workshop. 3. Service-Learning: Students can collaborate with a local nonprofit organization or community group. They can actively contribute by volunteering their time and skills to address a particular community need, such as tutoring, mentoring, or supporting vulnerable populations. 4. Cultural Exchange Activities: Students can organize a cultural exchange event that celebrates the diversity within the community. This could include food tastings, performances, and presentations that promote cross-cultural understanding.		
TEXT BOOKS AND READING MATERIAL		
1. "The Idea of Pakistan" by Stephen P. Cohen. 2. "Ideology of Pakistan" by Javed Iqbal. 3. "The Struggle for Pakistan" by I.H. Qureshi. 4. "Pakistan the Formative Phase" by Khalid Bin Sayeed. 5. "Pakistan: Political Roots and Development" by Safdar Mahmood. 6. "Ideology of Pakistan" by Sharif-ul-Mujahid. 2. "The Struggle for Pakistan: A Muslim Homeland and Global Politics" by Ayesha Jalal. 3. "Jinnah, Pakistan and Islamic Identity: The Search for Saladin" by Akbar S. Ahmed. 4. "The Making of Pakistan: A Study in Nationalism" by K.K. Aziz. 5. "Pakistan: A New History" by Ian Talbot. 6. "Pakistan in the Twentieth Century: A Political History" by Lawrence Ziring. 7. "The Constitution of Pakistan 1973". Original. 8. "Constitutional and Political Development of Pakistan" by Hamid Khan. 9. "The Parliament of Pakistan" by Mahboob Hussain. 10. "Constitutional Development in Pakistan" by G.W. Choudhury. 11. "Constitution-Making in Pakistan: The Dynamics of Political Order" by G.W. Choudhury.		
TEACHING – LEARNING STRATEGIES		
● Lecture based examination ● Presentation/seminars ● Class discussion ● Quizzes		

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.
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ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

SECOND YEAR, SEMESTER IV			
Code	COURSE	CREDIT HOURS	CATEGORY
ENSC-205	Environmental Toxicology	3 (3-0)	Major
ENSC-206	Environmental Pollution	3 (3-0)	Major
ENSC-207	Applied Ecology	3 (2-1)	Major
ENSC-208	Environmental Microbiology	3 (2-1)	Major
ENSC-209	Water and Wastewater Treatment	3 (2-1)	Major
ENSC-210	Environmental Economics	2 (2-0)	Interdisciplinary
Total Credit hrs Semester-IV		17	

Program	BS Environmental Sciences	Course Code	ENSC-205	Credit hours	03
Course Title	ENVIRONMENTAL TOXICOLOGY				
COURSE INTRODUCTION					
This course is designed to develop the understanding of students about the basic concepts in environmental toxicology viz; Classification and properties of toxic substances, biological properties of important classes of chemical compounds in relation to ecosystems, Fate of xenobiotics in the environment and Environmental risk assessment					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. learn fundamental knowledge on major classes of chemicals of environmental concern 2. familiar with the major classes of environmental contaminants. 3. understand the fate, transport and organismal exposure monitoring of environmental contaminants. 4. Study the effects of toxins on the physiologic, metabolic, reproductive, and developmental processes and body organ functions 5. learn the mechanisms of toxicological action of the major environmental contaminants. 6. learn the effects of environmental contaminants at the molecular, individual, population and community levels of biological organization. 7. Generate an applicable technical knowledge base in undergraduate students, as well as extend the expertise of graduate students pursuing careers in environmental sciences.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to Environmental Toxicology			Girard (2005), Principles of Environmental Chemistry, Ch. 1 (pp. 1–35)	
	Introduction and definition of toxicology				
	History and development of environmental toxicology				
	Applications of environmental toxicology in public health and policy				
WEEK-2	Scope and sub-disciplines of toxicology: ecotoxicology, clinical and forensic toxicology			Baird & Cann (2012), Environmental Chemistry, Ch. 1–2 (pp. 1–85)	
	Dose-response relationships and the concept of LD50				
	Routes of exposure: inhalation, ingestion, dermal contact				
WEEK-3	Unit-II: Classification and Types of Toxicants			Classify toxicants based on physical, chemical and biological properties.	
	Classification and properties of toxic substances: physical, chemical and biological				
	Toxicokinetics: absorption, distribution, metabolism and excretion (ADME)				
WEEK-4	Toxicodynamics: mechanisms of toxic action at the cellular and molecular level			Neilson (2018), Organic Chemicals in the Aquatic Environment, Ch. 2–3 (pp. 45–120)	
	Fate of chemicals in water, air and sediments				
	Biodegradation and biotransformation of toxic substances				
	Bioaccumulation and biomagnification in food chains				
WEEK-5	Unit-III: Biological Properties and Action of Toxicants			Discuss biological properties of organic and inorganic toxicants.	
	Biological properties of organic and inorganic toxicants				
	Biotransformation and metabolism of xenobiotic compounds				

WEEK-6	Fate and behavior of chemical substances in the environment	Explain oxidative stress, neurotoxicity and endocrine disruptors with examples.
	Oxidative stress, reactive oxygen species and antioxidant defense mechanisms	
	Neurotoxicity: mechanisms and examples of neurotoxic substances	
	Reproductive and developmental toxicology: teratogens and endocrine disruptors	
WEEK-7	Unit-IV: Toxicants in the Environment	Ibanez et al. (2008), Environmental Chemistry, Ch. 5–6 (pp. 150–220)
	Exhaust gases and automobile pollutants: CO, NOx, VOCs	
	Industrial pollutants and their environmental pathways	
WEEK-8	Particulate matter (PM2.5, PM10) and asbestos: sources and health effects	Discuss emerging contaminants: microplastics, e-waste and their management.
	Plastics, microplastics and cosmetics as emerging environmental toxicants	
	Toxicants and global climate change: feedback mechanisms	
	Electronic waste (e-waste): toxic components and management	
MID TERM EXAMINATION		
WEEK-9	Unit-V: Inorganic and Organic Toxicants Environmental toxicology of inorganic toxicants: arsenic, lead, mercury, cadmium	Assignment: Case study on heavy metals toxicity (Arsenic, Lead, Mercury, Cadmium).
	Heavy metals toxicity: sources, exposure routes and health effects	
WEEK-10	Persistent organic pollutants (POPs): characteristics, distribution and effects	Abelkop et al. (2018), Ch. 4–6 (pp. 120–220) Assignment: Review Persistent Organic Pollutants (POPs), Pesticides and EDCs.
	Pesticides and fertilizers: types, environmental fate and toxicity	
	Dioxins, furans and polychlorinated biphenyls (PCBs) Endocrine disrupting chemicals (EDCs) in the environment	
WEEK-11	Unit-VI: Human and Ecosystem Risk Toxicology	Girard (2005) & Baird & Cann (2012), Ch. 16–17 (pp. 610–680)
	Human exposure to environmental chemicals and toxicity at organ level	
	Humans as members of an ecosystem: interaction and vulnerability	
WEEK-12	Assessment of risk to humans: hazard identification and dose-response assessment	Prepare a report on ecological risk assessment methods and case studies.
	Interpreting toxicity data: NOAEL, LOAEL, safety factors	
	Ecological risk assessment: methods and case studies	
WEEK-13	Unit-VII: Regulatory Toxicology and Environmental Standards National and international regulatory frameworks for toxic substances	Pakistan Environmental Protection Act, NEQS and Stockholm Convention documents.
	Pakistan Environmental Protection Act and NEQS for toxic chemicals	
	Stockholm Convention on POPs and Basel Convention on hazardous waste	

WEEK-14	Risk communication: conveying toxicological information to the public	Baird & Cann (2012), Ch. 18 (pp. 700–750) Assignment: Discuss risk communication and occupational toxicology standards.
	Occupational toxicology: workplace exposure limits and safety standards	
	Toxicological testing methods: in vivo, in vitro and computational approaches	
WEEK-15	Unit-VIII: Case Studies in Environmental Toxicology	Prepare detailed case studies on Minamata Disease, DDT and Bhopal Gas Tragedy.
	Case study: Minamata disease and mercury poisoning in Japan	
	Case study: DDT and the decline of raptors — lessons from Rachel Carson	
	Case study: industrial chemical disasters — Bhopal gas tragedy	
WEEK-16	Emerging contaminants: pharmaceuticals, personal care products and nanomaterials in the environment	Write a policy brief on green chemistry and future directions in environmental toxicology.
	Future directions in environmental toxicology	
	green chemistry and safer alternatives	
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Neilson, H. A. (2018). <i>Organic Chemicals in the Aquatic Environment: Distribution, Persistence, and Toxicity</i>. CRC Press, USA. 2. Hayakawa, K. (Ed.). (2018). <i>Polycyclic aromatic hydrocarbons: environmental behavior and toxicity in East Asia</i>. Springer. 3. Abelkop, A. D., Graham, J. D., & Royer, T. V. (2018). <i>Persistent, bioaccumulative, and toxic (PBT) chemicals: technical aspects, policies, and practices</i>. CRC Press. 4. Speight, J. G. (2016). <i>Environmental organic chemistry for engineers</i>. ELSEVIER. 5. Ibanez, J.G., Hernandez-Esparza, M., Doria-Serrano, C., Fregoso-Infante, A. & Singh, M.M. (2008). <i>Environmental Chemistry</i>. Germany. 6. Girard, E., J. (2005). <i>Principles of Environmental Chemistry</i>.1st Ed., Jones & Barlett, USA. 7. Baird, C. & Cann, M. (2012). <i>Environmental Chemistry</i>. 5th Ed., W.H. Freeman and Company, New York. 8. Miller, G.T. (2004). <i>Environmental Science</i>. Thomson-Brooks, Canada. Further Reading: As suggested by the instructor.		
TEACHING – LEARNING STRATEGIES		
• Lecture based examination • Presentation/seminars • Class discussion • Quizzes		
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR		
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:		
• classroom participation, • attendance, assignments and presentation, • homework • attitude and behavior, • hands-on-activities, • short tests, quizzes etc.		

ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-206	Credit hours	03
Course Title	ENVIRONMENTAL POLLUTION				
COURSE INTRODUCTION					
This course provides an in-depth study of the various types of environmental pollution, their sources, effects, and control measures. It covers air, water, soil, noise, and radioactive pollution, exploring their chemical, physical, and biological impacts on ecosystems and human health. The course also addresses pollution monitoring techniques, legislation, and sustainable practices aimed at pollution prevention and remediation.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. By the end of this course, students will be able to: 2. Identify major types, sources, and impacts of environmental pollution. 3. Explain the processes and pathways of pollutants in air, water, and soil environments. 4. Analyze the effects of different pollutants on human health, ecosystems, and climate. 5. Evaluate strategies for monitoring, controlling, and managing pollution. 6. Discuss national and international environmental quality standards and regulations.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to Environmental Pollution			Read: Harrison (2023), Ch.1, pp. 1–18; Baird & Cann (2012), Ch.1, pp. 1–14	
	Definition and classification of pollution: primary and secondary pollutants				
	Major sources of environmental pollution: natural and anthropogenic				
	Pathways and fate of pollutants in the environment				
WEEK-2	Environmental quality parameters and standards (WHO, EPA, NEQS)			Read: Botkin & Keller (2014), Ch.1, pp. 3–22; Baird & Cann (2012), Ch.1, pp. 14–28	
	Global and local pollution concerns: an overview				
	Historical perspective on environmental pollution and key milestones				
WEEK-3	Unit-II: Air Pollution			Read: Baird & Cann (2012), Ch.3, pp. 65–98; Masters & Ela (2007), Ch.7, pp. 461–500	
	Composition of the atmosphere and its role in pollution dynamics				
	Types and sources of air pollutants: primary vs secondary pollutants				
	Effects of air pollution on human health, ecosystems and climate				
WEEK-4	Air quality standards and monitoring techniques: AQI and instrumentation			Read: Baird & Cann (2012), Ch.3, pp. 98–136; Masters & Ela (2007), Ch.7, pp. 500–545; Botkin & Keller (2014), Ch.19, pp. 452–470	
	Control measures: technology-based (filters, scrubbers) and policy-based solutions				
	Indoor air pollution: sources, health impacts and mitigation				
WEEK-5	Unit-III: Water Pollution			Read: Baird & Cann (2012), Ch.9, pp. 341–368; Masters & Ela (2007), Ch.3, pp. 103–140	
	Sources of water pollutants: domestic, industrial and agricultural				
	Categories of water pollutants: physical, chemical, biological and radiological				
	Effects of water pollution on aquatic ecosystems and public health				

WEEK-6	Water quality assessment: parameters and standards (WHO, NEQS)	Read: Baird & Cann (2012), Ch.9, pp. 368–406; Masters & Ela (2007), Ch.3, pp. 140–190; Botkin & Keller (2014), Ch.20, pp. 476–495
	Eutrophication: causes, effects and management strategies	
	Water pollution control and treatment technologies: an overview	
WEEK-7	Unit-IV: Soil Pollution	Read: Baird & Cann (2012), Ch.10, pp. 407–438; Spiro & Stigliani (2002), Ch.8, pp. 220–249
	Types and sources of soil contamination: industrial, agricultural and municipal	
	Effects on soil productivity, ecosystems and food safety	
	Heavy metals in soils: sources, mobility and phytotoxicity	
WEEK-8	Pesticides and persistent organic pollutants (POPs) in soils	Read: Baird & Cann (2012), Ch.10, pp. 438–475; Spiro & Stigliani (2002), Ch.9, pp. 250–283; Harrison (2023), Ch.7, pp. 178–210
	Soil pollution assessment methods and remediation techniques	
	Bioremediation and phytoremediation of contaminated soils	
MID TERM EXAMINATION		
WEEK-9	Unit-V: Noise Pollution	Read: Masters & Ela (2007), Ch.8, pp. 546–580; Botkin & Keller (2014), Ch.17, pp. 402–420
	Sources and types of noise pollution: industrial, traffic and domestic	
	Effects of noise on human health, wildlife and the environment	
	Noise measurement: decibel scale, frequency and permissible limits	
WEEK-10	Control and mitigation strategies: urban planning and engineering controls	Read: Masters & Ela (2007), Ch.8, pp. 580–615; Harrison (2023), Ch.9, pp. 258–285
	Thermal, Radioactive and Light Pollution	
	Thermal pollution: sources, impacts on aquatic ecosystems and control	
WEEK-11	Radioactive pollution: natural and anthropogenic sources, effects and management	Read: Spiro & Stigliani (2002), Ch.11, pp. 320–355; Baird & Cann (2012), Ch.12, pp. 513–548
	Light pollution: causes, ecological and health impacts and prevention	
	Electromagnetic radiation and its environmental implications	
WEEK-12	Unit-VI: Biomedical and Hazardous Waste Management	Read: Masters & Ela (2007), Ch.9, pp. 616–650; Harrison (2023), Ch.11, pp. 312–340
	Types and sources of biomedical and hazardous waste	
	Environmental and health impacts of improper waste disposal	
WEEK-13	Waste collection, segregation, recycling and disposal methods	Read: Masters & Ela (2007), Ch.9, pp. 650–690; Botkin & Keller (2014), Ch.23, pp. 556–575
	Hazardous waste: classification, treatment and safe disposal	
	National and international waste management policies: Basel Convention, NEQS	
WEEK-14	Unit-VII: Pollution Monitoring and Environmental Impact Assessment	Read: Masters & Ela (2007), Ch.10, pp. 691–720; Botkin & Keller (2014), Ch.22, pp. 526–545
	Environmental monitoring networks: national and global systems	
	Remote sensing and GIS applications in pollution monitoring	

WEEK-15	Environmental Impact Assessment (EIA): process, methodology and significance	Read: Botkin & Keller (2014), Ch.27, pp. 654–680; Harrison (2023), Ch.15, pp. 430–460
	Case studies: industrial pollution in Pakistan — textile, tannery and cement industries	
	Transboundary pollution: causes, agreements and international cooperation	
WEEK-16	Sustainable development and the role of clean technology in pollution prevention	Read: Botkin & Keller (2014), Ch.24, pp. 578–600; Masters & Ela (2007), Ch.1, pp. 1–30; Harrison (2023), Ch.16, pp. 461–488
	Pollution legislation in Pakistan: PEPA 1997	
	NEQS and enforcement mechanisms	

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Harrison, R. M. (Ed.). (2023). *Pollution: causes, effects and control*. Royal society of chemistry.
2. Baird, C. & Cann, M. (2012). *Environmental Chemistry* (5th ed.). W.H. Freeman.
3. Botkin, D.B. & Keller, E.A. (2014). *Environmental Science: Earth as a Living Planet* (9th ed.). Wiley.
4. Masters, G.M. & Ela, W.P. (2007). *Introduction to Environmental Engineering and Science* (3rd ed.). Pearson.
5. Spiro, T.G. & Stigliani, W.M. (2002). *Chemistry of the Environment* (2nd ed.). Prentice Hall.
6. Pakistan Environmental Protection Act 1997 and National Environmental Quality Standards (NEQS).

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-207	Credit hours	02
Course Title	APPLIED ECOLOGY (THEORY)				
COURSE INTRODUCTION					
The current course is designed to introduce the fundamentals of ecology and ecological principles to the participants. The course shall encompass the thorough study of climate and world major terrestrial and aquatic biomes including coral reefs and coastline mangroves. The dynamics of population and community ecology will be the core this course. Understanding population, communities, survival of species, life tables, food chain, food web, competition, predation, parasitism etc. will be focused in population and community ecology. Studying behavioral aspects of plants and animals shall be the central theme of this course. Finally, concepts of restoration of ecosystems and modern challenges of restoration shall also be encompassed in this course.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Explain the ideas used for the sustainability and application of applied ecology. 2. Understand the ideas of resource conservation and preservation and promote these ideas of sustainability 3. Evaluate the how human population growth changing in different natural resources of the world? 4. Assess and evaluate the impacts of human activities threaten global ecosystem integrity and sustainability.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Introduction to Applied Ecology		Begon, et al., (2014). Chapter 1 pp4-21		
	Definition, scope and importance of applied ecology				
	Ecological principles and their application to real-world problems				
WEEK-2	Extinction episodes of the past and estimating current extinction rates		The Sixth Extinction or related documentary (https://www.youtube.com/watch?v=rVwRnRYdiJ0) followed by quiz		
	Extinction processes: habitat loss, overexploitation, invasive species and climate change				
WEEK-3	The prospect of global climate change: ecological consequences		Cunningham, and Cunningham, (2020). Chapter 9 pp 206-2017 Begon, et al., (2014). Chapter 1 pp4-21		
	Conservation biology and its relationship with applied ecology				
WEEK-4	Contamination and pollution effects on ecosystem structure and function		Cunningham and Cunningham, (2011). Chapter 5 pp 113-145		
	Roads, dams and infrastructure: fragmentation and ecological barriers		Assignments on different topics related to human impacts on ecosystems (Individual)		
WEEK-5	Unit-II (continued): Ecosystem Degradation		Deadly Flood: A Climate Disaster (2022) or related documentary https://www.youtube.com/watch?v=cExZ5nHQzog followed by quiz		
	Fire, floods and earthquakes as natural disturbances to ecosystems				
	Deforestation and desertification: causes, rates and ecological consequences				
WEEK-6	Draining, dredging and damming: impacts on wetland and aquatic ecosystems		Begon, et al., (2014). pp: 113- 121.		
	Land use change and its effects on biodiversity and ecosystem services				

WEEK-7	Unit-III: Overexploitation and Its Impacts on Ecosystems	Here's Why 90% of Large Fish Are Disappearing or related documentary https://www.youtube.com/watch?v=daMrIG6sCig followed by quiz
	History and types of overexploitation: fisheries, wildlife and forests	
	Consequences of overexploitation: population collapse and trophic cascades	
WEEK-8	Habitat fragmentation: edge effects and island biogeography theory	Begon, et. Al., (2014). Chapter 9. 183-210
	Disease transmission in fragmented and degraded ecosystems	
MID TERM EXAMINATION		
WEEK-9	Unit-IV: Biodiversity Conservation	The Snow Leopard Documentary or related documentary https://www.youtube.com/watch?v=b86DLV8nwqQ
	In situ conservation: national parks, wildlife sanctuaries and biosphere reserves	
	Ex situ conservation: zoos, botanical gardens, seed banks and captive breeding	
WEEK-10	Establishing and managing protected areas: design principles and challenges	Begon, et. Al., (2014). Chapter 14 pp: 406 -429
	Managing endangered species: recovery plans and legal frameworks	
WEEK-11	Controlling invasive species: detection, management and eradication strategies	Cunningham, and Cunningham,. (2020). Chapter 6, pp:128-142
	Promoting sustainable resource management: community-based conservation	
WEEK-12	Reserve selection and design: size, shape and connectivity	Critical review assignment on efforts on forest conservation, wildlife etc in Pakistan
	Reserve management: fire management, predator-prey balance and habitat modification	
WEEK-13	Ecological restoration: principles, techniques and case studies	Urry, et al., (2021). Chapter 55 1246 -1255
	Ecotourism as a conservation tool: benefits, risks and best practices	
WEEK-14	Unit-VI: Urbanization and Sustainable Cities	City of the Future: Singapore or related documentary https://www.youtube.com/watch?v=xi6r3hZe5Tg
	Cities as ecological systems: urban heat islands, biodiversity and green infrastructure	
	Urban planning for ecological sustainability: green corridors and urban forests	
WEEK-15	Sustainable urban practices: waste management, water conservation and energy efficiency	Urry, et al., (2021). Chapter 1274- 1285
	Applied ecology in agriculture: agroecology, precision farming and soil health	
WEEK-16	Applied ecology and environmental policy	Cunningham, and Cunningham, (2020). Chapter 17, pp:564-585
	Applications of applied ecology in sustainable development	
FINAL TERM EXAMINATION		

TEXT BOOKS AND READING MATERIAL

1. Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., Orr, R. B., & Reece, J. B. (2021). *Campbell biology* (12th ed.). Pearson.
2. Frouz, J., & Frouzová, J. (2022). *Applied Ecology: How Agriculture, Forestry and Fisheries Shape Our Planet*. Cham, Switzerland: Springer International Publishing AG.
3. McKenney, E., & Rund, E. (Eds.). (2023). *Applied Ecology*. Raleigh, NC: North Carolina State University.
4. Sher, A. A. (2022). *An Introduction to Conservation Biology* (3rd ed.). Oxford, UK: Oxford University Press.
5. Urry et al., (2021). Biology. Title: Campbell biology Twelfth edition. | New York, NY : Pearson, |
6. Cunningham, W. P. and Cunningham, M. A. (2020). *Principals of Environmental Sciences, Inquiry & Applications* 9th edition, McGraw Hill
7. Begon, M. Howarth R. W., Townsend C. R. (2014). *Essentials of Ecology*, 4th Edition
8. Rubenstein, D. I., & Wrangham, R. W. (2016). *Ecological aspects of social evolution*. Princeton University Pres.
9. Friedland, A. and Relyea R. (2015). *Environmental Science for AP* 2nd edition, W. H. Freeman and Company
10. **Further Reading:** As suggested by the Instructor.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

21. classroom participation,
22. attendance, assignments and presentation,
23. homework
24. attitude and behavior,
25. hands-on-activities,
26. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-207	Credit hours	01
Course Title	APPLIED ECOLOGY (PRACTICAL)				
COURSE INTRODUCTION					
The practical course is designed to emphasize the measuring plants and animals; diversity in any ecosystem, evaluating major threats and assess future consequences. Further, evaluating measures needed for restoration of various ecosystems are key for this practical course. Lastly, some model habitats will be studied to see the human impacts on natural ecosystems and species and possible restoration measures.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Understand the ecological principles, measuring ecological foots and carbon sequestration. 2. Evaluate the threats to species, population communities and ecosystem 3. Explain the model ecosystem, measuring plants and animal diversity, its temporal deterioration 4. Perform activities to measures and challenges for restorations of ecosystems.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Introduction to field ecology: safety, equipment and field notebook techniques		Wheater et al., (2011), Chapter 1 pp: 1-33		
WEEK-2	Field surveys of plants: plot-based sampling, species identification and recording		Wheater et al., (2011), Chapter 1 pp: 1-33		
WEEK-3&4	Field surveys of animals: transect methods, point counts and mark-recapture techniques		Sutherland, (2006). Chapter 2 PP: 18-38		
WEEK-5 & 6	Measuring plant diversity using diversity indices: Shannon-Wiener and Simpson indices		Kiernan, (2014). Chapter 10 PP: 216 -227Wheater et al., (2011), Chapter 5 pp: 237- 256		
WEEK-7 &8	Study of carbon sequestration estimation by trees: methods and calculations		WWF-Canada. 2024. PP 1-24		
MID TERM EXAMINATION					
WEEK-8 & 9	Carbon footprint calculation: methods, tools and practical exercises		Muthu, (2015). Chapter 3 PP61-84		
WEEK-10 & 11	Assessment of city health using City Biodiversity Index (CBI)		Chan, et al., (2021). PP1-44		
WEEK-13 & 14	Assessment impacts of microplastics on the environment and on human health.		Secretariat of the Basel, Rotterdam and Stockholms Conventions. (2023). Section 3: 27-38		
WEEK-14	Assessment of Invasive Species’ Impact on an Ecosystem		Walker & Wood, (2010). Activity 14PP:91-97		
WEEK-15 & 16	Study of Human influences on ecosystems		Mackean and Hayward (2018).Chapter 21. Pp316-331		
FINAL TERM EXAMINATION					
TEXT BOOKS AND READING MATERIAL					
1. Walker, P., & Wood, E. (2010). <i>Ecology Experiments</i>. Facts On File. 2. WWF-Canada. 2024. Measuring Carbon in Trees: A Supplemental Guide. World Wildlife Fund Toronto, Canada 3. Secretariat of the Basel, Rotterdam and Stockholms Conventions. (2023). <i>Plastic is forever: Teacher resource book</i>. United Nations Environment Programme.					

4. Muthu, S. S. (Ed.). (2015). *The Carbon Footprint Handbook*. CRC Press.
5. Henderson, P. A.; Southwood T. R. E., (2016). *Ecological Methods*, 4th Edition, Wiley-Blackwell
6. Phillip Wheater, James R. Bell and Penny A. Cook. *Practical Field Ecology: A Project Guide*, Wiley-Blackwell, West Sussex, 2011. 389 pp.
7. Sutherland, W. J. (Ed.). (2006). *Ecological census techniques: A handbook* (2nd ed.). Cambridge University Press.
8. Mackean D. G. and D. Hayward (2018). *Cambridge IGCSE Biology* 3rd Edition Hodder Education
9. Chan, L., Hillel, O., Werner, P., Holman, N., Coetzee, I., Galt, R., & Elmqvist, T. (2021). *Handbook on the Singapore Index on Cities' Biodiversity*. Secretariat of the Convention on Biological Diversity; National Parks Board, Singapore.
10. Kiernan, D. (2014). *Natural Resources Biometrics*. Milne Publishing.
11. Sutherland, W.J. (2006). *Ecological Census Techniques: A Handbook* (2nd ed.). Cambridge University Press.
12. Kent, M. (2012). *Vegetation Description and Data Analysis* (2nd ed.). Wiley-Blackwell.

TEACHING – LEARNING STRATEGIES

27. Lecture based examination
28. Presentation/seminars
29. Class discussion
30. Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

12. classroom participation,
13. attendance, assignments and presentation,
14. homework
15. attitude and behavior,
16. hands-on-activities,
17. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-208	Credit hours	02
Course Title	ENVIRONMENTAL MICROBIOLOGY (THEORY)				
COURSE INTRODUCTION					
This course explores the role of microorganisms in the environment and their interactions with natural and human-influenced ecosystems. It focuses on the diversity, structure, function, and ecology of microbial life in soil, water, air, and extreme environments. Topics include microbial metabolism, biogeochemical cycles, biodegradation, bioremediation, wastewater treatment, and the impact of microbes on environmental health and sustainability.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. The students will learn about the ecology and diversity of microbial communities in soil, water and air 2. Students will learn about ecological importance of microorganism 3. Their roles in wastewater treatment and bioremediation of polluted environment 4. Role of microorganisms in industry and agriculture sectors					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to Environmental Microbiology			Maier et al. (2009) Ch.1 pp.1-7. Altas and Bartha (1981) Ch.3 pp. 51-77.	
	Introduction, scope and brief history of environmental microbiology				
	Microbial metabolism: types of nutrition and energy generation				
WEEK-2	Microbial growth in the environment: growth phases and limiting factors			Maier et al. (2009) Ch.3 pp.38-54.	
	Physicochemical factors affecting the environmental fate of microorganisms				
WEEK-3	Microbial habitats and ecology: soil, water and air environments			Maier et al. (2009) Ch.4 pp.57-81. Altas and Bartha (1981) Ch.2 pp. 15-49.	
	Microbial diversity: bacteria, archaea, fungi, protozoa and viruses in the environment				
WEEK-4	Nature of microbial communities: structure, function and succession			Maier et al. (2009) Ch.2 pp.10-34.	
	Life at low nutrient concentrations: oligotrophic microorganisms				
WEEK-5	Unit-II (continued)			Maier et al. (2009) Ch.7 pp.124-134. Maier et al. (2009) Ch.5 pp.83-101.	
	Occurrence and distribution of microbial communities in extreme environments				
	Air microbiology: bioaerosols, airborne pathogens and indoor air quality				
WEEK-6	Role of freshwater and marine microorganisms in nutrient cycling			Maier et al. (2009) Ch.6 pp.103-120. Altas and Bartha (1981) Ch.6 pp. 171-219.	
	Microorganisms in different terrestrial habitats: forest, agricultural and desert soils				
WEEK-7	Unit-III: Industrial and Agricultural Microbiology			Maier et al. (2009) Ch.24 pp.503-529. Altas and Bartha (1981) Ch.12 pp. 382-413. Altas and Bartha (1981) Ch.14 pp. 443-462.	
	Microorganisms in sewage and sewage treatment: activated sludge and biofilms				
	Role of microorganisms in biofuel production: bioethanol and biogas				
WEEK-8	Role of microbial enzymes in food, pharmaceutical and textile industries			Altas and Bartha (1981) Ch.9 pp. 284-314.	
	Soil microorganisms and their role in plant health and growth				
MID TERM EXAMINATION					

WEEK-9	Unit-IV: Ecological Importance of Microorganisms	Altas and Bartha (1981) Ch.8 pp. 247-281.
	Microbial ecology: community dynamics and interspecies interactions	
	Symbiosis between plants and microorganisms: nitrogen fixation and mycorrhiza	
WEEK-10	Microbial functions in biogeochemical cycles: carbon, nitrogen, phosphorus and sulfur	Altas and Bartha (1981) Ch.11 pp. 247-281.
	Solid waste treatment by composting: microbial succession and temperature dynamics	Maier et al. (2009) Ch.14 pp.287-318.
WEEK-11	Bioremediation of organic pollutants in soil and aquatic environments	Maier et al. (2009) Ch.20 pp.387-419.
	Heavy metal bioremediation: biosorption and bioprecipitation mechanisms	Maier et al. (2009) Ch.21 pp.421-440.
WEEK-12	Waterborne diseases: pathogens, transmission routes and prevention	Maier et al. (2009) Ch.22 pp.445-481.
	Indicator organisms for water quality: coliforms, E. coli and enterococci	Maier et al. (2009) Ch.23 pp.485-498.
WEEK-13	Foodborne illness: microbial hazards, outbreak investigation and food safety standards	Maier et al. (2009) Ch.22 pp.445-481.
	Antimicrobial resistance (AMR) as an emerging environmental and public health threat	
WEEK-14	Unit-V: Emerging Topics in Environmental Microbiology	Maier et al. (2009) Ch.17 pp.347-355.
	Microbiome science: human gut, soil and aquatic microbiomes	
	Metagenomics and molecular tools for studying environmental microbial communities	
WEEK-15	Microbial fuel cells	Altas and Bartha (1981) Ch.13 pp. 415-440.
	Biotechnology applications in environmental management	
WEEK-16	Microbial recovery of metals from ores and waste: Bioleaching	Altas and Bartha (1981) Ch.13 pp. 415-440.
	Biomining	
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Maier, R.M., Pepper, I.L. & Gerba, C.P. (2009). Environmental Microbiology (2nd ed.). Academic Press. 2. Pepper, I.L., Gerba, C.P. & Gentry, T.J. (2015). Environmental Microbiology (3rd ed.). Academic Press. 3. Atlas, R. M. and Bartha, R. (1981). <i>Microbial ecology: fundamentals and applications</i>. Addison-Wesley Publishing Company. 4. Roane, T.M. & Pepper, I.L. (2000). Microorganisms and Metal Pollutants. Academic Press.		
TEACHING – LEARNING STRATEGIES		
Lecture based examination Presentation/seminars Class discussion Quizzes		

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

2. classroom participation,
3. attendance, assignments and presentation,
4. homework
5. attitude and behavior,
6. hands-on-activities,
7. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-208	Credit hours	01
Course Title	ENVIRONMENTAL MICROBIOLOGY (PRACTICAL)				
COURSE INTRODUCTION					
This laboratory-based course provides hands-on experience in techniques used to study microorganisms in environmental samples such as soil, water, and air. Students will learn to isolate, culture, identify, and quantify various microorganisms using microbiological and biochemical methods. Key practical exercises include microbial sampling, serial dilution, plating techniques, staining, biochemical testing, and the analysis of microbial roles in biogeochemical cycles, pollution control, and wastewater treatment. The course emphasizes laboratory safety, aseptic techniques, accurate data recording, and scientific reporting. Through these exercises, students will gain essential skills for environmental monitoring, pollution assessment, and the application of microbiology in environmental management.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. the ecology and diversity of microbial communities in soil, water and air 2. Students will learn about ecological importance of microorganism 3. Their roles in wastewater treatment and bioremediation of polluted environment 4. Role of microorganisms in industry and agriculture sectors					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Introduction to laboratory safety, aseptic techniques and microbiology equipment			Maier et al. (2009) Ch.9 pp.157-172.	
WEEK-2	Preparation of microbial growth media: nutrient agar, nutrient broth and selective media			Maier et al. (2009) Ch.10 pp.173-188.	
WEEK-3	Sterilization methods: autoclave, dry heat, filtration and UV radiation			Altas and Bartha (1981) Ch.4 pp. 81-128.	
WEEK-4	Detection and isolation of microorganisms from soil samples			Maier et al. (2009) Ch.8 pp.137-154.	
WEEK-5	Detection and isolation of microorganisms from water samples: MPN and membrane filtration			Maier et al. (2009) Ch.8 pp.137-154.	
WEEK-6	Detection of airborne microorganisms using settle plates and RCS sampler			Maier et al. (2009) Ch.8 pp.137-154.	
WEEK-7	Isolation of bacteria from industrial effluents: enrichment and selective culture			Maier et al. (2009) Ch.8 pp.137-154.	
WEEK-8	Effect of pH on microbial growth: preparation of pH-adjusted media and colony counting			Maier et al. (2009) Ch.19 pp.365-382.	
MID TERM EXAMINATION					
WEEK-9	Effect of temperature on microbial growth: incubation at different temperatures			Barton and McLean (2019) Ch.5 pp. 167-209	
WEEK-10	Morphological characterization of microorganisms: colony morphology and cell shape			Barton and McLean (2019) Ch.1 pp.1-31.	
WEEK-11	Gram staining technique: procedure, interpretation and reporting			Altas and Bartha (1981) Ch.2 pp. 17-49.	
WEEK-12	Biochemical characterization of bacteria: catalase, oxidase and sugar fermentation tests			Barton and McLean (2019) Ch.2 pp.33-75.	

WEEK-13	Study of bacterial growth curves using spectrophotometry (OD measurements)	Maier et al. (2009) Ch.3 pp.38-54.	
WEEK-14	Plant growth promotion experiment: inoculation of seedlings with rhizobacteria	Barton and McLean (2019) Ch.6 pp.211-247.	
WEEK-15	Bioremediation experiment	Barton and McLean (2019) Ch.9 pp.341-370.	
WEEK-16	Removal of heavy metals by bacteria from contaminated water	Barton and McLean (2019) Ch.9 pp.341-370.	
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Cappuccino, J.G. & Welsh, C. (2018). Microbiology: A Laboratory Manual (11th ed.). Pearson. 2. Gerhardt, P. et al. (1994). Methods for General and Molecular Bacteriology. ASM Press. 3. Maier, R.M., Pepper, I.L. & Gerba, C.P. (2009). Environmental Microbiology (2nd ed.). Academic Press. 4. Atlas, R.M. and Bartha, R. (1981). <i>Microbial ecology: fundamentals and applications</i>. Addison-Wesley Publishing Company. 5. Barton, L. L., & McLean, R. J. (2019). <i>Environmental microbiology and microbial ecology</i>. John Wiley & Sons.			
TEACHING – LEARNING STRATEGIES			
31. Lecture based examination 32. Presentation/seminars 33. Class discussion 34. Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: 2. classroom participation, 3. attendance, assignments and presentation, 4. homework 5. attitude and behavior, 6. hands-on-activities, 7. short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-209	Credit hours	02
Course Title	WATER AND WASTEWATER TREATMENT (THEORY)				
COURSE INTRODUCTION					
The aim of this course is to introduce the students to the area of water and wastewater treatment. The course is meant to provide a broad theoretical and practical foundation of various wastewater treatments. The course also teaches the configurations, design and operation of relevant wastewater treatment processes, including physical, chemical and biological methods.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Understand various types of biological and physiochemical methods employed in water wastewater treatment 2. Learn effective ways to manage wastewater 3. Be able to select an economical and effective wastewater treatment system for a specific application 4. Will have a working knowledge of the water and wastewater industry to perform a preliminary design of a treatment plant					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Introduction to Wastewater Treatment		Reading: Study the introductory chapters of Spellman (2025), Handbook of Water and Wastewater Treatment Plant Operations, on the definition, types and levels of wastewater and the philosophy of safe water treatment.		
	Definition, types and levels of wastewater: domestic, industrial and agricultural				
	Water treatment philosophy: principles of safe water and public health				
WEEK-2	Importance and goals of wastewater treatment: environmental and regulatory perspectives		Assignment: Prepare a short note on the goals of wastewater treatment and the criteria for evaluating and selecting treatment systems, using Riffat & Husnain (2022), Fundamentals of Wastewater Treatment and Engineering.		
	Evaluation and selection of treatment systems: technical and economic criteria				
WEEK-3	Domestic and industrial wastewater: composition and characteristics		Reading: Read about domestic and industrial wastewater composition and collection systems in Riffat & Husnain (2022).		
	Wastewater collection systems: sewer networks and combined vs separate systems				
WEEK-4	Wastewater flow rates and flow equalization: design considerations		Assignment: Solve a short numerical exercise on wastewater flow rates and flow equalization design, referring to Spellman (2025).		
	Measurement and monitoring of wastewater discharge: sampling and analysis				
WEEK-5	Key water quality parameters: BOD, COD, TSS, pH, nutrients and pathogens		Reading: Review key water quality parameters (BOD, COD, TSS, pH, nutrients, pathogens) and NEQS/WHO standards in Riffat & Husnain (2022).		
	Water quality standards in Pakistan: NEQS and WHO guidelines				
	Laboratory analysis of wastewater: standard methods and procedures				
WEEK-6	Preliminary treatment: screening, grit removal and flow equalization		Assignment: Prepare a laboratory report format for preliminary and primary treatment		

	Primary treatment: sedimentation, flotation and oil-water separation	processes (screening, grit removal, sedimentation), based on Liu & Lipták (2020), Wastewater Treatment.
WEEK-7	Unit-III (continued): Biological Treatment	Reading: Study the activated sludge process and other biological treatment variants in Chen, van Loosdrecht, Ekama & Brdjanovic (2020), Biological Wastewater Treatment.
	Secondary treatment: activated sludge process and its variants	
	Trickling filters, rotating biological contactors and oxidation ponds	
WEEK-8	Anaerobic treatment processes: UASB reactors and anaerobic digesters	Assignment: Prepare a comparative note on anaerobic treatment (UASB, digesters) versus constructed wetlands, citing Chen et al. (2020).
	Constructed wetlands: types, design and performance for wastewater treatment	
MID TERM EXAMINATION		
WEEK-9	Unit-III (continued): Advanced Treatment	Reading: Read about tertiary treatment, nutrient removal and disinfection methods in Spellman (2025).
	Tertiary treatment: nutrient removal, disinfection and advanced filtration	
	Disinfection methods: chlorination, UV radiation and ozonation	
WEEK-10	Advanced oxidation processes (AOPs): Fenton reaction, photocatalysis and ozonation	Assignment: Write a short technical summary of advanced oxidation processes and membrane technologies (MF, UF, NF, RO), using Liu & Lipták (2020).
	Membrane technologies: microfiltration, ultrafiltration, nanofiltration and reverse osmosis	
WEEK-11	Sludge management: thickening, dewatering, digestion and disposal	Reading: Review sludge management and chemical unit processes (coagulation, flocculation, adsorption) in Riffat & Husnain (2022).
	Chemical unit processes in wastewater treatment: coagulation, flocculation and adsorption	
WEEK-12	Wastewater reuse guidelines and zero liquid discharge (ZLD) concept	Assignment: Prepare a feasibility note on zero liquid discharge and greywater recycling technologies, citing Bahadir & Haarstrick (2025), Water and Wastewater Management.
	Greywater recycling: technologies, practices and case studies	
WEEK-13	Water reuse applications: agricultural irrigation, industrial cooling and groundwater recharge	Reading: Study water reuse applications and the economic analysis of treatment and reuse systems in Bahadir & Haarstrick (2025).
	Cost and economic analysis of wastewater treatment and reuse systems	
WEEK-14	Unit-V: Industrial Wastewater Treatment	Assignment: Prepare a case-study report on textile, tannery and food-processing wastewater treatment challenges, referring to Chen et al. (2020).
	Textile wastewater: characteristics, treatment challenges and technologies	
	Tannery, pharmaceutical and food processing wastewater treatment	
WEEK-15	Case studies of wastewater treatment in Pakistan: challenges and solutions	Reading: Review Pakistani case studies on wastewater treatment challenges and decentralized/small-scale systems in Spellman (2025).
	Decentralized wastewater treatment: small-scale systems for rural communities	
WEEK-16	Emerging contaminants in wastewater: Microplastics	Assignment: Submit a short literature review on emerging contaminants (microplastics and pharmaceuticals) in wastewater, drawing on
	Pharmaceuticals and microplastics	

		all assigned texts, in preparation for the Final Term Examination.	
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Spellman, F. R. (2025). <i>Handbook of water and wastewater treatment plant operations</i>. CRC press. 2. Bahadir, Muefit & Haarstrick, Andreas. (2025). <i>Water and Wastewater Management Water and Wastewater Management</i>. 3. Riffat, R., & Husnain, T. (2022). <i>Fundamentals of wastewater treatment and engineering</i>. Crc Press. 4. Chen, G. H., van Loosdrecht, M. C., Ekama, G. A., & Brdjanovic, D. (Eds.). (2020). <i>Biological wastewater treatment: principles, modeling and design</i>. IWA publishing. 5. Liu, D. H., & Lipták, B. G. (Eds.). (2020). <i>Wastewater treatment</i>. Crc Press.			
TEACHING – LEARNING STRATEGIES			
Lecture based examination Presentation/seminars Class discussion Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: 1. classroom participation, 2. attendance, assignments and presentation, 3. homework 4. attitude and behavior, 5. hands-on-activities, 6. short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-209	Credit hours	01
Course Title	WATER AND WASTEWATER TREATMENT (PRACTICAL)				
COURSE INTRODUCTION					
This laboratory course is designed to provide practical aspects of wastewater treatments. It will also enable students to learn about the evaluation techniques and testing procedure for the assessment and remediation of major pollutions in water and wastewater. Student will know the sound knowledge about calculating pollution load in any given effluent.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Have a demonstration about the different treatment methods for the removal of pollutants from water/wastewater 2. Get hands on experience on several biological, physical, and chemical treatment methods					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Introduction to laboratory safety, glassware, instruments and standard methods for water analysis		Reading/Prep: Review the standard laboratory safety protocols and glassware/instrument list in APHA, AWWA, WEF (2017), Standard Methods for the Examination of Water and Wastewater, before the session.		
WEEK-2	Physical treatment lab: coagulation and flocculation using jar test experiment		Assignment: Submit a lab report on the jar test experiment for coagulation and flocculation, following the procedure in APHA/AWWA/WEF (2017).		
WEEK-3	Physical treatment lab: settling and sedimentation rate analysis		Reading/Prep: Read the settling and sedimentation-rate analysis procedure in Davis (2010), Water and Wastewater Engineering.		
WEEK-4	Adsorption experiment: removal of color and COD using activated carbon		Assignment: Submit a lab report on the adsorption experiment (color and COD removal using activated carbon), citing Metcalf & Eddy (2014), Wastewater Engineering.		
WEEK-5	Membrane filtration experiment: microfiltration of turbid water samples		Reading/Prep: Review the microfiltration procedure and relevant membrane theory in Metcalf & Eddy (2014) before conducting the experiment.		
WEEK-6	COD determination of industrial and synthetic effluents: standard dichromate method		Assignment: Submit a lab report on COD determination using the standard dichromate method, per APHA/AWWA/WEF (2017).		
WEEK-7	BOD determination: 5-day BOD test for domestic and industrial wastewater		Reading/Prep: Read the 5-day BOD test procedure in APHA/AWWA/WEF (2017) prior to the laboratory session.		
WEEK-8	TSS and TDS measurement in wastewater samples: gravimetric method		Assignment: Submit a lab report on TSS and TDS measurement using the gravimetric method, citing Davis (2010).		
MID TERM EXAMINATION					
WEEK-9	Ozonation experiment: color and COD removal from synthetic effluents		Reading/Prep: Review ozonation as an advanced oxidation process in Metcalf & Eddy (2014).		
WEEK-10	Electro-coagulation experiment: removal of pollutants from industrial effluents		Assignment: Submit a lab report on the electro-coagulation experiment for pollutant removal from industrial effluents.		

WEEK-11	Fenton reaction experiment: oxidative degradation of organic dyes	Reading/Prep: Read about Fenton's reaction and oxidative degradation of organic dyes in Metcalf & Eddy (2014).
WEEK-12	Reverse osmosis (RO) demonstration: salt rejection and permeate flux measurement	Assignment: Submit a lab report on the reverse osmosis demonstration, including salt rejection and permeate flux calculations.
WEEK-13	Determination of wastewater flow rate using V-notch weir experiment	Reading/Prep: Review flow-measurement theory for V-notch weirs in Davis (2010) before the experiment.
WEEK-14	Pollution load determination: BOD load, COD load and suspended solids load calculation	Assignment: Submit calculations for BOD load, COD load and suspended-solids load for a sample effluent, per APHA/AWWA/WEF (2017).
WEEK-15	Biological treatment simulation: activated sludge process using bench-scale reactor	Reading/Prep: Read about the activated sludge process and bench-scale reactor operation in Metcalf & Eddy (2014).
WEEK-16	Data analysis, lab report writing and presentation of practical results	Assignment: Submit the final practical report compiling data analysis and results from the semester's experiments, in preparation for the Final Term Examination.

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. APHA, AWWA, WEF (2017). Standard Methods for the Examination of Water and Wastewater (23rd ed.).
2. Metcalf & Eddy (2014). Wastewater Engineering: Treatment and Resource Recovery (5th ed.). McGraw-Hill.
3. Davis, M.L. (2010). Water and Wastewater Engineering. McGraw-Hill.

TEACHING – LEARNING STRATEGIES

1. Lecture based examination
2. Presentation/seminars
3. Class discussion
4. Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

1. classroom participation,
2. attendance, assignments and presentation,
3. homework
4. attitude and behavior,
5. hands-on-activities,
6. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-210	Credit hours	02
Course Title	ENVIRONMENTAL ECONOMICS				
COURSE INTRODUCTION					
This course explores the relationship between the economy and the environment, focusing on how economic principles can be applied to analyze and address environmental issues. Students will study the causes of environmental problems such as pollution, resource depletion, and climate change from an economic perspective and evaluate policy instruments used for environmental protection, including taxes, subsidies, tradable permits, and regulations.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Formulate conclusions by applying the basic concepts and tools from environmental economics and develop an understanding of how such conclusions can be used to guide environmental policy. 2. Understand the political and economic aspects of pollution, renewable and non-renewable resource consumption.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to Economics			Reading: Study the concepts of scarcity, choice and opportunity cost in Field & Field (2016), Environmental Economics: An Introduction.	
	Concept of scarcity, choice and opportunity cost in economics				
	Production possibilities frontier and trade-offs in resource allocation				
WEEK-2	Micro and macroeconomics: scope, tools and relationship			Assignment: Prepare a short note comparing market, command and mixed economic systems, citing Field & Field (2016).	
	Economic systems: market, command and mixed economies				
WEEK-3	Demand and supply: determinants, elasticity and market equilibrium			Reading: Review the determinants of demand and supply and the price mechanism in Field & Field (2016).	
	Price mechanisms and their role in resource allocation				
WEEK-4	Economics versus environment: the growth versus sustainability debate			Assignment: Write a short essay on the growth-versus-sustainability debate and the environment as natural capital, using Tietenberg & Lewis (2018), Environmental and Natural Resource Economics.	
	The environment as an economic and social asset: natural capital and ecosystem services				
WEEK-5	Unit-II (continued): Environmental Economics			Reading: Read about externalities and market failure in Kolstad (2011), Intermediate Environmental Economics.	
	Externalities, market failure and the environment: negative and positive externalities				
	Low-cost pathways to sustainability: green growth and decoupling				
WEEK-6	Economic valuation of ecosystem services: provisioning, regulating and cultural services			Assignment: Prepare a valuation exercise on ecosystem services and biodiversity conservation, drawing on Perman et al. (2011), Natural Resource and Environmental Economics.	
	The economics of biodiversity loss and the case for conservation				
WEEK-7	Unit-III: The Economics of Environmental Quality			Reading: Study Pigouvian taxes, public goods and the tragedy of the commons in Kolstad (2011).	
	Market failure and externalities: Pigouvian taxes and subsidies				

	Public goods, common pool resources and the tragedy of the commons	
WEEK-8	Property rights and the Coase Theorem: negotiation and efficiency	Assignment: Write a short analysis of the Coase Theorem applied to a local environmental dispute, citing Tietenberg & Lewis (2018).
	Environmental standards vs economic instruments: efficiency and equity	
MID TERM EXAMINATION		
WEEK-9	Unit-IV: Valuing Environmental Amenities and Benefit-Cost Analysis	Reading: Review direct and indirect valuation methods and the contingent valuation method in Perman et al. (2011).
	Valuation of environmental goods and services: direct and indirect methods	
	Contingent valuation method (CVM): willingness to pay and accept	
WEEK-10	Hedonic pricing and travel cost method for environmental valuation	Assignment: Solve a practice problem applying hedonic pricing/travel cost methods and cost-benefit analysis, using Field & Field (2016).
	Cost-benefit analysis (CBA) and its application in environmental project evaluation	
WEEK-11	Command and control regulations: standards, permits and enforcement	Reading: Read about command-and-control regulation versus market-based instruments in Tietenberg & Lewis (2018).
	Market-based instruments: emission taxes, subsidies and tradable pollution permits	
WEEK-12	Policy instruments to internalize externalities: theory and practice	Assignment: Prepare a case study comparing successful and unsuccessful environmental policy instruments, citing Kolstad (2011).
	Case studies of environmental policy success and failure (national and international)	
WEEK-13	Intergenerational equity and optimal extraction of renewable and non-renewable resources	Reading: Study intergenerational equity and optimal resource extraction in Perman et al. (2011).
	Economics of fisheries, forests and water resource management	
WEEK-14	Optimal pollution level and the marginal cost of abatement	Assignment: Prepare a short brief on Pakistan's natural resource depletion and policy gaps, using the latest Pakistan Economic Survey.
	The micro-economics of pollution: welfare analysis and deadweight loss	
	Pakistan's natural resources: economic value, depletion and policy gaps	
WEEK-15	Economics of global warming: the Stern Review and cost of inaction	Reading: Review the Stern Review on the economics of climate change (Stern, 2007) and international climate agreements.
	International climate agreements: Kyoto Protocol and Paris Agreement	
WEEK-16	Carbon pricing, carbon markets	Assignment: Submit a policy note on carbon pricing and climate finance mechanisms, drawing on Stern (2007) and Tietenberg & Lewis (2018), in preparation for the Final Term Examination.
	Climate finance mechanisms	
FINAL TERM EXAMINATION		

TEXT BOOKS AND READING MATERIAL

1. Tietenberg, T. & Lewis, L. (2018). Environmental and Natural Resource Economics (11th ed.). Routledge.
2. Field, B.C. & Field, M.K. (2016). Environmental Economics: An Introduction (7th ed.). McGraw-Hill.
3. Kolstad, C.D. (2011). Intermediate Environmental Economics (2nd ed.). Oxford University Press.
4. Perman, R. et al. (2011). Natural Resource and Environmental Economics (4th ed.). Pearson.
5. Stern, N. (2007). The Economics of Climate Change: The Stern Review. Cambridge University Press.
6. Pakistan Economic Survey (latest edition). Ministry of Finance, Government of Pakistan.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

1. classroom participation,
2. attendance, assignments and presentation,
3. homework
4. attitude and behavior,
5. hands-on-activities,
6. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

THIRD YEAR, SEMESTER V

Code	COURSE	CREDIT HOURS	CATEGORY
ENSC-301	Analytical Techniques in Environmental Science	3 (2-1)	Major
ENSC-302	Research Methods in Environmental Science	3 (3-0)	Major
ENSC-303	Geographical Information Systems and Remote Sensing	3 (2-1)	Major
ENSC-304	Environmental Governance Policy & Law	2 (2-0)	Major
ENSC-305	Internship	3 (3-0)	Major
ENSC-306	Elective – I *****	3 (3-0)	Major
Total Credit hrs Semester-I		17	

Program	BS Environmental Sciences	Course Code	ENSC-301	Credit hours	02
Course Title	ANALYTICAL TECHNIQUES IN ENVIRONMENTAL SCIENCES (THEORY)				
COURSE INTRODUCTION					
Sampling procedures, Preservation and sample digestion. Analytical techniques in Environmental Sciences, Spectroscopic methods (UV/VIS, IR, AAS, FES), Chromatographic techniques and Gravimetric analysis.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. A clear idea about sampling procedures, precise measurement and analysis of environmental pollution using different Instruments.					
2. Understand and apply the fundamental principles of analytical chemistry					
3. Understand and follow standard operating procedures of analysis.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to Analytical Chemistry			Fundamentals of Analytical Chemistry by Skoog Page 1-8	
	Role of Analytical Chemistry in Environmental Science				
	Overview of the analytical process				
WEEK-2	Qualitative analysis: principles and applications			Fundamentals of Analytical Chemistry by Skoog Page 8-10	
	Quantitative analysis in environment.				
WEEK-3	Unit-II: Classical Methods of Analysis			Principles of Analytical Chemistry by Haq Nawaz Page 11-15	
	Volumetric analysis and its types (acid-base, redox, complexometric, precipitation titrations)				
WEEK-4	Gravimetric analysis: principles, procedure,			Principles of Analytical Chemistry by Haq Nawaz Page 18-20	
	Gravimetric applications in environmental science				
WEEK-5	Classical methods versus instrumental methods of analysis			Principles of Analytical Chemistry by Haq Nawaz Page 30-35	
	Selection criteria for appropriate analytical methods				
WEEK-6	Unit-III: Spectroscopic Analysis			Analytical Chemistry by GD Christian, Page 398-402	
	Electromagnetic spectra - Absorption and Emission phenomena in spectroscopy				
WEEK-7	Lambert Beer's Law and its significance			Analytical Chemistry by GD Christian, Page 445	
	Lambert Beer’s Law calculation				
WEEK-8	Flame Emission Photometry			Quiz	
	Principles and environmental applications				
MID TERM EXAMINATION					
WEEK-9	Unit-III (continued) - Atomic Absorption Spectrophotometry (AAS)			Analytical Chemistry by GD Christian, Page 410	
	Principles, instrumentation, and applications in environmental monitoring				
WEEK-10	Molecular analysis using UV/VIS Spectrophotometry			Analytical Chemistry by GD Christian, Page 420-428	
	Principles and environmental applications				
WEEK-11	Infrared (IR) Spectrophotometry: principles and applications			Quiz / Presentation	
	Molecular identification and structural analysis				
WEEK-12	Unit-IV: Chromatographic Analysis			Analytical Chemistry by GD Christian, Page 505-510	
	Principles of adsorption and partition chromatography				

WEEK-13	Paper chromatography and Thin Layer Chromatography (TLC)	Analytical Chemistry by GD Christian, Page 505-510
	Column chromatography: principles and procedure	
WEEK-14	Applications in separation of environmental pollutants	Quiz / Presentation
	Gas Chromatography (GC): principle, instrumentation, and working. Gas Chromatography-Mass Spectrometry (GCMS) and its environmental applications	
WEEK-15	High Pressure Liquid Chromatography (HPLC): principles, components, and applications	Analytical Chemistry by GD Christian, Page 520-528
	Comparison of chromatographic techniques	
WEEK-16	overview and comparison of all analytical techniques	Quiz
	Applications of spectroscopic and chromatographic methods in environmental monitoring and research	

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Fundamentals of Analytical Chemistry by Douglas A. Skoog, Donald M. West and F. James Holler (2011). 10 Edition Fort Worth, Tex: Saunders College Publishers.
2. Analytical Chemistry by Gary D. Christian (2014), Jon Willey & Sons Inc
3. Harris, D.C., and Lucy, C.A. (2020). *Quantitative Chemical Analysis*, Tenth Edition. W.H. Freeman & Company, New York
4. Bhatti, H. N. (2017). *Principles of Analytical Chemistry*. Carvan Book House, Lahore.
5. Greenberg, A. (2005). *Standard Methods for the Examination of Water & Wastewater*. American Public Health Association.

Further Reading: As suggested by the Instructor.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-301	Credit hours	01
Course Title	ANALYTICAL TECHNIQUES IN ENVIRONMENTAL SCIENCES (PRACTICAL)				
COURSE INTRODUCTION					
This course provides hands-on training in environmental sampling, sample preparation, and instrumental analysis of air, water and soil using standard analytical techniques and procedures.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. A clear idea about sampling procedures, precise measurement and analysis of environmental pollution using different Instruments.					
2. Understand and apply the fundamental principles of analytical chemistry					
3. Understand and follow standard documented procedure of analysis.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Lab orientation: safety rules, equipment familiarization, and introduction to Standard Operating Procedures (SOPs) for environmental analysis			ASTM Standards Latest	
WEEK-2	Unit-I: Sampling techniques for water chemical analysis collection, preservation, and storage of water samples (surface water, groundwater, wastewater)			Laboratory Manual Practical #1	
WEEK-3	Sampling techniques for air chemical analysis – passive and active air sampling methods and preservation			Laboratory Manual Practical #2	
WEEK-4	Sampling techniques for soil chemical analysis – sample collection, homogenization, drying, and storage procedures			Laboratory Manual Practical #3	
WEEK-5	Unit-II: Pre-concentration methods liquid-liquid extraction, solid phase extraction (SPE), and evaporation techniques for environmental samples			Laboratory Manual Practical #4	
WEEK-6	Unit-III: Wet digestion methods (acid digestion) for soil and water samples Preparation for metal analysis			Quiz	
WEEK-7	Dry ashing and microwave digestion methods comparison, applications, and complete sample preparation protocol			Laboratory Manual Practical #5	
WEEK-8	Classical analysis: Volumetric analysis (acid-base and complexometric titrations) for estimation of parameters in water samples			Laboratory Manual Practical #6	
MID TERM EXAMINATION					
WEEK-9	Classical analysis (continued): Gravimetric analysis – determination of total dissolved solids (TDS) and total suspended solids (TSS) in water samples			Discussion	
WEEK-10	Unit-IV: Cationic estimation by Flame Photometry Determination of Na ⁺ and K ⁺ in water and soil samples; calibration and result interpretation			Handouts	
WEEK-11	Flame Photometry – estimation of Ca ²⁺ and other cations; comparing results with standard reference values			Laboratory Manual Practical #7	
WEEK-12	Unit-V: Estimation of metal ions by Atomic Absorption Spectrophotometry (AAS) determination of heavy metals (Pb, Cd, Cr) in water samples			Quiz	
WEEK-13	AS analysis of metal ions (Fe, Cu, Zn, Mn) in soil and sediment samples; data analysis and comparison with permissible limits			Discussions	

WEEK-14	Unit-VI: Determination of anions (nitrates, phosphates, sulfates) by UV/VIS Spectrophotometry calibration curves and sample analysis	Laboratory Manual Practical #8	
WEEK-15	Determination of colored pollutants and organic compounds by UV/VIS Spectrophotometry in environmental samples	Laboratory Manual Practical #9	
WEEK-16	GC/HPLC demonstration and practical review instrument overview, chromatogram interpretation, and submission of final lab portfolio/report	Quiz	
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Fundamentals of Analytical Chemistry by Douglas A. Skoog, Donald M. West and F. James Holler (2011). 10 Edition Fort Worth, Tex: Saunders College Publishers. 2. Analytical Chemistry by Gary D. Christian (2014), Jon Willey & Sons Inc 3. Harris, D.C., and Lucy, C.A. (2020). <i>Quantitative Chemical Analysis</i>, Tenth Edition. W.H. Freeman & Company, New York 4. Bhatti, H. N. (2017). <i>Principles of Analytical Chemistry</i>. Carvan Book House, Lahore. 5. Greenberg, A. (2005). <i>Standard Methods for the Examination of Water & Wastewater</i>. American Public Health Association. Further Reading: As suggested by the Instructor.			
TEACHING – LEARNING STRATEGIES			
Lecture based examination Presentation/seminars Class discussion Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: classroom participation, attendance, assignments and presentation, homework attitude and behavior, hands-on-activities, short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-302	Credit hours	03
Course Title	RESEARCH METHODS IN ENVIRONMENTAL SCIENCES				
COURSE INTRODUCTION					
This course will provide an opportunity for participants to establish their basic understanding about research, its types and methods used in environmental studies. Secondly, the participants will be able to learn about developing scientific questions, developing synopsis and applying variety of research designs in environmental studies. Further, the participants will be able handle and analyze data through statistical and mapping tools/software. Further, understanding about writing publications, and editorial process will also be a part of this course. The course introduces the language of research, ethical principles and challenges, and the elements of the research process within quantitative, qualitative, and mixed methods approaches. Participants will use these theoretical underpinnings to begin to critically review literature relevant to their field or interests and determine how research findings are useful in forming their understanding of their work, social, local and global environment.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: - Understand research, its major types and methods in Environmental Sciences - Be aware of the ethical principles of research, - Identify the components of a literature review process - Understand synopsis, research design and data acquisition in environmental studies - Describe quantitative, qualitative and mixed methods approaches to research - Understand data analysis through statistical and mapping tools - Understanding research publications and editorial process					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Fundamentals of Research Methods Introduction to research: definition, purpose, and importance			Introductory session, Previous knowledge checking	
	Types of research in Environmental Sciences (basic, applied, action research)			Classify 4 sample study titles into research types.	
	Significance of research in addressing local and global environmental challenges			Real-World Impact Mapping (e.g., air pollution, solid waste, water quality, biodiversity loss).	
WEEK-2	The scientific method: steps and applications in environmental research			Scientific Steps Mapping	
	Research paradigms: positivism, interpretivism, and pragmatism			Research Paradigm Debate	
WEEK-3	Ethical principles in environmental research			Consent Form Drafting	
	Research integrity: plagiarism, fabrication, and falsification			Citation Practice Exercise	
	Institutional Review Boards (IRB) and ethics in field research			Field Ethics Checklist	
WEEK-4	Unit-II: Research Planning Identification and formulation of research questions and hypotheses			Selection of a topic within environmental sciences	

	introduction to research synopsis: components and structure	Explained preliminary proposals (brief outlines or concept notes)
	Developing research objectives and scope	
	Literature review process: purpose and methodology	
WEEK-5	Conducting a systematic literature review	Guided Google Scholar/university library search; prepare 5-key-article summary table.
	Critically evaluating sources: peer-reviewed journals, reports, and grey literature	
	Pilot surveys: design and purpose	Design a 6–8 question pilot questionnaire for an environmental survey.
WEEK-6	Unit-III: Research Design Qualitative and quantitative research: characteristics and comparison	Book Reading (John W. Creswell & J. David Creswell, 2018) pp. 38-62, 231-284
	Deductive and inductive research approaches	
	Descriptive, explanatory, predictive, and empirical research designs	
	Mixed methods research: rationale and design	
WEEK-7	Case study design: features and environmental applications	Article Review
	Experimental design: controlled experiments in environmental science	
	Validity and reliability in research design	
WEEK-8	Unit-IV: Data Acquisitions in Environmental Studies Primary and secondary data: sources, advantages, and limitations	Identify 3 primary and 3 secondary sources
	Environmental survey data: methods and instruments	Convert pilot questionnaire into final survey form; discuss scaling (Likert, categorical).
	Experimental designs for environmental monitoring	Sketch a simple experimental design
	Field sampling for water, dust, soil, and air samples	Video: sampling bottles, preservation, chain-of-custody
MID TERM EXAMINATION		
WEEK-9	Unit-IV (continued)	
	Sampling of living organisms: protocols and ethical considerations	Case discussion on ethical sampling; prepare short ethical checklist for a field study
	Ethics in field sampling: permissions and data confidentiality	
WEEK-10	Questionnaire design: types, structure, and validation	Book Reading (John W. Creswell & J. David Creswell, 2018) pp. 302, 349, 379 Research Methodology for Environmental Studies pp. 77-89
	Interview and focus group methods in environmental research	
	Sampling techniques: random, stratified, cluster, and purposive sampling	
	Sample size determination and power analysis	(John W. Creswell & J. David Creswell, 2018) pp.248, 249, 261 Research Methodology for Environmental Studies pp. 175

WEEK-11	Unit-V: Data Analysis and Report Writing Data input, cleaning, and quality control	SPSS Practical: Enter sample dataset and produce descriptive statistics and frequency tables. Run independent-sample t-test on two sample groups (e.g., site A vs B), ANOVA, regression analysis
	Application of descriptive statistics: mean, median, mode, variance, standard deviation	
	Inferential statistical tools: t-tests, ANOVA, regression analysis	
WEEK-12	Mapping tools in environmental studies: GIS integration with research data	Show simple QGIS/ArcGIS map (point sampling)
	Data visualization: graphs, charts, and maps	
	Statistical software overview: SPSS, R, Excel	
WEEK-13	Contents and structure of research reports and scientific papers	Review a short sample report and mark the sections
	Scientific writing: abstract, introduction, methodology, results, discussion, conclusion	
	Report compilation: tables, figures, and references	
	Referencing styles: APA, Harvard, and Vancouver	Show APA examples; small referencing exercises
WEEK-14	Unit-VI: Research Publications Introduction to research publications: journals, conference papers, and technical reports	Find one journal suitable for the mini report topic
	Types of research publications: primary, secondary, and grey literature	Compare a journal article vs a technical report
	Preparation and submission of research publications	Research Paper Structure Review
WEEK-15	Introduction to journals: impact factor, h-index, and publisher reputation	Class talk: What impact factor/h-index mean
	Open access vs. subscription journals	Journal Identification Task, Simulate peer review in class
	Editorial process of research publications: peer review, revision, and acceptance	
	Predatory journals: identification and avoidance	
WEEK-16	Research dissemination: conferences, seminars, and policy briefs	Question to Publication
	Course synthesis: from research question to published findings	Peer Feedback Session
	Student research presentations and feedback	Presentations
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Tjora, A. (2018). <i>Qualitative Research as Stepwise-Deductive Induction</i>. Routledge Publisher. 2. Alley, M. (2018). <i>The Craft of Scientific Writing</i>. Springer-Verlag New York. 3. Bartels, K.P.R. and Wittmayer, J.M. (2018). <i>Action Research in Policy Analysis: Critical and Relational Approaches to Sustainability Transitions</i>. Routledge Publisher. 4. Smith, R.L., Nychka, D., Waller, L.A. and Schmidt, A. (2018). <i>Applied Environmental Statistics</i>. CRC Press, Taylor and Francis Group. 5. Creswell, J. W., & Creswell, J. D. (2017). <i>Research design: Qualitative, quantitative, and mixed methods approaches</i>. Sage publications. 6. Cook, E. R., & Kairiukstis, L. A. (Eds.). (2013). <i>Methods of dendrochronology: applications in the environmental sciences</i>. Springer Science & Business Media.		

7. Walliman, N. (2010). *Research methods: The basics*. Routledge.
8. Blackwell, J. and Martin, J. (2011). *A Scientific Approach to Scientific Writing*. Springer-Verlag New
9. Manly, B.F.J. (2008). *Statistics for Environmental Science and Management*. Chapman and Hall/CRC

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-303	Credit hours	02
Course Title	GEOGRAPHICAL INFORMATION SYSTEMS AND REMOTE SENSING (THEORY)				
COURSE INTRODUCTION					
This course provides knowledge about spatial and non-spatial datasets, spatial data creation, Data joining and import & export, digital cartography, spatial analysis, Applications of GIS & Remote sensing in environmental studies					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Spatial, non-spatial datasets including vector and raster datasets 2. Georeferencing, Digitization and Topological techniques 3. Digital cartography (Species mapping, water quality and quantity mapping) 4. Freely available online spatial data platforms 5. GIS and Remote sensing in Environmental sciences					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Fundamentals of GIS & Remote Sensing, Introduction to GIS: definitions, components, and applications -		Pucha Cofrep (2018) Ch.1 pp.1–25 Chuvieco (2020) Ch.1 pp.1–30		
	Globe and Coordinate Systems (geographic and projected)				
WEEK-2	Raster data model: characteristics, resolution, and applications		Pucha Cofrep (2018) Ch.2 pp.30–55; Ch.3 pp.56–80		
	Vector data model: points, lines, polygons, applications and comparison with raster				
WEEK-3	Georeferencing: absolute and relative georeferencing		Pucha Cofrep (2018) Ch.4 pp.85–110 Liu & Mason (2024) pp.50–75		
	Spatial adjustment techniques and control points				
WEEK-4	Spatial Data Creation		Pucha Cofrep (2018) Ch.5 pp.115–140		
	Shapefiles: structure and types				
WEEK-5	Geodatabases: personal and file geodatabases		Pucha Cofrep (2018) Ch.6 pp.145–170		
	digitization process: on-screen digitization				
WEEK-6	Topological errors and correction methods		Pucha Cofrep (2018) Ch.7 pp.175–200		
	Attribute tables: data entry and management				
WEEK-7	Data joining and relationship between spatial and tabular data introduction to geodatabases		Singh et al. (2022) pp.40–70 Liu & Mason (2024) pp.90–120		
	Data Acquisition and Vector Analysis				
	Online freely available spatial data platforms (DIVA GIS, USGS Earth Explorer, OpenStreetMap)				
WEEK-8	Spatial Data Import and Export formats (Shapefile, KML, GeoJSON)		Pucha Cofrep (2018) Ch.8 pp.210–250		
	Spatial Analysis: Buffer analysis, Masking, Clipping, and Querying				
	Vector and Raster Overlays and Overlay Analysis				

MID TERM EXAMINATION		
WEEK-9	Digital Cartography	Quattrochi & Goodchild (2023) Ch.2 pp.30–60
	Principles of Digital Cartography	
	Map elements: title, legend, scale bar, north arrow, grid	
WEEK-10	Cartography techniques: choropleth, graduated symbols, dot density maps	Pucha Cofrep (2018) Ch.9 pp.255–290
	Large-scale and Small-scale maps: preparation and applications	
WEEK-11	Unit-V: Remote Sensing Science Introduction to Remote Sensing: definitions and principles	Chuvieco (2020) Ch.2 pp.35–70
	Remote sensing resolutions: spatial, spectral, temporal, radiometric	
WEEK-12	Electromagnetic Spectrum (EMS) and energy interactions with atmosphere and earth surface	Emery & Camps (2017) Ch.3 pp.60–95
	Absorption and reflectance properties of different features	
WEEK-13	Remote sensing platforms: satellites, airborne sensors	Emery & Camps (2017) Ch.4 pp.100–140
	Sensor types: passive and active sensors Satellite orbits: polar, sun-synchronous, geostationary	
WEEK-14	Raster Analysis	Liu & Mason (2024) pp.130–170
	Imagery rectification and pre-processing	
	Band combinations and image enhancement techniques	
WEEK-15	Introduction to Digital Elevation Model (DEM)	Liu & Mason (2024) pp.180–210
	Extracting Elevation, Contours, Slope, and Aspect from DEM	
WEEK-16	satellite Imagery for Land Use/Land Cover Classification	Liu & Mason (2024) pp.220–260 Chuvieco (2020) pp.200–240
	Supervised and unsupervised classification techniques - Accuracy assessment of classified images	
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Liu, J. G., & Mason, P. J. (2024). Image processing and GIS for remote sensing: techniques and applications John Wiley & Sons. 2. Quattrochi, D. A., & Goodchild, M. F. (Eds.). (2023). Scale in remote sensing and GIS. CRC press. 3. Singh, V. P., Yadav, S., Yadav, K. K., Perez, G. A. C., Muñoz-Arriola, F., & Yadava, R. N. (Eds.). (2022). Application of Remote Sensing and GIS in Natural Resources and Built Infrastructure Management. Springer. 4. Petrou, M. M., & Kamata, S. I. (2021). <i>Image processing: dealing with texture</i>. John Wiley & Sons. 5. Chuvieco, E. (2020). Fundamentals of satellite remote sensing: An environmental approach. CRC press. 6. Pucha-Cofrep, F., Fries, A., Cánovas-García, F., Oñate-Valdivieso, F., González-Jaramillo, V., & Pucha-Cofrep, D. (2018). <i>Fundamentals of GIS: applications with ArcGIS</i>. Franz Pucha Cofrep. 7. Emery, W., & Camps, A. (2017). <i>Introduction to satellite remote sensing: atmosphere, ocean, land and cryosphere applications</i>. Elsevier.		
TEACHING – LEARNING STRATEGIES		
Lecture based examination Presentation/seminars Class discussion Quizzes		

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-303	Credit hours	01
Course Title	GEOGRAPHICAL INFORMATION SYSTEMS AND REMOTE SENSING (PRACTICAL)				
COURSE INTRODUCTION					
This course provides practical knowledge about spatial and non-spatial datasets, Data joining and import & export, digital cartography, spatial analysis, digital Elevation Model and Image analysis. Applications of GIS & RS in environmental studies. Different software’s will be used to perform these activities					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Georeferencing, Digitization and Topological techniques 2. Large and Small-scale maps preparation 3. Downloading of different freely available spatial datasets 4. Image processing and classification					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Introduction to GIS software (QGIS/ArcGIS) Interface navigation, toolbars, and basic operations; understanding geographic and projected coordinate systems		Identify toolbars, panels, and navigation tools; Load a shapefile and display CRS properties		
WEEK-2	Measurements and data preparation on Globe and Google Earth distance, area measurements, and coordinate identification; working with geographic vs projected CRS		Use Google Earth: Measure distance & area; Identify coordinates Compare geographic vs projected CRS		
WEEK-3	Google Earth/Google Maps data collection, placemark creation, KML file export, and importing KML into GIS software		Create placemarks in Google Earth Export as KML, Import KML into GIS software		
WEEK-4	Absolute and Relative Georeferencing registering scanned maps and satellite images to real-world coordinates using ground control points (GCPs)		Georeference a scanned map using GCPs Evaluate RMS error		
WEEK-5	Digitization of spatial features (points, lines, polygons) on-screen digitization and identification and correction of topological errors		Points (schools), Lines (roads) Polygons (land use), Correct topological errors		
WEEK-6	Attribute table management, data entry, field calculation, and table joins; creating and managing geodatabases		Create attribute table, Perform field calculations, Join Excel table with spatial data		
WEEK-7	Data downloading from freely available online platforms DIVA GIS, USGS Earth Explorer, OpenStreetMap, and Pakistan spatial datasets		Download datasets from: USGS Earth Explorer OpenStreetMap Document metadata		
WEEK-8	Spatial data import and export working with KML, Shapefile, GeoJSON, CAD, and Excel file formats in GIS software		Import/export: Shapefile, KML, GeoJSON, Convert format		
MID TERM EXAMINATION					
WEEK-9	Buffer analysis, Masking, and Clipping operations practical applications in environmental impact zones and protected area analysis		Perform: Buffer (e.g., 1 km around roads) Clip and Mask operations		

WEEK-10	Vector and Raster Overlays and overlay analysis; spatial querying using attribute and location-based queries	Perform overlay: Intersect / Union, Run spatial queries (attribute + location)
WEEK-11	Digital Cartography – creation of large-scale and small-scale maps with complete cartographic elements (legend, scale bar, north arrow, grid, labels)	Create a thematic map: Add legend, north arrow, scale bar, Prepare both: Large-scale map, Small-scale map
WEEK-12	Digital Elevation Model (DEM) and Satellite Imagery downloading from USGS Earth Explorer/SRTM; loading, visualizing, and pre-processing in GIS	Download DEM & satellite imagery, Load and visualize raster data
WEEK-13	Extraction of Elevation, Contours, Slope, and Aspect layers from DEM; hydrological analysis and watershed delineation	Generate: Slope, Aspect, Contours, Perform watershed delineation
WEEK-14	Satellite Image classification – supervised classification using training samples and maximum likelihood classifier	Perform supervised classification, Create training samples, Apply Maximum Likelihood
WEEK-15	Unsupervised classification (K-means/ISODATA) land use/land cover mapping and accuracy assessment using confusion matrix	Perform unsupervised classification, Generate confusion matrix, Calculate accuracy
WEEK-16	Final practical project – preparation and presentation of a complete GIS/Remote Sensing project map; submission of practical portfolio and final report	Complete final project: Data collection, Analysis, Map layout, Submit report + presentation

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Liu, J. G., & Mason, P. J. (2024). Image processing and GIS for remote sensing: techniques and applications. John Wiley & Sons.
2. Quattrochi, D. A., & Goodchild, M. F. (Eds.). (2023). Scale in remote sensing and GIS. CRC press.
3. Singh, V. P., Yadav, S., Yadav, K. K., Perez, G. A. C., Muñoz-Arriola, F., & Yadava, R. N. (Eds.). (2022). Application of Remote Sensing and GIS in Natural Resources and Built Infrastructure Management. Springer.
4. Petrou, M. M., & Kamata, S. I. (2021). *Image processing: dealing with texture*. John Wiley & Sons.
5. Chuvieco, E. (2020). Fundamentals of satellite remote sensing: An environmental approach. CRC press.
6. Pucha-Cofrep, F., Fries, A., Cánovas-García, F., Oñate-Valdivieso, F., González-Jaramillo, V., & Pucha-Cofrep, D. (2018). *Fundamentals of GIS: applications with ArcGIS*. Franz Pucha Cofrep.
7. Emery, W., & Camps, A. (2017). *Introduction to satellite remote sensing: atmosphere, ocean, land and cryosphere applications*. Elsevier.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-304	Credit hours	02
Course Title	ENVIRONMENTAL GOVERNANCE POLICY & LAW				
COURSE INTRODUCTION					
This course explores the frameworks, institutions, and legal instruments that shape environmental governance at the local, national, and global levels. It provides an in-depth understanding of how environmental policies are formulated, implemented, and enforced, with a particular focus on legal principles, regulatory mechanisms, and the role of governmental and non-governmental actors.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. be able to demonstrate an understanding of federal and provincial environmental laws and their importance in the protection of environmental quality					
2. have a thorough understanding of international treaties and conventions on environmental issues of global concern					
WEEK	COURSE CONTENTS		Assignments / Readings		
WEEK-1	Unit-I: Fundamentals of Environmental Laws		Reading: Evans, J., & Thomas, C. (2023). Environmental Governance (Routledge), Ch. 1.		
	Environment Protection in Pakistan				
	Environmental Law: Scope and Definition				
WEEK-2	Environmental Consciousness in Pakistan		Reading: Tan, A. (2002). Historical Development of International Environmental Law, Ch. 1. Assignment: Write a 500-word reflective essay on the significance of environmental consciousness in Pakistan.		
	Key Principles of Environmental Law				
WEEK-3	Unit-II: Historical Development of Environmental Laws		Reading: Bodansky, D., et al. (2024). The Art and Craft of International Environmental Law (OUP), Ch. 2.		
	Historical Development of Pakistani Environmental Laws				
	History of International Environmental Law				
WEEK-4	Stockholm Conference (1972) and its Declarations		Reading: Stockholm Conference (1972) Declaration — selected articles.		
	World Charter for Nature				
WEEK-5	Rio Declaration (UNCED) / Earth Summit 1992		Assignment: Prepare a comparative timeline of Pakistani and international environmental law milestones from 1970 to 2000.		
	Agenda 21 and Earth Charter				
WEEK-6	International Covenant on Environment and Development		Reading: Review selected sections of Agenda 21 and the Earth Charter. Class Discussion: Compare Pakistan's legislative response to international milestones.		
	Post-Rio International Environmental Milestones				

WEEK-7	Unit-III: Human Rights and Environmental Laws	Reading: Nanda, V. (2023). International Environmental Law & Policy, Vol. 2, Ch. 3 (Human Rights & Environment).
	Environmental Rights and Human Rights: Linkages	
	Islam and the Environment	
WEEK-8	Pakistani Environmental Laws: PEPA 1997	Reading: Pakistan Environmental Protection Act 1997 — selected sections. Field Visit: Trip to the Punjab Environment Department.
	Environmental Impact Assessment (EIA) under PEPA	
MID TERM EXAMINATION		
WEEK-9	Environmental Laws on Water: Quality and Quantity	Assignment: Conduct an EIA case study on a local environmental issue using PEPA guidelines and submit a 600-word report.
	Environmental Laws on Air and Noise Pollution	
WEEK-10	Environmental Laws on Conservation and Forest Protection	Class Discussion: Review recent environmental cases litigated under PEPA. Quiz: Water, Air & Noise Pollution Laws.
	Environmental Laws on Waste Management	
WEEK-11	Unit-IV: National Conservation Strategies	Reading: Fiorino, D. J. (2023). Making Environmental Policy (Univ. of California Press), Ch. 5; National Conservation Strategy of Pakistan (1992) — selected sections.
	Review of National Conservation Strategy (1992)	
	NGOs and the Environment in Pakistan	
WEEK-12	Environmental Cases in Pakistan: Case Studies	Assignment: Evaluate the role of NGOs in implementing Pakistan's National Conservation Strategy; present a 400-word policy brief.
	From Stockholm to Rio to the 21st Century: A Review	
WEEK-13	What are International Environmental Treaties?	Class Discussion: Analyse a selected international environmental treaty and Pakistan's obligations. Quiz: National Conservation Strategies.
	Pakistan's Participation in International Environmental Treaties	
WEEK-14	Unit-V: Environmental Laws and Policies in Pakistan	Reading: Environmental Governance: Law, Policy and Practice (2025, OrangeBooks), Ch. 7; National Environmental Policy of Pakistan (2005) — full document review.
	National Environmental Policy of Pakistan (2005) and its Implementation	
	All Environment-Related Policies of Pakistan	
WEEK-15	Conservation Strategies and National Action Plans	Assignment: Draft a 700-word critical analysis of Pakistan's National Environmental Policy, comparing it with at least one international environmental convention.
	Global Collaborations and International Conventions Ratified by Pakistan	
WEEK-16	Environmental Provisions in the Constitution of Pakistan	Class Discussion: Future directions for environmental governance in Pakistan. Course Review and Exam Preparation.
	Environmental Planning and Sustainable Development Goals (SDGs)	
FINAL TERM EXAMINATION		

TEXT BOOKS AND READING MATERIAL

1. Evans, J., & Thomas, C. (2023). Environmental Governance. Routledge.
2. Tan, A. (2002). Historical Development of International Environmental Law. Ch. 1.
3. Bodansky, D., et al. (2024). The Art and Craft of International Environmental Law. Oxford University Press.
4. Nanda, V. (2023). International Environmental Law & Policy, Vol. 2. Transnational Publishers.
5. Fiorino, D. J. (2023). Making Environmental Policy. University of California Press.
6. Environmental Governance: Law, Policy and Practice. (2025). OrangeBooks.
7. Pakistan Environmental Protection Act 1997 (PEPA).
8. National Conservation Strategy of Pakistan (1992).
9. National Environmental Policy of Pakistan (2005).
10. Stockholm Conference (1972) Declaration — selected articles.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-305	Credit hours	03
Course Title	INTERNSHIP				

REQUIREMENT OF INTERNSHIP

Supervision of internship of 3 credit hours in accordance with HEC Undergraduate Education Policy is a mandatory degree award requirement for BS Environmental Science. This requirement must be graded and supervised under a faculty member in collaboration with a supervisor in the field, protocols of which will be determined by the concerned department subject to approval of the same by the university's relevant statutory body.

Program	BS Environmental Sciences	Course Code	ENSC-306	Credit hours	03
Course Title	ELECTIVE - I				

ELECTIVE – I *****

An Elective Course of 03 Credit hrs will be opted from the Elective Courses List

THIRD YEAR, SEMESTER VI

Code	COURSE	CREDIT HOURS	CATEGORY
ENSC-307	Disaster Risk Management	3 (3-0)	Major
ENSC-308	Solid Waste Management	3 (3-0)	Major
ENSC-309	Environmental Management Systems	3 (3-0)	Major
ENSC-310	Elective – II *****	3 (3-0)	Major
ENSC-311	Elective – III *****	3 (3-0)	Major
Total Credit hrs Semester-VI		15	

Program	BS Environmental Sciences	Course Code	ENSC-307	Credit hours	03
Course Title	DISASTER RISK MANAGEMENT				
COURSE INTRODUCTION					
Natural hazards and processes, disaster prediction, and risk assessment, Early warning, human response to hazards, avoiding and adjusting to hazards, population increase, land-use change, and natural hazards.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Develop a critical capacity to evaluate the principles and practices of disaster risk reduction and management; 2. Develop a deep understanding of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe; 3. Develop the capacity to participate in debates on disaster governance and societal reconstruction.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Fundamentals of Disaster Risk Management Definitions and key concepts in disaster and risk management		Keller & DeVecchio (2016) Ch.1 pp.1-30 Wisner et al. (2004) Ch.1 pp.3-36		
	Types of disasters: natural, human-made and technological		Keller & DeVecchio (2016) Ch.1 pp.1-30 Wisner et al. (2004) Ch.2 pp.37-86		
	Principles of risk management and vulnerability assessment		Wisner et al. (2004) Ch.2 pp.37-86 Bankoff et al. (2004) pp.1-28		
	Global frameworks and policies for disaster management		Kelman et al. (2017) Ch.1 pp.1-18 UNDRR (2015) pp.1-12		
WEEK-2	Understanding the disaster management cycle.		Kelman et al. (2017) Ch.2 pp.19-38 Keller & DeVecchio (2016) pp.22-30		
	Sendai Framework for Disaster Risk Reduction (2015–2030)		UNDRR (2015) pp.1-25 Kelman et al. (2017) pp.39-60		
	Role of UNDRR, NDMA (Pakistan), and other institutions		NDMA Pakistan Act/Plan pp.1-20 UNDRR (2015) pp.12-25		
WEEK-3	Difference between hazard, disaster, risk, and vulnerability.		Wisner et al. (2004) Ch.1 pp.3-36 Bankoff et al. (2004) pp.29-48		
	Climate change and disaster risks		Kelman et al. (2017) Ch.3 pp.39-60 Maslin (2021) pp.69-105		
	Importance of disaster education and awareness		Kelman et al. (2017) Ch.8 pp.141-162 Wisner et al. (2004) pp.331-356		
WEEK-4	Unit-II: Risk Assessment and Hazard Identification Hazard identification and mapping		Keller & DeVecchio (2016) Ch.2 pp.31-60 Kelman et al. (2017) pp.85-110		
	Vulnerability and capacity assessment		Wisner et al. (2004) Ch.2 pp.37-86 Bankoff et al. (2004) pp.49-74		
	Analyzing Risk Factors: Environmental, Social, And Economic		Bankoff et al. (2004) pp.75-104 Wisner et al. (2004) pp.87-124		
	Risk prioritization and decision-making models		Kelman et al. (2017) pp.111-132 Keller & DeVecchio (2016) pp.31-60		

WEEK-5	Tools for disaster risk assessment	Keller & DeVecchio (2016) Ch.2 pp.31-60 Kelman et al. (2017) pp.85-110
	Risk communication strategies	Kelman et al. (2017) pp.163-184 Wisner et al. (2004) pp.356-376
	Community perception of risk	Bankoff et al. (2004) pp.105-130 Wisner et al. (2004) pp.87-124
WEEK-6	Role of historical records in hazard assessment	Keller & DeVecchio (2016) pp.31-60 Wisner et al. (2004) pp.125-168
	Multi Hazard Risk assessment approaches	Keller & DeVecchio (2016) Ch.2 pp.31-60 Kelman et al. (2017) Ch.5 pp.85-110
	Uncertainty in disaster prediction	Keller & DeVecchio (2016) pp.19-30 Kelman et al. (2017) pp.185-206
	Case Studies in Hazard Identification and Risk Assessment	Keller & DeVecchio (2016) case studies pp.183-206 Wisner et al. (2004) pp.125-168
WEEK-7	Unit-III: Disaster Preparedness and Early Warning Systems Components of early warning systems	Kelman et al. (2017) Ch.6 pp.111-132 UNDRR (2015) pp.10-18
	Planning for disaster preparedness	Kelman et al. (2017) pp.111-132 Wisner et al. (2004) pp.331-356
	Designing and implementing early warning systems (planning, drills, and simulation exercises)	Kelman et al. (2017) pp.207-232 UNDRR (2015) pp.16-20
WEEK-8	Emergency communication and public awareness campaigns	Kelman et al. (2017) pp.233-252 Wisner et al. (2004) pp.356-376
	Training and capacity-building for disaster readiness	Kelman et al. (2017) pp.253-274 Bankoff et al. (2004) pp.131-154
	Resource mobilization and logistical planning	Kelman et al. (2017) pp.275-296 Oxford Handbook (2018) pp.145-170
	Case study: Successful early warning systems in practice	Keller & DeVecchio (2016) case studies pp.207-230 Kelman et al. (2017) pp.207-232
MID TERM EXAMINATION		
WEEK-9	Unit-IV: Disaster Response and Emergency Management Principles of effective disaster response	Kelman et al. (2017) Ch.9 pp.185-206 Wisner et al. (2004) pp.377-410
	Incident command systems and coordination mechanisms	Kelman et al. (2017) pp.207-232 Wisner et al. (2004) pp.377-410
	Managing humanitarian assistance and relief operations	Kelman et al. (2017) pp.275-296 Oxford Handbook (2018) pp.171-198
WEEK-10	Ensuring safety and security during emergencies	Keller & DeVecchio (2016) pp.231-254 Kelman et al. (2017) pp.297-318
	Post-disaster assessment and documentation	Kelman et al. (2017) pp.319-340 Oxford Handbook (2018) pp.199-224
	Case study: Coordinated response to a major disaster	Keller & DeVecchio (2016) case studies pp.255-278 Wisner et al. (2004) pp.377-410
	Challenges in disaster logistics	Kelman et al. (2017) pp.341-362 Oxford Handbook (2018) pp.225-252

WEEK-11	Disaster response in developing countries	Wisner et al. (2004) Ch.6 pp.207-258 Bankoff et al. (2004) pp.155-178
	Coordination between international aid agencies	Kelman et al. (2017) pp.275-296 Wisner et al. (2004) pp.411-438
	Media role during disaster response	Kelman et al. (2017) pp.233-252 Bankoff et al. (2004) pp.179-204
WEEK-12	Unit-V: Recovery and Rehabilitation Strategies Principles of post-disaster recovery and reconstruction	Kelman et al. (2017) Ch.10 pp.207-232 Oxford Handbook (2018) pp.253-280
	Building back better: sustainable recovery practices	UNDRR (2015) Priority 4 pp.18-22 Kelman et al. (2017) pp.207-232
	Restoring infrastructure and essential services	Kelman et al. (2017) pp.297-318 Oxford Handbook (2018) pp.281-306
WEEK-13	Psychosocial support and community resilience building	Wisner et al. (2004) pp.331-356 Bankoff et al. (2004) pp.205-230
	Relocation of Disaster-affected communities	Wisner et al. (2004) pp.259-300 Bankoff et al. (2004) pp.231-256
	Cultural heritage preservation after disasters	Kelman et al. (2017) pp.363-384 Oxford Handbook (2018) pp.307-330
	Long-term Recovery	Kelman et al. (2017) pp.385-406 Wisner et al. (2004) pp.411-438
WEEK-14	Monitoring and evaluating recovery efforts	Kelman et al. (2017) pp.407-428 Oxford Handbook (2018) pp.331-358
	Role of Insurance in recovery	Oxford Handbook (2018) pp.359-386 Kelman et al. (2017) pp.429-448
	Case study: Successful recovery initiatives in disaster-affected regions.	Keller & DeVecchio (2016) case studies pp.279-302 Kelman et al. (2017) pp.385-406
WEEK-15	Unit-VI: Technological Innovations and Community Engagement The role of technology in disaster risk management	Kelman et al. (2017) pp.449-470 Keller & DeVecchio (2016) pp.303-326
	Geographic Information Systems (GIS) and remote sensing	Keller & DeVecchio (2016) pp.303-326 Kelman et al. (2017) pp.449-470
	Mobile applications and data tools for disaster response	Kelman et al. (2017) pp.471-492 UNDRR (2015) pp.22-24
	Artificial Intelligence for Disaster predictions	Kelman et al. (2017) pp.493-514 Keller & DeVecchio (2016) pp.327-350
WEEK-16	Promoting community-based disaster risk reduction	Wisner et al. (2004) pp.331-356 Kelman et al. (2017) pp.515-536
	Public-private partnerships in disaster management	Kelman et al. (2017) pp.537-558 Oxford Handbook (2018) pp.387-412
	Case study: Using technology to empower communities	Kelman et al. (2017) pp.559-580 Wisner et al. (2004) pp.411-438
FINAL TERM EXAMINATION		

TEXT BOOKS AND READING MATERIAL

1. Keller, E. A., & DeVecchio, D. E. (2016). Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes. Routledge.
2. Wisner, B., Blaikie, P., Cannon, T., & Davis, I. (2004). At Risk: Natural Hazards, People's Vulnerability and Disasters (2nd ed.). Routledge.
3. Kelman, I., Mercer, J., & Gaillard, J. C. (Eds.). (2017). The Routledge Handbook of Disaster Risk Reduction Including Climate Change Adaptation. Routledge.
4. Bankoff, G., Frerks, G., & Hilhorst, D. (Eds.). (2004). Mapping Vulnerability: Disasters, Development and People. Routledge.
5. Hallegatte, S., Bangalore, M., & Vogt-Schilb, A. (Eds.). (2018). The Oxford Handbook of the Economics of Disasters and Climate Change. Oxford University Press.
1. Further Reading: UNDRR Sendai Framework (2015-2030) and NDMA Pakistan documents.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

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- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-308	Credit hours	03
Course Title	SOLID WASTE MANAGEMENT				
COURSE INTRODUCTION					
The present course will cover the basic aspects of solid waste management including overview of waste management, characteristics of waste and functional elements of waste management from waste generation to final disposal.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Analyze a solid waste stream for its composition and properties 2. Describe the processes involved in collection, transport, processing and disposal of waste 3. Identify the waste management options from reduction to final disposal Identify the hazardous waste components					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Introduction to Solid Waste Management Definition of solid waste and Solid Waste Management	Textbook of solid waste management Sources & types of solid waste, Page 01			
	Types of solid waste	Sustainable solid waste management Classification and Types of Waste, Page 19			
	Properties of solid waste (Physical and chemical characteristics of solid waste)	Textbook of solid waste management Physical and Geotechnical properties of MSW, Page 07 Chemical properties of MSW, Page. 11			
	Environmental impacts of solid waste	Textbook of solid waste management Impacts of Solid Waste on Environment Page 01			
WEEK-2	Health impacts of solid waste	Textbook of solid waste management Impacts of Solid Waste on Environment, Page.01			
	Their generation, Disposal	Textbook of solid waste management Generation of Municipal solid waste, Page.04			
	Treatment of solid waste	Sustainable solid waste management Disposal, Page. 34			
WEEK-3	Six functional elements of Solid Waste Management (Generation, Storage, Collection, Transfer and Transport, Processing, Handling, Disposal)	Textbook of solid waste management Collection and processing of Solid waste, Page. 26			
	Waste generation trends in megacities	Textbook of solid waste management Generation of MSW, Page 04			
	Informal waste sector and scavengers	Sustainable solid waste management Collection and Transportation, Page. 42			
WEEK-4	Waste Management Challenges in developing countries Public attitude towards waste collection	Textbook of solid waste management MSW statistics of Delhi case study, Page. 16 Sustainable solid waste management Social Concerns, Page. 123			
	Environmental Justice and waste disposal	Textbook of solid waste management Environmental Management plan, Page. 177			
	Role of education and awareness of individuals towards waste generation	Textbook of solid waste management Solid Waste Legislation, Page. 18			

WEEK-5	Unit-II: Processing Techniques of Solid Waste Mechanical Volume Reduction (Compaction)	Sustainable solid waste management Waste Operational Units: Equipment and Facilities, Page. 42
	Compaction equipment and ratios	Sustainable solid waste management Reduction, Prevention, and Reuse, Page. 28
	Chemical Volume Reduction (Incineration)	Textbook of solid waste management Mechanical Treatment, Page. 47
WEEK-6	Incineration principles	Textbook of solid waste management Combustion or Incineration systems, Page. 38
	Energy recovery from incineration	Textbook of solid waste management Thermal Conversion, Page. 38
	Mechanical Size Reduction (Shredding)	Sustainable solid waste management Technology Matrix for Solid Waste Management, Page. 72
	Shredding and grinding	Sustainable solid waste management Systems Analysis, Waste Management, and Technology Hub, Page. 236
WEEK-7	Component Separation (Recycling)	Sustainable solid waste management Recycling Programs with Optimal Vehicle Routing and Scheduling Approaches, Page 518
	Recycling and Resource recovery	Sustainable solid waste management Waste Management Through Waste Hierarchy: Reduce, Reuse, Recycle, Recover, and Disposal, Page. 28
	Drying and dewatering (Moisture reduction)	Textbook of solid waste management Thermal Conversion, Page. 38
WEEK-8	Life cycle analysis of waste treatments methods	Sustainable solid waste management Life cycle Assessment, Page. 323
	Environmental impacts of waste processing plants	Textbook of solid waste management Impacts of Solid Waste on Environment, Page. 01
	Cost comparison of waste processing technologies	Sustainable solid waste management Waste Management Costs, Page. 101
	Industrial applications of waste processing	Sustainable solid waste management Industrial Ecology and Integrated Solid Waste Management Strategies Page.301
MID TERM EXAMINATION		
WEEK-9	Unit-III: Biological Treatment Biogas concept	Textbook of solid waste management Biological Processing Page.45
	Biogas principles	Textbook of solid waste management Biological Processing Page.45
	Biogas plant design, Factors affecting Biogas production	Textbook of solid waste management Biological Processing Page.45
WEEK-10	Composting and its types	Textbook of solid waste management Types of composting systems Page.47
	Anaerobic vs vermicomposting	Textbook of solid waste management Vermiculture Page.50
	Factors Affecting Composting	Textbook of solid waste management Critical design and parameters in composting Page.45

WEEK-11	Anaerobic Digestion Intro	Textbook of solid waste management Anaerobic Conversion Page.49
	Mechanism of Anaerobic Digestion	Textbook of solid waste management Anaerobic decomposition Page.63
	Odor control in biological treatment plants	Sustainable solid waste management Biological Treatment Page.59
WEEK-12	Comparison of the biological treatment processes	Sustainable solid waste management Biological recovery Page.33
	Economic Feasibility of Biological Treatment	Sustainable solid waste management ISWM Plans Page.162
	Challenges in Biological Treatment	Sustainable solid waste management Biological Treatment Page.59
WEEK-13	Unit-IV: Final Disposal Landfilling and its types	Textbook of solid waste management Disposal of Waste on landfills Page.62
	Site selection for Landfills	Textbook of solid waste management Site Selection Page.67
	Sanitary Landfill design	Sustainable solid waste management Disposal Page.69
	Linear and cover System	Textbook of solid waste management Layout of Landfill Page. 69
WEEK-14	Leachate collection and Treatment	Solid and hazardous waste management Leachate Management System Page.88
	Landfill gas management	Solid and hazardous waste management Landfill gas control pg Page 109
	Operation and Monitoring	Solid and hazardous waste management Monitoring and detection of landfill gas Page.119
WEEK-15	Closure and post closure care of Landfills	Textbook of solid waste management Landfill Siting Strategies Page.714
	Industrial vs Municipal disposal	Sustainable solid waste management Disposal Page.69
	Hazardous waste in landfills	Solid and hazardous waste management Hazardous waste management and site Remediation Page.123
	Environmental auditing of sites	Textbook of solid waste management Environmental Audit Page.181
WEEK-16	Applications of landfilling	Textbook of solid waste management Landfills operation Page.71
	Challenges of landfilling	Textbook of solid waste management of a landfill site Page.72
	Examples of Landfills in Pakistan	Municipal Solid Waste Lahore Sanitation Program Page. 225
FINAL TERM EXAMINATION		

TEXT BOOKS AND READING MATERIAL

1. Waste Management for a Sustainable Future Technologies, Strategies and Global Perspectives. (2025). United Kingdom: IntechOpen.
2. Rao, M. N., Sultana, R., Kota, S. H., Shah, A., & Davergave, N. (2016). *Solid and hazardous waste management: science and engineering*. Butterworth-Heinemann.
3. Rajaram, V., Siddiqui, F. Z., Agrawal, S., & Khan, M. E. (2016). *Solid and liquid waste management waste to wealth: Solid and liquid waste management waste to wealth*. PHI Learning Pvt. Ltd.
4. Wong, J. W., Surampalli, R. Y., Zhang, T. C., Tyagi, R. D., & Selvam, A. (Eds.). (2016, January). *Sustainable solid waste management*. Reston, VA: American Society of Civil Engineers.
5. Chang, N. B., & Pires, A. (2015). *Sustainable solid waste management: a systems engineering approach*. John Wiley & Sons.
6. Khan, I. H., & Ahsan, N. (2003). Textbook of solid waste management. *Satish Kumar Jain for CBS Publisher and Distributors, New Delhi, 608p*.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

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1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-309	Credit hours	03
Course Title	ENVIRONMENTAL MANAGEMENT SYSTEMS				
COURSE INTRODUCTION					
This course is intended to provide an understanding of the Environmental Management System and auditing techniques (ISO14001) required up to the level for developing them to any industrial field. It will facilitate students to have an in-depth interpretation of ISO 14001 EMS standard.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Demonstrate an understanding of the principles, structure, and significance of Environmental Management Systems (EMS) for sustainable development. 2. Apply key EMS components, including environmental policy, objectives, risk assessment, and monitoring, to develop and manage environmental programs effectively. 3. Interpret legal and regulatory requirements and use appropriate tools and audit techniques to ensure EMS compliance and continuous improvement.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit I: Foundations of Environmental Management Systems			Read: Dentch (2016), Ch.1, pp. 1–22; Gawaikar (2023), Ch.1, pp. 1–18	
	Introduction to EMS and ISO 14001				
	Evolution of EMS standards				
	Benefits of implementing EMS				
WEEK-2	Importance of EMS for sustainable development			Read: Dentch (2016), Ch.2, pp. 23–50; Gawaikar (2023), Ch.2, pp. 19–40	
	Environmental Policy: Vision, commitment, and top management support				
	Environmental leadership and organizational responsibility				
WEEK-3	Legal and Regulatory Requirements: National and international frameworks			Read: Gawaikar (2023), Ch.3, pp. 41–65; Davy (2017), pp. 169–176; Lee et al. (2017), pp. 108–115	
	EMS Roles and Responsibilities				
	Role of stakeholders and top management				
WEEK-4	Unit II: Environmental Aspects, Impacts, and Planning			Read: Dentch (2016), Ch.3, pp. 51–82; Gawaikar (2023), Ch.4, pp. 66–95	
	Methods for identifying environmental impacts				
	Environmental Risk Assessment				
	Environmental analysis techniques				
WEEK-5	Setting Objectives and Targets			Read: Dentch (2016), Ch.4, pp. 83–110; Gawaikar (2023), Ch.5, pp. 96–120	
	Linking environmental objectives with sustainability goals				
	Planning Processes in EMS				
WEEK-6	Unit III: EMS Implementation and Operational Control			Read: Will (2019), Ch.2, pp. 25–56; Gawaikar (2023), Ch.6, pp. 121–150	
	Environmental Management Program (EMP)				
	Structure and responsibility				
	Defining Organizational Boundaries				
	Components of Environmental Management Program (EMP)				

WEEK-7	EMS Training and Awareness	Read: Will (2019), Ch.3, pp. 57–88; Dentch (2016), Ch.5, pp. 111–138
	Evaluating effectiveness of environmental training	
	Internal and External Communications	
WEEK-8	EMS Documentation and Document Control	Read: Dentch (2016), Ch.6, pp. 139–168; Gawaikar (2023), Ch.7, pp. 151–180
	Environmental record keeping; Operational Controls and SOPs	
	Case studies of ISO 14001 certified organizations	
MID TERM EXAMINATION		
WEEK-9	Unit IV: Emergency and Incident Management Emergency Preparedness and Response	Read: Will (2019), Ch.4, pp. 89–120; Gawaikar (2023), Ch.8, pp. 181–208
	Development of environmental emergency response plan	
	Identification of potential environmental emergencies	
WEEK-10	Types of Environmental Incident in industries	Read: Will (2019), Ch.5, pp. 121–152; Dentch (2016), Ch.7, pp. 169–196
	Incident’s investigation techniques	
	Root cause analysis of environmental incidents	
WEEK-11	Environmental Incident Scenarios and Simulations	Read: Will (2019), Ch.6, pp. 153–184; Gawaikar (2023), Ch.9, pp. 209–238
	Environmental Risk Mitigation	
	Risk reduction strategies for environmental accidents	
WEEK-12	Unit V: Monitoring, Evaluation, and Continuous Improvement Monitoring and Measurement Tools	Read: Dentch (2016), Ch.8, pp. 197–225; Gawaikar (2023), Ch.10, pp. 239–265
	Environmental monitoring techniques	
	Environmental performance indicators	
	Non-conformance and Corrective/Preventive Actions	
WEEK-13	Identification of Environmental non-conformities	Read: Gawaikar (2023), Ch.11, pp. 266–294; Davy (2017), pp. 176–182; Lee et al. (2017), pp. 115–120
	Corrective action planning	
	Preventative environmental management strategies	
WEEK-14	EMS Records and Data Management	Read: Dentch (2016), Ch.9, pp. 226–255; Gawaikar (2023), Ch.12, pp. 295–320
	Continuous Improvement Strategies (Plan-Do-Check-Act Cycle in EMS)	
	Environmental compliance evaluation	
WEEK-15	Unit VI: EMS Auditing and Management Review	Read: Dentch (2016), Ch.10, pp. 256–290; Will (2019), Ch.7, pp. 185–218
	Environmental Auditing Principles	
	Conducting Environmental Audits	
	Audit Reporting	
WEEK-16	Management Review and Decision-Making	Read: Dentch (2016), Ch.11, pp. 291–316; Gawaikar (2023), Ch.13, pp. 321–350
	Decision-Making for Environmental Improvements	
	Continuous Improvement in EMS	
FINAL TERM EXAMINATION		

TEXT BOOKS AND READING MATERIAL

1. Gawaikar, V. (2023). *ISO 14001:2015 Implementation Handbook – An Indian context* (1st ed.). OrangeBooks Publication. ISBN: 9789356214057.
2. Bravi, L., Santos, G., Pagano, A., & Murmura, F. (2020). Environmental management system according to ISO 14001: 2015 as a driver to sustainable development. *Corporate Social Responsibility and Environmental Management*, 27(6), 2599-2614.
3. Will, M. (2019). *An Operations Guide to Safety and Environmental Management Systems (SEMS): Making Sense of BSEE SEMS Regulations*. Gulf Professional Publishing.
4. Davy, A. (2017). Environmental management systems: ISO 14001 issues for developing countries. In *ISO 14001 and Beyond* (pp. 169-182). Routledge.
5. Lee, S. M., Noh, Y., Choi, D., & Rha, J. S. (2017). Environmental policy performances for sustainable development: from the perspective of ISO 14001 certification. *Corporate Social Responsibility and Environmental Management*, 24(2), 108-120.
6. Dentch, M. P. (2016). *The ISO 14001: 2015 implementation handbook: Using the process approach to build an environmental management system*. Quality Press.

Further Reading as suggested by the instructor.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

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- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
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2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-310	Credit hours	03
Course Title	ELECTIVE - II				

ELECTIVE – II *****

An Elective Course of 03 Credit hrs will be opted from the Elective Courses List

Program	BS Environmental Sciences	Course Code	ENSC-311	Credit hours	03
Course Title	ELECTIVE - III				

ELECTIVE – III *****

An Elective Course of 03 Credit hrs will be opted from the Elective Courses List

FOURTH YEAR, SEMESTER VII

Code	COURSE	CREDIT HOURS	CATEGORY
ENSC-401	Biodiversity & Conservation	3 (2-1)	Major
ENSC-402	Artificial Intelligent (AI) and Emerging Technologies in Environmental Science	3 (3-0)	Major
ENSC-403	Health, Safety and Environment	3 (2-1)	Interdisciplinary
GENT-401	Entrepreneurship *	2 (2-0)	General Education
ENSC-404	Elective – IV *****	3 (3-0)	Major
ENSC-405	Climate Change	2 (2-0)	Major
Total Credit hrs Semester-VII		16	

Program	BS Environmental Sciences	Course Code	ENSC-401	Credit hours	02
Course Title	BIODIVERSITY & CONSERVATION (THEORY)				
COURSE INTRODUCTION					
The current course is designed to introduce the fundamentals of biodiversity and conservation and ways to manage biodiversity. It includes understanding the definitions, types, structure and function of biodiversity. Understanding genes, species and ecosystem level diversity and its significance. Understanding the economic, educational and aesthetic values of biodiversity. Explaining the threats such as, habitat loss, habitat fragmentation, extinction, climate change, invasive species, disease, overexploitation to biodiversity. Explaining the ways to manage the biodiversity through ecosystem, species and population management, reserve and protect areas management and ex-situ and in-situ management of species. Finally, the course also aims to analyze human social, economic and political factors to manage biodiversity in modern times.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Understanding the concepts of Biodiversity 2. Explaining the importance of biodiversity 3. Understanding the concept of conservation and its significance 4. Underpinning the threats to biodiversity 5. Understanding the ways to manage biodiversity 6. Explaining the biodiversity and modern human challenges					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Biodiversity and Its Importance			Assignment: Define and explain levels of biodiversity.	
	Definitions and types of biodiversity: genetic, species and ecosystem				
	Levels of biological organization and the concept of biodiversity hotspots				
WEEK-2	Species, genes and ecosystem diversity and their ecological significance			Wilson (1992) Chapter 2: The Diversity of Life	
	Economic, ecological, aesthetic, cultural and educational values of biodiversity				
WEEK-3	Alpha, beta and gamma diversity: measurement and ecological interpretation			Assignment: Calculate biodiversity indices.	
	Biodiversity indices: Shannon-Wiener, Simpson and species richness				
WEEK-4	Extinction rate and extinction processes: background vs mass extinction			Assignment: Categorize selected species according to IUCN criteria.	
	IUCN Red List categories and criteria for endangered species				
WEEK-5	Unit-II (continued): Threats to Biodiversity			Groom et al. (2006) Chapter 6: Threats to Biodiversity	
	Habitat loss, habitat fragmentation, pollution and desertification				
	Overexploitation and history of species extinction				
WEEK-6	Invasive species: pathways, ecological impacts and management			Assignment: Report on invasive species in Pakistan.	
	Disease transmission, climate change and their combined effects on biodiversity				
WEEK-7	Unit-III: Maintaining Biodiversity			Groom et al. (2006) Chapter 10: Conservation Strategies	
	Fundamentals of conservation biology: principles and goals				
	Ex-situ conservation: zoos, botanical gardens, seed banks and gene banks				

WEEK-8	In-situ conservation: national parks, wildlife sanctuaries and biosphere reserves	CBD Official Documents
	Protecting and managing ecosystems: buffer zones and ecological corridors	
MID TERM EXAMINATION		
WEEK-9	Unit-IV: Biodiversity and Modern Human Challenges	Pakistan Biodiversity Strategy and Action Plan (BSAP)
	Protected areas, reserves and their role in biodiversity conservation in Pakistan	
	Social factors and biodiversity: local communities and traditional knowledge	
WEEK-10	Economic factors, international trade and biodiversity: CITES and wildlife trade	Assignment: Wildlife trade analysis.
	Political factors and biodiversity: governance, policy and international agreements	
WEEK-11	Convention on Biological Diversity (CBD): objectives and obligations	Convention on Biological Diversity (CBD)
	Pakistan Biodiversity Strategy and Action Plan (BSAP)	
WEEK-12	Nagoya Protocol on access and benefit sharing of genetic resources	Nagoya Protocol Documentation
	Wildlife legislation in Pakistan: Wildlife Acts and enforcement challenges	
WEEK-13	Ecosystem services: provisioning, regulating, supporting and cultural services	Millennium Ecosystem Assessment
	Economic valuation of ecosystem services: methods and case studies	
WEEK-14	Payments for ecosystem services (PES): frameworks and examples from Pakistan	Presentation on ecosystem services.
	Role of biodiversity in food security, medicine and biotechnology	
	Restoration ecology: principles, techniques and success stories	
WEEK-15	Impacts of climate change on species distribution and phenology	Assignment: Climate adaptation plan for a threatened species.
	Climate change adaptation strategies for biodiversity conservation	
WEEK-16	Sustainable development and biodiversity	UN Sustainable Development Goals Reports
	SDGs, green economy and nature-based solutions	
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Primack, R.B. (2014). Essentials of Conservation Biology (6th ed.). Sinauer Associates. 2. Groom, M.J., Meffe, G.K. & Carroll, C.R. (2006). Principles of Conservation Biology (3rd ed.). Sinauer. 3. Wilson, E.O. (1992). The Diversity of Life. Harvard University Press. 4. Myers, N. et al. (2000). Biodiversity hotspots for conservation priorities. Nature, 403, 853-858. 2. Convention on Biological Diversity (CBD). Official text and protocols. UNEP.		
TEACHING – LEARNING STRATEGIES		
Lecture based examination Presentation/seminars Class discussion Quizzes		

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
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- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

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3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-401	Credit hours	01
Course Title	BIODIVERSITY & CONSERVATION (PRACTICAL)				
COURSE INTRODUCTION					
Practical knowledge of Biodiversity and conservation is necessary to reinforce the fundamentals concepts of biodiversity, its values and significance, threats and its management. The practical course is therefore, design to emphasize the identification and collection of plants and animals in the field for their nomenclature, classification and understating various systems. Secondly, the practical course is designed to underpin various threats to biodiversity and their role in species extinction and declines. Finally, the practical will also intend to visit different ex-situ and in-situ sites for species conservation. Lastly, some models habitats will be studied to see the human impacts on natural ecosystems and species.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Understanding fundaments of biodiversity					
2. Identification, classification and nomenclature of lab specimens of plants and animals					
3. Collection/observation of plants (bryophytes, peteredophytes, angiosperm and gymnosperms), for their nomenclature, classification and understanding various systems					
4. Collection/observation of animals (amphibians, reptiles, birds, mammals) their nomenclature, classification and understanding various systems					
5. Understanding various ecological processes such as, pollination, competition, predation, parasitism in the field					
6. Underpinning threats to species, population and ecosystem					
7. Understanding management of biodiversity at Ex-situ and is-situ sites					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Introduction to biodiversity field methods: equipment, safety and field notebook			Prepare a field notebook template	
WEEK-2	Demonstrating fundamental concepts of biodiversity: genes, species, population and ecosystem			Prepare a diagram showing levels of biodiversity	
WEEK-3	Evaluating values of different species: ecological, economic and cultural assessment			Assessment of ecological and economic value of selected species.	
WEEK-4	Collection and observation of various plants in the field: plot and transect methods			Field data collection using quadrat sampling.	
WEEK-5	Identification and nomenclature of local plant species using field guides and keys			Identification sheet of ten local plant species	
WEEK-6	Classification of plants: taxonomy and phylogenetic relationships			Prepare taxonomic hierarchy of collected plant specimens.	
WEEK-7	Understanding various reproductive and structural systems in plants			Comparative report on reproductive structures.	
WEEK-8	Collection and observation of various animals: trapping, netting and visual survey methods			Record observations from animal survey.	
MID TERM EXAMINATION					
WEEK-9	Identification and nomenclature of local animal species using field guides			Species identification worksheet.	

WEEK-10	Classification of animals: major phyla, taxonomy and ecological roles	Classification chart of observed animal specimens.
WEEK-11	Calculating plant diversity indices: Shannon-Wiener and Simpson index from field data	Calculate Shannon-Wiener Index using field data.
WEEK-12	Calculating animal diversity indices and comparing habitats	Compare diversity among sampled habitats.
WEEK-13	Habitat assessment: evaluating habitat quality, disturbance and conservation status	Habitat quality evaluation report.
WEEK-14	Herbarium preparation: pressing, mounting and labelling plant specimens	Prepare and submit herbarium specimens.
WEEK-15	Museum collection exercise: insect pinning and vertebrate specimen documentation	Prepare and submit herbarium specimens.
WEEK-16	Report writing and presentation of biodiversity field survey findings	Submission and Presentation of Biodiversity Field Survey Report.

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Sutherland, W.J. (2006). Ecological Census Techniques (2nd ed.). Cambridge University Press.
2. Kent, M. (2012). Vegetation Description and Data Analysis (2nd ed.). Wiley-Blackwell.
3. Krebs, C.J. (1999). Ecological Methodology (2nd ed.). Benjamin/Cummings.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

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3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-402	Credit hours	03
Course Title	ARTIFICIAL INTELLIGENCE (AI) AND EMERGING TECHNOLOGIES IN ENVIRONMENTAL SCIENCE				
COURSE INTRODUCTION					
This course introduces students to Artificial Intelligence and emerging digital technologies and their applications in environmental science. It covers core concepts of AI, machine learning, IoT, remote sensing and big data analytics, with emphasis on their use in environmental monitoring, climate modelling, pollution management and disaster prediction. Students will also explore the ethical and regulatory dimensions of deploying these technologies in sustainable development contexts.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Understand the basic concepts of Artificial Intelligence (AI) and emerging digital technologies. 2. Identify AI and technology-based tools used in environmental data analysis, modeling, and decision-making. 3. Apply machine learning, IoT, remote sensing, and big data analytics in environmental science applications. 4. Analyze case studies of AI applications in climate change, pollution management, resource optimization, and disaster prediction. 5. Evaluate ethical, regulatory, and sustainability implications of digital technologies in environmental science.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to AI and Emerging Technologies			Reading: Study the overview of AI, machine learning and deep learning, and key emerging technologies (IoT, Big Data, Cloud, Blockchain) in Abraham (2023), Artificial Intelligence for Environmental Science.	
	Overview of Artificial Intelligence (AI), Machine Learning (ML) and Deep Learning				
	Key emerging technologies: IoT, Big Data, Cloud Computing and Blockchain				
	Digital transformation in environmental science: opportunities and challenges				
WEEK-2	Data types and sources in environmental monitoring: satellites, sensors and public datasets			Assignment: Prepare a short note on data sources for environmental monitoring (satellites, sensors, public datasets) and complete a basic Python data-handling exercise.	
	Smart environmental systems and their global relevance				
	Fundamentals of Python programming and data handling for environmental applications				
WEEK-3	Unit-II: AI Applications in Environmental Monitoring			Reading: Read about AI-powered sensors, IoT networks and computer-vision applications for land-use tracking in Abraham (2023).	
	Environmental data collection using AI-powered sensors and IoT networks				
	AI-based water quality and air pollution monitoring systems				
	Satellite image analysis using computer vision for land-use and deforestation tracking				
WEEK-4	Real-time environmental data analytics and visualization tools			Assignment: Prepare a case-study summary of smart-city, AI-driven pollution control initiatives in Asia, citing Zhang & Goodchild (2021), Big Data in Environmental Science.	
	Case studies: smart cities and AI-driven pollution control in Asia				
	Machine learning algorithms: supervised and unsupervised learning in environmental contexts				

WEEK-5	Unit-III: AI in Climate Change and Disaster Risk Management	Reading: Study climate prediction models and AI-based early-warning systems in Abraham (2023).
	Climate prediction models using AI and ML algorithms	
	AI-supported early warning systems for floods, cyclones and earthquakes	
	Predictive analytics for climate risk assessment and vulnerability mapping	
WEEK-6	AI for greenhouse gas emissions modelling and management	Assignment: Prepare a short report on AI applications in greenhouse-gas modelling and Pakistan's climate adaptation planning, citing UNEP (2023), Harnessing Digital Technologies for Environmental Sustainability.
	Case studies: AI in climate adaptation and resilience planning in Pakistan	
	Deep learning applications in remote sensing for climate monitoring	
WEEK-7	Unit-IV: Big Data Analytics and Decision Support Systems	Reading: Review environmental big-data challenges and AI-based decision-support systems in Zhang & Goodchild (2021).
	Introduction to environmental big data: challenges, storage and processing	
	AI-based decision support systems for environmental policy and management	
	Data-driven models for sustainable urban planning and natural resource management	
WEEK-8	Integration of GIS and AI for spatial environmental applications	Assignment: Prepare a short comparative note on GIS-AI integration and cloud platforms (AWS, Google Earth Engine) for environmental data management.
	Case studies: data-driven decision-making in environmental governance	
	Cloud computing platforms for environmental data management: AWS, Google Earth Engine	
	Cloud computing platforms for environmental data management: AWS, Google Earth Engine	
MID TERM EXAMINATION		
WEEK-9	Role of IoT in smart agriculture, waste management and environmental control	Reading: Read about IoT in smart agriculture and blockchain for environmental compliance and carbon credits in World Bank (2022), Data for Better Lives.
	Blockchain applications for environmental compliance and carbon credit systems	
	Remote sensing innovations and AI-based geospatial analysis	
WEEK-10	Digital twins and simulation models for ecosystem management	Assignment: Prepare a case-study summary of digital twins, circular-economy technologies and drone-based environmental surveys.
	Case studies: technology-driven solutions in circular economy and biodiversity monitoring	
	Drone technology and robotics in environmental field surveys	
WEEK-11	Unit-VI: Ethics, Policy and Future Directions	Reading: Study the ethical, privacy and bias considerations of AI in environmental applications in Susskind (2021), Futureproof.
	Ethical considerations in AI and environmental technology applications	
	Data privacy, security and bias in AI environmental models	
	International frameworks and national policy implications of AI in environment	
WEEK-12	Digital divide and equitable access to environmental technologies in developing nations	Assignment: Prepare a short policy note on the digital divide and

	Open-source tools and datasets for environmental AI: availability and limitations	open-source tools/datasets for environmental AI in developing countries.
	Future trends: AI for biodiversity protection and smart environmental treaties	
WEEK-13	Autonomous pollution monitoring systems and environmental robotics	Reading: Review responsible-AI development for the SDGs and citizen-science applications in UNEP (2023).
	Responsible AI development for achieving Sustainable Development Goals (SDGs)	
	AI in environmental education, public awareness and citizen science	
WEEK-14	Practical session: introduction to ML tools (Scikit-learn) for environmental datasets	Assignment: Complete a hands-on exercise using Scikit-learn/satellite data for air-quality or vegetation-index computation.
	Hands-on: satellite data analysis for air quality and vegetation index computation	
	Case study analysis: AI applications in Pakistan's environmental management	
WEEK-15	Group project presentations: AI-based solutions for local environmental problems	Reading: Read about integrating traditional ecological knowledge with AI-based conservation tools in Weng (2020), Remote Sensing and GIS Integration.
	Review of key AI concepts, tools and their environmental applications	
	Future of environmental science in the age of AI: careers and research opportunities	
WEEK-16	Integration of traditional ecological knowledge with AI-based conservation tools	Assignment: Submit a group project report presenting an AI-based solution for a local environmental problem, in preparation for the Final Term Examination.
	Practical session: using Google Earth Engine for land cover change analysis	
	Emerging contaminant monitoring using AI: microplastics, PFAS and nanomaterials	
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Abraham, A. (2023). <i>Artificial Intelligence for Environmental Science</i>. Springer. 2. Peer-reviewed articles from journals like <i>Environmental Modelling & Software</i>, <i>Science of the Total Environment</i>, <i>Journal of Environmental Informatics</i> (2023–2025 issues). 3. UNEP (2023). <i>Harnessing Digital Technologies for Environmental Sustainability</i>. Nairobi: UNEP. 4. World Bank (2022). <i>Data for Better Lives: World Development Report</i>. World Bank Publications. 5. Zhang, C., & Goodchild, M. F. (2021). <i>Big Data in Environmental Science</i>. Elsevier. 6. Susskind, J. (2021). <i>Futureproof: 9 Rules for Humans in the Age of Automation</i>. Oxford University Press. 7. Weng, Q. (2020). <i>Remote Sensing and GIS Integration: Theories, Methods, and Applications</i>. McGraw-Hill Open-source tools documentation: Google Earth Engine, QGIS, TensorFlow tutorials for environmental applications.		
TEACHING – LEARNING STRATEGIES		
1. Lecture based examination 2. Presentation/seminars 3. Class discussion 4. Quizzes		

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

1. classroom participation,
2. attendance, assignments and presentation,
3. homework
4. attitude and behavior,
5. hands-on-activities,
6. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-403	Credit hours	02
Course Title	HEALTH, SAFETY AND ENVIRONMENT (THEORY)				
COURSE INTRODUCTION					
This course provides students with a comprehensive introduction to the principles and practices of health, safety, and environmental (HSE) management in the workplace. It explores the legal, technical, and ethical aspects of occupational health and safety, as well as environmental protection. Emphasis is placed on hazard identification, risk assessment, accident prevention, emergency response, and sustainable environmental practices across industries.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Learn basic understanding of potential workplace safety and health hazards and determine how to mitigate the hazards through engineering controls, administrative controls, and personal protective equipment 2. Review the principles for developing and implementing a successful occupational health and safety program and evaluation of a work site 3. Develop an occupational safety and health program based on national and international standards					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to Health, Safety and Environment			Health and Safety: Risk Management by Boyle, T./ Assignment 1: Write a short report on the importance, scope, and evolution of Occupational Health & Safety (2–3 pages).	
	Introduction to occupational health and safety: definitions, scope and importance				
	History of health and safety: evolution of standards from Industrial Revolution to present				
WEEK-2	Industrial hygiene: recognition, evaluation and control of workplace hazards			Health and Safety: Risk Management by Boyle, T./ Assignment 2: Prepare a timeline showing key milestones from the Industrial Revolution to ISO 45001.	
	Role of national and international agencies: ILO, WHO, OSHA, NIOSH				
WEEK-3	Elements of ILO-OSH 2001 and OHSAS 18001: key requirements and structure			Introduction to Health and Safety at work (6 th Ed.) by Hughes, P. Assignment 3: Identify workplace hazards (physical, chemical, biological) in a selected industry and suggest control measures.	
	Elements of ISO 45001: occupational health and safety management systems				
WEEK-4	Features and contents of OHS policy: development, implementation and review			Introduction to Health and Safety at work (6 th Ed.) by Hughes, Assignment 4: Write a comparative analysis of OHSAS 18001 and ISO 45001 standards.	
	Legal framework for occupational health and safety in Pakistan				
WEEK-5	Unit-III: Health and Safety Culture			Introduction to Health and Safety at work (6 th Ed.) by Hughes, Assignment 5: Conduct a survey (or case study) on safety culture in an organization or campus environment.	
	Concept and significance of health and safety culture in organizations				
	Factors influencing safety-related behavior and strategies for improvement				
WEEK-6	Principles and practice of risk assessment: hazard identification and risk evaluation			Assignment 6: Perform a basic risk assessment (hazard identification + risk matrix) for a laboratory or workshop.	
	Hierarchy of controls: elimination, substitution, engineering, administrative and PPE				
WEEK-7	Unit-IV (continued): Specific Hazard Controls			Health and Safety: Risk Management (6 th Ed.) by Boyle, T. / Quiz 1	
	Electrical safety: hazards, prevention and lockout/tagout procedures				

	Confined spaces: entry procedures, atmospheric testing and rescue planning	
WEEK-8	Physical and psychological health hazards and their risk control measures	Health and Safety: Risk Management (6th Ed.) by Boyle, T / Assignment 7: Apply hierarchy of controls to reduce hazards in a selected industrial scenario.
	Emergency preparedness and response planning	
MID TERM EXAMINATION		
WEEK-9	Unit-V: Inspection and Audit Systems	Health and Safety: Risk Management (6th Ed.) by Boyle, T / Assignment 8: Prepare an electrical safety checklist including LOTO (Lockout/Tagout) procedures.
	Workplace inspection systems: types, planning and reporting	
	Safety audits: internal and external audit procedures and outcomes	
WEEK-10	Incident reporting systems: near-miss reporting, investigation and root cause analysis	Health and Safety: Risk Management (6th Ed.) by Boyle, T / Assignment 9: Design an emergency response plan for chemical exposure or fire incident.
	Key performance indicators (KPIs) for health and safety management	
WEEK-11	Hazardous substances and health effects: chemical, biological and radiological hazards	Introduction to Health and Safety at work (6th Ed.) by Hughes, Assignment 10: Conduct a mock workplace inspection checklist and report findings.
	Toxicology and the importance of Material Safety Data Sheets (MSDS/SDS)	
WEEK-12	Work at height: risk assessment, fall prevention and rescue procedures	Introduction to Health and Safety at work (6th Ed.) by Hughes, / Assignment 11: Collect and analyze SDS (Material Safety Data Sheets) for 3 industrial chemicals.
	Fire safety: fire triangle, classification, prevention and firefighting equipment	
WEEK-13	Ergonomics and musculoskeletal disorders: risk factors, assessment and control	Introduction to Health and Safety at work (6th Ed.) by Hughes, / Assignment 12: Identify ergonomic risks in office or factory work and propose improvements.
	Permit to work systems: hot work, cold work and excavation permits	
WEEK-14	Unit-VII: Environmental Management in HSE	Introduction to Health and Safety at work (6th Ed.) by Hughes, / Quiz 2 and Quiz 3
	Integration of environmental management into HSE systems	
	Environmental aspects and impacts in industrial operations	
WEEK-15	Waste management, chemical storage and spillage control in industrial settings	Assignment 13: Explain integration of environmental management into HSE systems with examples.
	HSE legislation in Pakistan: Factory Act, NEQS and environmental compliance	
WEEK-16	HSE management in construction sector	Pakistan Factories Act 1934 and Provincial HSE Regulations Assignment 14: Prepare a fire safety plan and fall protection strategy for construction work.
	HSE management in oil and gas, and manufacturing sectors in Pakistan	Pakistan Factories Act 1934 and Provincial HSE Regulations Assignment 15: Case study on HSE practices in oil & gas or construction sector in Pakistan.
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Boyle, T., & Charlton, F. (2025). Health and safety: Risk management (6th ed.). Routledge. 2. Asbury, S. (2024). Navigating ISO 45001: Techniques, implementation tools and case studies. CRC Press. 3. Hughes, P. & Ferrett, E. (2016). Introduction to Health and Safety at Work (6th ed.). Routledge. 4. Stranks, J. (2010). Health and Safety at Work: Key Terms. Routledge.		

5. ISO 45001:2018. Occupational Health and Safety Management Systems. ISO.
6. ILO-OSH 2001. Guidelines on Occupational Safety and Health Management Systems. ILO.
7. Pakistan Factories Act 1934 and Provincial HSE Regulations.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-403	Credit hours	01
Course Title	HEALTH, SAFETY AND ENVIRONMENT (PRACTICAL)				
COURSE INTRODUCTION					
This course provides students with a comprehensive introduction to the principles and practices of health, safety, and environmental (HSE) management in the workplace. It explores the legal, technical, and ethical aspects of occupational health and safety, as well as environmental protection. Emphasis is placed on hazard identification, risk assessment, accident prevention, emergency response, and sustainable environmental practices across industries.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. This course will provide a demonstration about the different instruments. 2. The students will learn about the practical aspects of measuring and monitoring of occupational health and safety.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Introduction to personal protective equipment (PPE): types, selection, use and maintenance			Health and Safety: Risk Management (6 th Ed.) by Boyle, T / Write the name and functions of all equipment	
WEEK-2	Noise level monitoring in workplace environments using sound level meter			Laboratory Manual Practical #1	
WEEK-3	Illumination level monitoring: lux meter use and comparison with standards			Laboratory Manual Practical #2	
WEEK-4	Relative humidity and workplace temperature monitoring: instruments and recording			Laboratory Manual Practical #3	
WEEK-5	Hazard identification and risk assessment techniques: HAZOP and risk matrix			Laboratory Manual Practical #4	
WEEK-6	Development of an emergency response plan for a simulated workplace scenario			Case Study/Make a plan	
WEEK-7	Fire safety practical: fire extinguisher types, operation and hands-on demonstration			Prepare a fire safety plan and fall protection strategy for construction work.	
WEEK-8	Biological monitoring: air sampling for bioaerosols and analysis methods			Laboratory Manual Practical #5	
MID TERM EXAMINATION					
WEEK-9	Workplace drinking water quality testing: pH, turbidity, coliform and chemical analysis			Laboratory Manual Practical #6	
WEEK-10	First aid practical: wound care, fracture management and shock treatment			Laboratory Manual Practical #7	
WEEK-11	Cardiopulmonary Resuscitation (CPR) training and automated external defibrillator (AED) use			Prepare training and the use of equipment	
WEEK-12	Workplace ergonomic assessment: workstation evaluation and posture correction			Laboratory Manual Practical #8	

WEEK-13	Chemical safety practical: reading MSDS/SDS, chemical storage and spill response drill	Identify ergonomic risks in office or factory work and propose improvements.
WEEK-14	Lockout/tagout (LOTO) procedure demonstration: isolation and energy control	Prepare an electrical safety checklist including LOTO (Lockout/Tagout) procedures.
WEEK-15	HSE inspection exercise: conducting a mock workplace safety inspection and reporting	Conduct a mock workplace inspection checklist and report findings.
WEEK-16	Incident investigation practical: root cause analysis of a simulated accident scenario	Prepare a sample incident report and define KPIs for HSE performance monitoring.

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Boyle, T., & Charlton, F. (2025). Health and safety: Risk management (6th ed.). Routledge.
2. Asbury, S. (2024). Navigating ISO 45001: Techniques, implementation tools and case studies. CRC Press.
4. Hughes, P. & Ferrett, E. (2016). Introduction to Health and Safety at Work (6th ed.). Routledge.
5. APHA (2017). Standard Methods for the Examination of Water and Wastewater (23rd ed.).
6. NIOSH Pocket Guide to Chemical Hazards. National Institute for Occupational Safety and Health.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
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- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	GENT-401	Credit hours	02
Course Title	ENTREPRENEURSHIP				
COURSE INTRODUCTION					
This course is designed to promote entrepreneurial spirit and outlook among students, encouraging them to think critically, identify opportunities, and transform their ideas into successful ventures. It aims at imparting them with the requisite knowledge; skills and abilities, enabling them seize the identified opportunities for initiating of business (including requirements for registration and incorporation with regulators such as SECP and others), market research, opportunity identification, business planning, financial literacy for managing finances and securing funding, marketing and sales, team building and innovation, overall, the course is geared towards personal growth and professional development for pursuing innovative ideas, availing opportunities and initiating start-ups.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Knowledge of fundamental entrepreneurial concepts, skills and process:					
2. Understanding of different personal, social and financial aspects associated with entrepreneurial activities:					
3. Basic understanding of regulatory requirements to set up an enterprise in Pakistan, with special emphasis on exports;					
4. Ability to apply knowledge, skills and abilities acquired in the course to develop a feasible business plan for implementation.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to Entrepreneurship			Reading: Study the definition, types and scope of entrepreneurship in Kuratko (2020), Entrepreneurship: Theory, Process, and Practice.	
	Definition and concept of entrepreneurship: types and scope				
	Why become an entrepreneur? Motivations, opportunities and challenges				
WEEK-2	Entrepreneurial process: idea to venture creation			Assignment: Prepare a short reflection on the entrepreneurial process from idea to venture creation, citing Kuratko (2020).	
	Role of entrepreneurship in economic development and job creation				
WEEK-3	Characteristics and qualities of successful entrepreneurs: success and failure stories			Reading: Read about the characteristics of successful entrepreneurs and case studies of success and failure in Kuratko (2020).	
	Creative and critical thinking, innovation and risk-taking in entrepreneurship				
WEEK-4	Communication, negotiation and leadership skills for entrepreneurs			Assignment: Prepare a short exercise on problem-solving and decision-making under uncertainty, drawing on Drucker (1985), Innovation and Entrepreneurship.	
	Problem-solving and decision-making under uncertainty				
WEEK-5	Unit-III: Opportunity Recognition and Idea Generation			Reading: Study opportunity identification frameworks and idea-generation techniques (brainstorming, design thinking, SCAMPER) in Ries (2011), The Lean Startup.	
	Opportunity identification, evaluation and exploitation: frameworks and tools				
	Innovative idea generation techniques: brainstorming, design thinking and SCAMPER				

WEEK-6	Market research and feasibility analysis for entrepreneurial ventures	Assignment: Conduct a short market-research and feasibility exercise for a green/environmental business idea in Pakistan.
	Environmental entrepreneurship: green business opportunities in Pakistan	
WEEK-7	Unit-IV: Marketing and Sales	Reading: Review the four Ps of marketing and marketing-strategy development in Kuratko (2020).
	Four Ps of Marketing: product, price, place and promotion	
	Developing a marketing strategy for a new venture	
WEEK-8	Branding: building identity, value proposition and customer loyalty	Assignment: Prepare a branding and digital-marketing plan for a hypothetical startup, citing Ries (2011).
	Digital marketing and social media strategies for startups	
MID TERM EXAMINATION		
WEEK-9	Unit-V: Financial Literacy for Entrepreneurs	Reading: Study basic financial-literacy concepts (income, savings, cash flow, break-even analysis) in Kuratko (2020).
	Basic concepts of income, savings, investments, assets and liabilities	
	Revenue, expenses, cash flow management and break-even analysis	
WEEK-10	Overview of banking products including Islamic modes of financing (Murabaha, Musharaka)	Assignment: Prepare a short note comparing conventional and Islamic financing modes (Murabaha, Musharaka) and startup funding sources.
	Sources of funding for startups: angel financing, venture capital and equity financing	
WEEK-11	Components of a business plan: executive summary, market analysis and financial projections	Reading: Read about the components of a business plan and the lean-startup/MVP methodology in Blank & Dorf (2012), The Startup Owner's Manual.
	Lean startup methodology: minimum viable product (MVP) and pivot strategies	
WEEK-12	Team building and effective leadership for startups	Assignment: Prepare a team-building and HR-management plan for a small/medium enterprise.
	Human resource management in small and medium enterprises (SMEs)	
WEEK-13	Types of enterprises in Pakistan: sole proprietorship, partnership and private limited companies	Reading: Study the types of enterprises in Pakistan and intellectual-property protection in SECP's Guide to Incorporating a Company in Pakistan.
	Intellectual property rights, patents, trademarks and copyright protection	
WEEK-14	Unit-VIII: Social Entrepreneurship and Sustainability	Assignment: Prepare a short note on social entrepreneurship and sustainable/circular business models, citing Drucker (1985).
	Concept of social entrepreneurship: creating social and environmental value	
	Sustainable business models: circular economy and green entrepreneurship	
WEEK-15	Incubators, accelerators and government support for startups in Pakistan	Reading: Review examples of incubators, accelerators and successful Pakistani entrepreneurs in Kuratko (2020).
	Case studies: successful Pakistani entrepreneurs and their impact	
WEEK-16	Business pitch preparation and presentation	Assignment: Prepare and rehearse a business-pitch deck for a proposed venture, in preparation for the Final Term Examination.
	Investor readiness and pitch deck essentials	
FINAL TERM EXAMINATION		

TEXT BOOKS AND READING MATERIAL

1. Kuratko, D.F. (2020). Entrepreneurship: Theory, Process, and Practice (11th ed.). Cengage.
2. Ries, E. (2011). The Lean Startup. Crown Business.
2. Blank, S. & Dorf, B. (2012). The Startup Owner's Manual. K&S Ranch.
3. Drucker, P.F. (1985). Innovation and Entrepreneurship. Harper & Row.
4. SECP Pakistan. Guide to Incorporating a Company in Pakistan. Securities and Exchange Commission of Pakistan.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

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- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-404	Credit hours	03
Course Title	ELECTIVE - IV				

ELECTIVE – IV *****

An Elective Course of 03 Credit hrs will be opted from the Elective Courses List

Program	BS Environmental Sciences	Course Code	ENSC-405	Credit hours	02
Course Title	CLIMATE CHANGE				
COURSE INTRODUCTION					
The focus of the course is climate change impacts and the human response to climate change, including efforts to adapt to climate change, as well as efforts to achieve long term sustainability by avoiding or reducing the negative impacts of climate change					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. To carry out research, teaching, and consultancy in the field of climate change and adaptation. 2. To discuss how a changing climate translates into impacts 3. To highlight the most vulnerable regions and sectors of climate change 4. To recognize uncertainties in climate change science 5. To use the current knowledge to discuss climate change adaptation and mitigation options					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: The Climatic System			Reading: Study the components of the climatic system and atmosphere-ocean interactions (El Nino, La Nina) in IPCC (2021), Sixth Assessment Report.	
	Climatic system: atmosphere, hydrosphere, biosphere, cryosphere and lithosphere				
	Atmosphere-ocean interactions: El Nino, La Nina and their global effects				
WEEK-2	Greenhouse effect and global warming: mechanisms and feedback loops			Assignment: Prepare a short note distinguishing weather from climate and explaining the greenhouse-effect feedback loops, citing Houghton (2015), Global Warming: The Complete Briefing.	
	Weather vs climate: definitions, variability and long-term trends				
WEEK-3	Modelling of climate change: General Circulation Models (GCMs) and their applications			Reading: Read about General Circulation Models and paleoclimate evidence from ice cores and sediments in Houghton (2015).	
	Paleoclimatology: evidence of past climate change from ice cores and sediments				
WEEK-4	Natural causes of climate change: volcanic activity, solar variability and Milankovitch cycles			Assignment: Prepare a comparative note on natural versus anthropogenic drivers of climate change, citing IPCC (2021).	
	Anthropogenic drivers of climate change: fossil fuels, deforestation and land use change				
WEEK-5	Unit-II (continued): Impacts of Climate Change			Reading: Review the RCP emission scenarios and climate-change impacts on health, agriculture and biodiversity in IPCC (2021).	
	Climate change scenarios and projections: RCP 2.6, 4.5 and 8.5				
	Impacts on hydrosphere, atmosphere, agriculture, human health and biodiversity				
WEEK-6	Climate change hazards: sea level rise, extreme weather events and droughts			Assignment: Prepare a short case study on a climate hazard (sea-level rise, extreme weather or drought) and its effect on a vulnerable community.	
	Vulnerable communities and climate justice: inequality and adaptation capacity				

WEEK-7	Unit-III: Climate Change Adaptation	Reading: Study climate-change adaptation concepts and sectoral strategies (water, agriculture, health, urban) in Houghton (2015).
	Introduction to climate change adaptation: concepts, frameworks and strategies	
	Adaptation strategies in water, agriculture, health and urban sectors	
WEEK-8	Ways to measure climate change vulnerability: indices and assessment methods	Assignment: Prepare a vulnerability-assessment exercise using a recognized climate-vulnerability index.
	Stakeholder participation and individual contributions to climate resilience	
MID TERM EXAMINATION		
WEEK-9	Unit-III (continued): Adaptation in Practice	Reading: Read about climate-resilient infrastructure design and early-warning systems in IPCC (2021).
	Climate-resilient infrastructure: design principles and examples	
	Prediction, early warnings and relocation of climate-prone communities	
WEEK-10	Climate change mitigation measures: overview of strategies and sectors	Assignment: Prepare a short report on mitigation strategies across transport, industry and development sectors.
	Emissions reduction in automobiles, industries, societies and development projects	
WEEK-11	Carbon sequestration techniques: forests, soils, wetlands and blue carbon	Reading: Study carbon-sequestration techniques (forests, soils, wetlands, blue carbon) and renewable-energy options in IPCC (2021).
	Renewable and green energy sources: solar, wind, hydro and geothermal	
WEEK-12	Biofuels and their role in climate mitigation: benefits and controversies	Assignment: Prepare a critical note on the benefits and controversies of biofuels and geoengineering technologies.
	Geoengineering technologies: carbon capture, solar radiation management and risks	
WEEK-13	Pakistan's National Climate Change Policy and National Adaptation Plan	Reading: Review Pakistan's National Climate Change Policy, National Adaptation Plan and the Climate Change Act 2017.
	Climate change legislation in Pakistan: Climate Change Act 2017	
WEEK-14	International climate change negotiations: UNFCCC, Kyoto Protocol and Paris Agreement	Assignment: Prepare a policy brief on Pakistan's Nationally Determined Contributions, citing Pakistan Climate Change Authority (2021) and UNFCCC (2015), The Paris Agreement.
	Nationally Determined Contributions (NDCs): Pakistan's commitments and progress	
	Climate finance mechanisms: Green Climate Fund, Adaptation Fund and bilateral support	
WEEK-15	Carbon credits and carbon markets: cap-and-trade systems and voluntary markets	Reading: Study carbon markets and cap-and-trade systems and their link to the SDGs, citing Stern (2007).
	Climate change and sustainable development: SDGs, green economy and just transition	
WEEK-16	Climate change communication and awareness:	Assignment: Submit a short communication piece (infographic or brief) raising public awareness of climate change, in preparation for the Final Term Examination.
	Climate Change media, education and public engagement	
FINAL TERM EXAMINATION		

TEXT BOOKS AND READING MATERIAL

1. IPCC (2021). Sixth Assessment Report: Climate Change 2021. Cambridge University Press.
2. Stern, N. (2007). The Economics of Climate Change: The Stern Review. Cambridge University Press.
3. Houghton, J. (2015). Global Warming: The Complete Briefing (5th ed.). Cambridge University Press.
4. Pakistan Climate Change Authority. Pakistan's Nationally Determined Contributions (NDC). 2021.
5. UNFCCC (2015). The Paris Agreement. United Nations Framework Convention on Climate Change.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

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- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester.

FOURTH YEAR, SEMESTER VIII			
Code	COURSE	CREDIT HOURS	CATEGORY
ENSC-406	Sustainable Development	3 (3-0)	Interdisciplinary
ENSC-407	Elective – V *****	3 (3-0)	Major
ENSC-408	Elective – VI *****	3 (3-0)	Major
ENSC-409	Elective – VII *****	3 (3-0)	Major
ENSC-410	Capstone Project	3 (3-0)	Capstone
Total Credit hrs Semester-VIII		15	

Program	BS Environmental Sciences	Course Code	ENSC-406	Credit hours	03
Course Title	SUSTAINABLE DEVELOPMENT				
COURSE INTRODUCTION					
This course offers a comprehensive exploration of sustainability, emphasizing the interconnection between social, economic, and environmental dimensions. Students will develop a foundational understanding of the historical evolution of sustainability and engage with key concepts, principles, and frameworks essential for addressing complex global challenges.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Demonstrate a comprehensive understanding of sustainability principles, key concepts, and frameworks. 2. Critically assess the interdependence of social, economic, and environmental aspects of sustainable development, both locally and globally. 3. Apply sustainable practices and solutions to address real-world challenges in professional and personal contexts.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit 1: Introduction to Sustainability		Elliott (2013) Ch.1 pp.1-28 Baker (2016) Ch.1 pp.1-24		
	Defining sustainability and its core principles		Elliott (2013) Ch.1 pp.1-28 Goldin (2018) pp.1-18		
	The three pillars of sustainability: Social, Economic, Environmental		Baker (2016) Ch.2 pp.25-52 Elliott (2013) pp.29-58		
	History and evolution of sustainability as a global concept		Elliott (2013) Ch.2 pp.29-58 Baker (2016) pp.53-78		
WEEK-2	Global sustainability challenges and opportunities		Goldin (2018) pp.19-44 Elliott (2013) Ch.3 pp.59-92		
	Sustainable Development Goals (SDGs): overview and significance		Browne (2022) Ch.1 pp.1-24 Elliott (2013) pp.93-124		
	SDG implementation frameworks: national and local strategies		Browne (2022) Ch.2 pp.25-50 Baker (2016) pp.79-108		
WEEK-3	Unit 2: Sustainable Urban Development and Smart Cities		Rogers et al. (2012) Ch.8 pp.179-206 Browne (2022) pp.51-74		
	Concept of sustainable cities and global urbanization trends		Rogers et al. (2012) pp.179-206 Baker (2016) pp.109-136		
	Key characteristics of Smart Cities: IoT, AI and big data integration		Rogers et al. (2012) pp.207-236 Elliott (2013) pp.125-152		
	Urban sustainability challenges: energy, waste and water management		Rogers et al. (2012) pp.237-266 Baker (2016) pp.137-162		
WEEK-4	Case studies: Smart City initiatives globally (Singapore, Barcelona)		Rogers et al. (2012) pp.267-292 Elliott (2013) pp.153-178		
	Sustainable infrastructure and eco-friendly building practices (LEED, BREEAM)		Rogers et al. (2012) pp.293-318 Baker (2016) pp.163-190		
	Green architecture and passive building design for energy efficiency		Rogers et al. (2012) pp.319-340 Elliott (2013) pp.179-202		

WEEK-5	Unit 3: Sustainable Transportation and Waste Management	Banister (2008) pp.73-96 Elliott (2013) pp.203-226
	Sustainable transportation models: public transport, electric vehicles and cycling	Banister (2008) pp.73-96 Rogers et al. (2012) pp.341-362
	Innovations in green transportation: autonomous electric vehicles and high-speed rail	Banister (2008) pp.97-120 Elliott (2013) pp.227-250
	Waste management strategies: waste reduction, recycling and circular economy	Rogers et al. (2012) pp.363-388 Baker (2016) pp.191-216
WEEK-6	Challenges in waste disposal and the role of technology in waste reduction	Rogers et al. (2012) pp.363-388 Elliott (2013) pp.251-274
	Zero-waste cities and successful global initiatives (e.g., Kamikatsu, Japan)	Baker (2016) pp.217-242 Elliott (2013) pp.275-296
	Extended producer responsibility (EPR) and its application in Pakistan	Rogers et al. (2012) pp.389-410 Baker (2016) pp.243-264
WEEK-7	Unit 4: Green Finance, ESG and Impact Investing	Baker (2016) Ch.7 pp.165-194 Elliott (2013) pp.297-318
	Introduction to Green Finance and its importance in sustainable development	Baker (2016) pp.165-194 Rogers et al. (2012) pp.411-430
	Environmental, Social and Governance (ESG) criteria and their application	Routledge Handbook of Sustainable Finance (2020) pp.1-28 Baker (2016) pp.195-218
	Impact investing: definition, strategies and global growth trends	Routledge Handbook of Sustainable Finance (2020) pp.29-58 Goldin (2018) pp.45-68
WEEK-8	Role of financial markets and institutional investors in driving sustainability	Routledge Handbook of Sustainable Finance (2020) pp.59-88 Elliott (2013) pp.319-340
	Case studies of ESG-driven companies and investments (Tesla, Patagonia)	Baker (2016) pp.219-242 Rogers et al. (2012) pp.431-452
	Green bonds, climate finance and sustainable banking in Pakistan	Routledge Handbook of Sustainable Finance (2020) pp.89-118 Baker (2016) pp.243-264
MID TERM EXAMINATION		
WEEK-9	Unit 5: Corporate Responsibility and Sustainability in Business	Baker (2016) Ch.8 pp.195-224 Elliott (2013) pp.319-340
	Corporate Social Responsibility (CSR) and its relationship to sustainability	Baker (2016) pp.195-224 Elliott (2013) pp.341-362
	The role of businesses in achieving sustainable development	Elliott (2013) pp.341-362 Goldin (2018) pp.69-92
	Sustainable supply chains and ethical sourcing: standards and certification	Baker (2016) pp.225-252 Rogers et al. (2012) pp.453-474
WEEK-10	Strategies for integrating sustainability into corporate governance	Baker (2016) pp.253-278 Routledge Handbook of Sustainable Finance (2020) pp.119-146
	Case studies: Leading sustainable companies (Unilever, IKEA)	Elliott (2013) pp.363-384 Baker (2016) pp.279-300

	Sustainability reporting frameworks: GRI, TCFD and integrated reporting	Baker (2016) pp.301-326 Routledge Handbook of Sustainable Finance (2020) pp.147-174
WEEK-11	Unit 6: Innovation and Future Trends in Sustainability	Elliott (2013) Ch.10 pp.247-278 Goldin (2018) pp.93-114
	Technological innovations shaping sustainability	Elliott (2013) pp.247-278 Browne (2022) pp.75-98
	Renewable energy, AI and blockchain	Goldin (2018) pp.93-114 Maslin (2021) pp.129-150
	Emerging trends in sustainable agriculture and food systems	Elliott (2013) pp.279-304 Baker (2016) pp.327-350
WEEK-12	The role of circular economy in driving sustainable change	Rogers et al. (2012) pp.475-498 Baker (2016) pp.351-374
	Future of green tech: clean energy, carbon capture and climate technology	Maslin (2021) pp.129-150 Goldin (2018) pp.115-136
	Sustainability in emerging industries: biotech, green building and sustainable fashion	Elliott (2013) pp.305-330 Baker (2016) pp.375-398
WEEK-13	Unit 7: Sustainability Policy and Governance	Baker (2016) Ch.9 pp.225-252 Browne (2022) pp.99-122
	International sustainability frameworks: Agenda 2030, Paris Agreement, Sendai Framework	Browne (2022) pp.99-122 Maslin (2021) pp.129-150
	National sustainability policies and plans in Pakistan	Baker (2016) pp.253-278 Elliott (2013) pp.331-352
	Role of government, civil society and private sector in sustainability governance	Baker (2016) pp.279-300 Goldin (2018) pp.137-156
WEEK-14	Environmental Impact Assessment (EIA) as a sustainability tool	Rogers et al. (2012) pp.499-522 Elliott (2013) pp.353-370
	Life Cycle Assessment (LCA): methodology and application in green product design	Rogers et al. (2012) pp.523-546 Baker (2016) pp.301-326
	Measuring sustainability: indicators, indices and reporting (HDI, EPI, ecological footprint)	Baker (2016) pp.327-350 Goldin (2018) pp.157-176
WEEK-15	Unit 8: Sustainability in Practice — Case Studies and Applications	Elliott (2013) Ch.11 pp.331-370 Baker (2016) pp.351-374
	Sustainability challenges and initiatives in Pakistan: energy, water and agriculture	Elliott (2013) pp.331-352 Goldin (2018) pp.177-196
	Community-based sustainability projects: local solutions for global challenges	Baker (2016) pp.351-374 Rogers et al. (2012) pp.547-568
	Example Case studies	Elliott (2013) pp.353-370 Browne (2022) pp.123-146
WEEK-16	Youth, gender and social equity in sustainable development	Baker (2016) pp.375-398 Goldin (2018) pp.197-214
	Integrating sustainability into professional careers in environmental science	Elliott (2013) pp.371-384 Baker (2016) pp.399-420
	Future outlook: pathways to a sustainable world by 2050	Goldin (2018) pp.215-230 Browne (2022) pp.147-168
FINAL TERM EXAMINATION		

TEXT BOOKS AND READING MATERIAL

1. Elliott, J. A. (2013). An Introduction to Sustainable Development (4th ed.). Routledge.
2. Baker, S. (2016). Sustainable Development (2nd ed.). Routledge.
3. Rogers, P. P., Jalal, K. F., & Boyd, J. A. (2012). An Introduction to Sustainable Development. Earthscan/Routledge.
4. Goldin, I. (2018). Development: A Very Short Introduction. Oxford University Press.
8. Browne, S. (2022). The Sustainable Development Goals: A Very Short Introduction. Oxford University Press.

Further Reading: As suggested by the instructor.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ENSC-407	Credit hours	03
Course Title	ELECTIVE - V				

ELECTIVE – V *****

An Elective Course of 03 Credit hrs will be opted from the Elective Courses List

Program	BS Environmental Sciences	Course Code	ENSC-408	Credit hours	03
Course Title	ELECTIVE - VI				

ELECTIVE – VI *****

An Elective Course of 03 Credit hrs will be opted from the Elective Courses List

Program	BS Environmental Sciences	Course Code	ENSC-409	Credit hours	03
Course Title	ELECTIVE - VII				

ELECTIVE – VII *****

An Elective Course of 03 Credit hrs will be opted from the Elective Courses List

Program	BS Environmental Sciences	Course Code	ENSC-410	Credit hours	03
Course Title	CAPSTONE PROJECT				

Capstone Project of (03) credit hours must be completed individually as a standard requirement of the degree program.

LIST OF ELECTIVE COURSES

SR. NO.	TITLE OF COURSES	TYPE	CREDIT HRS
1.	HAZARDS OF HEAVY METAL POLLUTION	ELECTIVE	3 (3-0)
2.	PLANTS AND ENVIRONMENT	ELECTIVE	3 (3-0)
3.	ANIMALS AND ENVIRONMENT	ELECTIVE	3 (3-0)
4.	TEXTILE WASTEWATER MANAGEMENT	ELECTIVE	3 (2 – 1)
5.	HYDROLOGICAL SYSTEM AND ENVIRONMENT	ELECTIVE	3 (2 – 1)
6.	ECOTOURISM	ELECTIVE	3 (3-0)
7.	WATER POLLUTION AND CONTROL	ELECTIVE	3 (2 – 1)
8.	ROCK, SOIL AND ENVIRONMENT	ELECTIVE	03 (2-1)
9.	ENVIRONMENTAL BIOTECHNOLOGY	ELECTIVE	3 (2 – 1)
10.	OCEAN AND ENVIRONMENT	ELECTIVE	3 (3-0)
11.	ENVIRONMENTAL ENGINEERING	ELECTIVE	3 (2-1)
12.	ENVIRONMENTAL STANDARDS, AUDITING	ELECTIVE	3 (3-0)
13.	ENVIRONMENT AND HUMANITY	ELECTIVE	3 (3-0)
14.	AIR AND NOISE POLLUTION	ELECTIVE	3 (2-1)
15.	INDUSTRIAL WASTE MANAGEMENT PRACTICES	ELECTIVE	3 (2-1)
16.	ENVIRONMENTAL IMPACT ASSESSMENT	ELECTIVE	3 (3-0)
17.	RENEWABLE ENERGY TECHNOLOGIES	ELECTIVE	3 (3-0)
18.	INTRODUCTION TO ATMOSPHERIC SCIENCE	ELECTIVE	3 (3-0)
19.	ENVIRONMENTAL FIELD STUDIES	ELECTIVE	3 (0-3)

Program	BS Environmental Sciences	Course Code	ELECTIVE I	Credit hours	03
Course Title	HAZARDS OF HEAVY METAL POLLUTION				
COURSE INTRODUCTION					
The identification of inorganic micropollutants, heavy metals, cations, radioactive compounds etc. impacts on abiotic environment and biota, reversing toxicity					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. A clear understanding of the inorganic micropollutants, significance and associated environmental hazards					
2. An understanding of pharmacokinetics and environmental fate of different inorganic micropollutants					
3. Information about possible methods of controlling micropollutant contamination					
4. A critical grasp on public health and environmental burdens caused by inorganic pollutant					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction Micropollutants			Verma et al. (2023) Ch 1, 3-24 Agarwal (2009) Ch. 7 pp89-134	
	Basic introduction to micropollutants				
	General mechanism of toxicity				
	Bioaccumulation, bioconcentration and biomagnification				
WEEK-2	Global disease burden caused by inorganic micropollutants			Wang et al. (2009) Ch. 2 pp. 13-62. Bradl (2005) Ch. 2 pp. 28-148	
	Introduction to Mercury, its uses and sources				
	Historical incidents of mercury contamination				
WEEK-3	Metabolic pathways of mercury poisoning			Verma et al. (2023) Ch. 15, 297-312	
	Impacts on environment				
	Reversing mercury poisoning through chelation etc.				
WEEK-4	Unit-III: Arsenic and its Environmental Impacts			Wang et al. (2009) Ch. 2 pp. 13-62. Bradl (2005) Ch. 2 pp. 28-148.	
	Introduction to Arsenic, its sources and sinks, applications				
	Historical arsenic contamination incidents				
	Movement of arsenic in groundwater				
WEEK-5	Carcinogenicity and permissible levels established by EPA-IRIS, WHO, PEQS.			Wang et al. (2009) Ch. 2 pp. 13-62. Bradl (2005) Ch. 2 pp. 28-148.	
	Natural and anthropogenic sources of lead				
	Historic and industrial applications of lead				
WEEK-6	Health and environmental consequences, global disease burden			Wang et al. (2009) Ch. 2 pp. 13-62. Bradl (2005) Ch. 2 pp. 28-148.	
	Global Alliance to eliminate lead				
	Cadmium, its sources, historic and current day uses				
	Presence in various environmental media				
WEEK-7	Cadmium specific health effects			Wang et al. (2009) Ch. 2 pp. 13-62. Bradl (2005) Ch. 2 pp. 28-148.	
	Itai Itai disease etc.				
WEEK-8	Unit-VI: Chromium and Environmental Impacts			Wang et al. (2009) Ch. 2 pp. 13-62.	
	Sources, speciation and toxic states of chromium				

	Specific diseases, bioaccumulation potential, contamination of abiotic and biotic factors	Bradl (2005) Ch. 2 pp. 28-148.
	Reclamation of chromium contaminated soils etc.	
MID TERM EXAMINATION		
WEEK-9	Overview of remediation technologies: physical, chemical and biological approaches	Verma et al. (2023) Ch. 13, 247-259 Bradl (2005) Ch. 3 pp. 165-249.
	Phytoremediation: hyperaccumulator plants and mechanisms of metal uptake	
	Bioremediation of heavy metal contaminated soils and water bodies	
WEEK-10	Immobilization and stabilization techniques using soil amendments	Bradl (2005) Ch. 3 pp. 165-249.
	Electrokinetic remediation and emerging nano-remediation technologies	
	Analytical methods for heavy metal detection: AAS, ICP-MS and XRF	
	Biomonitoring: using organisms as indicators of heavy metal contamination	
WEEK-11	Health risk assessment for communities exposed to heavy metal pollution	Bradl (2005) Ch. 3 pp. 165-249.
	WHO, EPA and NEQS permissible limits for heavy metals in water, air and food	
	Minamata Convention on Mercury: objectives and implementation status	
WEEK-12	Basel Convention on hazardous waste containing heavy metals	Bradl (2005) Ch. 3 pp. 165-249.
	Heavy metal pollution case studies in Pakistan: industrial and mining areas	
	Best available techniques (BAT) for reducing heavy metal emissions	
WEEK-13	Heavy metal pollution in food chains: dietary exposure assessment	Bradl (2005) Ch. 3 pp. 165-249.
	Occupational exposure to heavy metals in industries: prevention measures	
	Future research directions: green chemistry and metal-free alternatives	
	Integrated heavy metal management: source reduction to site remediation	
WEEK-14	Community awareness and education on heavy metal pollution risks	Bradl (2005) Ch. 3 pp. 165-249.
	Review of key concepts and examination preparation	
	Review of key concepts and examination preparation	
WEEK-15	Review of key concepts and examination preparation	Bradl (2005) Ch. 3 pp. 165-249.
	Community engagement and public awareness programs for heavy metal pollution reduction	
	Pakistan-specific case study: tannery effluent heavy metal contamination in Kasur	
	Pakistan-specific case study: tannery effluent heavy metal contamination in Kasur	

WEEK-16	Nickel and manganese toxicity: sources, environmental fate and health effects	Bradl (2005) Ch. 3 pp. 165-249.	
	Zinc toxicity in aquatic environments: sources, bioavailability and thresholds	Bradl (2005) Ch. 3 pp. 165-249.	
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Wang, L. K., Chen, J. P., Hung, Y. T., & Shammass, N. K. (2009). <i>Heavy metals in the environment</i>. CRC press. 2. Verma, D. K.; Verma, C.; Mahish, P. K. (Eds.). (2023). <i>Heavy Metals in the Environment: Management Strategies for Global Pollution</i>. American Chemical Society: Washington, DC. 3. Bradl, H. (Ed.). (2005). <i>Heavy metals in the environment: origin, interaction and remediation</i> (Vol. 6). Elsevier. 4. Agarwal, S. K. (2009). <i>Heavy metal pollution</i> (Vol. 4). APH publishing			
TEACHING – LEARNING STRATEGIES			
• Lecture based examination • Presentation/seminars • Class discussion • Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: • classroom participation, • attendance, assignments and presentation, • homework • attitude and behavior, • hands-on-activities, • short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE III	Credit hours	03
Course Title	ANIMALS AND ENVIRONMENT				
COURSE INTRODUCTION					
This course focuses on animal ecology and population biology, emphasizing the relationships between animals and their physical, biological, and human environments. It covers zoogeography, population dynamics, species interactions, and animal behavior, with particular attention to ecological processes and environmental factors that shape animal distribution, survival, and adaptation.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Explain fundamental principles of animal ecology and population biology. 2. Describe global and regional patterns of animal distribution. 3. Analyze population structure and growth using ecological models. 4. Interpret animal interactions within communities and ecosystems. 5. Evaluate adaptive significance of animal behavior. 6. Assess the effects of human population growth and environmental change on animals.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit- I: Introduction to Animals and environment		Mason et al., (2017). Chapter 58 pp: 1232-1258		
	Introduction and Historical Background of Animal ecology				
	Role of animals in food chain, web, and ecosystem				
	Factors affecting the global distribution of animals				
WEEK-2	Distribution Patterns and Barriers to Dispersal		Malleesh and Narsaiah (2025). Chapter 3. PP: 88-144		
	Dispersal Mechanisms:				
	Zoogeographic regions				
WEEK-3	Animal Population Demographics,		Urry, et al., (2020). Chapter 53 pp: 1191 - 1209		
	Population Size, Population Density and Distribution,				
	Age Structure, Population Size and Population dynamics				
WEEK-4	Unit- IV: Population Growth Models		Starr etal., (2015). Chapter 44. Pp 782-792		
	Exponential Growth				
	Logistic Growth				
	Density-Dependent Factors Density-Independent Factors				
WEEK-5	Life History Patterns		Overpopulation or Overconsumption? Or related documentary. https://www.youtube.com/watch?v=2IJ358Vt9VI followed by quiz.		
	Human Population Growth.				
	Human population and sustainability				

WEEK-6	Competitive Interactions Resource Partitioning,	Urry, et al., (2020). Chapter 54 pp: 1214 - 1234
	Predator–Prey Interactions,	
	Parasitism, Parasitoids Brood Parasites,	
	Mutualism	
WEEK-7	Coevolution among plants and animals	Mason et al., (2017). Chapter 55 pp: 1187-1204
	Species Introduction, Loss, and Invision	
	Keystone Species and Ecosystem stability	
WEEK-8	Animal Behaviour	Hickman, et al., (2008). Chapter 36 pp785-800
	Instinct and Learning,	
	Instinctive Behavior,	
MID TERM EXAMINATION		
WEEK-9	Evolution of Animal Communication,	How Do Animals Communicate in the Wild? or related documentary. https://www.youtube.com/watch?v=2d85y8Yqyl8 followed by quiz
	Types of Learned Behavior	
	Primate behaviors	
WEEK-10	Foraging behaviour	Mason et al., (2017). Chapter55 pp 1140 -11160
	Territorial behaviour	
	Animal migration routes and corridors: importance and threats	
WEEK-11	Reproductive Strategies,	Researchers discover the surprisingly complex cognitive skills or related documentaries https://www.youtube.com/watch?v=xZ5P8khu9kQ&t=78s followed by quiz
	Mating Systems, Parental Care	
	Group Living, Benefits and Costs of Grouping	
WEEK-12	Unit-VIII: Animal Conservation and Management Wildlife conservation strategies	Assignment of Protected areas of Pakistan or related topics
	Protected areas	
	Species recovery plans	
WEEK-13	Illegal wild life trade	Miller, & Spoolman (2009). Chapter 9. pp: 183 211-
	Wildlife trade and CITES: international regulations and enforcement	
	Human-wildlife conflict: causes, impacts and mitigation strategies in Pakistan	
WEEK-14	Pollution effects on wildlife	Miller, & Spoolman (2009). Chapter 11. pp: 250-272.
	Indicator species and their use in environmental health monitoring	
	Urban wildlife: adaptation of animals to city environments	
WEEK-15	Citizen science and community-based wildlife monitoring programs	Dyke, (2020). Chapter 415-436
	Animal welfare considerations and environmental management	
	Emerging technologies in wildlife monitoring.	

WEEK-16	Successful wildlife conservation programs	Cunningham, and Cunningham,. (2020). Chapter 6, pp:128-142
	Future challenges and opportunities in animal ecology and conservation	
	Discussion	
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Mader D., Sylvia S. (2024). <i>Biology</i> 14th Edition, McGraw-Hill Higher Education 2. Hickman, C. P., Keen, S. L., Eisenhour, D. J., Ober, W. C., & Larson, A. (2022). <i>Integrated principles of zoology</i> (19th ed.). McGraw-Hill Education. 3. Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Reece, J. B. (2020). <i>Campbell biology</i>. Pearson Education 4. Mason, K. A., Jonathan, B. L., Singer, S. R. (2017). <i>Biology</i>, 11 Edition, McGraw-Hill Education, 5. Mason, K. A., Losos, J. B., Duncan, T., & Raven, P. H. (2020). <i>Biology</i>. 12th Ed. McGraw-Hill Education 6. Dyke, F. V. (2020). <i>Conservation Biology: Foundations, Concepts, Applications</i>, 3 Edition, Springer 7. Urry, L., Cain, M., Wasserman, S., Morgan, J., Reece, J., Minorsky, P., & Carter, M. E. (2017). <i>Investigating Biology</i>. 9th Ed. Pearson. 8. Cunningham, W. P. and Cunningham, M. A. (2020). <i>Principals of Environmental Sciences, Inquiry & Applications</i> 9th edition, Mcgraw Hill 9. Starr, C. Ralph Taggart, Christine (2015). <i>Biology: The Unity and Diversity of Life</i>, Fourteenth Edition 10. Mallesh, M. and Narsaiah, S. (2025). <i>A Textbook of Ecology, Zoogeography and Evolution</i> Red ‘shine Publication Pvt. Ltd. India 11. Hickman, C. P., Jr., Roberts, L. S., Keen, S. L., Larson, A., I'Anson, H., & Eisenhour, D. J. (2008). <i>Integrated principles of zoology</i> (14th ed.). McGraw-Hill Higher Education. 12. Narendran, T. C., & Balakrishnan, M. (2008). <i>Systematics and Biodiversity Conservation</i>. Riddhi International. 13. Miller, G. T., Jr., & Spoolman, S. E. (2009). <i>Essentials of ecology</i> (5th ed.). Brooks/Cole Cengage Learning. 14. Gotelli, N. J. (2008). <i>A primer of ecology</i> (No. 577.88 G6). Sunderland, Massachusetts, USA: Sinauer Associates. 15. Pearl, M. C. (2000). <i>Research Techniques in Animal Ecology</i>. Publisher: Columbia University Press, Further Reading: As suggested by the Instructor.		
TEACHING – LEARNING STRATEGIES		
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR		
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:		

ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE IV	Credit hours	02
Course Title	TEXTILE WASTEWATER MANAGEMENT (THEORY)				
COURSE INTRODUCTION					
Introduction to textile industry-Polluting sectors of textile value chain-Conventional and Advanced treatment methods employed in textile industry					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Comprehend how wastewater in textile industry is produced and its characteristics 2. understand various types of physical, biological and chemical treatment methods used in textile industry 3. learn modern ways to manage wastewater in the textile industry 4. be able to select an economical and effective wastewater treatment system for textile industry					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to Textile Industry			Book: Pocket Textile Expert (p 20-62)	
	Introduction to fiber manufacturing sector				
	spinning process, knitting and weaving processes,				
WEEK-2	dyeing/finishing, and apparel manufacturing			Book: Pocket Textile Expert (p 63-69)	
	pollution sources, types, and characteristics of pollution/ wastewater/ emissions from various textile operations				
WEEK-3	Batch and continuous flow operations			Book: Pocket Textile Expert (p 70-79)	
	scouring, bleaching, mercerization, dyeing, printing, finishing, dyestuff and textile chemical manufacturing industries				
WEEK-4	source reduction, substitution of hazardous chemicals			Class Handout #1	
	reuse and recycling of wastewater, water consumption				
WEEK-5	Unit-III: Conventional and Advanced treatment methods			Selected Video Clips	
	Mixing, flocculation, and chemical precipitation Trickling Filters, Activated Sludge Tanks, Oxidation Tanks, Constructed Wetlands				
	sedimentation, gravity settlers and sludge thickeners, dissolved air flotation				
WEEK-6	Ion-exchange softening, activated sludge and extended aeration, ultrafiltration			Selected Video Clips	
	Nanofiltration, reverse osmosis, and advanced oxidation processes				
WEEK-7	Unit-IV: Advanced Treatment Methods for Textile Wastewater			Read Article:	
	Adsorption using agricultural waste and low-cost adsorbents for dye removal			Advances in Wastewater Treatment- a Review	
	Photocatalytic degradation of textile dyes using TiO2 and solar radiation				
WEEK-8	Electrochemical treatment methods: electrocoagulation and electro-oxidation			Same article	
	Membrane bioreactors (MBR) for integrated biological and physical treatment				
MID TERM EXAMINATION					

WEEK-9	Unit-V: Sludge Management and Resource Recovery	Class Handout #2
	Characterization and management of textile treatment sludge	
	Energy recovery from textile wastewater: biogas and co-generation	
WEEK-10	Recovery of valuable materials from textile effluents: dyes, metals and salts	Zero liquid discharge (ZLD) in the textile industry: a complete guide for sustainability managers
	Zero liquid discharge (ZLD) technologies in textile industry	
WEEK-11	NEQS for textile sector effluents: Pakistan EPA requirements	Class Handout #3
	Environmental monitoring and self-reporting requirements for textile mills	
WEEK-12	Cleaner production in textile industry: source reduction and substitution	Article: Cleaner production in textile industry
	Case study: effluent treatment plants in Faisalabad textile sector	
WEEK-13	Case study: common effluent treatment plants (CETPs) for textile clusters	Class Handout #4
	Environmental management systems (EMS) in textile companies	
WEEK-14	Economic analysis of textile wastewater treatment: cost-benefit approach	Class Discussions
	International best practices in sustainable textile manufacturing	
	Role of stakeholders: government, industry and community in pollution control	
WEEK-15	Review of key concepts and exam preparation	Class Discussions
	Review of key concepts and exam preparation	
WEEK-16	Current research trends and recent developments in textile wastewater management	Article: Recent Advances in the Remediation of Textile-Dye-Containing Wastewater
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Woodard, F., & Curran Inc., W. (2006). Industrial waste treatment handbook (2nd ed.). Butterworth-Heinemann. 2. Metcalf & Eddy (2014). Wastewater Engineering (5th ed.). McGraw-Hill. 2. Rott, U. & Minke, R. (1999). Treatability of Textile Wastewater. Water Science & Technology. 3. APHA (2017). Standard Methods for the Examination of Water and Wastewater (23rd ed.). 4. Shaikh, IA, Pocket Textile Expert (2005), Textile Info Society, Lahore Pakistan.		
TEACHING – LEARNING STRATEGIES		
Lecture based examination Presentation/seminars Class discussion Quizzes		
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR		
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:		
1. classroom participation, 2. attendance, assignments and presentation,		

3. homework 4. attitude and behavior, 5. hands-on-activities, 6. short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-IV	Credit hours	01
Course Title	TEXTILE WASTEWATER MANAGEMENT (PRACTICAL)				
COURSE INTRODUCTION					
This laboratory course is designed to provide practical aspects of wastewater treatments being employed in a modern textile factory, characterization, treatment, and analysis of textile wastewater, including sample collection, field measurements, and various treatment technologies, use of laboratory equipment for the determination, analysis, and treatments of wastewaters generated during textile related processes					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. be able to use understand several wastewater treatment methods being used in textile industry 2. able to use laboratory equipment for the determination, analysis, and treatments of wastewaters generated during textile related processes 3. be able to select an economical and effective wastewater treatment system for textile industry					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Production/generation of various textile wastewaters in the laboratory			Book: Pocket Textile Expert (p 20-62)	
WEEK-2	Measurement of discharge parameters (BOD, COD, TSS, pH, acidity, alkalinity electric conductivity (EC), etc.) in real wastewaters collected from various textile mills			Lab manual Practical # 1	
WEEK-3	adsorption, reverse osmosis, coagulation/flocculation, ozonation, biological treatments, etc.			EISENMANN P1-10	
WEEK-4	Experiments to reuse/recycle treated wastewater in textile processes			EISENMANN P1-11	
WEEK-5	Pollution load determination in wastewater			Lab Manual Practical # 2	
WEEK-6	Characterization of real textile effluent: color, pH, COD, BOD and TSS measurement			Lab Manual Practical # 3	
WEEK-7	Optimization of coagulation-flocculation for textile wastewater treatment			Lab Manual Practical # 4	
WEEK-8	Preparation of low-cost adsorbent and dye removal efficiency study			Lab Manual Practical # 5	
MID TERM EXAMINATION					
WEEK-9	Photocatalytic degradation experiment using TiO2 under UV light			Lab Manual Practical # 6	
WEEK-10	Batch adsorption study: equilibrium and kinetics using activated carbon			Hand-out notes	
WEEK-11	Biofilm formation study using textile wastewater as growth medium			Hand-out notes	
WEEK-12	Preparation of synthetic textile dye wastewater and treatment comparison			Lab Manual Practical # 7	
WEEK-13	Data analysis, report writing and presentation of practical findings			Hand-out notes	
WEEK-14	Current research trends and recent developments in textile wastewater management			Latest Article on the subject	

WEEK-15	Case studies: applications of textile wastewater management in Pakistan	Latest Article on the subject	
WEEK-16	Interdisciplinary connections of textile wastewater management with other environmental sciences	Hand-out notes	
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Metcalf & Eddy (2014). Wastewater Engineering (5th ed.). McGraw-Hill. 2. Rott, U. & Minke, R. (1999). Treatability of Textile Wastewater. Water Science & Technology. 3. APHA (2017). Standard Methods for the Examination of Water and Wastewater (23rd ed.).			
TEACHING – LEARNING STRATEGIES 1. Lecture based examination 2. Presentation/seminars 3. Class discussion 4. Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: 1. classroom participation, 2. attendance, assignments and presentation, 3. homework 4. attitude and behavior, 5. hands-on-activities, 6. short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-V	Credit hours	02
Course Title	HYDROLOGICAL SYSTEM AND ENVIRONMENT (THEORY)				
COURSE INTRODUCTION					
This course provides a comprehensive understanding of the hydrological cycle and its integral role in shaping the environment. It examines the movement, distribution, and quality of water within various components of the Earth system, including the atmosphere, surface waters, groundwater, and biosphere.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. This course will provide understanding of Hydrology and its system in Environmental sciences 2. The students will learn about the surface water resources 3. They will have the knowledge about the occurrences and importance of ground water resources and different water bearing formations 4. The students will get used to the different methods for measurement of stream flow					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction			Reading: Chow et al. Ch.1 - Introduction to Hydrology; List physical properties of water	
	Occurrence of Water on Earth				
	Physical and chemical properties of water				
WEEK-2	Importance of Water			Reading: Davie Ch.1 - Fundamentals of Hydrology; Write a paragraph on water's importance	
	Introduction to Hydrology, origin and history				
WEEK-3	Importance of Hydrology			Assignment: Prepare a concept map of hydrology branches and their applications	
	Branches of Hydrology				
WEEK-4	Introduction and importance of hydrological cycle			Reading: Ward & Robinson Ch.2 - Hydrological Cycle; Label components on a blank diagram	
	Components of Hydrological Cycle				
WEEK-5	Global Water Budget			Assignment: Calculate global water budget using provided dataset; submit calculation sheet	
	Hydrological Losses (Interception, Infiltration, Evaporation, transpiration)				
	Occurrence of fresh Water on Earth on earth				
WEEK-6	Runoff Process and hydrological losses			Reading: Chow et al. Ch.3 - Precipitation; Analyze runoff process in a Pakistani river basin	
	Rivers				
WEEK-7	Lakes and reservoirs			Reading: Davie Ch.4 - Surface Water; Compare surface water resources of two major rivers	
	Glacier				
	Surface water resources of Pakistan				
WEEK-8	Ground water resources, occurrence and importance			Assignment: Describe types of aquifers with diagrams; identify aquifer types in Indus Basin	
	Aquifers and types of aquifers				
MID TERM EXAMINATION					
WEEK-9	Hydraulic properties of aquifers			Reading: Chow et al. Ch.7 - Groundwater; Calculate hydraulic conductivity from provided data	
	Stage measurement				
	Velocity measurements using different methods				

WEEK-10	Velocity-Area method for streamflow measurement	Assignment: Practice velocity-area method calculations using field data worksheet
	Stream gauges	
WEEK-11	Current research trends and recent developments in hydrological system and environment	Reading: Ward & Robinson Ch.8 - Hydrological Monitoring; Summarize a recent research article
	Case studies: applications of hydrological system and environment in Pakistan	
WEEK-12	Interdisciplinary connections of hydrological system and environment with other environmental sciences	Assignment: Prepare a 1-page case study linking hydrology with climate change in Pakistan
	Field and laboratory methods for hydrological system and environment monitoring	
WEEK-13	Data analysis and interpretation in hydrological system and environment	Reading: Davie Ch.9 - Data Interpretation; Practice interpreting hydrograph data
	Reporting and communication of hydrological system and environment findings	
WEEK-14	Unit: Policy and Regulation in Hydrological System And Environment	Assignment: Review NEQS water quality standards and write a one-page policy summary
	National and international standards relevant to hydrological system and environment	
	Regulatory frameworks and compliance in hydrological system and environment	
WEEK-15	Environmental legislation related to hydrological system and environment in Pakistan	Reading: Research article on water legislation in Pakistan; list key regulatory bodies
	Emerging challenges and opportunities in hydrological system and environment	
WEEK-16	Technological innovations shaping the future of hydrological system and environment	Assignment: Identify one emerging technology in hydrology and write a short critical review
	Adaptive management, and future horizons in hydrological governance	

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Chow, V.T., Maidment, D.R. & Mays, L.W. (1988). Applied Hydrology. McGraw-Hill.
2. Ward, R.C. & Robinson, M. (2000). Principles of Hydrology (4th ed.). McGraw-Hill.
3. Davie, T. (2008). Fundamentals of Hydrology (2nd ed.). Routledge.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

2. classroom participation,
3. attendance, assignments and presentation,
4. homework
5. attitude and behavior,
6. hands-on-activities,
7. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-V	Credit hours	01
Course Title	HYDROLOGICAL SYSTEM AND ENVIRONMENT (PRACTICAL)				
COURSE INTRODUCTION					
This course provides a comprehensive understanding of the hydrological cycle and its integral role in shaping the environment. It examines the movement, distribution, and quality of water within various components of the Earth system, including the atmosphere, surface waters, groundwater, and biosphere.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. This course will provide a demonstration about the different instruments used for recording hydrological data 2. The students will learn about the practical aspects of the runoff measurement techniques 3. They will have the knowledge about development and interpretation of unit hydrographs 4. The students will get used to the concepts of frequency analysis of precipitation data 5. They will become conversant with the different methods to measure infiltration					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	practice in taking actual data from weather stations including a visit to weather station			Practical Report: Summarize observations from weather station visit with labeled instrument diagram	
WEEK-2	Determination of physical and chemical properties of water samples			Practical Report: Record physical and chemical properties of collected water samples	
WEEK-3	Rainfall data analysis: calculating mean, median and return periods			Assignment: Calculate mean annual rainfall and return period from provided rainfall dataset	
WEEK-4	Development and interpretation of unit hydrograph from rainfall-runoff data			Practical Report: Plot and interpret unit hydrograph from given rainfall-runoff data	
WEEK-5	Aquifer pumping test: measuring drawdown and calculating transmissivity			Practical Report: Record drawdown data and calculate transmissivity from pumping test results	
WEEK-6	Water budget calculation for a small watershed: inputs and outputs			Assignment: Prepare water budget worksheet for a small watershed using provided inputs/outputs	
WEEK-7	GIS mapping of watershed boundaries and drainage networks			Practical Report: Submit GIS map of watershed boundary with labeled drainage network	
WEEK-8	Flow measurement in the field using current meter and float method			Practical Report: Document field flow measurements using current meter and float method	
MID TERM EXAMINATION					
WEEK-9	Groundwater level monitoring and interpretation of piezometric maps			Assignment: Interpret piezometric surface map	
WEEK-10	Analysis of water quality data from multiple sampling stations			Assignment: Interpret piezometric surface map through groundwater flow direction	
WEEK-11	Field report writing and presentation of hydrological survey findings			Assignment: Write a structured field report on hydrological survey findings	
WEEK-12	Current research trends and recent developments in hydrological system and environment			Reading: Review a recent journal article on hydrological monitoring technology in South Asia	

WEEK-13	Case studies: applications of hydrological system and environment in Pakistan	Practical Report: Present one case study application of hydrology in Pakistan context	
WEEK-14	Interdisciplinary connections of hydrological system and environment with other environmental sciences	Assignment: Identify interdisciplinary links between hydrology and environmental sciences	
WEEK-15	Field and laboratory methods for hydrological system and environment monitoring	Practical Report: Compare laboratory and field methods for one hydrological parameter	
WEEK-16	Data analysis and interpretation in hydrological system and environment	Assignment: Prepare a final data interpretation summary from semester lab results	
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Chow, V.T., Maidment, D.R. & Mays, L.W. (1988). Applied Hydrology. McGraw-Hill. 2. Ward, R.C. & Robinson, M. (2000). Principles of Hydrology (4th ed.). McGraw-Hill. 3. Davie, T. (2008). Fundamentals of Hydrology (2nd ed.). Routledge.			
TEACHING – LEARNING STRATEGIES 1. Lecture based examination 2. Presentation/seminars 3. Class discussion 4. Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: 1. classroom participation, 2. attendance, assignments and presentation, 3. homework 4. attitude and behavior, 5. hands-on-activities, 6. short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-VI	Credit hours	03
Course Title	ECOTOURISM				
COURSE INTRODUCTION					
The course has been designed for the students to enable them meet the existing global challenges of achieving a sustainable growth in a competitive environment of Tourism industry.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Understand the theories of ecotourism experience 2. Critically evaluate ecotourism business operations and planning contexts 3. Understand the benefits and professional status of ecotourism 4. Apply the knowledge of a variety of interpretations and approaches to ecotourism, in a number of case studies. 5. Apply knowledge of sustainable ecotourism to management practices. 6. Understand the sound professional practice in the development of management of ecotourism opportunities.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction			Reading: Study Chapters 1 and 2 in Fennell (2015) examining the evolution of ecotourism, sustainable tourism concepts, and distinctions between nature-based tourism and mass tourism	
	Introduction and general overview, Context and definitions of Ecotourism				
	Types of Ecotourism				
	Alternative and mass tourism				
WEEK-2	Principles and philosophies of Ecotourism			Assignment: Prepare a 2-page comparative review explaining the differences between conventional tourism, sustainable tourism, and ecotourism using concepts presented in Honey (2008).	
	Ecotourism Resources				
	Protected areas in ecotourism				
WEEK-3	Identifying and describing ecotourism products			Reading: Read relevant sections from Weaver (2001) discussing ecotourism product development, destination attractions, and visitor experiences.	
	Components of Ecotourism				
	Impacts of Ecotourism				
WEEK-4	Resources required for Eco and Urban Tourism, Ecotourism practices			Assignment: Develop an ecotourism destination inventory identifying ecological, cultural, and recreational resources for a selected protected area using Fennell (2015) guidelines.	
	Environmental and ecological Impacts of ecotourism				
	Ecotourism Markets, Clients, and Motivation, Community based ecotourism				
	Ecotourism Developments, Developing an Ecotourism product				
WEEK-5	Ecotourism in the national and Global context			Reading: Review case studies from Honey (2008) evaluating successful ecotourism initiatives and their contributions to biodiversity conservation and local livelihoods.	
	Carrying capacity analysis for ecotourism sites: methods and calculations				
	Environmental impact assessment of proposed ecotourism developments				
WEEK-6	Zoning and visitor management plans for ecotourism destinations			Assignment: Conduct a carrying-capacity assessment exercise for a selected ecotourism destination using visitor management	
	Infrastructure requirements for sustainable ecotourism: low-impact design				

	Principles of community-based ecotourism and benefit sharing	indicators and environmental thresholds.
	Engaging local communities in ecotourism planning and management	
WEEK-7	Capacity building for local guides, hospitality and service providers	Reading: Read selected case studies on community-based ecotourism projects in developing countries, focusing on local participation and livelihood enhancement.
	Case study: community-based ecotourism in Northern Pakistan (Hunza, Skardu)	
	Ecotourism market segmentation: identifying and targeting responsible travelers	
WEEK-8	Digital marketing, social media and online platforms for ecotourism promotion	Assignment: Design a digital marketing strategy for an ecotourism destination incorporating social media campaigns, sustainability messaging, and target market analysis.
	Pricing strategies and economic feasibility of ecotourism ventures	
	Certification standards for ecotourism: GSTC criteria and local schemes	
	Ecological monitoring frameworks for ecotourism impact assessment	
MID TERM EXAMINATION		
WEEK-9	Visitor satisfaction surveys and feedback mechanisms	Reading: Read Chapter 8 in Fennell (2015) on ecotourism monitoring, indicators, and adaptive management frameworks.
	Key performance indicators for sustainable ecotourism management	
	Adaptive management: using monitoring data to improve ecotourism practices	
WEEK-10	Unit-IX: Ecotourism Policy and Governance	Assignment: Prepare a 2-page Policy Brief evaluating the Pakistan Tourism Act and the regulatory role of protected area management authorities.
	National ecotourism policies and strategies: Pakistan Tourism Act and guidelines	
	Role of protected area management authorities in ecotourism regulation	
	Public-private partnerships in ecotourism development	
WEEK-11	International ecotourism networks and collaboration opportunities	Reading: Read selected chapters from Weaver (2001) on climate change vulnerability, overtourism, and international collaboration networks.
	Climate change impacts on ecotourism destinations and adaptation strategies	
	Overtourism and its ecological consequences: lessons learned globally	
WEEK-12	Technological innovations in ecotourism: apps, virtual reality and AI guides	Assignment: Prepare a comparative case study report analyzing a regenerative tourism initiative vs. an overtourism failure in South Asia.
	Regenerative tourism: moving beyond sustainability to ecological restoration	
	Case study: ecotourism success and failure stories from South Asia	
WEEK-13	Gender and social inclusion in ecotourism: empowering marginalized communities	Reading: Read Chapter 3 in Honey (2008) on community empowerment, gender equity, and ethical wildlife tourism practices.
	Wildlife tourism: birdwatching, marine ecotourism and safari best practices	
	Ecotourism and cultural heritage: preserving traditions while sharing them	
	Developing an ecotourism business plan: market analysis and implementation	

WEEK-14	Review of key concepts and preparation for ecotourism project presentations	Assignment: Submit and present the final group Ecotourism Business & Destination Management Plan featuring market analysis and zoning strategies.	
	Volunteer tourism and its ecological benefits and risks		
	Blue economy and marine ecotourism: coral reefs, whale watching and diving		
WEEK-15	Unit-V: Ecotourism Management and Sustainability	Reading: Review Global Sustainable Tourism Council (GSTC) criteria and certification frameworks in Fennell (2015).	
	Visitor management strategies: carrying capacity and zoning		
	Environmental impact monitoring in ecotourism destinations		
	Certification schemes for ecotourism: GSTC and national standards		
WEEK-16	Economic benefits of ecotourism for local communities	Reading / Prep: Review regional case studies on Gilgit-Baltistan and KPK ecotourism potential; prepare for Final Term Examination.	
	Ecotourism potential of northern Pakistan: Gilgit-Baltistan and KPK		
	Challenges of Ecotourism		
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Fennell, D.A. (2015). Ecotourism (4th ed.). Routledge. 2. Weaver, D.B. (2001). The Encyclopedia of Ecotourism. CABI Publishing. 3. Honey, M. (2008). Ecotourism and Sustainable Development (2nd ed.). Island Press.			
TEACHING – LEARNING STRATEGIES			
Lecture based examination Presentation/seminars Class discussion Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:			
classroom participation, attendance, assignments and presentation, homework attitude and behavior, hands-on-activities, short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester.

Program	BS Environmental Sciences	Course Code	ELECTIVE-VII	Credit hours	02
Course Title	WATER POLLUTION AND CONTROL (THEORY)				
COURSE INTRODUCTION					
This course provides an introduction to the fundamental concepts of water pollution, its control, and management. The student will comprehend the scientific principles, analysis tools and operations involved in water pollution and control.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: The student is expected to have a basic understanding of water related issues and their solutions. This course will provide information on the basic concepts of water pollution and its effects on human and ecosystem health The students will learn how to assess and measure pollution load, stream flows, consequences of water pollution, treatment, disposal, and impacts.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Introduction		Raed: Study the categorization of water pollutants and major global river basin degradation in Metcalf & Eddy (2014), <i>Wastewater Engineering: Treatment and Resource Recovery</i> .		
	Major Water pollutants				
	Polluted Rivers of the World				
WEEK-2	Chemical, Physical and Biological properties of polluted water		Assignment: Solve a problem set on parameter unit conversions (mg/L to ppm) and dissolved oxygen deficit calculations, referencing Sawyer et al. (2003).		
	Acidity, alkalinity, electric conductivity (EC), Suspended Solids (TSS), Total Dissolved Solids (TDS), Dissolved Oxygen (DO)				
WEEK-3	Glossary of water pollution		Reading: Study groundwater contamination transport mechanisms and sub-surface hydrology in Todd & Mays (2005), <i>Groundwater Hydrology</i> .		
	Groundwater Pollution				
WEEK-4	Measure of water quality		Prepare a comparative table detailing heavy metal sources, toxicity mechanisms, and permissible limits, citing WHO Guidelines for Drinking-water Quality.		
	Heavy metal pollution				
WEEK-5	Eutrophication, Characterization of polluted water		Reading: Read principles of chemical dosing, mixing kinetics, detention time, and flow blending in Davis (2010), <i>Water and Wastewater Engineering</i> .		
	Pollution load calculations				
WEEK-6	Chemical feed, dose, demand, residual, and chemical concentrations		Assignment: Review biological operational parameters (F/M ratio, MCRT, surface loading rates) and standard analytical methods (BOD ₅ , COD, TOC) in APHA (2017)		
	Removal efficiency, detention time, and chemical blending				
WEEK-7	Surface loading rate, F/M and MCRT ratios		Assignment: Draw a detailed Process Flow Diagram (PFD) for a wastewater treatment plant handling industrial effluent, justifying unit selection using Metcalf & Eddy (2014).		
	NEQS, Testing methods (BOD, COD, TOC, etc.)				
WEEK-8	Pollution reduction at source, effluent disposal		Reading: Read about aerobic versus anaerobic conversion kinetics and recent innovations in membrane bioreactors (MBRs) in Metcalf & Eddy (2014).		
	Preliminary treatment, Primary treatment, Secondary treatment, Advanced and tertiary treatment				
MID TERM EXAMINATION					

WEEK-9	Principle and types of aerobic and anaerobic treatment methods	Assignment: Prepare a case study note analyzing an industrial water pollution challenge in Pakistan and proposing localized mitigation options, citing Pak-EPA reports.
	Collection and transportation of wastes, Optimization, Recycling & Reuse	
WEEK-10	Case studies: applications of water pollution and control in Pakistan	Reading: Read field sampling protocols, monitoring network design, and data interpretation techniques in APHA (2017).
	Interdisciplinary connections of water pollution and control with other environmental sciences	
WEEK-11	Field and laboratory methods for water pollution and control monitoring	Assignment: Prepare a comparative policy memo evaluating Pakistan National Environmental Quality Standards (NEQS) against WHO effluent standards, citing official regulatory documents.
	Data analysis and interpretation in water pollution and control	
WEEK-12	Reporting and communication of water pollution and control findings	Reading: Read the legislative mechanisms, compliance requirements, and enforcement frameworks in the Pakistan Environmental Protection Act (PEPA 1997).
	National and international standards relevant to water pollution and control	
WEEK-13	Regulatory frameworks and compliance in water pollution and control	Quiz
	Environmental legislation related to water pollution and control in Pakistan	
WEEK-14	Unit: Future Directions in Water Pollution And Control	Assignment: Prepare a concept proposal for a low-cost, nature-based wastewater treatment technology (e.g., constructed wetlands), citing UN-Water reports.
	Emerging challenges and opportunities in water pollution and control	
	Technological innovations shaping the future of water pollution and control	
WEEK-15	Career pathways and professional development in water pollution and control	Reading: Review professional ethics codes and engineering career pathways in ASCE, Ethics and Professional Practice for Engineers.
	Industrial water stewardship and Zero Liquid Discharge (ZLD) systems	
WEEK-16	Climate resilience and risk assessment in urban water infrastructure	Reading: Study climate change impacts on water quality dynamics and SDG 6 targets in IPCC (2021), <i>Sixth Assessment Report (WGII)</i> .
	Sustainable Development Goal 6 (SDG 6) and circular water economy	

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Metcalf & Eddy (2014). Wastewater Engineering (5th ed.). McGraw-Hill.
2. Davis, M.L. (2010). Water and Wastewater Engineering. McGraw-Hill.
3. Gray, N.F. (2004). Biology of Wastewater Treatment (2nd ed.). Imperial College Press.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

2. classroom participation,
3. attendance, assignments and presentation,
4. homework
5. attitude and behavior,
6. hands-on-activities,
7. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-VII	Credit hours	01
Course Title	WATER POLLUTION AND CONTROL (PRACTICAL)				
COURSE INTRODUCTION					
This laboratory course is designed to provide practical aspects of water pollution and its control. It will also enable students to learn about the evaluation techniques and testing procedure for the assessment and remediation of major pollutions in water and wastewater. Student will know the sound knowledge about calculating pollution load in any given effluent.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. This course will provide a demonstration about the different instrumentation used in the assessment of major water pollutants					
2. Students will learn about the practical aspects of domestic and industrial water pollution					
3. They will also get the working knowledge about standard testing protocols for evaluation of pollutants in water/wastewater					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Determination of BOD5 in industrial and municipal wastewater samples		Reading/Prep: Review the BOD5 determination procedure in Metcalf & Eddy (2014), Wastewater Engineering, before the laboratory session.		
WEEK-2	Determination of COD using dichromate open reflux method		Assignment: Submit a lab report on COD determination using the dichromate open-reflux method, citing Davis (2010), Water and Wastewater Engineering.		
WEEK-3	Measurement of heavy metals in water using atomic absorption spectroscopy		Reading/Prep: Read about atomic absorption spectroscopy for heavy-metal analysis in Gray (2004), Biology of Wastewater Treatment.		
WEEK-4	Biological assessment of water quality: macroinvertebrate index		Assignment: Submit a lab report on the biological assessment of water quality using a macroinvertebrate index.		
WEEK-5	Jar test for optimization of coagulant dose in water treatment		Reading/Prep: Review jar-test methodology for coagulant-dose optimization in Metcalf & Eddy (2014).		
WEEK-6	Adsorption experiment: removal of pollutants using activated carbon		Assignment: Submit a lab report on the adsorption experiment for pollutant removal using activated carbon.		
WEEK-7	Determination of nitrates and phosphates in water: colorimetric method		Reading/Prep: Read the colorimetric method for nitrate and phosphate determination in Davis (2010).		
WEEK-8	Calculation of pollution load and dilution factor for industrial discharges		Assignment: Submit calculations for pollution load and dilution factor for a sample industrial discharge.		
MID TERM EXAMINATION					
WEEK-9	Field sampling of water from river, canal and industrial outlet		Reading/Prep: Review sampling protocols for rivers, canals and industrial outlets in Gray (2004).		
WEEK-10	Data analysis and pollution load report for sampled water bodies		Assignment: Submit a data-analysis and pollution-load report for the sampled water bodies.		
WEEK-11	Preparation and presentation of water quality assessment report		Reading/Prep: Read guidance on preparing and presenting a water-quality assessment report in Metcalf & Eddy (2014).		

WEEK-12	Current research trends and recent developments in water pollution and control	Assignment: Prepare a short literature summary of current research trends in water pollution and control.
WEEK-13	Case studies: applications of water pollution and control in Pakistan	Reading/Prep: Review Pakistani case studies on water-pollution control applications in Davis (2010).
WEEK-14	Interdisciplinary connections of water pollution and control with other environmental sciences	Assignment: Prepare a short note on the interdisciplinary connections between water pollution control and other environmental sciences.
WEEK-15	Field and laboratory methods for water pollution and control monitoring	Reading/Prep: Read about field and laboratory monitoring methods for water pollution control in Gray (2004).
WEEK-16	Data analysis and interpretation in water pollution and control	Assignment: Submit a final data-analysis and interpretation report compiling the semester's practical work, in preparation for the Final Term Examination.

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Metcalf & Eddy (2014). Wastewater Engineering (5th ed.). McGraw-Hill.
2. Davis, M.L. (2010). Water and Wastewater Engineering. McGraw-Hill.
3. Gray, N.F. (2004). Biology of Wastewater Treatment (2nd ed.). Imperial College Press.

TEACHING – LEARNING STRATEGIES

1. Lecture based examination
2. Presentation/seminars
3. Class discussion
4. Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

2. classroom participation,
3. attendance, assignments and presentation,
4. homework
5. attitude and behavior,
6. hands-on-activities,
7. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester.

Program	BS Environmental Sciences	Course Code	ELECTIVE-VIII	Credit hours	02
Course Title	ROCK, SOIL AND ENVIRONMENT (THEORY)				
COURSE INTRODUCTION					
This course explores the fundamental properties and processes of rocks and soils and their critical roles in shaping and sustaining the environment. Students will examine the origin, classification, and composition of rocks and soils, as well as the physical, chemical, and biological processes that govern their formation, transformation, and interaction with environmental systems.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. This course will provide an introduction to the Soil to the students. 2. The students will learn about the Soil and Rock Mechanics. 3. They will have the knowledge about the Geological and Engineering Classification of Soil. 4. The students will get used to the design of foundation of Dams, Highways and Civil Structures.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Sieve Analysis			Reading: Brady & Weil Ch.1 - Introduction to Soils; Define soil and list its key functions	
	Introduction and Definition of Soil				
	Function of Soil				
WEEK-2	Soil Profile			Assignment: Draw a labeled soil profile showing O, A, B, C horizons with descriptions	
	Soil Horizons				
WEEK-3	Compaction, Permeability and Capillarity of Soil			Reading: Das Ch.4 - Compaction; Summarize factors affecting soil compaction in 200 words	
	Stress and Stress Distribution of Soil, Consolidation and Consolidation Settlement.				
WEEK-4	Soil Colors			Assignment: Create a color chart matching Munsell soil colors to soil types in Pakistan	
	Soil Processes				
WEEK-5	Soil Formation			Reading: Brady & Weil Ch.5 - Soil Formation; Write a note on parent material influence on soil	
	Shear Strength of Soil, Laboratory Measurements of Soil Properties,				
WEEK-6	Soil Fertility			Assignment: Compare soil fertility levels in irrigated vs rain-fed agricultural land	
	Physical Properties of Soil				
WEEK-7	Soil Moisture			Reading: Das Ch.7 - Soil Moisture; Describe methods to measure soil moisture content	
	Bearing Capacity of Soils, Shallow and Pile Foundation				
WEEK-8	Soil Matrix			Assignment: Analyze soil chemistry data worksheet; identify nutrient deficiencies in samples	
	Soil Chemistry				
MID TERM EXAMINATION					
WEEK-9	Soil Nutrients, Soil Organic Matter			Reading: Brady & Weil Ch.9 - Organic Matter; Explain role of humus in soil improvement	
	Soil Improvement, Embankment Dams, Dynamic Loading of Soil				
WEEK-10	Soil Classification			Assignment: Apply USDA soil classification to 5 soil samples described in the worksheet	
	Soil Uses				
WEEK-11	Soil Degradation			Reading: Brady & Weil Ch.11 - Soil Degradation; Identify degraded soils in Pakistan with map	
	Soil Reclamation				

WEEK-12	Environmental Geotechnology	Assignment: Write a 400-word essay on soil pollution sources in urban environments
	Soil Pollution	
WEEK-13	Geological Classification of Soil	Reading: Das Ch.3 - Geological Classification; Compare geological vs engineering soil classes
	Soil Structure	
WEEK-14	Soil Texture	Assignment: Describe texture and structure of 3 soil samples using provided data sheet
	Rocks as an Aggregates	
WEEK-15	Description and Classification of Aggregates	Reading: Coduto Ch.5 - Aggregate Sources; Identify aggregate deposits on a geological map
	Occurrences and Associations of Sources,	
WEEK-16	Field Investigation of Deposits.	Assignment: Review extraction methods of aggregates; write a short environmental impact note
	Extraction of Aggregates	

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Das, B.M. (2014). Principles of Geotechnical Engineering (8th ed.). Cengage.
2. Brady, N.C. & Weil, R.R. (2016). Nature and Properties of Soils (15th ed.). Pearson.
3. Coduto, D.P. (1999). Geotechnical Engineering: Principles and Practices. Prentice Hall.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

2. classroom participation,
3. attendance, assignments and presentation,
4. homework
5. attitude and behavior,
6. hands-on-activities,
7. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-VIII	Credit hours	01
Course Title	ROCK, SOIL AND ENVIRONMENT (PRACTICAL)				
COURSE INTRODUCTION					
This course explores the fundamental properties and processes of rocks and soils and their critical roles in shaping and sustaining the environment. Students will examine the origin, classification, and composition of rocks and soils, as well as the physical, chemical, and biological processes that govern their formation, transformation, and interaction with environmental systems.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. This course will provide an introduction to the Laboratory Test of Soil to the students. 2. The students will learn about the Gradation and Density of the Soil. 3. They will have the knowledge about the Engineering Test of Soil. 4. The students will get used to the design of foundation of Dams, Highways and Civil Structures.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Definition and Apparatus of Sieve Analysis		Practical Report: Document sieve set-up with labeled apparatus diagram and preliminary results		
WEEK-2	Procedure, Results, Methods of Sieve Analysis		Practical Report: Submit completed sieve analysis results table and particle size distribution curve		
WEEK-3	Types of Gradation, Types of Sieves		Assignment: Classify gradation type (well/poorly/gap graded) from your sieve analysis data		
WEEK-4	Limitations of Sieve Analysis, Properties and Engineering Applications of Sieve Analysis		Practical Report: Identify limitations observed during sieve analysis and suggest improvements		
WEEK-5	Definition and Apparatus of Moisture Content Test		Practical Report: Record moisture content test setup with apparatus labels and initial readings		
WEEK-6	Procedure, Results, Methods of Moisture Content Test		Practical Report: Submit completed moisture content calculation sheet with results discussion		
WEEK-7	Measurements, Classification and Uses in Aggregates		Assignment: Compare aggregate measurements from two different sample sizes; tabulate results		
WEEK-8	Definition and Apparatus of Organic Content Test		Practical Report: Document organic content test apparatus and write preliminary procedure steps		
MID TERM EXAMINATION					
WEEK-9	Procedure, Results, Methods of		Practical Report: Record organic content test observations and intermediate calculations		
WEEK-10	Organic Content Test				
WEEK-11	Soil Organic Matter, Sources, Composition of Vegetal Detritus Decomposition		Reading: Brady & Weil Ch.9 - Organic Matter; relate lab findings to soil organic matter theory		
WEEK-12	Humus and Function in Carbon Cycling		Assignment: Explain carbon cycling role of humus with a labeled diagram		
WEEK-13	Definition and Apparatus of		Practical Report: Document specific gravity test apparatus; compare with standard ASTM values		
WEEK-14	Specific Gravity and Water Absorption Test		Practical Report: Submit specific gravity and water absorption test calculations and discussion		

WEEK-15	Procedure, Results, Methods of Specific Gravity and Water Absorption Test	Practical Report: Record specific gravity results and analyze water absorption significance	
WEEK-16	Definition and Apparatus of Liquid Limit Test	Practical Report: Document liquid limit test apparatus setup; compare with Atterberg limits theory	
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Das, B.M. (2014). Principles of Geotechnical Engineering (8th ed.). Cengage. 2. Brady, N.C. & Weil, R.R. (2016). Nature and Properties of Soils (15th ed.). Pearson. 3. Coduto, D.P. (1999). Geotechnical Engineering: Principles and Practices. Prentice Hall.			
TEACHING – LEARNING STRATEGIES 1. Lecture based examination 2. Presentation/seminars 3. Class discussion 4. Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: 2. classroom participation, 3. attendance, assignments and presentation, 4. homework 5. attitude and behavior, 6. hands-on-activities, 7. short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-IX	Credit hours	02
Course Title	ENVIRONMENTAL BIOTECHNOLOGY (THEORY)				
COURSE INTRODUCTION					
This course provides an in-depth exploration of how biotechnology can be applied to address environmental challenges. It focuses on the use of biological systems and organisms particularly microbes and plants for the sustainable management of environmental resources, pollution control, and ecosystem restoration.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Basic concept of biotechnology, branches of biotechnology and role of biotechnology in environment					
2. Wastewater treatment using biotechnological tools					
3. Air pollution treatment with reference to environmental biotechnology					
4. Role of environmental biotechnology in agriculture and bioremediation of contaminants					
5. Role microbes in Bio gasification, wastewater treatment, composting, industry manufacturing etc.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction			Scragg (2005), Environmental Biotechnology (2nd Ed.) Chapter 2: Environmental Biotechnology Fundamentals	
	What is biotechnology				
	Branches of biotechnology				
WEEK-2	Environmental Biotechnology				
	Biomarkers, Biosensor, Bioreactors				
WEEK-3	Overview of air, soil and water pollution abatement using environmental biotechnology			Assignment: Review a case study on biological treatment of air, water, or soil pollution.	
	Ethical and legal problems in creation and use of transgenic organisms.				
WEEK-4	Fundamentals of biological interventions			Glazer & Nikaido (2007), Microbial Biotechnology Chapter 5: Recombinant DNA Technology	
	Recombinant DNA Technology and Genetic manipulations				
WEEK-5	Unit-II: Xenobiotic compounds, hazardous wastes and their treatment			Scragg (2005) Chapter 7: Hazardous Waste Treatment	
	Introduction				
	Bio-treatment of xenobiotic compounds and hazardous waste				
WEEK-6	Detoxification methods			Assignment: Literature review on microbial detoxification mechanisms.	
	Introduction				
WEEK-7	Transgenic plants for food security, nutrition and health care			Glazer & Nikaido (2007) Chapter 10: Agricultural Biotechnology	
	Biofertilizers and biopesticides				
	Biotechnology and Industrial Manufacturing Process				
WEEK-8	Biotechnology and Bio-gasification/ biofuels			Presentation on biofuels, biogasification, and composting technologies.	
	Biotechnology and composting				
MID TERM EXAMINATION					
WEEK-9	Ethical problems in Biotechnology			Scragg (2005) Chapter 11: Bioremediation Technologies	
	Bio-strategies for pollution control; Air, Water and Soil				
	Bioremediation				

WEEK-10	Phytoremediation	Prepare a comparative table of phytoremediation and biofilm-based treatment systems.
	Biofilm	
WEEK-11	Bio-sorption	Glazer & Nikaido (2007) Chapter 12: Biosorption and Microbial Applications
	Mycoremediation	
WEEK-12	Phycoremediation	Assignment: Critical review of recent advances in phycoremediation.
	Current research trends and recent developments in environmental biotechnology	
WEEK-13	Case studies: applications of environmental biotechnology in Pakistan	Research Articles and Case Studies from Pakistan
	Interdisciplinary connections of environmental biotechnology with other environmental sciences	
WEEK-14	Unit: Monitoring and Assessment in Environmental Biotechnology	Design a monitoring plan for a biotechnology-based environmental project.
	Field and laboratory methods for environmental biotechnology monitoring	
	Data analysis and interpretation in environmental biotechnology	
WEEK-15	Reporting and communication of environmental biotechnology findings	Scientific Reporting and International Standards Documents
	National and international standards relevant to environmental biotechnology	
WEEK-16	Regulatory frameworks and compliance in environmental biotechnology	National and International Regulatory Frameworks
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Scragg, A. (2005). Environmental Biotechnology (2nd ed.). Oxford University Press. 2. Rittmann, B.E. & McCarty, P.L. (2001). Environmental Biotechnology. McGraw-Hill. 3. Glazer, A.N. & Nikaido, H. (2007). Microbial Biotechnology (2nd ed.). Cambridge University Press.		
TEACHING – LEARNING STRATEGIES		
Lecture based examination Presentation/seminars Class discussion Quizzes		
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR		
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: 1. classroom participation, 2. attendance, assignments and presentation, 3. homework 4. attitude and behavior, 5. hands-on-activities, 6. short tests, quizzes etc.		

ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-IX	Credit hours	01
Course Title	ENVIRONMENTAL BIOTECHNOLOGY (PRACTICAL)				
COURSE INTRODUCTION					
This course provides an in-depth exploration of how biotechnology can be applied to address environmental challenges. It focuses on the use of biological systems and organisms particularly microbes and plants for the sustainable management of environmental resources, pollution control, and ecosystem restoration.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Methods of heavy metals removal based on biological treatment 2. Various case studies related to bioremediation of water and soil 3. GMOs and their role in reducing environmental stresses in agriculture 4. Degradation techniques for of organic pollutants					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Biotechnological techniques and tools			Standard Operating Procedure (SOP) for autoclave and laminar flow cabinet.	
	Laminar flow cabinet and Autoclave operation; Culture media preparation				
WEEK-2	Disinfection of Lab, instruments, media; Isolation, purification, propagation and screening of suitable microbe			Laboratory report on microbial isolation.	
WEEK-3	Microbe culture and application in the field; Carrier material and microbe			Record growth characteristics of selected microorganisms.	
WEEK-4	PCR, DNA extraction methods, sequencing and phylogenetic techniques; Biochemical & Molecular Identification of microbes			Flowchart of molecular identification procedures.	
WEEK-5	Biosafety measures in Enviro-biotechnology lab;Bacterial, Fungal Culture Isolation/ Acquisition; Bacterial/ Fungal inoculum preparation and application technique			Biosafety assessment checklist.	
WEEK-6	Monitoring of microbe-assisted remediation technique; Case studies			Monitoring report of microbe-assisted remediation.	
WEEK-7	Unit: Advanced Topics in Environmental Biotechnology				
	Current research trends and recent developments in environmental biotechnology; Case studies: applications of environmental biotechnology in Pakistan			Literature review on emerging biotechnology applications.	
WEEK-8	Interdisciplinary connections of environmental biotechnology with other environmental sciences; Field and laboratory methods for environmental biotechnology monitoring			Field data collection and interpretation exercise.	
MID TERM EXAMINATION					
WEEK-9	Data analysis and interpretation in environmental biotechnology			Analyze experimental data using spreadsheets.	
WEEK-10	Reporting and communication of environmental biotechnology findings			Prepare a laboratory technical report.	
WEEK-11	National and international standards relevant to environmental biotechnology			Comparative review of environmental biotechnology standards.	
WEEK-12	Regulatory frameworks and compliance in environmental biotechnology			Summary of biotechnology compliance requirements.	
WEEK-13	Environmental legislation related to environmental biotechnology in Pakistan			Review biotechnology-related regulations in Pakistan.	

WEEK-14	Emerging challenges and opportunities in environmental biotechnology	Presentation on emerging challenges and opportunities.	
WEEK-15	Technological innovations shaping the future of environmental biotechnology	Case study review of advanced environmental biotechnology tools.	
WEEK-16	Career pathways and professional development in environmental biotechnology	Submission of Complete Practical Portfolio and Laboratory Record Book.	
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Scragg, A. (2005). Environmental Biotechnology (2nd ed.). Oxford University Press. 2. Rittmann, B.E. & McCarty, P.L. (2001). Environmental Biotechnology. McGraw-Hill. 3. Glazer, A.N. & Nikaido, H. (2007). Microbial Biotechnology (2nd ed.). Cambridge University Press.			
TEACHING – LEARNING STRATEGIES • Lecture based examination • Presentation/seminars • Class discussion • Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: 1. classroom participation, 2. attendance, assignments and presentation, 3. homework 4. attitude and behavior, 5. hands-on-activities, 6. short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-X	Credit hours	03
Course Title	OCEAN AND ENVIRONMENT (THEORY)				
COURSE INTRODUCTION					
This course explores the vital relationship between the world’s oceans and the environment, emphasizing the ocean's role in regulating Earth’s climate, supporting biodiversity, and sustaining human life. Students will gain an understanding of oceanographic processes and how physical, chemical, biological, and geological factors interact within marine ecosystems.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Basic understanding of marine pollution, its sources, types and impacts 2. Develop a knowledge of ocean pollution control and management techniques. 3. Know the ocean science concepts, global warming and climate change phenomena 4. Gain information of blue economy and sustainable aquaculture strategies					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Ocean pollution definition, history, types, causes and impacts		Reading: Read Chapters 1 and 2 in <i>Wang (2020)</i> exploring historical baseline definitions of anthropogenic marine pollution and oil degradation kinetics		
	Chronic and acute inorganic and organic marine pollutants				
	Oil pollution and impact of oil spills				
WEEK-2	Heavy metal pollution; dangers & hazards		Assignment: Draft a 2-page research synthesis comparing the trophic transfer risks of Microplastics (MPs) vs. Nanoplastics (NPs) based on parameters in <i>UNEP (2016)</i> .		
	Wastes; solid garbage and liquid waste, marine outfalls, shipboard wastes, dumping of sludge, disposal of dredge spoil				
	Risks in oceans from plastic pollution; MPs, NPs				
WEEK-3	Radioactive waste disposal risks in oceans		Reading: Review the global economic impact assessment metrics for ecosystem service loss outlined in Chapter 4 of <i>UNEP (2016)</i> .		
	Ocean Health and anthropogenic activities				
	Economic losses from marine pollution				
WEEK-4	SDGs and Implementation Scenario		Reading: Study Chapters 3 and 4 in <i>Garrison (2012)</i> detailing physical bathymetry and the light/temperature zonation of marine layers.		
	Major oceans of the world				
	Oceanic layers				
WEEK-5	Global Oceanic conveyor belt and importance		Assignment: Construct a diagnostic flowchart tracking how structural anomalies in the global thermohaline circulation affect regional monsoon cycles using <i>Garrison (2012)</i> frameworks.		
	Marine debris and impacts				
	Climate change due to ocean circulations; AL Nino, La Nina Nina, Monsoons				
WEEK-6	Ocean and control of heat/ GHGs		Reading: Read Chapter 5 in <i>Wang (2020)</i> analyzing carbon sink sequestration capacities and tidal/thermal green energy harvesting		
	Ocean energy potential				
	Major Environmental Issues of Oceans				
WEEK-7	Dead zones		Reading: Study Chapters 9 and 10 in <i>Levinton (2017)</i> regarding		
	Algal blooms				

	Coral bleaching	nutrient-induced hypoxia pathways and the breakdown of zooxanthellae symbioses.
WEEK-8	Ocean Acidification, Blast water/ Blige water	Assignment: Complete the carbonate chemistry buffer system problem set (calculating pH drops relative to \$p\$CO_2\$ rises) using equations from Chapter 11 of <i>Levinton (2017)</i> .
	Bio-accumulation and Bio-magnification in Oceans	
	Tsunamis, Coastal Floods, Tides/Waves Hazards	
MID TERM EXAMINATION		
WEEK-9	Loss of Oceanic Biodiversity	Reading: Review the industrial fishing demographic trends and structural habitat loss tables in the core marine crisis chapters of <i>UNEP (2016)</i> .
	Overfishing and Unsustainable Aquaculture	
	Climate change and Global warming due ocean circulation	
WEEK-10	Ocean-based mitigation measures to tackle climate change	Reading: Read Chapter 8 in <i>Wang (2020)</i> exploring mitigation protocols for acoustic pollution from offshore industrial operations.
	Ocean engineering and drilling impacts on aquatic life	
	Noise, light, or the spread of invasive organisms in oceans	
WEEK-11	High mercury level and impacts	Assignment: Create a comparative legal framework analysis table matching specific pollution categories against <i>MARPOL</i> annex restrictions and <i>London Convention</i> mandates via <i>UNEP (2016)</i> .
	Contamination of oceanic food	
	Ocean Health Index, law of sea, MARPOL and London convention	
WEEK-12	Adaptation and mitigation measures for control of marine and coastal pollution	Reading: Study Chapter 15 in <i>Garrison (2012)</i> focusing on historical containment booms, microbial oil-remediation, and sustainable mariculture design.
	Oceanic Pollution Treatment Strategies; Physical, chemical, biological	
	Conservation of ocean biodiversity and promotion of blue economy/aquaculture	
WEEK-13	Marine pollution and hazards preparedness and response	Assignment: Design an emergency coastal oil-slick tracking protocol using geospatial telemetry rules and remote sensing spectral signature identification via <i>Wang (2020)</i> .
	Monitoring of Marine pollution through RS & GIS	
	Stricter Pollution Control Standards/ guideline; sustainable practices in industries	
WEEK-14	Role of Artificial Intelligence and Machine Learning for marine pollution mitigation	Reading: Study the policy implementation frameworks and compliance bottlenecks under the <i>UNCLOS (Law of the Sea)</i> recorded in Chapter 12 of <i>Wang (2020)</i> .
	National and International Marine laws/policies/ regulations/ treaties compliance	
	Individual/Govt./ International organizations contributions to combat marine pollution	
WEEK-15	Current research trends and recent developments in ocean and environment	Reading: Read Chapter 19 in <i>Levinton (2017)</i> regarding multi-point water column sampling techniques, plankton net deployments, and dissolved oxygen titration.
	Interdisciplinary connections of ocean and environment with other environmental sciences	
	Field and laboratory methods for ocean and environment monitoring	

WEEK-16	Data analysis and interpretation in ocean and environment	Assignment: Formulate a baseline monitoring and variance report for a coastal estuary case study, evaluating toxicological sample data against international <i>UNEP</i> guidelines.	
	Reporting and communication of ocean and environment findings		
	National and international standards relevant to ocean and environment		
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Wang, Y. (Ed.). (2020). <i>Coastal and marine environments</i>. CRC Press. 2. Levinton, J.S. (2017). <i>Marine Biology: Function, Biodiversity, Ecology</i> (5th ed.). Oxford. 3. UNEP (2016). <i>The First Global Integrated Marine Assessment</i>. United Nations. 4. Garrison, T. (2012). <i>Oceanography: An Invitation to Marine Science</i> (8th ed.). Cengage.			
TEACHING – LEARNING STRATEGIES - Lecture based examination - Presentation/seminars - Class discussion - Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: - classroom participation, - attendance, assignments and presentation, - homework - attitude and behavior, - hands-on-activities, - short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-XI	Credit hours	02
Course Title	ENVIRONMENTAL ENGINEERING (THEORY)				
COURSE INTRODUCTION					
This course provides a basic knowledge and applications of engineering principles for wastewater treatment engineering, solid waste management engineering, air and noise pollution control.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. The Environmental Engineering is structured to provide students with appropriate background in analysis and design tools necessary to address complex environmental engineering concerns. 2. Students will be able for doing basic engineering calculations, various units&#x2019; conversion for 3. gases, liquids and solids and developing material balance equations which are used in the environmental sciences and engineering 4. Instigate translation of acquired knowledge of environmental engineering into potential applied solutions of environmental problems of Pakistan in the areas of waste water treatment 5. Students will learn about the engineering aspects of solid waste and air and noise pollution.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to Environmental Engineering and Basic Engineering Calculations			Read: Masters & Ela (2007), Ch.1, pp. 1–30; Davis & Cornwell (2012), Ch.1, pp. 1–18	
	Introduction and Historical perspective of Environmental Engineering				
	Transitioning of knowledge of Environmental Sciences into Environmental Engineering				
WEEK-2	Principles of environmental engineering			Read: Davis & Cornwell (2012), Ch.1, pp. 18–42	
	Major issues of air, water and land pollution in Pakistan				
WEEK-3	An overview of the constraints of national industrial stakeholders to comply with NEQS of Pakistan			Read: Masters & Ela (2007), Ch.1, pp. 30–55	
	Use of Environmental Engineering in designing sustainable development policy				
WEEK-4	Units’ conversion and Dimensions			Read: Masters & Ela (2007), Ch.2, pp. 56–90;	
	Basic Engineering Calculations				
WEEK-5	Material balance equations in Environmental Engineering			Read: Davis & Cornwell (2012), Ch.2, pp. 68–95	
	Application of mass balance in closed and open systems				
WEEK-6	Unit-II: Design Consideration in Water and Wastewater Treatment Plants			Read: Davis & Cornwell (2012), Ch.4, pp. 135–165	
	Methods and techniques for population forecasting				
	Introduction to Unit operation for wastewater treatment				
WEEK-7	Design and functioning equations of the waste water collection/pumping systems			Read: Masters & Ela (2007), Ch.2, pp. 125–158	
	Hydraulic design considerations for sewers				

WEEK-8	Design of primary wastewater treatment system (screens, grit chamber)	Read: Metcalf & Eddy (2014), Ch.4, pp. 140–186; Davis & Cornwell (2012), Ch.5, pp. 166–204
	Engineering aspects of secondary and tertiary treatment of wastewater	
MID TERM EXAMINATION		
WEEK-9	Design layout of a typical sludge treatment and handling system	Read: Metcalf & Eddy (2014), Ch.5, pp. 187–230
	Major constraints and extent of efficacy of the typical wastewater systems in Pakistan	
WEEK-10	Unit-III: Engineering Aspects of Solid Waste Management	Read: Davis & Cornwell (2012), Ch.5, pp. 204–240
	Calculations of waste generation rates	
	Components of solid waste management system	
WEEK-11	Designing of incinerators	Read: Metcalf & Eddy (2014), Ch.8, pp. 350–400;
	Relationship between moisture contents, transport cost and leachate generation	
WEEK-12	Management of Hazardous waste	Read: Davis & Cornwell (2012), Ch.6, pp. 241–280
	Designing of land filling system	
WEEK-13	Unit-IV: Air Pollution Control Systems	Read: Davis & Cornwell (2012), Ch.7, pp. 281–315
	Design and functioning equations of major components of air pollution control	
	Abatement systems: Gravity settlers, Cyclone separators	
WEEK-14	Abatement systems: Gravity settlers, Cyclone separators	Read: Metcalf & Eddy (2014), Ch.14, pp. 620–660
	Electrostatic precipitators and Bag houses	
WEEK-15	Calculations for noise measurement	Read: Masters & Ela (2007), Ch.5, pp. 280–316
	Designing of noise control systems	
WEEK-16	Major constraints and efficacy of typical air pollution control systems in Pakistan	Read: Davis & Cornwell (2012), Ch.8, pp. 355–392; Masters & Ela (2007), Ch.5, pp. 316–355
	Course Review and Final Project Discussion	
FINAL TERM EXAMINATION		
TEXT BOOKS AND READING MATERIAL		
1. Principles of Environmental Engineering. (2024). Germany: Springer Nature Singapore. 2. Davis, M.L. & Cornwell, D.A. (2012). Introduction to Environmental Engineering (5th ed.). McGraw-Hill. 3. Masters, G.M. & Ela, W.P. (2007). Introduction to Environmental Engineering and Science. Pearson. 4. Metcalf & Eddy (2014). Wastewater Engineering (5th ed.). McGraw-Hill.		
TEACHING – LEARNING STRATEGIES		
Lecture based examination Presentation/seminars Class discussion Quizzes		

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

2. classroom participation,
3. attendance, assignments and presentation,
4. homework
5. attitude and behavior,
6. hands-on-activities,
7. short tests, quizzes etc.

Read: Davis & Cornwell (2012), Ch.8, pp. 392–428; Masters & Ela (2007), Ch.6, pp. 356–395

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Read: Masters & Ela (2007), Ch.7, pp. 461–505; Davis & Cornwell (2012), Ch.9, pp. 429–468
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-XI	Credit hours	01
Course Title	ENVIRONMENTAL ENGINEERING (PRACTICAL)				
COURSE INTRODUCTION					
This course is designed to make students learn about sampling techniques, monitoring of waste water quality and engineering calculations for waste water treatment plant and solid waste management.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Students will learn about sampling techniques for environmental monitoring. 2. Students will learn about environmental monitoring tests for wastewater, solid waste and air. 3. Students will be able to perform basic design calculations for wastewater treatment plant. 4. Students will be able to perform engineering estimates for solid waste generation and leachate rates calculations for wastewater treatment plant.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Quantitative and Qualitative Monitoring of Wastewater			Read: Metcalf & Eddy (2014), Ch.3, pp. 80–120; Davis & Cornwell (2012), Ch.5, pp. 166–195	
	Measurement of wastewater discharge and flow rate				
WEEK-2	Design practice on wastewater collection systems			Read: Metcalf & Eddy (2014), Ch.4, pp. 140–175	
WEEK-3	Design calculations for Primary treatment systems			Read: Davis & Cornwell (2012), Ch.5, pp. 195–220	
WEEK-4	Sizing and detention time calculations for sedimentation tanks			Read: Metcalf & Eddy (2014), Ch.8, pp. 350–385	
WEEK-5	Design calculations for Secondary treatment systems			Read: Davis & Cornwell (2012), Ch.6, pp. 241–268	
WEEK-6	Process design for Activated Sludge or Trickling Filters			Read: Metcalf & Eddy (2014), Ch.8, pp. 385–420	
WEEK-7	Design of constructed wetlands			Read: Davis & Cornwell (2012), Ch.6, pp. 268–295	
WEEK-8	Calculation of surface area and hydraulic loading rates			Read: Metcalf & Eddy (2014), Ch.10, pp. 460–498; Davis & Cornwell (2012), Ch.7, pp. 296–320	
MID TERM EXAMINATION					
WEEK-9	Unit-II: Design Calculation for Solid Waste Management System			Read: Metcalf & Eddy (2014), Ch.10, pp. 498–535; Davis & Cornwell (2012), Ch.7, pp. 320–345	
	Practical regarding estimation of solid waste generation rates				
WEEK-10	Statistical analysis of per capita waste production			Read: Metcalf & Eddy (2014), Ch.12, pp. 548–582;	
WEEK-11	Practical calculations for container collection system			Read: Davis & Cornwell (2012), Ch.7, pp. 345–368	
WEEK-12	Sizing of landfill cells and site capacity estimation			Read: Metcalf & Eddy (2014), Ch.7, pp. 280–320	
WEEK-13	Estimation of leachate generation			Read: Davis & Cornwell (2012), Ch.8, pp. 369–398	

WEEK-14	Techniques and methods for representative sampling of solid waste	Read: Masters & Ela (2007), Ch.5, pp. 280–316;
WEEK-15	Characterization of solid waste samples	Read: Davis & Cornwell (2012), Ch.8, pp. 398–428
WEEK-16	Techniques and methods for representative sampling of wastewater bodies	Read: Masters & Ela (2007), Ch.5, pp. 316–345

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Read: Metcalf & Eddy (2014), Ch.3, pp. 80–115; Davis & Cornwell (2012), Ch.3, pp. 96–125
2. Davis, M.L. & Cornwell, D.A. (2012). Introduction to Environmental Engineering (5th ed.). McGraw-Hill.
3. Masters, G.M. & Ela, W.P. (2007). Introduction to Environmental Engineering and Science. Pearson.
4. Metcalf & Eddy (2014). Wastewater Engineering (5th ed.). McGraw-Hill.
5. Read: Davis & Cornwell (2012), Ch.8, pp. 354–380; Masters & Ela (2007), Ch.6, pp. 380–410

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

1. classroom participation,
2. attendance, assignments and presentation,
3. homework
4. attitude and behavior,
5. hands-on-activities,
6. short tests, quizzes etc.
- 7.

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Read: Davis & Cornwell (2012), Ch.9, pp. 429–460; Masters & Ela (2007), Ch.6, pp. 410–440
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Read: Metcalf & Eddy (2014), Ch.14, pp. 620–655; Davis & Cornwell (2012), Ch.9, pp. 460–485

Program	BS Environmental Sciences	Course Code	ELECTIVE-XII	Credit hours	03
Course Title	ENVIRONMENTAL STANDARDS AND AUDITING				
COURSE INTRODUCTION					
This course consists of two segments to prepare students to assess various aspects of work environment through auditing and prepare various protocols for project management.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Know the various standards and types of auditing and environmental audits. 2. Know how to conduct an audit according to ISO 14001 as well as to local management systems. 3. Understand the project definition and project management tools. 4. Understand the identification of stakeholders, the role of sponsors and the role of project manager. 5. Know how to apply project life cycle to a project					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Introduction to Environmental Standards		Environmental Management Systems and ISO 14001 Implementation Principles and Practice (2 nd Ed.) by Seifi, M. / Assignment 1: Explain the importance of environmental standards in modern industries with examples.		
	History and Origin of Environmental Standards				
	Standards Importance				
	Evolution of Environmental Standards				
WEEK-2	Types of Environmental Standards		Environmental Management Systems and ISO 14001 Implementation Principles and Practice (2 nd Ed.) by Seifi, M. / Assignment 2: Prepare a comparative summary of ISO 14000 family standards and ISO 14001 requirements.		
	Environmental Standards related to Industries		Assignment 3: Develop a concept note on integrating ISO 14001 with ISO 9001 and ISO 45001.		
	ISO 9001, Four Trade, OOROTA, REACH				
WEEK-3	Fundamentals of Auditing		Environmental Management Systems and ISO 14001 Implementation Principles and Practice (2 nd Ed.) by Seifi, M. / Assignment 4: Write a report on ISO 19011 guidelines and its role in environmental auditing.		
	Introduction to ISO 19011 for auditing				
	Principles of Auditing				
WEEK-4	History of Environmental Auditing; Types of environmental audits; Audit preparation and planning		Environmental Management Systems and ISO 14001 Implementation Principles and Practice (2 nd Ed.) by Seifi, M. / Assignment 5: Compare different types of environmental audits with real-world applications.		
	Methods of Gathering Audit Evidence		Assignment 6: Prepare a mock environmental audit report based on a sample industry scenario.		
	Practical Audit Exercise				
	Audit communication and reporting system				
WEEK-5	History of ISO 14000 Family; ISO 14001; Integrated management system		Environmental Management Systems and ISO 14001 Implementation Principles and Practice (2 nd Ed.) by Seifi, M. /		
	Fundamentals of Auditing; Introduction to ISO 19011 for auditing; Principals of Environmental Auditing				
	Local and international environmental auditing systems				
WEEK-6	Project perspectives				

	Stakeholders Analysis and Participation	Environmental Management Systems and ISO 14001 Implementation Principles and Practice (2nd Ed.) by Seifi, M. / Assignment 8: Perform stakeholder analysis for an environmental infrastructure project.
	Project goal and scope management	
	Project life cycle	
WEEK-7	Project initiation	Environmental Management Systems and ISO 14001 Implementation Principles and Practice (2nd Ed.) by Seifi, M. / Assignment 9: Develop a basic project plan including scope, timeline, and deliverables.
	Project planning,	
	Project execution and control	
WEEK-8	Project closure management	Assignment 10: Write a report on project monitoring tools and closure procedures.
	Communication and conflict management	
	Reasons for project success or failure	
	Planning commission proformas	
MID TERM EXAMINATION		
WEEK-9	Project planning and approval processes	Environmental Management Systems and ISO 14001 Implementation Principles and Practice (2nd Ed.) by Seifi, M. / Assignment 11: Case study on communication breakdown in environmental project and solutions.
	Resource mobilization	
	Case Study-I Industrial Project	
WEEK-10	Case Study-II MS Project	Environmental Management Systems and ISO 14001 Implementation Principles and Practice (2nd Ed.) by Seifi, M. / Assignment 12: Identify and classify operational and management environmental indicators for an industry.
	Environmental performance indicators (EPIs): operational and management indicators	
	Carbon footprint calculation and disclosure: GHG Protocol methodology	
	Life Cycle Assessment (LCA): principles, phases and applications in auditing	
WEEK-11	LCA software tools and databases: SimaPro, GaBi and ecoinvent overview	Quiz
	Global Reporting Initiative (GRI) Standards for sustainability reporting	
	Integrated reporting: linking environmental performance with financial disclosure	
WEEK-12	Greenwashing: identification, risks and regulatory responses	Making sustainability work: Best practices in managing and measuring corporate environmental performance (3rd ed.). by Epstein, M.J./ Assignment 13: Calculate a basic carbon footprint for a household or university activity.
	Environmental due diligence in mergers, acquisitions and project financing	
	Supply chain environmental auditing: scope, methodology and challenges	
WEEK-13	Unit-IX: Environmental Compliance in Pakistan	Making sustainability work: Best practices in managing and measuring corporate environmental performance (3rd ed.). by Epstein, M.J./ Assignment 14: Review Pakistan EPA and NEQS compliance requirements and enforcement mechanisms.
	Environmental compliance auditing under Pakistan EPA and NEQS requirements	
	IEE and EIA audit requirements: post-approval monitoring and compliance	
	Corrective action planning: from audit findings to implementation	
WEEK-14	Role of third-party auditors and accreditation requirements in Pakistan	Making sustainability work: Best practices in managing and measuring corporate environmental performance (3rd ed.). by Epstein, M.J./
	Digital auditing tools and AI applications in environmental compliance monitoring	

	Review of key concepts and mock audit exercise	Assignment 15: Prepare a post-EIA monitoring checklist for a development project.	
WEEK-15	Environmental certification schemes for SMEs: simplified approaches and benefits	Making sustainability work: Best practices in managing and measuring corporate environmental performance (3rd ed.). by Epstein, M.J./ Assignment 16: Explain LCA phases with a real product example (e.g., plastic bottle or cement).	
	ISO 50001 Energy Management Systems and their link to environmental auditing		
	Introduction to LCA: principles, phases and applications		
	LCA methodology: goal definition, inventory analysis and impact assessment		
WEEK-16	LCA software tools and databases:	Making sustainability work: Best practices in managing and measuring corporate environmental performance (3rd ed.). by Epstein, M.J. Assignment 17: Compare LCA software tools and their applications in environmental studies.	
	SimaPro, GaBi and ecoinvent		
	Application of LCA in product design and environmental decision-making		
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Seifi, M., & Crowder, S. (2025). Environmental management systems and ISO 14001 implementation: Principles and practice (2nd ed.). CRC Press. 2. Epstein, M. J., & Buhovac, A. R. (2024). Making sustainability work: Best practices in managing and measuring corporate environmental performance (3rd ed.). Routledge. 3. ISO 19011:2018. Guidelines for Auditing Management Systems. ISO. 4. Stapleton, P.J. (1996). ISO 14000 and the Law. Wiley.			
TEACHING – LEARNING STRATEGIES Lecture based examination Presentation/seminars Class discussion Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: classroom participation, attendance, assignments and presentation, homework attitude and behavior, hands-on-activities, short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-XIII	Credit hours	03
Course Title	ENVIRONMENT AND HUMANITY				
COURSE INTRODUCTION					
Earth in space and time-Atmospheric Circulation-Introduction to landforms-Human population distribution-Population-Physiography Nexus-Interrelationship between population and physical setup-Population and resources-Interrelationship between population and physical setup.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Relationship between environment and humanity 2. The interrelation between man and physical set up in various areas/regions 3. Human interaction with the environment in the interests of solving environmental issues					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Definition, Solar system, Electromagnetic radiation, Earth interior			Reading: Study the Earth's place in the solar system and the atmospheric circulation cells (Hadley, Ferrel, Polar) in Goudie (2013), The Human Impact on the Natural Environment.	
	Atmosphere, Lithosphere, Hydrosphere and Biosphere				
	Hadley Cell, Polar Cell, Ferrel Cell				
WEEK-2	Diurnal wind changes in coastal areas			Assignment: Prepare a short note on diurnal coastal winds, the Walker circulation/El Nino-Southern Oscillation and an introduction to landforms.	
	Walker circulation, El Nino, Southern Oscillation				
	Brief introduction to landforms				
WEEK-3	Population: Location, Distribution and Density			Reading: Read about population location, distribution, density and demographic processes in Goudie (2013).	
	Processes and Cycles of population change				
	Demography and policies				
WEEK-4	Population expansion and environmental stress			Assignment: Prepare a short essay on population expansion and environmental stress, covering global food systems, land degradation and water scarcity, citing Diamond (2005), Collapse: How Societies Choose to Fail or Succeed.	
	Global food systems: production, distribution and environmental footprint				
	Land degradation, soil erosion and their effects on agricultural productivity				
	Water scarcity and food production: irrigation, virtual water and food trade				
WEEK-5	Food security in Pakistan: challenges, policies and future pathways			Reading: Review food security challenges in Pakistan and global energy-consumption trends in McNeill (2000), Something New Under the Sun.	
	Energy consumption patterns globally and in Pakistan: trends and projections				
	Environmental consequences of fossil fuel dependence				
WEEK-6	Transition to renewable energy: socioeconomic and environmental implications			Assignment: Prepare a comparative note on the transition to renewable energy and the environmental implications of global urbanization.	
	Energy poverty and its links to human health and development				
	Global urbanization trends and their environmental implications				
	Urban heat islands, air quality and health in growing cities				

WEEK-7	Informal settlements and environmental justice in urban Pakistan	Reading: Study informal settlements, environmental justice and sustainable urban planning in Goudie (2013).
	Sustainable urban planning: green infrastructure and smart city concepts	
	Environmental determinants of health: air, water and soil quality linkages	
WEEK-8	Emerging infectious diseases linked to environmental change and deforestation	Assignment: Prepare a short report on emerging infectious diseases, toxic exposures and international environmental governance, citing Diamond (2005).
	Toxic environmental exposures: chemicals, radiation and their health effects	
	Environmental justice: inequitable distribution of pollution burdens	
	International environmental governance: UN system and multilateral agreements	
MID TERM EXAMINATION		
WEEK-9	Right to a healthy environment: emerging international human rights norm	Reading: Read about the right to a healthy environment and the role of civil society in environmental governance in McNeill (2000).
	Role of civil society and indigenous communities in environmental governance	
	Environmental conflict and peacebuilding: resource competition and cooperation	
WEEK-10	Unit-X: Climate Change and Humanity	Assignment: Prepare a short case study on climate migration, displacement and climate-finance responsibilities.
	Climate change as a human development challenge: vulnerability and adaptation	
	Climate migration and displacement: causes, scale and policy responses	
	Climate finance and the responsibilities of developed and developing nations	
WEEK-11	Pakistan and climate change: vulnerability, impacts and national responses	Reading: Review Pakistan's climate vulnerability and the concept of planetary boundaries in Goudie (2013).
	Concept of planetary boundaries and safe operating space for humanity	
	Green economy, circular economy and nature-based solutions	
WEEK-12	Sustainable Development Goals (SDGs) and their relevance to Pakistan	Assignment: Prepare a short note on the Sustainable Development Goals and their relevance to Pakistan.
	Role of technology and innovation in sustainable human development	
	Scenarios for humanity-environment relations in 2050 and beyond	
WEEK-13	Youth activism and the role of education in environmental transformation	Reading: Study the ethical responsibilities of environmental scientists and youth activism in environmental transformation, citing Diamond (2005).
	Ethical responsibilities of environmental scientists in society	
	Career pathways in environmental sciences and sustainability	
	Review of key themes and integrated discussion	
WEEK-14	Review of key themes and integrated discussion	Assignment: Prepare a short reflective note on the
	Environmental refugee crisis: displacement due to floods, desertification and sea level rise	

	Intergenerational equity: obligations of present generations to future generations	environmental refugee crisis and intergenerational equity.	
WEEK-15	Traditional ecological knowledge: its role in modern environmental management	Reading: Read about traditional ecological knowledge and green-technology transfer in McNeill (2000).	
	Green technology transfer: North-South cooperation for sustainable development		
	Environmental literacy and science communication for the public		
	Pakistan's environmental challenges: policy gaps and pathways to sustainability		
WEEK-16	Global food systems: production, distribution and environmental impact	Assignment: Submit a concluding review paper on Pakistan's environmental policy gaps and pathways to sustainability, in preparation for the Final Term Examination.	
	Land degradation and its effects on agricultural productivity		
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Diamond, J. (2005). Collapse: How Societies Choose to Fail or Succeed. Viking. 2. Goudie, A. (2013). The Human Impact on the Natural Environment (7th ed.). Wiley-Blackwell. 3. McNeill, J.R. (2000). Something New Under the Sun. Norton.			
TEACHING – LEARNING STRATEGIES			
Lecture based examination Presentation/seminars Class discussion Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: classroom participation, attendance, assignments and presentation, homework attitude and behavior, hands-on-activities, short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-XIV	Credit hours	02
Course Title	AIR AND NOISE POLLUTION (THEORY)				
COURSE INTRODUCTION					
This course offers an in-depth study of two major forms of environmental pollution: air pollution and noise pollution. It explores their sources, causes, measurement techniques, environmental and health impacts, and control strategies. The course integrates scientific, technological, and regulatory perspectives to provide a comprehensive understanding of how these pollutants affect ecosystems and human well-being.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. The purpose of this course is to give the students an overview of air and noise pollution. 2. This course will provide an understanding of the sources and effects of air pollutants 3. The students will have the knowledge about main causes and reasons of the air and noise pollution. 4. The students will be able to answer why air pollution should be controlled. 5. The students are expected to be familiar with methods for prevention, control, measures and management of the pollution.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Introduction to air pollution		Reading: Read Chapter 1 of Cooper & Alley on history of air pollution; note three major historical events.		
	History of air pollution? Where, why and when?				
	Sources of air pollution				
WEEK-2	Types of air pollutants and pollution		Assignment: List five primary and five secondary air pollutants with their main emission sources.		
	Air emission estimates and measurements				
WEEK-3	Transport of pollutants		Reading: Read about the Gaussian Plume Model; explain the role of wind speed in pollutant dispersion.		
	Air pollution Models/ Gaussian Plume Model				
WEEK-4	Effects of air pollution on Environment/Human health		Assignment: Summarize two health effects of PM2.5 based on textbook or WHO guidelines.		
	Air pollution laws and regulations around globe				
WEEK-5	Air pollution rules and regulations in Pakistan		Reading: Review Pakistan’s NEQS air quality standards; compare SO ₂ limits with WHO guidelines.		
	Air pollution control philosophies				
WEEK-6	Organizations for air pollution control		Assignment: Identify two engineering controls used in a Pakistani industry to reduce air emissions.		
	Engineering control of air pollution				
WEEK-7	Air pollution control by devices		Reading: Read about electrostatic precipitators; explain their working principle in simple terms.		
	Control devices for liquid or mist, Control devices for particulates				
WEEK-8	Control devices for gaseous contaminants		Assignment: Briefly explain the difference between SO _x control using wet scrubbing and dry injection methods.		
	Sulfur oxides (SO _x) control				
MID TERM EXAMINATION					
WEEK-9	Nitrogen oxides (NO _x) control		Reading: Review NO _x control technologies; explain selective catalytic reduction (SCR) in 5 sentences.		
	Carbon monoxide (CO) control				
WEEK-10	Carbon dioxide (CO ₂) control		Reading: Read about mercury, dioxin, and furan control strategies; list two relevant regulatory standards.		
	Hg, Dioxins and Furans control				

WEEK-11	Sources	Assignment: Describe the sources and pathway of one indoor air pollutant and suggest a control measure.
	Transportation/Movement	
WEEK-12	Specific Health Effects	Assignment: Summarize two health effects of indoor air pollution and describe one mitigation strategy.
	Control of indoor air pollution	
WEEK-13	Introduction, characteristics and kinds of noise	Reading: Read about types of noise (continuous, intermittent, impulsive); give one real-life example of each.
	Introduction to noise pollution	
WEEK-14	Sources of noise pollution/man made noise	Assignment: List three major noise sources in a Pakistani urban area and their approximate decibel levels.
	Overview of laws and regulations of noise	
WEEK-15	Mitigation and control techniques of noise pollution	Reading: Read about noise barriers and sound insulation techniques; explain one mitigation method clearly.
	Current research trends and recent developments in air and noise pollution	
WEEK-16	Case studies: applications of air pollution control in Pakistan	Assignment: Write a one-page case study on air or noise pollution in a Pakistani city of your choice.
	Case studies: applications of noise pollution control in Pakistan	

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Cooper, C.D. & Alley, F.C. (2011). Air Pollution Control (4th ed.). Waveland Press.
2. Wark, K., Warner, C.F. & Davis, W.T. (1998). Air Pollution: Its Origin and Control. Addison-Wesley.
3. Harris, C.M. (1991). Handbook of Acoustical Measurements and Noise Control. McGraw-Hill.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

2. classroom participation,
3. attendance, assignments and presentation,
4. homework
5. attitude and behavior,
6. hands-on-activities,
7. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-XIV	Credit hours	01
Course Title	AIR AND NOISE POLLUTION (PRACTICAL)				
COURSE INTRODUCTION					
This course offers an in-depth study of two major forms of environmental pollution: air pollution and noise pollution. It explores their sources, causes, measurement techniques, environmental and health impacts, and control strategies. The course integrates scientific, technological, and regulatory perspectives to provide a comprehensive understanding of how these pollutants affect ecosystems and human well-being.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. This course will provide a demonstration about the different instruments used for monitoring air pollution. 2. This course will provide a demonstration about the different instruments used for monitoring noise pollution. 3. The students will learn about the practical aspects of noise survey. 4. They will become conversant with the different methods to conduct monitoring and survey.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Monitoring of ambient air pollution		Reading: Review principles of ambient air monitoring; list instruments used for PM and gaseous pollutant measurement.		
WEEK-2	Monitoring of ambient particulate matter		Assignment: Prepare a data recording sheet for monitoring ambient PM10 and PM2.5 concentrations.		
WEEK-3	Stack monitoring		Reading: Read about stack monitoring equipment; explain the purpose of isokinetic sampling.		
WEEK-4	Vehicle exhaust monitoring.		Assignment: List three parameters measured in vehicle exhaust monitoring and their permissible limits.		
WEEK-5	Monitoring of indoor air pollution		Reading: Review common indoor air pollutants; describe one instrument used for indoor CO monitoring.		
WEEK-6	Monitoring of sound pressure and sound levels.		Assignment: Sketch a simple diagram of a sound level meter and label its three main components.		
WEEK-7	Monitoring of traffic noise.		Reading: Read about traffic noise measurement protocols; note the recommended measurement height and duration.		
WEEK-8	Measurement of reverberation time.		Assignment: Define reverberation time and explain in 5 sentences why it matters in building design.		
MID TERM EXAMINATION					
WEEK-9	Measurement of sound absorption of materials.		Reading: Review sound absorption coefficients of common materials; compare a hard and a soft surface.		
WEEK-10	Industrial noise survey		Assignment: Design a simple noise survey form for an industrial site, listing five parameters to be recorded.		
WEEK-11	Current research trends and recent developments in air and noise pollution		Reading: Identify one recent technological advancement in air quality monitoring and describe it briefly.		

WEEK-12	Case studies: applications of air and noise pollution in Pakistan	Assignment: Write a short summary of a noise or air pollution monitoring case study from Pakistan.
WEEK-13	Interdisciplinary connections of air and noise pollution with other environmental sciences	Reading: Explain how air pollution monitoring data can inform water and soil pollution studies.
WEEK-14	Field and laboratory methods for air and noise pollution monitoring	Assignment: List three field instruments used in air and noise monitoring with their specific uses.
WEEK-15	Data analysis and interpretation in air and noise pollution	Reading: Review basic statistical methods (mean, standard deviation) applied to environmental monitoring data.
WEEK-16	Reporting and communication of air and noise pollution findings	Assignment: Prepare a sample pollution monitoring report using data collected during any lab session.

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. Cooper, C.D. & Alley, F.C. (2011). Air Pollution Control (4th ed.). Waveland Press.
2. Wark, K., Warner, C.F. & Davis, W.T. (1998). Air Pollution: Its Origin and Control. Addison-Wesley.
3. Harris, C.M. (1991). Handbook of Acoustical Measurements and Noise Control. McGraw-Hill.

TEACHING – LEARNING STRATEGIES

1. Lecture based examination
2. Presentation/seminars
3. Class discussion
4. Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

2. classroom participation,
3. attendance, assignments and presentation,
4. homework
5. attitude and behavior,
6. hands-on-activities,
7. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-XV	Credit hours	02
Course Title	INDUSTRIAL WASTE MANAGEMENT PRACTICES (THEORY)				
COURSE INTRODUCTION					
The course delineates study of the complexities associated with waste generation, environmental effects and management, relevant regulations; integrated waste management strategies; disposal and diversion methods and site selection and operational health risks.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Describe hazardous waste management issues; 2. Learn approaches to minimize hazardous waste production and safe methods to transport it to disposal facilities; 3. Understand national and international waste management regulations and guidelines; 4. Prepare waste management programs and train facilities employees and manage it properly in compliance with all applicable regulatory requirements.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Introduction to Hazardous wastes		USEPA (2020) Overview of Hazardous waste Page.05		
	hazardous waste sources, characteristics and classification		Hazardous Waste Management Hazardous Waste Generators Page.08		
	hazardous waste management priorities		Hazardous Waste Management Hazardous Waste Management Page.06		
WEEK-2	hierarchy of potential implementation strategies		USEPA (2020) Overview of Hazardous waste Page.05		
	US-EPA hazardous waste lists		USEPA (2020) List of Hazardous waste Page.05		
WEEK-3	industrial waste generation and management		Hazardous Waste Management Hazardous Waste Management Page.06		
	characteristics of solid waste streams from industries		Hazardous Waste Management Toxicology Page.53		
WEEK-4	management of an industrial site classified as a very small quantity generator		Hazardous Waste Management Managing Hazardous Waste on site Page.11		
	management of environmental hazards at industrial sites		Hazardous Waste Management Hazardous Waste management v.06		
WEEK-5	Unit-III: Waste management and treatment strategies		National Hazardous Waste Management Policy 2022 Infrastructure for Treatment, Storage, Disposal and Testing Facilities Page.11		
	current waste reduction, reuse, and recycling strategies		National Hazardous Waste Management Policy 2022 Reuse, Recycle, Treatment and Disposal of HW Page.10		
	treatment and disposal of solid wastes from industry		National Hazardous Waste Management Policy 2022 Collection, Storage and Transportation of HW Page.10		

WEEK-6	health and safety issues in handling, transportation and waste disposal	National Hazardous Waste Management Policy 2022 Collection, Storage and Transportation of HW Page.10
	best practices of hazardous waste management in world (developed/developing)	Hazardous Waste Management Managing Hazardous Waste on site Page.11
WEEK-7	hazardous waste management regulations in Pakistan	National Hazardous Waste Management Policy 2022 Hazardous Waste Prevention, Reduction & Minimization Page.09
	hazardous waste generator status and regulatory requirements	Hazardous Waste Management Hazardous Waste Generators Page.08
	waste audits (strategies, administrative processes)	Handbook of Solid Waste Management Risk Assessment Page.69
WEEK-8	Current research trends and recent developments in industrial waste management practices	National Hazardous Waste Management Policy 2022 The Issue of Hazardous Waste Management in Pakistan Page.05
	Case studies: applications of industrial waste management practices in Pakistan	National Hazardous Waste Management Policy 2022 The Issue of Hazardous Waste Management in Pakistan Page.05
MID TERM EXAMINATION		
WEEK-9	Interdisciplinary connections of industrial waste management practices with other environmental sciences	Handbook of Solid Waste Management Five technological phases Page.05
	Field and laboratory methods for industrial waste management practices monitoring	Handbook of Solid Waste Management Best practice strategies Page.78
	Data analysis and interpretation in industrial waste management practices	National Hazardous Waste Management Policy 2022 Statistical analysis Page.02
WEEK-10	Reporting and communication of industrial waste management practices findings	Handbook of Solid Waste Management Implementation and reporting Page.32
	National and international standards relevant to industrial waste management practices	National Hazardous Waste Management Policy 2022 Formulation of Hazardous Waste Management Policy, 2022 Page.01
WEEK-11	Regulatory frameworks and compliance in industrial waste management practices	National Hazardous Waste Management Policy 2022 Regulatory Framework Page.03
	Environmental legislation related to industrial waste management practices in Pakistan	National Hazardous Waste Management Policy 2022 Prevailing HWM Regulatory Framework in Pakistan Page.06
WEEK-12	Emerging challenges and opportunities in industrial waste management practices	Handbook of Solid Waste Management Best practice strategies Page.78
	Technological innovations shaping the future of industrial waste management practices	Handbook of Solid Waste Management Best practice strategies Page.78
WEEK-13	Career pathways and professional development in industrial waste management practices	Handbook of Solid Waste Management Career Opportunities and Job Market Analysis Page.09
	E-waste and electronic waste management: growing challenge, global regulations and Pakistan's response	Hazardous Waste Management Waste Generation & Management Page.19
WEEK-14	Unit-IV: Emerging Issues and Future Directions in Industrial Waste Management	Hazardous Waste Management Waste Generation & Management Page.20
	Industrial symbiosis and waste exchange networks: turning one industry's waste into another's resource	

	Circular economy principles applied to industrial waste: design for disassembly and zero waste manufacturing	Hazardous Waste Management Waste Generation & Management Page.21-22
WEEK-15	Climate change and industrial waste: carbon emissions from waste, landfill gas and mitigation strategies	Handbook of Solid Waste Management. Integrated Waste Management Page. 759-764
	Corporate environmental responsibility and waste reporting: ESG frameworks and sustainability disclosures	
WEEK-16	Community engagement and right-to-know: public participation in industrial waste management decisions	Handbook of Solid Waste Management. Solid Waste legislation Page.87-90
	Future of industrial waste management: AI, automation and smart waste monitoring systems	

FINAL TERM EXAMINATION

TEXT BOOKS AND READING MATERIAL

1. LaGrega, M.D., Buckingham, P.L. & Evans, J.C. (2010). Hazardous Waste Management. Waveland.
2. Tchobanoglous, G. & Kreith, F. (2002). Handbook of Solid Waste Management. McGraw-Hill.
3. Pakistan National Hazardous Waste Management Policy 2022.
4. USEPA (2020). RCRA Orientation Manual. US Environmental Protection Agency.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

2. classroom participation,
3. attendance, assignments and presentation,
4. homework
5. attitude and behavior,
6. hands-on-activities,
7. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-XV	Credit hours	01
Course Title	INDUSTRIAL WASTE MANAGEMENT PRACTICES (PRACTICAL)				
COURSE INTRODUCTION					
The course delineates study of the complexities associated with waste generation, environmental effects and management, relevant regulations; integrated waste management strategies; disposal and diversion methods and site selection and operational health risks.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. Describe hazardous waste management issues; 2. Learn approaches to minimize hazardous waste production and safe methods to transport it to disposal facilities; 3. Understand national and international waste management regulations and guidelines; 4. Prepare waste management programs and train facilities employees and manage it properly in compliance with all applicable regulatory requirements.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	hazardous waste sources, characteristics and classification		Hazardous Waste Management Hazardous Waste generators Page.08		
WEEK-2	hazardous waste management priorities		Hazardous Waste Management Hazardous Waste management Page.06		
WEEK-3	hierarchy of potential implementation strategies		USEPA (2020) Overview of Hazardous waste Page.05		
WEEK-4	US-EPA hazardous waste lists		USEPA (2020) List of Hazardous waste Page.05		
WEEK-5	industrial waste generation and management		Hazardous Waste Management Hazardous Waste management Page.06		
WEEK-6	characteristics of solid waste streams from industries		Hazardous Waste Management Toxicology p Page g.53		
WEEK-7	management of an industrial site classified as a very small quantity generator		Hazardous Waste Management Managing Hazardous Waste on site Page.11		
WEEK-8	management of environmental hazards at industrial sites		Hazardous Waste Management Hazardous Waste management Page.06		
MID TERM EXAMINATION					
WEEK-9	current waste reduction, reuse, and recycling strategies		National Hazardous Waste Management Policy 2022 Reuse, Recycle, Treatment and Disposal of HW Page.10		
WEEK-10	treatment and disposal of solid wastes from industry		National Hazardous Waste Management Policy 2022 Infrastructure for Treatment, Storage, Disposal and Testing Facilities Page.11		
WEEK-11	health and safety issues in handling, transportation and waste disposal		National Hazardous Waste Management Policy 2022 Collection, Storage and Transportation of HW Page.10		
WEEK-12	best practices of hazardous waste management in world (developed/developing)		Hazardous Waste Management Managing Hazardous Waste on site Page.11		
WEEK-13	hazardous waste management regulations in Pakistan		National Hazardous Waste Management Policy 2022		

		The Issue of Hazardous Waste Management in Pakistan Page.05	
WEEK-14	hazardous waste generator status and regulatory requirements	Hazardous Waste Management Hazardous Waste generators Page.08	
WEEK-15	waste audits (strategies, administrative processes)	Handbook of Solid Waste Management Risk Assessment Page.69	
WEEK-16	Current research trends and recent developments in industrial waste management practices	National Hazardous Waste Management Policy 2022 Statistical Analysis of Generation Rate Page.21	
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. LaGrega, M.D., Buckingham, P.L. & Evans, J.C. (2010). Hazardous Waste Management. Waveland. 2. Tchobanoglous, G. & Kreith, F. (2002). Handbook of Solid Waste Management. McGraw-Hill. 3. USEPA (2020). RCRA Orientation Manual. US Environmental Protection Agency.			
TEACHING – LEARNING STRATEGIES			
1. Lecture based examination 2. Presentation/seminars 3. Class discussion 4. Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:			
1. classroom participation, 2. attendance, assignments and presentation, 3. homework 4. attitude and behavior, 5. hands-on-activities, 6. short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-XVI	Credit hours	03
Course Title	ENVIRONMENTAL IMPACT ASSESSMENT				
COURSE INTRODUCTION					
This course provides an insight the importance and historical development of EIA, principles and purposes of IEE and EIA and main stages in EIA process. It also includes methods and techniques for impact prediction and evaluation, EIA review, EIA process management and overview of EIA regulations of Pakistan.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. This course will provide an introduction to the Environmental Impact Assessment to the students. 2. The students will learn how to identify the physical, biological and cultural impacts 3. They will have the knowledge about the role of EIA in decision making. 4. The students will get used to how to manage different Environmental Impacts.					
COURSE CONTENTS				Assignments / Readings	
WEEK-1	Unit-I: Introduction to EIA			Reading: Read Chapter 1 of Morris & Therivel; list three key purposes and two limitations of EIA.	
	Definition, Principles, Origin and Development of EIA				
	Purposes, Objectives, Scope and Effectiveness of EIA				
	Different types of impacts considered in EIA				
WEEK-2	Physical, Biological and Social Aspects.			Assignment: Explain the difference between screening and scoping in EIA using a simple flowchart.	
	What is Screening and how is it done				
	Checklists for Screening and Project Categorization				
WEEK-3	Scoping, its Purpose, Objectives Guiding Principles			Reading: Read about scoping methods; describe the role of the public in the scoping process.	
	How Scoping is undertaken and Role of Public				
	Methods and Techniques used for Assessing Impacts in EIA				
WEEK-4	The most Frequently used EIA Methods and Techniques			Assignment: Compare the matrix method and the checklist method for impact prediction; note one advantage of each.	
	Moderately used Methods and Techniques				
	Key Role of Public Participation and Consultation in the EIA Process				
WEEK-5	The Public and Public Interest, Stakeholders and their Representatives			Reading: Review stakeholder categories in EIA; identify three stakeholder groups relevant to a dam project.	
	History and Rationale of Public Involvement in EIA				
	Participation and Consulting Techniques, Public Participation in Pakistan				
WEEK-6	Unit-V: EIA Baseline Data Collection, Consideration of Alternatives and Mitigation			Assignment: Define baseline data and list five types of environmental baseline data required in an EIA report.	
	What Baseline Data need to be Collected and Reported in EIA				
	Role of Alternatives in EIA				
	The Importance of Avoidance, Mitigation, as well as Compensation Measures				
WEEK-7	EIA Requirement of the World Bank and the Asian Development Bank			Reading: Review the World Bank’s Environmental	
	The EIA Report, Focus of an EIA Report				

	Pakistan Guidelines for Preparing Environmental Reports of Specific Sectors	Assessment requirements; summarize two key obligations.
WEEK-8	The Importance of EIA Quality Review, EIA Report Quality Review Packages	Assignment: Outline the key sections of a standard EIA report for a proposed industrial facility.
	The EIA Report in Pakistan	
	Introduction to SEA: definition, purpose and difference from project EIA	
MID TERM EXAMINATION		
WEEK-9	SEA process: screening, scoping, assessment and reporting	Reading: Read about Strategic Environmental Assessment; explain in 5 sentences how it differs from project EIA.
	SEA in policy, plan and programme development	
	SEA in practice: examples from energy, transport and urban planning sectors	
WEEK-10	Unit-VIII: Social Impact Assessment (SIA)	Assignment: Identify three potential social impacts of a road construction project and suggest one mitigation each.
	Introduction to SIA: scope, methods and integration with EIA	
	Stakeholder analysis and community consultation in SIA	
	Resettlement action plans and livelihood restoration	
WEEK-11	Gender analysis and vulnerable groups in impact assessment	Reading: Read about gender and vulnerable groups in impact assessment; explain the need for inclusive analysis.
	EIA for infrastructure projects: roads, dams and bridges in Pakistan	
	EIA for industrial facilities: chemical plants, refineries and factories	
WEEK-12	EIA for energy projects: power plants, wind farms and solar installations	Assignment: List three EIA-specific requirements for energy projects and give one Pakistani example.
	EIA for urban development and real estate projects	
	EIA quality review criteria and assessment of EIA report quality	
WEEK-13	Post-project monitoring and audit: verifying EIA predictions	Reading: Read about Environmental Management Plans; explain the role of monitoring in effective EMP implementation
	EIA effectiveness: measuring success and areas for improvement	
	EIA case studies from Pakistan: lessons from approved and rejected projects	
WEEK-14	Future directions: digital EIA, cumulative impact assessment and AI tools	Assignment: Describe two methods used in cumulative impact assessment with brief real-world examples.
	Mock EIA exercise: applying EIA process to a simulated project	
	Cumulative impact assessment: addressing combined effects of multiple projects	
WEEK-15	Climate change and EIA: integrating carbon footprint into impact assessment	Reading: Review transboundary EIA principles under the Espoo Convention; give one relevant international case.
	Transboundary EIA: international obligations and case studies	
	Future of EIA: digital tools, AI and participatory approaches	

WEEK-16	Current research trends and recent developments in environmental impact assessment	Assignment: Write a one-page reflection on the role of EIA in promoting sustainable development in Pakistan.	
	Case studies: applications of environmental impact assessment in Pakistan		
	Interdisciplinary connections of environmental impact assessment with other environmental sciences		
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Morris, P. & Therivel, R. (2009). Methods of Environmental Impact Assessment (3rd ed.). Routledge. 2. Wood, C. (2003). Comparative Evaluation of EIA Systems. IAIA. 3. Pakistan Environmental Protection Act 1997 and IEE/EIA Regulations 2000.			
TEACHING – LEARNING STRATEGIES - Lecture based examination - Presentation/seminars - Class discussion - Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: - classroom participation, - attendance, assignments and presentation, - homework - attitude and behavior, - hands-on-activities, - short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-XVII	Credit hours	03
Course Title	RENEWABLE ENERGY TECHNOLOGIES				
COURSE INTRODUCTION					
This course introduces the principles, design, and applications of renewable energy technologies as sustainable alternatives to conventional fossil fuels. Students will explore various renewable energy sources including solar, wind, biomass, geothermal, hydro, and emerging technologies such as tidal and hydrogen energy.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
1. Understand the fundamentals of various renewable energy resources and technologies. 2. Compare the efficiency, feasibility, and environmental impacts of renewable versus conventional energy systems. 3. Analyze the principles, working, and applications of solar, wind, hydro, biomass, geothermal, and emerging energy technologies. 4. Evaluate challenges and prospects in adopting renewable energy systems in different contexts. 5. Propose sustainable and regionally appropriate renewable energy solutions.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Introduction to Renewable Energy		Reading: Study Chapters 1 and 2 in Boyle (2012) analyzing historic global energy consumption trends and the thermodynamics of fossil fuel greenhouse forcing.		
	Overview of global and national energy scenarios				
	Environmental impacts of fossil fuels				
	Benefits of renewable energy				
WEEK-2	Classification of renewable energy sources: solar, wind, biomass		Assignment: Draft a 2-page synthesis paper explaining the fundamental differences between mechanical, thermal, and electrochemical energy conversion systems using Twidell & Weir (2015) framework.		
	Classification of renewable energy sources: geothermal, ocean energy				
	Energy conversion principles and technologies				
WEEK-3	International agreements and targets		Reading: Review the global renewable targets and policy milestones listed in the executive summaries of IRENA (2023) and Chapter 1 of BR Publications (2025).		
	SDG-7, Paris Agreement				
	Solar radiation and its measurement				
WEEK-4	Photovoltaic (PV) systems		Assignment: Solve the mathematical problem set in Chapter 3 of Twidell & Weir (2015) for calculating solar cell efficiency using varying peak solar irradiance values (W/m²).		
	components, types, and working principles of photovoltaic systems				
	Solar thermal systems: water heating, space heating, and cooling				
WEEK-5	Solar cookers, dryers, and concentrators		Reading: Read Chapters 4 and 5 in CRC Press (2021) evaluating industrial solar concentrator engineering and wind speed boundary-layer mechanics		
	Applications, limitations, and future trends				
	Wind resource assessment and measurement techniques				
WEEK-6	Types of wind turbines: horizontal and vertical axis		Assignment: Construct an optimal wind farm layout site assessment checklist based on wake effect calculations and landscape topology guidelines from Boyle (2012).		
	Site selection, and grid integration for Wind turbines				
	Wind farm design				
WEEK-7	Environmental impacts of wind energy projects				

	Offshore wind energy prospects	Reading: Read Chapter 7 in IntechOpen (2021) exploring acoustic and ecological impacts of onshore vs. deep offshore wind array construction.
	Classification of hydropower: micro, small, and large hydro projects	
WEEK-8	Components a hydroelectric power plant	Assignment: Prepare a comparative matrices chart contrasting the local socio-ecological displacement footprints of run-of-river micro-hydro setups vs. large impoundment reservoirs using Twidell & Weir (2015).
	Working of a hydroelectric power plant	
	Environmental and social impacts of large dams	
MID TERM EXAMINATION		
WEEK-9	Ocean energy: tidal, wave, and ocean thermal energy conversion (OTEC)	Reading: Read Chapter 9 in Boyle (2012) concerning the fluid dynamics of ocean wave converters and the biochemical phases of anaerobic biomass digestion.
	Technological challenges and future developments	
	Bioenergy conversion technologies: combustion, gasification, pyrolysis, anaerobic digestion	
WEEK-10	Biofuels: biodiesel, bioethanol	Reading: Study Chapters 10 and 11 in BR Publications (2025) on the transesterification chemistry of lipids into biodiesel and the scalable economics of third-generation algal fuels.
	biogas, and algae-based fuels	
	Applications in rural and industrial sectors	
WEEK-11	Environmental implications of biofuels	Assignment: Draft a lifecycle assessment summary assessing the net carbon balance of corn ethanol production vs. cellulosic biomass using energy budget formulas from CRC Press (2021).
	sustainability considerations of biofuels	
	Introduction to geothermal resources and heat flow	
WEEK-12	Geothermal power plants: dry steam, flash	Reading: Study Chapter 13 in Twidell & Weir (2015) analyzing thermodynamic efficiencies of binary cycle geothermal heat exchanges running low-temperature water reservoirs.
	Binary cycle systems	
	Direct uses of geothermal energy	
WEEK-13	Emerging renewable energy technologies:	Assignment: Complete the chemical equation calculations balancing hydrogen fuel cell proton-exchange membrane mass-flows according to IntechOpen (2021) models.
	hydrogen fuel cells, energy storage systems, smart grids	
	Innovations and trends in distributed and off-grid renewable energy	
WEEK-14	Unit-7: Renewable Energy Integration and Management	Reading: Review grid stability, phase matching, and micro-grid synchronization frameworks inside Chapter 14 of BR Publications (2025).
	Challenges in integrating renewables into national grids	
	Smart grids and decentralized energy systems	
	Cities and smart grids	
WEEK-15	Energy storage technologies	Reading: Read and summarize the Levelized Cost of Electricity tracking metrics across globally deployed energy storage installations using IRENA (2023) data sets.
	batteries, pumped hydro, thermal storage	
	Economic feasibility, policy frameworks, and financing renewable energy projects	
WEEK-16	Case studies on renewable energy initiatives in Pakistan	Assignment: Author a final case profile highlighting the barriers and integration successes of utility-scale solar parks or micro-hydro networks in regional Pakistan using structural metrics from CRC Press (2021).
	Case studies on renewable energy initiatives at Global Scale	
	Regional case studies	
FINAL TERM EXAMINATION		

TEXT BOOKS AND READING MATERIAL

1. Renewable Energy Technologies. (2025). BR Publications.
2. Renewable Energy: Technologies and Applications. (2021). United Kingdom: IntechOpen.
3. Renewable Energy and Green Technology: Principles and Practices. (2021). United Kingdom: CRC Press.
4. Boyle, G. (2012). Renewable Energy: Power for a Sustainable Future (3rd ed.). OUP.
5. Twidell, J. & Weir, T. (2015). Renewable Energy Resources (3rd ed.). Routledge.
6. IRENA (2023). Renewable Power Generation Costs. International Renewable Energy Agency.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

2. classroom participation,
3. attendance, assignments and presentation,
4. homework
5. attitude and behavior,
6. hands-on-activities,
7. short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentation, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-XVII	Credit hours	03
Course Title	INTRODUCTION TO ATMOSPHERIC SCIENCE				
COURSE INTRODUCTION					
The concepts of atmospheric temperature, pressure, humidity, wind, and how these factors are measured. Investigation of the physical processes of the atmosphere in such areas as heat transfer, condensation and precipitation, stability-instability and lapse rate. Study of atmospheric circulation and weather changes..					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. understand the major events in the history of meteorology 2. identify climatology, basic principles, composition, structure, and layering of the atmosphere 3. discuss the earth/sun relationship and the energy received from the sun as seasons 4. list and discuss the effects of pressure, density, and wind on weather phenomena 5. demonstrate an understanding of water and its associated atmospheric phenomena 6. discuss clouds and precipitation, atmospheric circulation systems and mid-latitude low pressure systems 7. identify and discuss unusual or extreme weather phenomena					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit- I: Foundations of the Atmosphere & Radiation		Reading: Study Chapters 1 and 2 in Ahrens (2012) exploring volatile outgassing periods of early Earth and current mixing ratios of permanent vs. variable atmospheric trace gases.		
	The Atmosphere				
	Origin of the Earth’s Atmosphere				
	Composition of the Atmosphere				
WEEK-2	Vertical Structure of the Atmosphere		Assignment: Plot a comprehensive 1-page vertical profile graph calculating and mapping the boundaries of the troposphere, stratosphere, mesosphere, and thermosphere relative to kinetic temperature shifts from Lutgens & Tarbuck (2016) parameters.		
	The Earth in Space				
	Earth and Sun				
WEEK-3	Earth-Sun Relationships		Reading: Read Chapter 3 in Wallace & Hobbs (2006) reviewing Earth’s orbital obliquity, axial tilt mechanics, and the physical absorption bands of greenhouse gases (CO ₂ , H ₂ O).		
	Cause of the Seasons				
	Solar Energy and Greenhouse Effect				
WEEK-4	Unit II: Atmospheric Dynamics, Pressure, and Wind		Assignment: Calculate horizontal pressure gradient forces (PGFs) across a sample isobar grid map using fluid density and distance equations from Chapter 4 of Achatz (2022).		
	Energy Budget of the Earth				
	Pressure and its Measurement				
	Vertical and Horizontal Pressure Gradient				
WEEK-5	Measurement of Wind		Reading: Study Chapter 6 in Chandrasekar (2022) detailing the balance between the Coriolis force and the pressure gradient force producing geostrophic wind balances.		
	Geostrophic Wind and Gradient Wind				
	Isobars and Wind Speeds				
WEEK-6	Unit III: Atmospheric Thermodynamics, Moisture, and Stability		Assignment: Complete thermodynamic exercise equations tracking latent heat exchange during phase transformations		
	Phases of Water, Vapor Pressure and the Boiling Point				

	Humidity Parameters and measurement	and calculate dew point temperatures relative to varying vapor pressures using tables in Ahrens (2012).
	Environmental and Adiabatic Lapse Rate	
WEEK-7	Inversions and Stability	Reading: Read Chapters 4 and 5 in Lutgens & Tarbuck (2016) reviewing dry vs. moist adiabatic lapse rates (DALR/MALR) and matching cloud morphology categories.
	Clouds and Precipitation	
	Cloud Classification	
WEEK-8	Formation of Precipitation	Assignment: Create an illustrated flow layout tracing the ice-crystal (Bergeron) process vs. the collision-coalescence mechanism of raindrop generation based on Wallace & Hobbs (2006).
	Types of Precipitation	
	Atmospheric Circulation Systems	
MID TERM EXAMINATION		
WEEK-9	Unit IV: Global and Local Circulation Systems	Reading: Study Chapter 7 in Ahrens (2012) focusing on macro-scale circulation models including Hadley, Ferrel, and Polar three-cell convective loops.
	Scales of Atmospheric Motion	
	Global Scale Circulation	
	Cyclones and Anticyclones	
WEEK-10	Monsoon Circulation	Reading: Read Chapters 8 and 9 in Chandrasekar (2022) exploring differential land-sea thermal imbalances that drive monsoon tracks, severe microbursts, and supercell tornadogenesis.
	Small Scale Circulations	
	Weather at Its Worst	
WEEK-11	Unit V: Meteorological Observation, Analysis, and Forecasting	Assignment: Translate standard station model symbols plotted on a synoptic surface weather chart to evaluate local temperature, wind direction, cloud cover, and barometric trends using Lutgens & Tarbuck (2016) guidelines.
	Reading a Weather Map	
	Observation, Analysis and Prediction	
	Organization of the National Weather Service	
WEEK-12	Long-Range Forecasts	Reading: Read selected modern climate assessment journals or operational guides tracked in Chapter 12 of Achatz (2022) concerning seasonal predictive telemetry across northern Pakistan.
	Current research trends and recent developments in introduction to atmospheric science	
	Case studies: applications of introduction to atmospheric science in Pakistan	
WEEK-13	Field and laboratory methods for introduction to atmospheric science monitoring	Assignment: Compile an entry-level atmospheric data-cleaning manifest, applying variance standard deviation checks on a historical baseline surface temperature data record via Chandrasekar (2022).
	Data analysis and interpretation in introduction to atmospheric science	
	Reporting and communication of introduction to atmospheric science findings	
WEEK-14	National and international standards relevant to introduction to atmospheric science	Reading: Study global World Meteorological Organization (WMO’s) instrumentation standards and regional environmental pollution acts recorded in Ahrens (2012).
	Regulatory frameworks and compliance in introduction to atmospheric science	
	Environmental legislation related to introduction to atmospheric science in Pakistan	
WEEK-15	Unit VI: Future Directions in Introduction To Atmospheric Science	Reading: Study Chapter 11 in Wallace & Hobbs (2006) focusing on the computational structures, parameterizations, and grid bounds of
	Anthropogenic climate feedback loops and extreme weather attribution	

	Application of AI, machine learning	modern Numerical Weather Prediction (NWP) systems.	
	High-resolution numerical models in modern forecasting.		
WEEK-16	Emerging challenges and opportunities in introduction to atmospheric science	Assignment: Design a career pathway conceptual map charting how digital satellite payloads and AI assimilation techniques will impact real-time air quality forecasting networks over the next decade based on trends in Achatz (2022).	
	Technological innovations shaping the future of introduction to atmospheric science		
	Career pathways and professional development in introduction to atmospheric science		
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Achatz, U. (2022). <i>Atmospheric dynamics</i> (Vol. 10, pp. 978-3). Springer Spektrum. 2. Chandrasekar, A. (2022). <i>Basics of atmospheric science</i>. PHI Learning Pvt. Ltd.. 3. Lutgens, F.K. & Tarbuck, E.J. (2016). <i>The Atmosphere</i> (13th ed.). Pearson. 4. Ahrens, C.D. (2012). <i>Meteorology Today</i> (10th ed.). Cengage. 5. Wallace, J.M. & Hobbs, P.V. (2006). <i>Atmospheric Science</i> (2nd ed.). Academic Press.			
TEACHING – LEARNING STRATEGIES - Lecture based examination - Presentation/seminars - Class discussion - Quizzes			
ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR			
It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes: - classroom participation, - attendance, assignments and presentation, - homework - attitude and behavior, - hands-on-activities, - short tests, quizzes etc.			
ASSESSMENT AND EXAMINATIONS:			
Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	Written Assessment at the mid-point of the semester.
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3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-X	Credit hours	03
Course Title	OCEAN AND ENVIRONMENT (THEORY)				
COURSE INTRODUCTION					
This course explores the vital relationship between the world’s oceans and the environment, emphasizing the ocean's role in regulating Earth’s climate, supporting biodiversity, and sustaining human life. Students will gain an understanding of oceanographic processes and how physical, chemical, biological, and geological factors interact within marine ecosystems.					
LEARNING OUTCOMES					
At the end of this course the students will be able to:					
5. Basic understanding of marine pollution, its sources, types and impacts					
6. Develop a knowledge of ocean pollution control and management techniques.					
7. Know the ocean science concepts, global warming and climate change phenomena					
8. Gain information of blue economy and sustainable aquaculture strategies					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Ocean pollution definition, history, types, causes and impacts		Reading: Read Chapters 1 and 2 in <i>Wang (2020)</i> exploring historical baseline definitions of anthropogenic marine pollution and oil degradation kinetics		
	Chronic and acute inorganic and organic marine pollutants				
	Oil pollution and impact of oil spills				
WEEK-2	Heavy metal pollution; dangers & hazards		Assignment: Draft a 2-page research synthesis comparing the trophic transfer risks of Microplastics (MPs) vs. Nanoplastics (NPs) based on parameters in <i>UNEP (2016)</i> .		
	Wastes; solid garbage and liquid waste, marine outfalls, shipboard wastes, dumping of sludge, disposal of dredge spoil				
	Risks in oceans from plastic pollution; MPs, NPs				
WEEK-3	Radioactive waste disposal risks in oceans		Reading: Review the global economic impact assessment metrics for ecosystem service loss outlined in Chapter 4 of <i>UNEP (2016)</i> .		
	Ocean Health and anthropogenic activities				
	Economic losses from marine pollution				
WEEK-4	SDGs and Implementation Scenario		Reading: Study Chapters 3 and 4 in <i>Garrison (2012)</i> detailing physical bathymetry and the light/temperature zonation of marine layers.		
	Major oceans of the world				
	Oceanic layers				
WEEK-5	Global Oceanic conveyor belt and importance		Assignment: Construct a diagnostic flowchart tracking how structural anomalies in the global thermohaline circulation affect regional monsoon cycles using <i>Garrison (2012)</i> frameworks.		
	Marine debris and impacts				
	Climate change due to ocean circulations; AL Nino, La Nina Nina, Monsoons				
WEEK-6	Ocean and control of heat/ GHGs		Reading: Read Chapter 5 in <i>Wang (2020)</i> analyzing carbon sink sequestration capacities and tidal/thermal green energy harvesting		
	Ocean energy potential				
	Major Environmental Issues of Oceans				

WEEK-7	Dead zones	Reading: Study Chapters 9 and 10 in <i>Levinton (2017)</i> regarding nutrient-induced hypoxia pathways and the breakdown of zooxanthellae symbioses.
	Algal blooms	
	Coral bleaching	
WEEK-8	Ocean Acidification, Blast water/ Blige water	Assignment: Complete the carbonate chemistry buffer system problem set (calculating pH drops relative to \$pCO_2\$ rises) using equations from Chapter 11 of <i>Levinton (2017)</i> .
	Bio-accumulation and Bio-magnification in Oceans	
	Tsunamis, Coastal Floods, Tides/Waves Hazards	
MID TERM EXAMINATION		
WEEK-9	Loss of Oceanic Biodiversity	Reading: Review the industrial fishing demographic trends and structural habitat loss tables in the core marine crisis chapters of <i>UNEP (2016)</i> .
	Overfishing and Unsustainable Aquaculture	
	Climate change and Global warming due ocean circulation	
WEEK-10	Ocean-based mitigation measures to tackle climate change	Reading: Read Chapter 8 in <i>Wang (2020)</i> exploring mitigation protocols for acoustic pollution from offshore industrial operations.
	Ocean engineering and drilling impacts on aquatic life	
	Noise, light, or the spread of invasive organisms in oceans	
WEEK-11	High mercury level and impacts	Assignment: Create a comparative legal framework analysis table matching specific pollution categories against <i>MARPOL</i> annex restrictions and <i>London Convention</i> mandates via <i>UNEP (2016)</i> .
	Contamination of oceanic food	
	Ocean Health Index, law of sea, MARPOL and London convention	
WEEK-12	Adaptation and mitigation measures for control of marine and coastal pollution	Reading: Study Chapter 15 in <i>Garrison (2012)</i> focusing on historical containment booms, microbial oil-remediation, and sustainable mariculture design.
	Oceanic Pollution Treatment Strategies; Physical, chemical, biological	
	Conservation of ocean biodiversity and promotion of blue economy/aquaculture	
WEEK-13	Marine pollution and hazards preparedness and response	Assignment: Design an emergency coastal oil-slick tracking protocol using geospatial telemetry rules and remote sensing spectral signature identification via <i>Wang (2020)</i> .
	Monitoring of Marine pollution through RS & GIS	
	Stricter Pollution Control Standards/ guideline; sustainable practices in industries	
WEEK-14	Role of Artificial Intelligence and Machine Learning for marine pollution mitigation	Reading: Study the policy implementation frameworks and compliance bottlenecks under the <i>UNCLOS (Law of the Sea)</i> recorded in Chapter 12 of <i>Wang (2020)</i> .
	National and International Marine laws/policies/ regulations/ treaties compliance	
	Individual/Govt./ International organizations contributions to combat marine pollution	
WEEK-15	Current research trends and recent developments in ocean and environment	Reading: Read Chapter 19 in <i>Levinton (2017)</i> regarding multi-point water column sampling techniques, plankton net deployments, and dissolved oxygen titration.
	Interdisciplinary connections of ocean and environment with other environmental sciences	
	Field and laboratory methods for ocean and environment monitoring	

WEEK-16	Data analysis and interpretation in ocean and environment	Assignment: Formulate a baseline monitoring and variance report for a coastal estuary case study, evaluating toxicological sample data against international <i>UNEP</i> guidelines.	
	Reporting and communication of ocean and environment findings		
	National and international standards relevant to ocean and environment		
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Wang, Y. (Ed.). (2020). <i>Coastal and marine environments</i>. CRC Press. 2. Levinton, J.S. (2017). <i>Marine Biology: Function, Biodiversity, Ecology</i> (5th ed.). Oxford. 3. UNEP (2016). <i>The First Global Integrated Marine Assessment</i>. United Nations. 4. Garrison, T. (2012). <i>Oceanography: An Invitation to Marine Science</i> (8th ed.). Cengage.			
TEACHING – LEARNING STRATEGIES - Lecture based examination - Presentation/seminars - Class discussion - Quizzes			
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3.	Final Assessment	40%	Written examination at the end of the semester. It is mostly

Program	BS Environmental Sciences	Course Code	ELECTIVE-XVIII	Credit hours	03
Course Title	ENVIRONMENTAL FIELD STUDIES				
COURSE INTRODUCTION					
The students will visit Khewra Salt Mine, Choa Saiden Shah, Islamabad, Galiat, Murree- Kohala Road, Abbottabad, Manshera, Oghi Road, Muzaffarabad, Khanpur, Rawal, Mangla and Tarbela Dam.					
LEARNING OUTCOMES					
At the end of this course the students will be able to: 1. This course will provide information regarding Environmental Geology to the students in field. 2. The students will learn about the different aspects of Geology, Biodiversity. 3. They will have the knowledge about the Dams and Meteorology. 4. The students will be able to identify rocks and minerals in the field.					
COURSE CONTENTS			Assignments / Readings		
WEEK-1	Unit-I: Environmental Geology		Reading: Study Chapters 1 and 2 in Birkby (2012) concerning physical field geomorphic descriptions, structural lithology mapping, and recording fault strike alignments.		
	Identification of minerals and Igneous, Sedimentary and Metamorphic Rocks at Natural Formations in Salt Range, Islamabad, Galiat, Abbottabad and Mansehra Areas.				
	Sedimentary Structure, mainly Bedding, Cross Bedding, Ripple Marks, Fossils, Mud Cracks, Graded Bedding.				
	Color, Fabric, Texture OF Rocks, Identification of Joints, Faults and Cleavage.				
WEEK-2	A visit to Natural History Museum, Islamabad.		Assignment: Write a 2-page industrial field visitation essay reviewing the raw material extraction process, quarry runoff patterns, and environmental dust management layouts seen at the cement complex following Zhang (2024) templates.		
	A visit to Bestway Cement Factory, Chakwal.				
	A visit to Dams				
WEEK-3	Study of Geologic Hazards, Visit to some Seismic Stations.		Reading: Read Chapters 1 and 3 in Sutherland (2006) exploring structural line-transect line methodologies and mountain plant population sampling along altitudinal gradients.		
	Visit to some Petroleum Drilling/Petroleum Sites.				
	Study of Vegetation, change in vegetation with altitudinal changes.				
WEEK-4	Study of Role of Vegetation in Controlling Soil Erosion		Assignment: Formulate a structured wildlife population inventory framework sheet utilizing standard point-count and capture-mark-recapture parameters outlined in Sutherland (2006).		
	Study of Conditions Supporting Gymnosperm Growth.				
	Study of Animal Diversity of the visited Areas.				
WEEK-5	Study of Dams		Reading: Study Chapter 4 in Davis (2010) exploring impounded surface water quality, natural wetlands filtration kinetics, and ecological river reservoir structures.		
	Study of Reservoirs				
	Study of Wetlands				
WEEK-6	Flow Measurements, Weather Stations		Assignment: Compute open-channel stream flow discharge velocities using the area-		
	Seepage Control through Dams and Foundations, Power Houses, Spillways.				

	Air quality field monitoring: portable instruments, sensors and data logging	velocity method mathematical formulas found in Chapter 6 of Davis (2010).
WEEK-7	Water quality field testing: pH, DO, turbidity, conductivity and nitrates	Reading: Read Chapters 3 and 4 in Zhang (2024) detailing field instrument calibration routines (pH/DO probes) and the formal statistics of grid vs. random soil core layouts.
	Noise level monitoring and mapping in field environments	
	Soil sampling strategies: grid, random and stratified sampling methods	
WEEK-8	Unit-V: Data Collection, Analysis and Reporting	Assignment: Organize a set of geo-referenced field tracking coordinates into a spreadsheet and generate descriptive mean and standard deviation variations using the statistical frameworks in Zhang (2024).
	Field data recording: GPS mapping, photography and specimen collection protocols	
	Statistical analysis of field data: means, standard deviations and comparisons	
	GIS mapping of field survey data: spatial analysis and visualization	
MID TERM EXAMINATION		
WEEK-9	Technical report writing for field studies: structure, style and conventions	Assignment: Draft a Job Hazard Analysis (JHA) safety protocol briefing sheet for a remote river basin excursion based on risk management models in Chapter 5 of Birkby (2012).
	Field safety planning: risk assessment, PPE and emergency procedures	
	Environmental ethics in field research: minimizing disturbance and footprint	
WEEK-10	Working with communities: consent, respect and benefit sharing in field studies	Reading: Review the statutory conservation area access rules, community engagement protocols, and ethical field collection guidelines listed in Sutherland (2006).
	Project design: selecting study site, defining objectives and methodology	
	Geological survey exercise: rock and mineral identification in the field	
WEEK-11	Biological survey exercise: vegetation mapping and wildlife observation	Assignment: Prepare a raw data summary layout comparing measured ambient noise decibels (\$dB\$) and turbidity units (\$NTU\$) against regional Pakistani environmental standards using Davis (2010) benchmarks.
	Hydrological survey exercise: stream flow and water quality measurements	
	Air and noise quality survey: measurement and comparison with standards	
WEEK-12	Integration of multi-disciplinary field data into a comprehensive report	Reading: Study structural multi-layer data integration and GIS spatial error correction mechanics outlined in Chapter 7 of Birkby (2012).
	Spatial analysis: mapping findings using QGIS or ArcGIS	
	Environmental assessment: comparing field findings with regulatory standards	
WEEK-13	Oral presentation of integrated field project findings	Assignment: Outline a 10-slide oral brief template synthesizing field project outputs, including charts showing localized water-column degradation trends via Zhang (2024).
	Peer evaluation and constructive feedback on field project reports	
	Reflection on field experience: lessons learned and professional development	
WEEK-14	Advanced field mapping with Unmanned Aerial Vehicles (UAVs) and drones.	Reading: Study automated drone sensor error profiles and ground-reflection

	Ground-truthing procedures for satellite remote sensing validation.	validation target mechanics detailed in Chapter 9 of Birkby (2012).	
	Practical calibration and troubleshooting of field sensors under extreme weather conditions.		
WEEK-15	Environmental forensics: using field evidence to investigate pollution incidents	Assignment: Draft a short technical memo translating trace chemical contamination plume dynamics into non-specialist safety alerts based on the communications guides in Zhang (2024).	
	Remote sensing in field studies: interpreting satellite and drone imagery		
	Science communication: presenting field study results to non-specialist audiences		
WEEK-16	Reflective journal: documenting personal learning throughout field study experience	Reading: Review the data protection, quality assurance verification metrics, and instrument storage checklists in Appendix A of Birkby (2012).	
	Post-field data consolidation, calibration cross-checks, and digital archiving protocols.		
	Air quality field monitoring: portable instruments and data logging		
FINAL TERM EXAMINATION			
TEXT BOOKS AND READING MATERIAL			
1. Zhang, C. (2024). <i>Fundamentals of environmental sampling and analysis</i>. John Wiley & Sons. 2. Birkby, J. (2012). <i>Field Trip Companion for Environmental Scientists</i>. Routledge. 3. 2. Davis, M.L. (2010). <i>Water and Wastewater Engineering</i>. McGraw-Hill. 4. 3. Sutherland, W.J. (2006). <i>Ecological Census Techniques</i> (2nd ed.). Cambridge University Press.			
TEACHING – LEARNING STRATEGIES			
Lecture based examination Presentation/seminars Class discussion Quizzes			
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