UNIVERSITY OF THE PUNJAB

NOTIFICATION

It is hereby notified that the Syndicate at its meeting held on 27-07-2023 has approved the recommendations of the Academic Council made at its meeting dated 24-05-2023 regarding approval of the Revised Syllabi and Courses of Reading BS Environmental Sciences (04 years) Degree Program under Semester System at the College of Earth and Environmental Sciences w.e.f. the Academic Session, 2021onward.

The Revised Syllabi and Courses of Reading for BS Environmental Sciences (04 years) Degree Program under Semester System is attached herewith as Annexure 'A'.

Sd/-
REGISTRAR

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

No. D/ 7675 /Acad. **Dated: 11 – 10 /2023.**

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 for placement at the website
5. Admin Officer (Statutes)
6. Secretary to the Vice-Chancellor.
7. PS to the Registrar.
8. Assistant Syllabus.

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 Sciences**

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, M.Sc., 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 Introduction

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. Students will study different aspects of climate change, agro-biodiversity, environmental management, pollution and control, population dynamics, ecosystems and urbanization. Impart quality education based on knowledge, research and skill to produce graduates of international caliber who contribute to science and technology, of the country with global perspectives. Teach high ethical and moral standards, develop leadership capabilities and equip with professionalism for the socio-economic and sustainable development of the society particularly in the industrial hub of Pakistan.

4. 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.

5. 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 fulfill 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.

6. Admission Eligibility Criteria

A student holding HSSC (FA or F.Sc.) or equivalent with minimum 2nd division or equivalent 12 Years educations 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.

7. 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 136 credit hours total with 08 semesters varied by 16-19 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.

8. Categorization of Courses as per HEC Recommendation and Difference

Semester	Courses	Category (Credit Hours)					
		Core Courses	Basic Courses	Major Electives	Minor Electives	Any Other	Semester Load
1	7	8	2	--	--	08 (General Course)	18
2	6	8	3	--	--	06 (General Course)	18
3	6	3	3	8	--	03 (General Course)	17
4	7	3	3	7	--	05 (General Course)	19
5	6	3	6	8	--	--	17
6	6		3	15	--	--	19
7	7		8	8	--	--	16
8	6		3	12	--	--	22
PU	**51**	**25**	**31**	**58**		**22**	**146**
HEC Guidelines	**40-44**	**25**	**30**	**48-54**		**21-24**	**124-136**
Difference (HEC &) PU	**+7**	**NIL**	**+1**	**+4**	**--**	**NIL**	**NIL**

**Core: Compulsory, Basic: Foundation, Major Electives: Professional Minor Electives: Specialization*

Note: The course/column heads are customizable according to nature and level of the program.

9. Scheme of Studies / Semester-Wise Workload

#	Code	Course Title	Course Type	Prerequisite	Credit Hours
Semester I					
1.	HQ-001	Translation of Holy Quran	Compulsory	F.Sc. or equivalent	Non Credit
2.	ENSC-101	English-I	Core Course	F.Sc. or equivalent	3+0
3.	ENSC-102	Mathematics	Core Course	F.Sc. or equivalent	3+0
4.	ENSC-103	Islamic Studies	Core Course	F.Sc. or equivalent	2+0
5.	ENSC-104	General Physics	General Course	F.Sc. or equivalent	2+0
6.	ENSC-105	General Chemistry	General Course	F.Sc. or equivalent	2+1
7.	ENSC-106	General Biology	General Course	F.Sc. or equivalent	2+1
8.	ENSC-107	Environmental Issues	Basic Course	F.Sc. or equivalent	2+0
				Total Credit Hours:	**18**
SEMESTER II					
9.	HQ-002	Translation of Holy Quran	Compulsory	HQ-001	01
10.	ENSC-108	English II	Core Course	ENSC-101	3+0
11.	ENSC-109	Introduction to Computer	Core Course	F.Sc. or equivalent	1+2
12.	ENSC-110	Pakistan Studies	Core Course	F.Sc. or equivalent	2+0
13.	ENSC-111	General Geology	General Course	F.Sc. or equivalent	2+1
14.	ENSC-112	Environmental Chemistry	Basic Course	ENSC-105	2+1
15.	ENSC-113	Systematics and Biodiversity	General Course	ENSC-106	2+1
				Total Credit Hours:	**18**
SEMESTER III					
16.	HQ-003	Translation of Holy Quran	Compulsory	HQ-002	Non Credit
17.	ENSC-201	English III	Core Course	ENSC-108	3+0
18.	ENSC-202	Environmental Geology	Basic Course	ENSC-111	2+1
19.	ENSC-203	Biotechnology and Environment	Major Elective	F.Sc. or equivalent	2+1
20.	ENSC-204	Plants and Environment	General Course	ENSC-113	2+1
21.	ENSC-205	Rock, Soil & Environment	Major Elective	ENSC-111	2+1
22.	ENSC-206	Environmental Law and Policies	Major Elective	F.Sc. or equivalent	2+0
				Total Credit Hours:	**17**

#	Code	Course Title	Course Type	Prerequisite	Credit Hours
SEMESTER IV					
23.	HQ-004	Translation of Holy Quran	Compulsory	HQ-003	01
24.	ENSC-207	English IV	Core Course	ENSC-201	3+0
25.	ENSC-208	Hydrological Systems and Environment	Major Elective	F.Sc. or equivalent	2+1
26.	ENSC-209	Animals and Environment	General Course	ENSC-113	2+1
27.	ENSC-210	Environmental Microbiology	Basic Course	ENSC-106	2+1
28.	ENSC-211	Air and Noise Pollution	Major Elective	ENSC-107	2+1
29.	ENSC-212	Meteorology	General Course	F.Sc. or equivalent	2+0
30.	ENSC-213	Environmental Field Studies I	Major Elective	F.Sc. or equivalent	1
				Total Credit Hours	**19**
SEMESTER V					
31.	HQ-005	Translation of Holy Quran	Compulsory	HQ-004	Non Credit
32.	ENSC-301	Statistics in Environmental Science	Core Course	F.Sc. or equivalent	2+1
33.	ENSC-302	Analytical Chemistry	Basic Course	ENSC-112	2+1
34.	ENSC-303	Conservation Biology	Major Elective	ENSC-204 ENSC-209	2+0
35.	ENSC-304	Water Pollution and Control	Basic Course	ENSC-203	2+1
36.	ENSC-305	Occupational Health and Safety	Major Elective	F.Sc. or equivalent	2+1
37.	ENSC-306	Solid Waste Management	Major Elective	ENSC-203	2+1
				Total Credit Hours	**17**
Semester VI					
38.	HQ-006	Translation of Holy Quran	Compulsory	HQ-005	01
39.	ENSC-307	Natural Hazards and Disaster Management	Major Elective	ENSC-205	2+0
40.	ENSC-308	Industrial Pollution and Its Control	Basic Course	ENSC-304	2+1
41.	ENSC-309	Advanced Ecology	Major Elective	ENSC-303	3+1
42.	ENSC-310	Wastewater Treatment	Major Elective	ENSC-304	2+1
43.	ENSC-311	Environmental Impact Assessment	Major Elective	F.Sc. or equivalent	03
44.	ENSC-312	Environmental Management Systems	Major Elective	ENSC-305	2+1
				Total Credit Hours	**19**

#	Code	Course Title	Course Type	Prerequisite	Credit Hours
Semester VII					
45.	HQ-007	Translation of Holy Quran	Compulsory	HQ-006	Non Credit
46.	ENSC-401	Geological Resources of Pakistan	Basic Course	ENSC-205	2+1
47.	ENSC-402	Research Methods in Environmental Science	Basic Course	ENSC-301	2+0
48.	ENSC-403	Environmental Health and Risk Assessment	Basic Course	ENSC-311	2+1
49.	ENSC-404	GIS and Remote Sensing	Major Elective	ENSC-109	2+1
50.	ENSC-405	Environmental Economics and Sustainable Development	Major Elective	F.Sc. or equivalent	2+0
51.	ENSC-406	Hazards of Heavy Metal Pollution	Major Elective	ENSC-205 ENSC-308	2+0
52.	ENSC-407	Environmental Field Studies II	Major Elective	ENSC0213	1
				Total Credit Hours	**16**
Semester VIII					
53.	HQ-008	Translation of Holy Quran	Compulsory	HQ-007	01
54.	ENSC-408	Environment and Humanity	Basic Course	ENSC-206	3+0
55.	ENSC-409	Environmental Engineering	Major Elective	ENSC-203	2+1
56.	ENSC-410	Environmental Standards, Auditing and Project Management	Major Elective	ENSC-312	3+0
57.	ENSC-411	Optional Paper I	Major Elective	F.Sc. or equivalent	2+1
58.	ENSC-412	Optional Paper II	Major Elective	F.Sc. or equivalent	2+1
59.	ENSC-417	Research Project/Internship	Major Elective	ENSC-402	6
				Total Credit Hours	**22**
				GRAND TOTAL (I, II, III, IV, V, VI, VII, VIII)	**146**

10. Type of course may be core (compulsory), basic (foundation), major elective (professional), minor elective (specialization) etc.

11. Research Thesis / Project /Internship

Besides the course work, each BS student is required to write a dissertation in the final semester. The BS dissertation is supervised by a faculty member. Furthermore, at the time of appointment as supervisor, the faculty member is a full-time faculty member of the University of Punjab in

which the student is enrolled. Plagiarism policy is conducted before finalizing the research work. After completion of research, external evaluate the research project.

12. Award of Degree

As a requirement, 04 Year BS degree will be awarded on the successful completion of courses & syllabi and research thesis with minimum required CGPA 2.5/4.00. In the final semester, the student is officially allowed to start the research and BOS finalize the research work titles. The BS dissertation is supervised by a faculty member. Plagiarism policy is conducted before finalizing the research work. After completion of research, external evaluate the research project.

13. NOC from Professional Councils (if applicable)

Not Applicable

14. Faculty Strength

Degree	Name of Faculty Member	Area / Specialization	Total
PhD	1. Prof. Dr. Sajid Rashid Ahmad	Earth and Environmental Sciences, Climate Change, Remote Sensing & GIS	**15**
	2. Prof. Dr. Irfan Ahmad Shaikh	Water and Wastewater Treatment	
	3. Prof. Dr. Nadia Jamil	Analytical / Environmental Chemistry	
	4. Dr. Abdul Qadir	Environmental Biology	
	5. Dr. Yumna Sadef	Environmental Sciences	
	6. Dr. Muhammad Kamran	Environmental Tourism	
	7. Dr. Muzaffar Majid Ch.	Environmental Geology	
	8. Dr. Azhar Ali	Water and Wastewater Treatment, Health & Safety	
	9. Dr. Sana Ashraf	Biotechnology Bioremediation and Env. Microbiology	
	10. Dr. Naeem Akhtar Abbasi	Environmental Toxicology	
	11. Dr. Muhammad Bilal Shakoor	Water and Wastewater Treatment and Quality Assessment	
	12. Dr. Mehwish Mumtaz	Environmental Engineering / Toxicology	
	13. Dr. Rizwan Aziz	Hydrology and Water Resources Management	
	14. Dr. Muhammad Awais	Hydrology and Water Resources Management	
	15. Dr. Muhammad Asif Javed	GIS and Remote	
MS / M.Phil.	16. Mr. Muhammad Waqar	Hydrology and Water Resources Management	**04**
	17. Ms. Anum Tariq	Urban Ecology, Environmental Sciences	
	18. Mr. Muhammad Dastgeer	Environmental Tourism	
	19. Ms. Zahra Majid	Hydrology and Water Resources Management	
		TOTAL FACULTY:	**19**

15. Present Student Teacher Ratio in the Department 447: 19= (1:23)

16. Course Outlines separately for each course.

1ST YEAR, FIRST SEMESTER			
Code	**Course Title**	**C.H.**	**Course Type**
HQ-001	Translation of Holy Quran	Non Credit	Compulsory
ENSC-101	English-I	3+0	Core Course
ENSC-102	Mathematics	3+0	Core Course
ENSC-103	Islamic Studies	2+0	Core Course
ENSC-104	General Physics	2+0	General Course
ENSC-105	General Chemistry	2+1	General Course
ENSC-106	General Biology	2+1	General Course
ENSC-107	Environmental Issues	2+0	Basic Course
	Total Credit hrs Semester-I	**18**	

HQ-001: TRANSLATION OF HOLY QURAN (Non Credit)

PRE-REQUISITE: F.Sc. or equivalent

COURSE OUTLINE

سورة الفاتحہ تا سورة آل عمران

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after mid term 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

ENSC-101: ENGLISH-I (03 Credit Hrs)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES

- The course will provide basic understanding of English grammar and comprehension, concepts of sentence, structure of sentences, punctuations, spellings etc.
- Further, the course will also improve the reading, writing and listening skills for English language.

CONTENTS:

Unit-I: Grammar

1.1. Basic grammar
1.2. Sentence structure
1.3. Parts of speech and Articles,
1.4. Punctuation and Spellings, etc.

Unit-II: Reading Comprehension:

2.1. Answering question from given text
2.2. MCQs or Descriptive questions.

Unit-III: Paragraph Writing

3.1. Basic paragraph structure,
3.2. Different forms of paragraph writing. i.e. Narrative, Descriptive etc. (Word limit up to 120 words)

Unit-IV: Listening:

4.1. Enhancing the listening skills of the students with the help of different documentaries
4.2. Exercises on listening comprehension

Unit-V: Group and Class Room Discussion

5.1. Different social, economic, political topic etc.

Unit-VI: Presentation Skills:

6.1. Introduction to presentation skills, introducing yourself.

Unit-VII: Translation Skills:

7.1. From Urdu to English.

TEACHING-LEARNING STRATEGIES

- Lecture based examination
- Presentations/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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Yule, G. (2015). *Oxford practice grammar advanced*. Oxford University Press.
2. Peter, E., (2009). Focus on Comprehension Book 4. Learners Publishers Pvt. Ltd., Singapore.
3. Hashemi, L., & Murphy, R. (2004). English Grammar in Use. *Supplementary exercises. Cambridge*.
4. John, E. (2004). Oxford Practice Grammar. New Edition, with tests and answers. Oxford University Press, London.
5. Belolan, C. J. (2004). Real Writing with Readings: Paragraphs and Essays for College, Work, and Everyday Life.
6. Lee, B., (2004). Paragraphs and Essays: a work text with readings. St Antonio college pub. New York.
7. Howe, D.H., Kirkpatrick, T.A. and Kirkpatrick, D.L., (1993). English for undergraduates. Oxford University Press, London.
8. Jacobs, G. and Loh, I.W., (2004). Grammar in Use. Learners Publishers Pvt. Ltd. Singapore.
9. Arnauder, M.L. and Ellen, B.M., (1981). Paragraph Development: A Guide for Students of English as a Second Language. Prentice Hall College Div.
10. Goatly, A., (2000). Critical Reading and Writing: An Introductory Course. Taylor and Francis, London.

Further Reading: As suggested by the Instructor.

ENSC-102: MATHEMATICS (03 Credit Hrs)

PRE-REQUISITE : F. Sc. or equivalent

LEARNING OUTCOMES

At the end of the course, the student will be able to:

- understand and become competent in basic computations.
- understand and improve problem-solving skills.
- understand and become familiar with mathematical terminology.
- become competent using a calculator.
- understand and improve estimation skills.

CONTENTS:

Unit-1: Elementary Concepts

1.1. Numbers and Factors,
1.2. Decimal Fractions,
1.3. Metric System,
1.4. Conversions,
1.5. Significant figures,
1.6. Ratios and Percentages.

Unit-II: Algebra and Matrices

2.1. Linear Equations
2.2. Simultaneous Equations,
2.3. Quadratic Equations
2.4. Equation Formation
2.5. Matrices and Determinants.

Unit-III: Elementary Calculus

3.1. Coordinate Geometry and Trigonometry (Coordinates, Points, Circle, Line, Slope of a line,
3.2. Equation of a line, Use of tables, Tangent Ratio, Sine Ratio, Cosine Ratio and Right angled Triangle),
3.3. Exponential and Logarithmic functions (Inverse Functions, Exponential Functions, Logarithms, Exponential and Logarithmic Equations).

Unit-IV: Derivatives and their Applications

4.1. Differentiable functions,
4.2. differentiation of polynomial,
4.3. rational functions
4.4. derivatives.

Unit-V: Integration and Definite Integrals:

5.1. Techniques of evaluating indefinite integrals
5.2. integration by substitution, integration by parts
5.3. change of variables in indefinite integrals.

TEACHING-LEARNING STRATEGIES

- Lecture based examination
- Presentations/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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1 Weiner, I. D. M. (2019). *Calculus with Analytic Geometry I. Instructor*.

2 Demana, F., Waits, B. K., & Kennedy, D. (2010). *Calculus: Graphical, Numerical, and Algebraic* (p. 787). Pearson Prentice Hall.

3 Weir, M. D. (2008). *Thomas' Calculus: Early Transcendentals. Part one*. Pearson Education India.

4 Elvin, R., Ledsham, A. and Oliver, C., (2001). *Basic mathematics: Revision and practice*. Oxford: Oxford University Press.

5 Keisler, H.J., (2000). *Elementary Calculus, An Infinitesimal Approach*: An e-book.

6 Anton, H., (2000). *Calculus with Analytical Geometry.* 5th Ed., John Wiley and Sons, Reprint National Book Foundation

Further Reading: As suggested by the Instructor.

ENSC-103: ISLAMIC STUDIES **(02 Credit Hrs)**

PRE-REQUISITE : F.Sc. or equivalent

اھداف ومقاصد

۱۔ طلبہ کو قرآن وحدیث سے استفادہ کے قابل بنانا۔

۲۔ طلبہ کے قلوب واذہان میں قرآن وسنت کی روح اور علم کو راسخ کرنا۔

۳۔ طلبہ میں اسوۂ ختم المرسلین صلی اللہ علیہ وسلم کے اتباع اور حُبِّ رسولؐ کا جذبہ پیدا کرنا۔

۴۔ اسلام کی بنیادی تعلیمات کا فہم آسان بنانا اور طلبہ کی اسلامی بنیادوں پر تربیت کرنا۔

۵۔ اُمتِ مسلمہ کو درپیش عصرِ جدید کے چیلنجوں سے طلبہ کو آگاہ کرنا۔

نصابی تفصیلات(تفاصیل المنهج الدّراسی)

1. القرآن الكريم

الف. قواعد لغة القرآن (قرآنی گرامر)

الماضی و المضارع، الأمر والنهی، الجملة الإسمية والفعلية، المركب الإضافی والتوصيفی، الضمائر وحروف الجر

ب۔ منتخب قرآنی آیات کا لغوی و بامحاورہ ترجمہ وتشریح (ضمیمہ ''الف'')

(ترجمة و شرح نخبة من الآيات القرآنية لغة وسلاسة:ملحق "الف")

2. الحديث النبوی

منتخب احادیثِ نبویہ کا لغوی و بامحاورہ ترجمہ اور تشریح (ضمیمہ ''ب'')

(ترجمة و شرح نخبة من الاحاديث النبوية لغة وسلاسة:ملحق "ب")

نوٹ: اساتذہ کرام آیات واحادیث کی تعلیم وتدریس کے دوران لغوی اور بامحاورہ ترجمہ کے ضمن میں مندرجہ بالا قواعدِ عربیہ کی تطبیق کا اہتمام کریں۔

3. سیرۃ النبی صلّی اللّٰہ علیہ وسلّم

(۱) مطالعۂ سیرت کی ضرورت واہمیت (اهمية وضرورة دراسة السيرة)

(۲) نبی کریم صلّی اللہ علیہ وسلّم کی حکمتِ انقلاب (الحكمة الثورية للنبي الكريم صلّى الله عليه وسلّم)
(ہجرت، مواخات، میثاقِ مدینہ، صلح حدیبیہ، خطبۂ حجۃ الوداع)

(۳) تزکیۂ نفس اور تعمیرِ سیرت وشخصیت کا نبویؐ منہاج اور عملی نمونے
(المنهج النبوي لتكوين الشخصية و السيرة و تزكية النفس ونماذجها الفعلية)
(عشرہ مبشرہؓ، امہات المومنینؓ، اولاد النبیؐ)

(۴) تشکیلِ اجتماعیت ومعاشرت اور اسوۂ حسنہ (تكوين المجتمع والمعاشرة في ضوء الأسوة الحسنة)

4. اسلامی تہذیب وثقافت (الحضارة والثقافة الاسلامية)

(الف) اسلامی تہذیب وثقافت کے خصائص
توحید، روحانیت، تصورِ مسؤلیت، انسانی عظمت ومساوات، عالمگیر اُخوت، عدل اجتماعی، اخلاقی اقدار، انسانی حقوق، رواداری، اعتدال وتوازن

(ب) اسلامی تہذیب وثقافت کے عالمی اثرات

(ج) مغربی تہذیب وثقافت اور اسلام
(i) مغربی تہذیب وثقافت کے خصائص واثرات
(ii) تہذیبوں کے تصادم کے نظریے کا تنقیدی جائزہ

معروضی سوالات: پورے نصاب پر مشتمل ہوں گے۔

نوٹ: ایڈہاک کمیٹی نے اس نصاب برائے اسلامیات لازمی کے بی اے، بی ایس سی، بی کام نیز گریجوائیشن کے دیگر تمام پروگراموں کی سطح پر ستمبر 2010ء سے شروع ہونے والے تعلیمی سال سے نفاذ کی سفارش کی۔

نوٹ: اس مضمون کی تدریس وامتحانات کے لئے اردو، عربی اور انگریزی زبانوں کی اجازت ہے۔

ضمیمه الف: منتخب آیات قرآن

(ملحق الف: نخبة من آیات القرآن)

(i) البقرة (۲) الآیة ۱ تا ۵ و ۲۸۴ تا ۲۸۶ (ایمانیات)

الٓمّٓ [1] ذٰلِكَ الْكِتٰبُ لَا رَيْبَ فِيْهِ هُدًى لِّلْمُتَّقِيْنَ [2] الَّذِيْنَ يُؤْمِنُوْنَ بِالْغَيْبِ وَ يُقِيْمُوْنَ الصَّلٰوةَ وَ مِمَّا رَزَقْنٰهُمْ يُنْفِقُوْنَ [3] وَ الَّذِيْنَ يُؤْمِنُوْنَ بِمَآ اُنْزِلَ اِلَيْكَ وَ مَآ اُنْزِلَ مِنْ قَبْلِكَ وَ بِالْاٰخِرَةِ هُمْ يُوْقِنُوْنَ [4] اُولٰٓئِكَ عَلٰى هُدًى مِّنْ رَّبِّهِمْ وَ اُولٰٓئِكَ هُمُ الْمُفْلِحُوْنَ [5]

لِلّٰهِ مَا فِي السَّمٰوٰتِ وَ مَا فِي الْاَرْضِ وَ اِنْ تُبْدُوْا مَا فِيْٓ اَنْفُسِكُمْ اَوْ تُخْفُوْهُ يُحَاسِبْكُمْ بِهِ اللّٰهُ فَيَغْفِرُ لِمَنْ يَّشَآءُ وَ يُعَذِّبُ مَنْ يَّشَآءُ وَاللّٰهُ عَلٰى كُلِّ شَيْءٍ قَدِيْرٌ [284] اٰمَنَ الرَّسُوْلُ بِمَآ اُنْزِلَ اِلَيْهِ مِنْ رَّبِّهٖ وَ الْمُؤْمِنُوْنَ كُلٌّ اٰمَنَ بِاللّٰهِ وَ مَلٰٓئِكَتِهٖ وَ كُتُبِهٖ وَ رُسُلِهٖ لَا نُفَرِّقُ بَيْنَ اَحَدٍ مِّنْ رُّسُلِهٖ وَ قَالُوْا سَمِعْنَا وَ اَطَعْنَا غُفْرَانَكَ رَبَّنَا وَ اِلَيْكَ الْمَصِيْرُ [285] لَا يُكَلِّفُ اللّٰهُ نَفْسًا اِلَّا وُسْعَهَا لَهَا مَا كَسَبَتْ وَ عَلَيْهَا مَا اكْتَسَبَتْ رَبَّنَا لَا تُؤَاخِذْنَآ اِنْ نَّسِيْنَآ اَوْ اَخْطَاْنَا رَبَّنَا وَ لَا تَحْمِلْ عَلَيْنَآ اِصْرًا كَمَا حَمَلْتَهٗ عَلَى الَّذِيْنَ مِنْ قَبْلِنَا رَبَّنَا وَ لَا تُحَمِّلْنَا مَا لَا طَاقَةَ لَنَا بِهٖ وَاعْفُ عَنَّا وَ اغْفِرْ لَنَا وَ ارْحَمْنَا اَنْتَ مَوْلٰنَا فَانْصُرْنَا عَلَى الْقَوْمِ الْكٰفِرِيْنَ [286]

(ii) الأحزاب (۳۳) الآیة ۶، ۲۱، ۳۲، ۳۳، ۴۰، ۵۶ تا ۵۸، ۵۹

(تخصّصاتِ نبویه: اسوه حسنه، ختم نبوت، مقامِ رسالت، ناموسِ رسالت، ازواجُ النّبیؐ)

اَلنَّبِيُّ اَوْلٰى بِالْمُؤْمِنِيْنَ مِنْ اَنْفُسِهِمْ وَ اَزْوَاجُهٗٓ اُمَّهٰتُهُمْ وَ اُولُوا الْاَرْحَامِ بَعْضُهُمْ اَوْلٰى بِبَعْضٍ فِيْ كِتٰبِ اللّٰهِ مِنَ الْمُؤْمِنِيْنَ وَ الْمُهٰجِرِيْنَ اِلَّآ اَنْ تَفْعَلُوْٓا اِلٰٓى اَوْلِيٰٓئِكُمْ مَّعْرُوْفًا كَانَ ذٰلِكَ فِي الْكِتٰبِ مَسْطُوْرًا [6]

لَقَدْ كَانَ لَكُمْ فِيْ رَسُوْلِ اللّٰهِ اُسْوَةٌ حَسَنَةٌ لِّمَنْ كَانَ يَرْجُوا اللّٰهَ وَ الْيَوْمَ الْاٰخِرَ وَ ذَكَرَ اللّٰهَ كَثِيْرًا [21]

يٰنِسَآءَ النَّبِيِّ لَسْتُنَّ كَاَحَدٍ مِّنَ النِّسَآءِ اِنِ اتَّقَيْتُنَّ فَلَا تَخْضَعْنَ بِالْقَوْلِ فَيَطْمَعَ الَّذِيْ فِيْ قَلْبِهٖ مَرَضٌ وَّ قُلْنَ قَوْلًا مَّعْرُوْفًا [32] وَ قَرْنَ فِيْ بُيُوْتِكُنَّ وَ لَا تَبَرَّجْنَ تَبَرُّجَ الْجَاهِلِيَّةِ الْاُوْلٰى وَ اَقِمْنَ الصَّلٰوةَ وَ اٰتِيْنَ الزَّكٰوةَ وَ اَطِعْنَ اللّٰهَ وَ رَسُوْلَهٗ اِنَّمَا يُرِيْدُ اللّٰهُ لِيُذْهِبَ عَنْكُمُ الرِّجْسَ اَهْلَ الْبَيْتِ وَيُطَهِّرَكُمْ تَطْهِيْرًا [33]

مَا كَانَ مُحَمَّدٌ اَبَآ اَحَدٍ مِّنْ رِّجَالِكُمْ وَ لٰكِنْ رَّسُوْلَ اللّٰهِ وَ خَاتَمَ النَّبِيّٖنَ وَ كَانَ اللّٰهُ بِكُلِّ شَيْءٍ عَلِيْمًا [40]

اِنَّ اللّٰهَ وَ مَلٰٓئِكَتَهٗ يُصَلُّوْنَ عَلَى النَّبِيِّ يٰٓاَيُّهَا الَّذِيْنَ اٰمَنُوْا صَلُّوْا عَلَيْهِ وَ سَلِّمُوْا تَسْلِيْمًا [56]

اِنَّ الَّذِيْنَ يُؤْذُوْنَ اللّٰهَ وَ رَسُوْلَهٗ لَعَنَهُمُ اللّٰهُ فِى الدُّنْيَا وَ الْاٰخِرَةِ وَ اَعَدَّ لَهُمْ عَذَابًا مُّهِيْنًا[57]
وَ الَّذِيْنَ يُؤْذُوْنَ الْمُؤْمِنِيْنَ وَ الْمُؤْمِنٰتِ بِغَيْرِ مَا اكْتَسَبُوْا فَقَدِ احْتَمَلُوْا بُهْتَانًا وَّ اِثْمًا مُّبِيْنًا[58]
يٰۤاَيُّهَا النَّبِىُّ قُلْ لِّاَزْوَاجِكَ وَبَنٰتِكَ وَ نِسَآءِ الْمُؤْمِنِيْنَ يُدْنِيْنَ عَلَيْهِنَّ مِنْ جَلَابِيْبِهِنَّ ذٰلِكَ اَدْنٰۤى اَنْ
يُّعْرَفْنَ فَلَا يُؤْذَيْنَ وَ كَانَ اللّٰهُ غَفُوْرًا رَّحِيْمًا[59]

(iii) الفتح (۴۸)الآية : ۲۹ (رسالتِ محمديه اور خصائص اصحاب رسولؐ)

مُحَمَّدٌ رَّسُوْلُ اللّٰهِ وَالَّذِيْنَ مَعَهٗۤ اَشِدَّآءُ عَلَى الْكُفَّارِ رُحَمَآءُ بَيْنَهُمْ تَرٰىهُمْ رُكَّعًا سُجَّدًا يَّبْتَغُوْنَ
فَضْلًا مِّنَ اللّٰهِ وَرِضْوَانًا سِيْمَاهُمْ فِىْ وُجُوْهِهِمْ مِّنْ اَثَرِ السُّجُوْدِ ذٰلِكَ مَثَلُهُمْ فِى التَّوْرٰىةِ وَمَثَلُهُمْ
فِى الْاِنْجِيْلِ كَزَرْعٍ اَخْرَجَ شَطْئَهٗ فَاٰزَرَهٗ فَاسْتَغْلَظَ فَاسْتَوٰى عَلٰى سُوْقِهٖ يُعْجِبُ الزُّرَّاعَ لِيَغِيْظَ
بِهِمُ الْكُفَّارَ وَعَدَ اللّٰهُ الَّذِيْنَ اٰمَنُوْا وَعَمِلُوا الصّٰلِحٰتِ مِنْهُمْ مَّغْفِرَةً وَّاَجْرًا عَظِيْمًا [29]

(iv) الصف (۶۱) الآية:۱ تا ۱۴(بشارتِ بعثتِ ختم المرسلينؐ، هجرت،جهاد،نصرت اور غلبۂ دين)

سَبَّحَ لِلّٰهِ مَا فِى السَّمٰوٰتِ وَمَا فِى الْاَرْضِ وَهُوَ الْعَزِيْزُ الْحَكِيْمُ [1] يٰۤاَيُّهَا الَّذِيْنَ اٰمَنُوْا لِمَ تَقُوْلُوْنَ
مَا لَا تَفْعَلُوْنَ [2] كَبُرَ مَقْتًا عِنْدَ اللّٰهِ اَنْ تَقُوْلُوْا مَا لَا تَفْعَلُوْنَ [3] اِنَّ اللّٰهَ يُحِبُّ الَّذِيْنَ يُقَاتِلُوْنَ
فِىْ سَبِيْلِهٖ صَفًّا كَاَنَّهُمْ بُنْيَانٌ مَّرْصُوْصٌ [4] وَاِذْ قَالَ مُوْسٰى لِقَوْمِهٖ يٰقَوْمِ لِمَ تُؤْذُوْنَنِىْ وَقَدْ
تَّعْلَمُوْنَ اَنِّىْ رَسُوْلُ اللّٰهِ اِلَيْكُمْ فَلَمَّا زَاغُوْۤا اَزَاغَ اللّٰهُ قُلُوْبَهُمْ وَاللّٰهُ لَا يَهْدِى الْقَوْمَ الْفٰسِقِيْنَ [5]
وَاِذْ قَالَ عِيْسَى ابْنُ مَرْيَمَ يٰبَنِىْۤ اِسْرَآءِيْلَ اِنِّىْ رَسُوْلُ اللّٰهِ اِلَيْكُمْ مُّصَدِّقًا لِّمَا بَيْنَ يَدَىَّ مِنَ التَّوْرٰىةِ
وَمُبَشِّرًا بِرَسُوْلٍ يَّاْتِىْ مِنْۢ بَعْدِى اسْمُهٗۤ اَحْمَدُ فَلَمَّا جَآءَهُمْ بِالْبَيِّنٰتِ قَالُوْا هٰذَا سِحْرٌ مُّبِيْنٌ [6]
وَمَنْ اَظْلَمُ مِمَّنِ افْتَرٰى عَلَى اللّٰهِ الْكَذِبَ وَهُوَ يُدْعٰۤى اِلَى الْاِسْلَامِ وَاللّٰهُ لَا يَهْدِى الْقَوْمَ الظّٰلِمِيْنَ[7]
يُرِيْدُوْنَ لِيُطْفِـُٔوْا نُوْرَ اللّٰهِ بِاَفْوَاهِهِمْ وَاللّٰهُ مُتِمُّ نُوْرِهٖ وَلَوْ كَرِهَ الْكٰفِرُوْنَ [8] هُوَ الَّذِىْۤ اَرْسَلَ
رَسُوْلَهٗ بِالْهُدٰى وَدِيْنِ الْحَقِّ لِيُظْهِرَهٗ عَلَى الدِّيْنِ كُلِّهٖ وَلَوْ كَرِهَ الْمُشْرِكُوْنَ [9] يٰۤاَيُّهَا الَّذِيْنَ اٰمَنُوْا
هَلْ اَدُلُّكُمْ عَلٰى تِجَارَةٍ تُنْجِيْكُمْ مِّنْ عَذَابٍ اَلِيْمٍ [10] تُؤْمِنُوْنَ بِاللّٰهِ وَرَسُوْلِهٖ وَتُجَاهِدُوْنَ فِىْ
سَبِيْلِ اللّٰهِ بِاَمْوَالِكُمْ وَاَنْفُسِكُمْ ذٰلِكُمْ خَيْرٌ لَّكُمْ اِنْ كُنْتُمْ تَعْلَمُوْنَ [11] يَغْفِرْ لَكُمْ ذُنُوْبَكُمْ
وَيُدْخِلْكُمْ جَنّٰتٍ تَجْرِىْ مِنْ تَحْتِهَا الْاَنْهٰرُ وَمَسٰكِنَ طَيِّبَةً فِىْ جَنّٰتِ عَدْنٍ ذٰلِكَ الْفَوْزُ الْعَظِيْمُ [12]
وَاُخْرٰى تُحِبُّوْنَهَا نَصْرٌ مِّنَ اللّٰهِ وَفَتْحٌ قَرِيْبٌ وَبَشِّرِ الْمُؤْمِنِيْنَ [13] يٰۤاَيُّهَا الَّذِيْنَ اٰمَنُوْا كُوْنُوْۤا
اَنْصَارَ اللّٰهِ كَمَا قَالَ عِيْسَى ابْنُ مَرْيَمَ لِلْحَوَارِيّٖنَ مَنْ اَنْصَارِىْۤ اِلَى اللّٰهِ قَالَ الْحَوَارِيُّوْنَ نَحْنُ
اَنْصَارُ اللّٰهِ فَاٰمَنَتْ طَّآئِفَةٌ مِّنْ بَنِىْۤ اِسْرَآءِيْلَ وَكَفَرَتْ طَّآئِفَةٌ فَاَيَّدْنَا الَّذِيْنَ اٰمَنُوْا عَلٰى عَدُوِّهِمْ
فَاَصْبَحُوْا ظٰهِرِيْنَ[14]

يٰۤاَيُّهَا الَّذِيْنَ اٰمَنُوْا لَا تُقَدِّمُوْا بَيْنَ يَدَيِ اللّٰهِ وَرَسُوْلِهٖ وَاتَّقُوا اللّٰهَ اِنَّ اللّٰهَ سَمِيْعٌ عَلِيْمٌ [1] يٰۤاَيُّهَا الَّذِيْنَ اٰمَنُوْا لَا تَرْفَعُوْۤا اَصْوَاتَكُمْ فَوْقَ صَوْتِ النَّبِيِّ وَلَا تَجْهَرُوْا لَهٗ بِالْقَوْلِ كَجَهْرِ بَعْضِكُمْ لِبَعْضٍ اَنْ تَحْبَطَ اَعْمَالُكُمْ وَاَنْتُمْ لَا تَشْعُرُوْنَ [2] اِنَّ الَّذِيْنَ يَغُضُّوْنَ اَصْوَاتَهُمْ عِنْدَ رَسُوْلِ اللّٰهِ اُولٰٓئِكَ الَّذِيْنَ امْتَحَنَ اللّٰهُ قُلُوْبَهُمْ لِلتَّقْوٰى لَهُمْ مَّغْفِرَةٌ وَّاَجْرٌ عَظِيْمٌ [3] اِنَّ الَّذِيْنَ يُنَادُوْنَكَ مِنْ وَّرَآءِ الْحُجُرٰتِ اَكْثَرُهُمْ لَا يَعْقِلُوْنَ [4] وَلَوْ اَنَّهُمْ صَبَرُوْا حَتّٰى تَخْرُجَ اِلَيْهِمْ لَكَانَ خَيْرًا لَّهُمْ وَاللّٰهُ غَفُوْرٌ رَّحِيْمٌ [5] يٰۤاَيُّهَا الَّذِيْنَ اٰمَنُوْۤا اِنْ جَآءَكُمْ فَاسِقٌ بِنَبَاٍ فَتَبَيَّنُوْۤا اَنْ تُصِيْبُوْا قَوْمًا بِجَهَالَةٍ فَتُصْبِحُوْا عَلٰى مَا فَعَلْتُمْ نٰدِمِيْنَ [6] وَاعْلَمُوْۤا اَنَّ فِيْكُمْ رَسُوْلَ اللّٰهِ لَوْ يُطِيْعُكُمْ فِيْ كَثِيْرٍ مِّنَ الْاَمْرِ لَعَنِتُّمْ وَلٰكِنَّ اللّٰهَ حَبَّبَ اِلَيْكُمُ الْاِيْمَانَ وَزَيَّنَهٗ فِيْ قُلُوْبِكُمْ وَكَرَّهَ اِلَيْكُمُ الْكُفْرَ وَالْفُسُوْقَ وَالْعِصْيَانَ اُولٰٓئِكَ هُمُ الرّٰشِدُوْنَ [7] فَضْلًا مِّنَ اللّٰهِ وَنِعْمَةً وَاللّٰهُ عَلِيْمٌ حَكِيْمٌ [8] وَاِنْ طَآئِفَتٰنِ مِنَ الْمُؤْمِنِيْنَ اقْتَتَلُوْا فَاَصْلِحُوْا بَيْنَهُمَا فَاِنْۢ بَغَتْ اِحْدٰىهُمَا عَلَى الْاُخْرٰى فَقَاتِلُوا الَّتِيْ تَبْغِيْ حَتّٰى تَفِيْٓءَ اِلٰٓى اَمْرِ اللّٰهِ فَاِنْ فَآءَتْ فَاَصْلِحُوْا بَيْنَهُمَا بِالْعَدْلِ وَاَقْسِطُوْا اِنَّ اللّٰهَ يُحِبُّ الْمُقْسِطِيْنَ [9] اِنَّمَا الْمُؤْمِنُوْنَ اِخْوَةٌ فَاَصْلِحُوْا بَيْنَ اَخَوَيْكُمْ وَاتَّقُوا اللّٰهَ لَعَلَّكُمْ تُرْحَمُوْنَ [10] يٰۤاَيُّهَا الَّذِيْنَ اٰمَنُوْا لَا يَسْخَرْ قَوْمٌ مِّنْ قَوْمٍ عَسٰۤى اَنْ يَّكُوْنُوْا خَيْرًا مِّنْهُمْ وَلَا نِسَآءٌ مِّنْ نِّسَآءٍ عَسٰۤى اَنْ يَّكُنَّ خَيْرًا مِّنْهُنَّ وَلَا تَلْمِزُوْۤا اَنْفُسَكُمْ وَلَا تَنَابَزُوْا بِالْاَلْقَابِ بِئْسَ الِاسْمُ الْفُسُوْقُ بَعْدَ الْاِيْمَانِ وَمَنْ لَّمْ يَتُبْ فَاُولٰٓئِكَ هُمُ الظّٰلِمُوْنَ [11] يٰۤاَيُّهَا الَّذِيْنَ اٰمَنُوا اجْتَنِبُوْا كَثِيْرًا مِّنَ الظَّنِّ اِنَّ بَعْضَ الظَّنِّ اِثْمٌ وَّلَا تَجَسَّسُوْا وَلَا يَغْتَبْ بَّعْضُكُمْ بَعْضًا اَيُحِبُّ اَحَدُكُمْ اَنْ يَّاْكُلَ لَحْمَ اَخِيْهِ مَيْتًا فَكَرِهْتُمُوْهُ وَاتَّقُوا اللّٰهَ اِنَّ اللّٰهَ تَوَّابٌ رَّحِيْمٌ [12] يٰۤاَيُّهَا النَّاسُ اِنَّا خَلَقْنٰكُمْ مِّنْ ذَكَرٍ وَّاُنْثٰى وَجَعَلْنٰكُمْ شُعُوْبًا وَّقَبَآئِلَ لِتَعَارَفُوْا اِنَّ اَكْرَمَكُمْ عِنْدَ اللّٰهِ اَتْقٰكُمْ اِنَّ اللّٰهَ عَلِيْمٌ خَبِيْرٌ [13]

قَالَتِ الْاَعْرَابُ اٰمَنَّا قُلْ لَّمْ تُؤْمِنُوْا وَلٰكِنْ قُوْلُوْۤا اَسْلَمْنَا وَلَمَّا يَدْخُلِ الْاِيْمَانُ فِيْ قُلُوْبِكُمْ وَاِنْ تُطِيْعُوا اللّٰهَ وَرَسُوْلَهٗ لَا يَلِتْكُمْ مِّنْ اَعْمَالِكُمْ شَيْئًا اِنَّ اللّٰهَ غَفُوْرٌ رَّحِيْمٌ [14] اِنَّمَا الْمُؤْمِنُوْنَ الَّذِيْنَ اٰمَنُوْا بِاللّٰهِ وَرَسُوْلِهٖ ثُمَّ لَمْ يَرْتَابُوْا وَجٰهَدُوْا بِاَمْوَالِهِمْ وَاَنْفُسِهِمْ فِيْ سَبِيْلِ اللّٰهِ اُولٰٓئِكَ هُمُ الصّٰدِقُوْنَ [15] قُلْ اَتُعَلِّمُوْنَ اللّٰهَ بِدِيْنِكُمْ وَاللّٰهُ يَعْلَمُ مَا فِي السَّمٰوٰتِ وَمَا فِي الْاَرْضِ وَاللّٰهُ بِكُلِّ شَيْءٍ عَلِيْمٌ [16] يَمُنُّوْنَ عَلَيْكَ اَنْ اَسْلَمُوْا قُلْ لَّا تَمُنُّوْا عَلَيَّ اِسْلَامَكُمْ بَلِ اللّٰهُ يَمُنُّ عَلَيْكُمْ اَنْ هَدٰىكُمْ لِلْاِيْمَانِ اِنْ كُنْتُمْ صٰدِقِيْنَ [17] اِنَّ اللّٰهَ يَعْلَمُ غَيْبَ السَّمٰوٰتِ وَالْاَرْضِ وَاللّٰهُ بَصِيْرٌ بِمَا تَعْمَلُوْنَ [18]

(vi) الأنعام (٦) الآية:١٥١ تا ١٥٣ (حقوق العباد)

قُلْ تَعَالَوْا اَتْلُ مَا حَرَّمَ رَبُّكُمْ عَلَيْكُمْ اَلَّا تُشْرِكُوْا بِهٖ شَيْئًا وَّ بِالْوَالِدَيْنِ اِحْسَانًا وَ لَا تَقْتُلُوْٓا اَوْلَادَكُمْ مِّنْ اِمْلَاقٍ نَحْنُ نَرْزُقُكُمْ وَ اِيَّاهُمْ وَ لَا تَقْرَبُوا الْفَوَاحِشَ مَا ظَهَرَ مِنْهَا وَ مَا بَطَنَ وَ لَا تَقْتُلُوا النَّفْسَ الَّتِيْ حَرَّمَ اللّٰهُ اِلَّا بِالْحَقِّ ذٰلِكُمْ وَصّٰكُمْ بِهٖ لَعَلَّكُمْ تَعْقِلُوْنَ [151] وَ لَا تَقْرَبُوْا مَالَ الْيَتِيْمِ اِلَّا بِالَّتِيْ هِيَ اَحْسَنُ حَتّٰى يَبْلُغَ اَشُدَّهٗ وَ اَوْفُوا الْكَيْلَ وَ الْمِيْزَانَ بِالْقِسْطِ لَا نُكَلِّفُ نَفْسًا اِلَّا وُسْعَهَا وَ اِذَا قُلْتُمْ فَاعْدِلُوْا وَ لَوْ كَانَ ذَا قُرْبٰى وَ بِعَهْدِ اللّٰهِ اَوْفُوْا ذٰلِكُمْ وَصّٰكُمْ بِهٖ لَعَلَّكُمْ تَذَكَّرُوْنَ [152] وَ اَنَّ هٰذَا صِرَاطِيْ مُسْتَقِيْمًا فَاتَّبِعُوْهُ وَ لَا تَتَّبِعُوا السُّبُلَ فَتَفَرَّقَ بِكُمْ عَنْ سَبِيْلِهٖ ذٰلِكُمْ وَصّٰكُمْ بِهٖ لَعَلَّكُمْ تَتَّقُوْنَ [153]

(vii) الفرقان (٢٥) الآية:٦٣ تا ٧٧ (آداب معاشرت)

وَعِبَادُ الرَّحْمٰنِ الَّذِيْنَ يَمْشُوْنَ عَلَى الْاَرْضِ هَوْنًا وَّاِذَا خَاطَبَهُمُ الْجٰهِلُوْنَ قَالُوْا سَلٰمًا [63] وَالَّذِيْنَ يَبِيْتُوْنَ لِرَبِّهِمْ سُجَّدًا وَّقِيَامًا [64] وَالَّذِيْنَ يَقُوْلُوْنَ رَبَّنَا اصْرِفْ عَنَّا عَذَابَ جَهَنَّمَ اِنَّ عَذَابَهَا كَانَ غَرَامًا [65] اِنَّهَا سَآءَتْ مُسْتَقَرًّا وَّمُقَامًا [66] وَالَّذِيْنَ اِذَا اَنْفَقُوْا لَمْ يُسْرِفُوْا وَلَمْ يَقْتُرُوْا وَكَانَ بَيْنَ ذٰلِكَ قَوَامًا [67] وَالَّذِيْنَ لَا يَدْعُوْنَ مَعَ اللّٰهِ اِلٰهًا اٰخَرَ وَلَا يَقْتُلُوْنَ النَّفْسَ الَّتِيْ حَرَّمَ اللّٰهُ اِلَّا بِالْحَقِّ وَلَا يَزْنُوْنَ وَمَنْ يَّفْعَلْ ذٰلِكَ يَلْقَ اَثَامًا [68] يُّضٰعَفْ لَهُ الْعَذَابُ يَوْمَ الْقِيٰمَةِ وَيَخْلُدْ فِيْهٖ مُهَانًا [69] اِلَّا مَنْ تَابَ وَاٰمَنَ وَعَمِلَ عَمَلًا صَالِحًا فَاُولٰٓئِكَ يُبَدِّلُ اللّٰهُ سَيِّاٰتِهِمْ حَسَنٰتٍ وَكَانَ اللّٰهُ غَفُوْرًا رَّحِيْمًا [70] وَمَنْ تَابَ وَعَمِلَ صَالِحًا فَاِنَّهٗ يَتُوْبُ اِلَى اللّٰهِ مَتَابًا [71] وَالَّذِيْنَ لَا يَشْهَدُوْنَ الزُّوْرَ وَاِذَا مَرُّوْا بِاللَّغْوِ مَرُّوْا كِرَامًا [72] وَالَّذِيْنَ اِذَا ذُكِّرُوْا بِاٰيٰتِ رَبِّهِمْ لَمْ يَخِرُّوْا عَلَيْهَا صُمًّا وَّعُمْيَانًا [73] وَالَّذِيْنَ يَقُوْلُوْنَ رَبَّنَا هَبْ لَنَا مِنْ اَزْوَاجِنَا وَذُرِّيّٰتِنَا قُرَّةَ اَعْيُنٍ وَّاجْعَلْنَا لِلْمُتَّقِيْنَ اِمَامًا [74] اُولٰٓئِكَ يُجْزَوْنَ الْغُرْفَةَ بِمَا صَبَرُوْا وَيُلَقَّوْنَ فِيْهَا تَحِيَّةً وَّسَلٰمًا [75] خٰلِدِيْنَ فِيْهَا حَسُنَتْ مُسْتَقَرًّا وَّمُقَامًا [76] قُلْ مَا يَعْبَؤُا بِكُمْ رَبِّيْ لَوْلَا دُعَآؤُكُمْ فَقَدْ كَذَّبْتُمْ فَسَوْفَ يَكُوْنُ لِزَامًا [77]

(viii) النّحل (١٦) الآية:١٢ تا ١٤ (تفکّر و تدبّر)

وَ سَخَّرَ لَكُمُ الَّيْلَ وَ النَّهَارَ وَ الشَّمْسَ وَ الْقَمَرَ وَ النُّجُوْمُ مُسَخَّرٰتٌۢ بِاَمْرِهٖ اِنَّ فِيْ ذٰلِكَ لَاٰيٰتٍ لِّقَوْمٍ يَّعْقِلُوْنَ [12] وَ مَا ذَرَاَ لَكُمْ فِي الْاَرْضِ مُخْتَلِفًا اَلْوَانُهٗ اِنَّ فِيْ ذٰلِكَ لَاٰيَةً لِّقَوْمٍ يَّذَّكَّرُوْنَ [13] وَ هُوَ الَّذِيْ سَخَّرَ الْبَحْرَ لِتَاْكُلُوْا مِنْهُ لَحْمًا طَرِيًّا وَّ تَسْتَخْرِجُوْا مِنْهُ حِلْيَةً تَلْبَسُوْنَهَا وَ تَرَى الْفُلْكَ مَوَاخِرَ فِيْهِ وَ لِتَبْتَغُوْا مِنْ فَضْلِهٖ وَ لَعَلَّكُمْ تَشْكُرُوْنَ [14]

ضمیمه ب: منتخب احادیث نبویه

(ملحق ب: نخبة من الأحاديث النّبويه)

(۱) عن عمر بن الخطاب رضی اللّٰه عنه قال: سمعت رسول اللّٰه صلی اللّٰه علیه وسلم یقول: إنما الأعمال بالنیات، و إنما لامرىء ما نوی، فمن کانت هجرته الی اللّٰه ورسوله فهجرته إلی اللّٰه ورسوله و من کانت هجرته إلی دنیا یصیبها او امرأة یتزوجها فهجرته إلی ماهاجر إلیه. (رواه البخاری و مسلم)

(۲) عن عثمان بن عفان رضی اللّٰه عنه عن النبی صلی اللّٰه علیه وسلم قال: خیرکم من تعلّم القرآن و علّمه. (رواه البخاری)

(۳) عن مالك بن انس قال، قال رسول اللّٰه صلی اللّٰه علیه وسلم: ترکت فیکم أمرین لن تضلوا ما تمسکتم بهما، کتاب اللّٰه و سنّة رسوله. (رواه مالك فی المؤطّا مرسلاً)

(۴) عن ابن عمر رضی اللّٰه عنهما قال، قال رسول اللّٰه صلّی اللّٰه علیه وسلّم: بنی الإسلام علی خمس، شهادة أن لّا الهٰ الّا اللّٰه و أنّ محمّداً عبده و رسوله و إقام الصّلوٰة و إیتاء الزّکوٰة والحجّ و صوم رمضان. (متفق علیه)

(۵) عن عمر بن الخطاب رضی اللّٰه عنه قال: بینما نحن عند رسول اللّٰه صلّی اللّٰه علیه وسلّم ذات یوم إذ طلع علینا رجل شدید بیاض الثیاب شدید سواد الشعر لا یری علیه اثر السفر ولا یعرفه منا احد حتی جلس الی النبی صلی الله علیه سلم فاسند رکبتیه الی رکبتیه ووضع کفیه علی فخذیه و قال: یا محمد، أخبر نی عن الإسلام؟ فقال رسول الله صلی الله علیه وسلم: الإسلام أن تشهد أن لا إله إلا اللّٰه و أن محمدًا رسول اللّٰه و تقیم الصلوٰة وتؤتی الزکوٰة و تصوم رمضان وتحج البیت إن استطعت إلیه سبیلاً، قال صدقت، قال: فعجبنا له یسأ له و یصدّقه، قال: فأخبرنی عن الإیمان؟ قال: أن تؤمن باللّٰه وملئکته و کتبه و رسله والیوم الآخر و تؤمن بالقدر خیره و شرّه، قال: صدقت، قال: فأخبرنی عن الإحسان؟ قال: أن تعبداللّٰه کأنك تراه فإن لم تکن تراه فإنه یراك، قال فأخبرنی عن الساعة؟ قال: ماالمسؤل عنها بأ علم من السائل، قال: فأخبرنی عن اماراتها؟ قال: أن تلد الأمة ربّتها و أن تری الحفاة العراة العالة رِعاء الشاء یتطاولون فی البنیان، قال: ثم انطلق، فلبثت ملیّاً ثم قال لی: یا عمر أتدری من السائل؟ قلت: اللّٰه ورسوله أعلم، قال: فإنه جبرئیل أتاکم یعلّمکم دینکم. (رواه مسلم)

(۶) عن شبرمة بن معبد رضی اللّٰه عنه قال: قال رسول اللّٰه صلّی اللّٰه علیه وسلّم: مروا الصّبیان الصّلوٰة إذا بلغ سبع سنین و إذا بلغ عشر سنین فاضربوه علیها. أخرجه أبوداؤد والتّرمذی ولفظه: علّموا الصّبیّ الصّلوة ابن سبع سنین واضربوه علیها ابن عشر. (صحیح البخاری)

(۷) عن معاوية رضى الله عنه قال: قال رسول الله صلى الله عليه وسلم:
من يُرد الله به خيراً يفقّهه فى الدّين. (رواه البخارى)

(۸) عن أبى هريرة رضى الله عنه قال: قال رسول الله صلّى الله عليه وسلّم: من سلك طريقاً يلتمس فيه علماً سهّل الله له به طريقاً الى الجنّة، و ما اجتمع قوم فى بيت من بيوت الله يتلون كتاب الله و يتدارسون بينهم الا نزلت عليهم السّكينة و غشيتهم الرّحمة وحفّتهم الملئكة و ذكرهم الله فيمن عنده، و من بطّأ به عمله لم يسرع به نسبه. (رواه مسلم)

(۹) عن أبى هريرة رضى الله عنه قال: كان رسول الله صلّى الله عليه وسلّم يقول: اللّهمّ إنّى أعوذ بك من أربع، من علم لا ينفع، و من قلب لا يخشع، و من نفس لا تشبع، و من دعاء لا يسمع.
(رواه احمد، وأبوداؤد، وابن ماجة: مشكوٰة المصابيح)

(۱۰) عن ابن مسعود رضى الله عنه عن النّبى صلّى الله عليه وسلّم قال: لا تزول قدما ابن آدم حتّى يسئل عن خمس عن عمره فيما أفناه و عن شبابه فيما أبلاه و عن ما له من اين اكتسبه و فيما أنفقه و ما ذا عمل فيما علم. (جامع الترمذى)

(۱۱) عن عبدالله قال: قال رسول الله صلّى الله عليه وسلّم طلب كسب الحلال فريضة بعد الفريضة. (شعب الايمان للبيهقى)

(۱۲) عن أبى سعيد رضى الله عنه قال: قال رسول الله صلّى الله عليه وسلّم: التّاجر الصّدوق الأمين مع النّبيّين والصّدّيقين والشّهدآء. (جامع الترمذى، سنن الدارمى، سنن دار قطنى)

(۱۳) عن أبى هريرة رضى الله عنه أنّ رسول الله قال: أتدرون ما المفلس؟ قالوا المفلس فينا من لا درهم له و لا متاع، فقال: إنّ المفلس من امّتى من يأتى يوم القيٰمة بصلوٰة و صيام و زكوة، و يأتى قد شتم هذا وقذف هذا و أكل مال هذا و سفك دم هذا وضرب هذا فيعطى هذا من حسناته و هذا من حسناته، فإن فنيت حسناته ، قبل أن يقضى ما عليه أخذ من خطاياهم فطرحت عليه ثمّ طرح فى النّار. (مسلم: كتاب البر)

(۱۴) عن أبى الدرداء رضى الله عنه أنّ رسول الله صلّى الله عليه وسلّم قال: إنّ أثقل شىء يوضع فى ميزان المؤمن يوم القيامة خلق حسن، و إنّ الله يبغض الفاحش البذئ (رواه الترمذى)

(۱۵) عن ابن عباس رضى الله عنهما أنّ النّبى صلّى الله عليه وسلّم قال: أربع من أعطيهنّ فقد أعطى خير الدنيا والآخرة، قلباً شاكراً ولساناً ذاكراً وبدناً على البلاء صابراً و زوجة لا تبغى حوباً فى نفسها و ماله. (سنن النسائى)

(۱۶) عن أبى هريرة رضى الله عنه قال، قال رسول الله صلّى الله عليه وسلّم: إجتنبوا السبع الموبقات، قالوا: يا رسول الله وماهنّ؟ قال: الشّرك بالله والسّحر وقتل النّفس الّتى حرّم الله إلّا بالحق وأكل الرّبا وأكل مال اليتيم والتولّى يوم الزحف وقذف المحصنات المؤمنات الغافلات. (متفق عليه)

(۱۷) عن أبى سعيد الخُدرى رضى الله عنه، عن رسول الله صلّى الله عليه وسلّم قال: من رأى منكم منكرًا فليغيّره بيده فإن لّم يستطع فبلسانه، وإن لّم يستطع فبقلبه و ذٰلك أضعف الإيمان (رواه مسلم)

(۱۸) قال رسول اللّٰه صلّی اللّٰه علیه وسلّم یجاء بالرّجل یوم القیامة فیلقی فی النّار فتندلق اقتابه فی النّار فیطحن فیها کطحن الحمار برحاه فیجتمع أهل النّار علیه فیقولون، ای فلان ماشأنك؟ أ لیس کنت تأمرنا بالمعروف و تنهانا عن المنکر؟ قال کنت امرکم و لا آتیه و أنهاکم عن المنکر و آتیه.(رواه مسلم)

(۱۹) عن انس قال قال رسول اللّٰه والّذی نفسی بیده لا یؤمن عبد حتّی یحبّ لا خیه ما یحبّ لنفسه (متفق علیه)

(۲۰) عن النّعمان بن بشیر رضی الله عنه قال:قال رسول اللّٰه صلّی اللّٰه علیه وسلّم:تری المؤمنین فی تراحمهم و توادّهم و تعاطفهم کمثل الجسد اذا اشتکی عضو تداعی له سائر الجسد بالسّهر والحمّی (متفق علیه)

(۲۱) عن عبداللّٰه بن عمر رضی الله عنهما قال، قال رسول اللّٰه صلّی اللّٰه علیه وسلّم:ألا کلّکم راع و کلّکم مسئول عن رّعیته فالامام الّذی علی النّاس راع و هو مسئول عن رّعیّته والرّجل راع علی اهل بیت و هو مسئول عن رعیّته و المرأة راعیة علی بیت زوجها وولده و هی مسئولة عنهم و عبد الرّجل راع عن مال سیّده و هو مسئول عنه ألا فکلّکم راع و کلّکم مسئول عن رعیّته (متّفق علیه)

(۲۲) عن أبی هریرة رضی الله عنه قال، قال رسول اللّٰه صلّی اللّٰه علیه وسلّم:
مثلی و مثل الأنبیاء کمثل قصراُحسن بنیانه، تُرك منه موضع لبنة، فطاف به النظّار یتعجّبون من حسن بنائه إلا موضع تلك اللبنة، فکنت أنا سددت موضع اللبنة، ختم بی البنیان و ختم بی الرسل..وفی روایة:فأنا اللبنة و أنا خاتم النبیّین. (رواه البخاری)

(۲۳) و عن أنس رضی اللّٰه عنه عن النّبی صلّی اللّٰه علیه وسلّم قال:أرحم أمتی بأمتی أبوبکر و أشدّهم فی أمر اللّٰه عمر وأصدقهم حیاءً عثمان، وأقضاهم علی، وأفرضهم زید بن ثابت وأقرأهم أبی بن کعب وأعلمهم بالحلال والحرام معاذبن جبل و لکل أمة أمین وأمین هذه الأمة أبو عبیدة بن الجراح.(رواه احمد و الترمذی، مشکوٰة المصابیح، باب مناقب العشرة)

(۲۴) عن أبی بکرة رضی اللّٰه عنه قال:رأیت رسول اللّٰه صلّی اللّٰه علیه وسلّم علی المنبر والحسن بن علی إلٰی جنبه وهو یقبل علی النّاس مرّة وعلیه أخری ویقول:إنّ ابنی هذا سیّد و لعلّ اللّٰه أن یّصلح به بین فئتین عظیمتین من المسلمین.(رواه البخاری)

(۲۵) و عن عمران بن حصین رضی اللّٰه عنه قال، قال رسول اللّٰه صلّی علیه وسلّم:خیرأمّتی قرنی ثم الّذین یلونهم، ثم الّذین یلونهم...(متّفق علیه، مشکوٰة المصابیح، باب مناقب الصّحابةؓ)

(۲۶) عن جابر بن عبداللّٰه رضی اللّٰه عنه قال:خطبنا رسول اللّٰه صلّی اللّٰه علیه وسلم فی وسط أیام التشریق خطبة الوداع فقال:یأیها الناس:إن ربکم واحد وإن أباکم واحد، ألا لا فضل لعربی علٰی عجمی ولا لعجمی علٰی عربی ولا لأحمر علٰی أسود، و لا لأسود علٰی أحمر إلاّ بالتقوی، إنّ أکرمکم عند اللّٰه أتقاکم، ألاهل بلّغت؟قالوا:بلٰی یا رسول اللّٰه، قال:فلیبلّغ الشاهد الغائب. (البیهقی، شعب الایمان، باب فی حفظ اللسان، فصل فی حفظ اللسان عن الفخر بالآباء).

****

مجوزہ کتب (الکتب المقترحة)Recommended Books

(عربی)

۱.	القرآن الکریم	اللّٰہ جلّ جلالہ
۲.	مشکوۃ المصابیح	الخطیب التبریزی
۳.	تفسیر القرآن العظیم	ابن کثیر الدمشقی
۴.	تفسیر روح المعانی	شہاب الدین محمود الآلوسی
۵.	فی ظلال القرآن	سید قطب
۶.	السیرۃ النبویۃ	ابن ہشام
۷.	قصص النبیین(۱-۵)	ابو الحسن علی الندوی
۸.	النحو الواضح فی قواعد اللغۃ العربیۃ(۱-۲)	مصطفی امین ،علی الجارم
۹.	دروس اللغۃ العربیۃ	دکتور فاء عبدالرحیم
۱۰.	دائرۃ المعارف الاسلامیۃ باللغۃ العربیۃ	مجموعۃ من المؤلفین

انجلیزی (English)انگریزی

11. The Holy Quran(Text, Translation & Commentary):Abdullah Yousuf Ali.
12. The Glorious Quran:Muhammad Marma Duke Pickthall.
13. The Message of Quran: Muhammad Asad (Leopold Weiss).
14. Sahih-al-Bukhari (English Translation) Muhammad Mohsin Khan.
15. Takalam-al-Arabiyyah (تکلّم العربیۃ) Arabic-English: Mahmud Ismaeel al-Seeni.
16. al-Mawrid (المورد) English - Arabic Dictionary: Munir al-Balabakki.
17. The Road To Makkah: Muhammad Asad (Leopold Weiss).
18. Quran, Bible & Science (القرآن والانجیل والعلم) Maurice de Boucai.
19. Towards Understanding Islam(مبادیء الاسلام) :دینیات Abul Ala Maudoodi.
20. Introduction to Islam(المدخل الی الاسلام): Dr. Muhammad Hamidullah.
21. Spirit of Islam(روح اسلام): Syed Ameer Ali.
22. Purdah & Status of Woman in Islam(الحجاب) پردہ: Abul Ala Maudoodi.
23. Ettiquates of Life in Islam (آسان فقہ): Muhammad Yousuf Islahi.

24. Social Justice in Islam :Sayyid Qutb.

اسلام میں عدل اجتماعی (العدالة الإجتماعية فی الإسلام)

25. Islam in Theory & Practice :Maryam Jameela.(Margrate Marcus)

اسلام ایک نظریہ ایک تحریک (الإسلام فی النظرية و التطبيق)

26. Umar the Great: (الفاروق): Shibli Nomani (Translated by Zafar Ali Khan)

Note: The books available in two or three languages

(Arabic,English, Urdu (have been mentioned accordingly.)

Urdu (اردو)

۱۔	معارف القرآن	مفتی محمد شفیع
۲۔	تفہیم القرآن	سید ابوالاعلیٰ مودودی
۳۔	تدبر قرآن	امین احسن اصلاحی
۴۔	ضیاء القرآن	پیر کرم شاہ الازہری
۵۔	معارف الحدیث	محمد منظور نعمانی
۶۔	ترجمان السنة	بدر عالم میرٹھی
۷۔	اللسان العربی	محمد نعمان طشقندی (AIOU)
۸۔	قواعد القرآن (مختصر قرآنی عربی گرامر)	عبدالرحمٰن طاہر مدنی
۹۔	تعلیم اللغة العربية: مختصر القواعد (مختصر عربی گرامر)	ڈاکٹر مظہر معین
۱۰۔	عربی کا معلم	مولانا عبدالستار خان
۱۱۔	عربک گرامر اینڈ ٹرانسلیشن	ایم ڈی چوہدری
۱۲۔	مصباح اللغات (عربی، اردو ڈکشنری)	عبدالحفیظ بلیاوی...
۱۳۔	سیرۃ النبیؐ	شبلی نعمانی، سلیمان ندوی
۱۴۔	الرّحیق المختوم	صفی الرحمٰن مبارکپوری
۱۵۔	رحمۃ للعالمینؐ	محمد سلیمان منصور پوری
۱۶۔	انسانِ کاملؐ	ڈاکٹر خالد علوی
۱۷۔	سیرۃ عائشہؓ	سید سلیمان ندوی
۱۸۔	سیَر الصحابہؓ	شاہ معین الدین ندوی
۱۹۔	تاریخ اسلام	شاہ معین الدین ندوی
۲۰۔	اصحابی کالنجوم	حفیظ تائب
۲۱۔	(الثقافة الاسلامية) تاریخ افکار وعلوم اسلامی	راغب الطباخ (ترجمہ: افتخار احمد بلخی)
۲۲۔	اسلامی تہذیب اور اس کے اصول ومبادی	سید ابوالاعلیٰ مودودیؒ

(12)

۲۳۔	عشرہ مبشرہ	محمود احمد ظفر
۲۴۔	تنقیحات	سید ابوالاعلیٰ مودودی
۲۵۔	اسلام اور مغرب کے تہذیبی مسائل	سید قطب شہید ترجمہ ساجد الرحمٰن صدیقی
۲۶۔	اسلامی نظریۂ حیات	پروفیسر خورشید احمد
۲۷۔	اسلام کا معاشرتی نظام	ڈاکٹر خالد علوی
۲۸۔	اسلام اور جدید ذہن کے شبہات (شبهات حول الاسلام) (Islam the Misunderstood Religion)	محمد قطب
۲۹۔	معرکۂ اسلام و جاہلیت	صدر الدین اصلاحی
۳۰۔	خطبات بہاولپور (Emergance of Islam)	ڈاکٹر محمد حمید اللہ

TEACHING-LEARNING STRATEGIES

1. Lecture based examination
2. Presentations/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:

- 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

ENSC-104: GENERAL PHYSICS (02 Credit Hrs)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES

At the end of this course a student is expected to have learnt

- fundamental laws of Newtonian Mechanics
- Fundamental laws of Thermodynamics.

CONTENTS:

Unit-1: Mechanics:

1.1. Using Newton's Law of Motion:
1.2. Particle in Equibilum, Using Second Law of Motion:
1.3. Dynamics of Particle, Frictional Forces.
1.4. Work and Kinetic Energy, Work and Energy with Varying Forces,
1.5. Power, Gravitational Potential Energy, Conservative and Non-conservative forces,
1.6. Force and Potential Energy.

Unit-II: Heat and Thermodynamics:

2.1. Overview of the Universe, Solar system,
2.2. Sun as a source of energy, Earth as a planet,
2.3. Transfer of heat through Conduction, Convention and Radiation,
2.4. Weather Changes, Cloud Formation,
2.5. Entropy, Equation of State,
2.6. The Ideal Gas Equation,
2.7. The Van Der Walls Equations.

TEACHING-LEARNING STRATEGIES

- Lecture based examination
- Presentations/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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

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. Boeker, E. and Van Grondelle, R. (2001). Introductory Environmental Physics. John Wiley and Sons Inc. New York, USA.
5. Routledge, S. C. (2001). Environmental Physics. Kentucky, USA.
6. Seinfeld, J. H. and Pandis, S. N. (2006). Atmospheric Chemistry and Physics: From Air Pollution to Climate Change. John Wiley and Sons Inc. USA.
7. Guyot, G. (1998). *Physics of the Environment and Climate.* Praxis publishing. UK.

Further Reading: As suggested by the Instructor.

ENSC-105: GENERAL CHEMISTRY (THEORY) (02 Credit hrs)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES

- The students will be able to have an understanding of periodic laws and atomic properties.
- The students will be able to learn basic concepts of chemical bonding and strength of acids and bases.
- The students will have an understanding of buffers application in pharmaceutical industries and environment.
- The students will learn chemistry of functional groups in organic compounds and their role in environment.

CONTENTS

Unit-1: Introduction to Periodic Table

1.1 Periodic law
1.2 Metals
1.3 Non-metals
1.4 Periodic trends of atomic properties (Electronegativity, Electro positivity, Ionization potential, Electron affinity)

Unit- II: Chemical Bonding

2.1. Ionic
2.2. Covalent
2.3. Coordinate covalent bonding
2.4. Lattice Energy

Unit-III: Acid and Base strengths

3.1. Strong and weak acids and bases
3.2. PH
3.3. Buffers, Selected applications of Buffers in pharmaceutical industries and environment.
3.4. Water Hardness

Unit-IV : Organic Chemistry

4.1. General Chemistry of functional groups of organic compounds and pollutants
4.2. Alcohols
4.3. Carbonyls
4.4. Esters
4.5. Carboxylic acids
4.6. Amines
4.7. Aromatic compounds
4.8. Ethers
4.9. Amino acids & Proteins
4.10. Carbohydrates

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Petrucci, R. H. (2017). *General chemistry: principles and modern applications.* Pearson.
2. Schwarzenbach, R. P., Gschwend, P. M., & Imboden, D. M. (2016). *Environmental organic chemistry*. John Wiley & Sons.
3. Ucko, D. A. (2013). *Basics for chemistry.* Elsevier.
4. Silberberg, M. (2012). *Principles of general chemistry*. McGraw-Hill Education.
5. Nilsson, A., Pettersson, L. G., & Norskov, J. (Eds.). (2011). *Chemical bonding at surfaces and interfaces.* Elsevier.
6. Myers, R. (2003). *The basics of chemistry*. Greenwood Publishing Group.

ENSC-105: GENERAL CHEMISTRY (PRACTICAL) (01 Credit Hr)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES:

- The students will be able to learn the practical aspects of chemical solution preparation of different concentrations.
- The students will be able to learn concepts of quantitative volumetric analysis.
- The students will have an understanding of quantitative gravimetric determinations.
- The students will learn chemistry of functional groups in organic compounds and their role in environment.

CONTENTS

Unit-I: Preparation of Chemical solution

1.1. Standard solutions
1.2. Molar
1.3. Molal
1.4. Normal
1.5. Serial Dilutions

Unit-II: Chemical Analysis

2.1. Qualitative Analysis
2.2. Quantitative analysis (I. Volumetric, II. Gravimetric Analysis)

Unit-III: Types of titrations

3.1. Acid-Base titration
3.2. Redox Titration
3.3. Precipitation titrations
3.4. Complexometric titrations

Unit-IV: Mass based Estimations

4.1. Sulphate estimation
4.2. Barium estimation

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. McPherson, P. (2014). *Practical Volumetric Analysis*. Royal Society of Chemistry.
2. Flaschka, H. A. (2013). *EDTA titrations: an introduction to theory and practice*. Elsevier.
3. Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2013). *Fundamentals of analytical chemistry*. Cengage learning.
4. Li, N., & Hefferren, J. J. (2013). *Quantitative chemical analysis*. World Scientific Publishing Company.
5. Svehla, G. (2008). *Vogel's Qualitative Inorganic Analysis, 7/e*. Pearson Education India.
6. Mittal, K. L. (Ed.). (2000). *Acid-base interactions: relevance to adhesion science and technology* (Vol. 2). VSP.

ENSC-106: GENERAL BIOLOGY (THEORY) (02 CREDIT HRS)

PRE-REQUISITE: Fsc. or equivalent

LEARNING OUTCOMES:

- Explain the scope of biology and molecular basis of life
- Understand the cell, cell division and cell cycle
- Understand the origin of species and process of evolution
- Outline basic processes of cellular kinetics including Respiration and photosynthesis
- Explain the classification of living organism
- Understand the basic concepts of genetics and inheritance
- Understand basic ecology, ecosystem and biodiversity

CONTENTS

Unit-1: An introduction to Biology

1.1. Definitions and basic concept of biology
1.2. Different branches of biology
1.3. Significance of Biology in modern days

Unit- II: Chemical foundation of Life

2.1. Concept of cell and cell theories
2.2. Concept of organelles and their functions
2.3. Micro and macro molecules in living cells

Unit- III: Structure and functions of Cells

3.1. Types of cells, prokaryotes, Eukaryotes
3.2. Differences in structure and functions of different cells
3.3. Systems in living organisms

Unit- IV: Cell division and cell cycle

4.1. Introduction to cell cycles
4.2. Mitosis and meiosis

Unit- V: Cellular Kinetics

5.1. Cellular respiration and energy production
5.2. Glycolysis and Kreb's cycle
5.3. Photosynthesis
5.4. Transport in cells

Unit- VI: Biological organization and classification

6.1. Organization from sub atomic particles to biomes
6.2. Nomenclature and five kingdom system of classification
6.3. Species, population, communities, ecosystem and biodiversity

Unit- VII: Genetics and inheritance

7.1. Concepts of genes, alleles and inheritances
7.2. DNA, RNA, protein synthesis
7.3. Laws and theories of inheritance

Unit- VIII: Evolution and its processes

8.1. Origin of species and concept of evolution

8.2. Processes of evolution
8.3. Theories of evolution

TEACHING – LEARNING STRATEGIES

- Lectures based examinations
- 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%	It takes place at the mid of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, deadlines of assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Wells, H. G. (2018). *Text-book of Biology*. BoD–Books on Demand.
2. Reece, J. B., Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Jackson, R. B. (2014). *Campbell biology* (No. s 1309). Boston: Pearson.
3. Klipp, E., Liebermeister, W., Wierling, C., & Kowald, A. (2016). *Systems biology: a textbook*. John Wiley & Sons.
4. Lewis, B., Cassimeris, L., Lingappa, V. R., Plopper, G. Jones (2007). Cells, and Bartlett Publishers. Canada

ENSC-106: GENERAL BIOLOGY (PRACTICAL) (01 Credit hrs)

PRE-REQUISITE: FSc. or equivalent

LEARNING OUTCOMES:

- Introduction to microscope and microscopic organisms
- Differentiation between prokaryotic and Eukaryotic cell
- Differentiation between plants and animal cells
- Identification of bacteria, protozoans, fungus, Algae under microscope
- Examination of animal and plant tissues through thin sections
- Identification of different plants and animals
- Understanding different parts of living organisms
- Inflorescence of plants

CONTENTS

Unit- 1: Introduction to Microscope and microscopic organisms

1.1. Definitions and types of microscope
1.2. Significance of the use of microscope in biology
1.3. Microscopic and macroscopic organisms

Unit- II: Examination of Cell structure and function

2.1. Identification of prokaryotic and Eukaryotic cells
2.2. Identification of plant and animal cells
2.3. Identification of different organelles and their functions

Unit- III: Identification of different microorganisms

3.1. Identifications of slides of different Bacteria
3.2. Identifications of slides of different Protozoans
3.3. Identification of slides of different fungus and Algae

Unit- IV: Identification of different Microorganism

4.1. Identification of specimens of different plants and animals
4.2. Identification of different plants and animals in field
4.3. Examination of thin sections of plants and animals' tissues
4.4. Identifications various systems of plants and animals through specimens

Unit- V: Introduction to molecules of life

5.1. Studying carbohydrates, proteins, lipids, fats structure
5.2. Understanding enzymes and their functions

TEACHING – LEARNING STRATEGIES

- Lectures and practical performance based examinations
- Demonstrations,
- Field based learning
- 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%	It takes place at the mid of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, deadlines of assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Wells, H. G. (2018). *Text-book of Biology*. BoD–Books on Demand.
2. Reece, J. B., Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Jackson, R. B. (2014). *Campbell biology* (No. s 1309). Boston: Pearson.
3. Klipp, E., Liebermeister, W., Wierling, C., & Kowald, A. (2016). *Systems biology: a textbook*. John Wiley & Sons.
4. Lewis, B., Cassimeris, L., Lingappa, V. R., Plopper, G. Jones (2007). Cells, and Bartlett Publishers. Canada,
5. Morgan, S. (2002). Advanced Level Practical Work for Biology (Advanced Level Practical Work Series). S. Hodder & Stoughton.

ENSC-107: ENVIRONMENTAL ISSUES (02 Credit Hrs)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES:

- Students will learn about importance of Environmental Science as an academic discipline
- Students will learn about natural resources of earth
- Students will understand the relationships between different components of environment
- They will learn about sources of water, air, land and soil and their preventive measures

CONTENTS

Unit-1: Importance of environmental science and different aspects of environment

1.1. History, Nature and scope of Environmental Science and its contribution to society
1.2. Different aspects of environment: Physical, Ecological, Socio-economic, Ethical and Philosophical
1.3. Human environment and its problems
1.4. Across the globe-environmental issues, national and regional

Unit-1I: Types of environmental pollution

2.1. Environmental pollution
2.2. Air Pollution (outdoor and indoor)
2.3. Global Warming, Ozone Depletion; Acid Rain, Solutions,
2.4. Water Pollution; Rivers, Lakes, Groundwater, Solutions,
2.5. Water use and management
2.6. Soil Pollution, Fertilizers, Pesticides and Pest Control, Solutions
2.7. Solid and Hazardous Waste, Solutions
2.8. Noise and Noise pollution
2.9. Environment of Cities, Light pollution and visual pollution, Solutions
2.10. Global Problems of Deforestation and loss of Biodiversity, Mangroves and their disappearance

Unit--1II: Environmental education and sustainable development

3.1. Environmental education
3.2. Sustainable Development, Environmental challenges for sustainable development
3.3. Population Dynamics and Control, Current and future trends in population growth
3.4. Development in industry and agriculture
3.5. Urbanization, poverty and resource depletion

Unit--1V: Food and alternate energy sources

4.1. Food Resources and World Hunger
4.2. Energy concepts in environment
4.3. Fossil Fuels, Alternate Energy Sources and Environment
4.4. Nuclear energy and Environment

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Liboiron, M. (2021). *Pollution is colonialism*. Duke University Press.
2. Harper, C. L., & Snowden, M. (2017). *Environment and society: Human perspectives on environmental issues*. Routledge.
3. McKinney, M. L., Schoch, R. M., Yonavjak, L., & Mincy, G. (2017). *Environmental Science: Systems and Solutions: Systems and Solutions*. Jones & Bartlett Learning.
4. Miller, G. T., & Spoolman, S. (2015). *Living in the environment: concepts, connections, and solutions*. Brooks/Cole.
5. Miller, G. T., & Spoolman, S. (2015). *Environmental science*. Cengage Learning.
6. Botkin, D.B. (2014). *Environmental Science: Earth as a Living Planet.* John Wiley & Sons.
7. Harris, F. (Ed.). (2012). *Global environmental issues*. John Wiley & Sons.
8. Botkin, D. B., & Keller, E. A. (2010). *Environmental science: Earth as a living planet*. Wiley Global Education.

Further Reading: As suggested by the Instructor.

1ST YEAR, SECOND SEMESTER			
Code	**Course Title**	**C.H.**	**Course Type**
HQ-002	Translation of Holy Quran	01	Compulsory
ENSC-108	English II	3+0	Core Course
ENSC-109	Introduction to Computer	1+2	Core Course
ENSC-110	Pakistan Studies	2+0	Core Course
ENSC-111	General Geology	2+1	General Course
ENSC-112	Environmental Chemistry	2+1	Basic Course
ENSC-113	Systematics and Biodiversity	2+1	General Course
	Total Credit Hrs Semester-II	**18**	

HQ-002: TRANSLATION OF HOLY QURAN (01 Credit hr)

PRE-REQUISITE: F.Sc. or equivalent

COURSE OUTLINE

سورة النسا تا سورة الانعام

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after mid term 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

ENSC-108: ENGLISH-II (03 Credit hrs)

PRE-REQUISITE: ENSC-101

LEARNING OUTOCMES:

By the end of this course, students will be able to

- Learn basics of grammar
- Essay and study skills
- Composing different documents
- Present different documents
- Vocabulary and its use

CONTENTS:

Unit-I: Grammar

1.1. Use of Tenses, Direct and Indirect speech
1.2. Active voice and Passive voice
1.3. Correction of errors

Unit-II: Essay writing

2.1. How to develop an essay,
2.2. different types of essay writing.

Unit-III: Study Skills

3.1. Skimming and scanning,
3.2. faulty reading habits, strategies to enhance reading speed.

Unit-IV: CV, Cover letter, Memo writings

4.1. How to write an ideal cover letter, Importance of a CV,
4.2. writing a resume, letter/memo writing etc.

Unit-V: Presentations skills

5.1. Personality development (more focus on content, style and pronunciation)
5.2. Answering an audience, Mock presentations.

Unit-VI: Research Skills

6.1. Use of library and internet resources to prepare an assignment or a research paper

Unit-VII: Listening Skills and Class Room Discussion

7.1. Different documentaries will be shown to the students for class room
7.2. discussions and reviews.

Unit-VIII: Vocabulary Development

8.1 Vocabulary list from GAT (General Aptitude Test) Book by NTS

TEACHING-LEARNING STRATEGIES

- Lecture based examination
- Presentations/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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. John, E. (2004). *Oxford Practice Grammar*. New Edition, with tests and answers. Oxford University Press.
2. Howe, D.H., Kirkpatrick, T.A. and Kirkpatrick, D.L., (1993). *English for undergraduates.* London: Oxford University Press.
3. Alfred, R. and Paul, E., (2002). *Models for writers. Short essays for composition*. St Martins Press, New York.
4. George, J. and Loh, I.W. (2004). *Grammar in use*. Learners Publishers Private Ltd.
5. Nadeem, A. (2007). *English Language Communication Skills*. Majeed Book Depot, Lahore.
6. Wallace, M., (1992). *Study Skills.* Cambridge University Press.

Further Reading: As suggested by the Instructor.

ENSC-109: INTRODUCTION TO COMPUTER (THEORY) (01 Credit hr)

PRE-REQUISITE: F.Sc or equivalent

LEARNING OUTCOMES

- The students will learn about Computer system, computer networks and internet
- The students will get familiar with input, output and components of system unit
- Students will get knowledge about system and application software's
- The students will get the concepts about databases and different types
- Concepts about Cybercrime and artificial intelligence will also be covered

CONTENTS:

Unit-1: Computer system and components

1.1. Data and information
1.2. Information Processing Cycle
1.3. Components of a computer
1.4. System and Application Software
1.5. Elements of an Information System
1.6. Computer Applications in society

Unit-II: Internet and WWW

2.1. How the Internet Works
2.2. connecting to the Internet, access Providers
2.3. How data travels the Internet, Internet Address
2.4. Web Browsing, Web Address
2.5. Navigating Web Pages, Searching information on the Web,
2.6. Types of Web sites

Unit-III: Databases

3.1. File Systems and Databases
3.2. Importance of DBMS
3.3. Database Design, and Historical Roots of Database
3.4. Files and File Systems, File System Data Management
3.5. Database Models, Relational Database Model

Unit-IV: Search Engine Optimization

4.1. Search Engines History
4.2. Widely used Search Engines
4.3. Ranking of Websites
4.4. Search Engine Optimization

Unit-V: Computer Networking

5.1. Switches, routers, and wireless access points
5.2. Network Topology types
5.3. LAN, MAN,WAN and PAN

Unit-VI: Cyber Crime and Artificial Intelligence

6.1. What is cyber crime
6.2. Cybercrime types
6.3. Artificial intelligence evolution
6.4. Application of Artificial intelligence

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Nisan, N., & Schocken, S. (2021). *The elements of computing systems: building a modern computer from first principles*. MIT press.
2. Coronel, C., & Morris, S. (2016). *Database systems: design, implementation, & management*. Cengage Learning.
3. Comer, D. E. (2018). *The Internet book: everything you need to know about computer networking and how the Internet works*. Chapman and Hall/CRC.
4. Vermaat, M. E., Sebok, S. L., Freund, S. M., Campbell, J. T., & Frydenberg, M. (2017). *Discovering Computers© 2018: Digital Technology, Data, and Devices*. Cengage Learning.
5. Roberts, M. L., & Zahay, D. (2012). *Internet marketing: Integrating online and offline strategies*. Cengage Learning.
6. Flasiński, M. (2016). *Introduction to artificial intelligence*. Switzerland: Springer International Publishing.

Further Reading: As suggested by the Instructor.

ENSC-109: INTRODUCTION TO COMPUTER (PRACTICAL) (02 Credit hrs)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES

- Hands on practice about system and application software's
- Working on MS word, Excel, Power point and Access
- Hands on practice System plugins, drivers, browsing, cookies etc.
- Practical's on Databases development and management
- Working on HTML and page Publishing

CONTENTS:

Unit-I: System and Application Software's

1.1. Google Earth/ Google Maps, Google Chrome
1.2. Windows Media Player
1.3. Operating system
1.4. Language processor
1.5. Utility software.

Unit-II: Working in MS Offices

2.1. MS Word
2.2. MS Excel
2.3. MS Power Point
2.4. MS Access
2.5. Types of Web sites

Unit-III: Databases

3.1. File Systems and Databases
3.2. Importance of DBMS
3.3. Database Design, and Historical Roots of Database
3.4. Files and File Systems, File System Data Management
3.5. Database Models, Relational Database Model

Unit-IV HTML

4.1. HTML Elements,
4.2. HTML Attributes, HTML Headings
4.3. HTML Paragraphs, HTML Formatting
4.4. HTML Images, HTML Tables
4.5. HTML Lists, HTML Forms

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Nisan, N., & Schocken, S. (2021). *The elements of computing systems: building a modern computer from first principles*. MIT press.
2. Coronel, C., & Morris, S. (2016). *Database systems: design, implementation, & management*. Cengage Learning.
3. Comer, D. E. (2018). *The Internet book: everything you need to know about computer networking and how the Internet works*. Chapman and Hall/CRC.
4. Vermaat, M. E., Sebok, S. L., Freund, S. M., Campbell, J. T., & Frydenberg, M. (2017). *Discovering Computers© 2018: Digital Technology, Data, and Devices*. Cengage Learning.
5. Roberts, M. L., & Zahay, D. (2012). *Internet marketing: Integrating online and offline strategies*. Cengage Learning.
6. Flasiński, M. (2016). *Introduction to artificial intelligence*. Switzerland: Springer International Publishing.

Further Reading: As suggested by the Instructor.

ENSC-110: PAKISTAN STUDIES (02 Credit Hrs)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES:

At the end of this course the students will be able to:

- Know historical perspective about the creation of Pakistan
- Discuss Government of Pakistan and its policies
- Understand current issues of Pakistan

CONTENTS

Unit-I: Historical Perspective

1.1. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Iqbal and Quaid-e-Azam Muhammad Ali Jinnah.
1.2. Factors leading to Muslim separatism
1.3. Early Problems of Pakistan and their solutions

Unit-II: Government and Politics in Pakistan

2.1. Political and constitutional phases:
2.1.1. 1947-58: Constitutional Struggle
2.1.2. 1958-69: Ayub Khan's Era
2.1.3. 1971: Fall of Dhaka
2.1.4. 1971-77: Bhutto's Era
2.1.5. 1977-88: Zia ul Haq's Era and his policy of Islamization
2.1.6. 1988-99: PPP and PML Govts.
2.1.7. 1999-2008: Pervaiz Mushraf's Era
2.1.8. 2008 till date: Current Political Scenario

Unit-III: Contemporary Pakistan

3.1. China-Pak Economic Corridor (CPEC)
3.2. National Action Plan (NAP)
3.3. Baluchistan Issue
3.4. Foreign Policy of Pakistan
3.5. 18th and 21st Amendments and their after effects
3.6. PANAMA papers and its effects on Pakistan Politics

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

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 (PJSS)*, *34*(1), 205-216.
4. Khan, T. A. (2000). Economy, society and the state in Pakistan. *Contemporary South Asia*, *9*(2), 181-195.
5. Ahmed, N. (2010). Military and the foreign policy of Pakistan. *South Asian Survey*, *17*(2), 313-330.
6. Hussain, F. (2011). *The judicial system of Pakistan* (p. 19). Pakistan: Supreme Court of Pakistan.
7. Safdar, M., 1994. Pakistan Political Roots and Development. Lahore.
8. Wayne, W., 1972. The Emergence of Bangladesh. American Enterprise, Institute of Public Policy Research, Washington.
9. Safdar, M. Pakistan Kayyun Toota. Idara-e-Saqafat-e-Islamia, Club Road, nd, Lahore.
10. Tahir, A. Ethano-National Movement in Pakistan. Institute of Plicy Studies, Islamabad.
11. Lawrence, Z., 1980. Enigma of Political Development. WmDawson and Sons Ltd, Kent England.
12. Zahid, A.Z., 1980. History and Culture of Sindh. Royal Book Company, Karachi.
13. Afzal and Rafique, M., 1998. Political Parties in Pakistan. Vol. I, II and III. National Institute of Historical and Culture Research, Islamabad.
14. Burki and Javed, S., 1980. State and Society in Pakistan. The MacMillan Press Ltd.
15. Khalid, B.S., 1979. The Political System of Pakistan. Houghton Mifflin, Boston.
16. Aziz, K.K., 1976. Party, Politics in Pakistan. National Commission on Historical and Culture Research, Islamabad.
17. Waseem, M., 1987. Pakistan Under Martial Law. Vangurd, Lahore.
18. Haq, Noor Ul, 1993. Making of Pakistan: The Military Perspective. National Commission on Historical and Cultural Research, Islamabad.

Further Reading: As suggested by the Instructor.

ENSC-111: GENERAL GEOLOGY (THEORY) (02 Credit hrs)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES

- This course will provide an introduction to the Geology to the students.
- The students will learn about the Rocks and Minerals.
- They will have the knowledge about the occurrences and importance of Geology.
- The students will get used to the different Geological Features.

CONTENTS

Unit-1: Introduction

1.1. Evolution of the Geologic Time Scale
1.2. Internal Structure of the Earth
1.3. Earths Four Spheres

Unit-II: Igneous Rocks

2.1. Magma, Plutonic and Volcanic Rocks,
2.2. Formation and Structure of Igneous Rocks
2.3. Textures and Classification of Igneous Rocks

Unit-III: Weathering, Soil and Erosion

3.1. Weathering, Erosion, Transportation
3.2. Types of Weathering
3.3. Mechanical Weathering
3.4. Chemical Weathering

Unit-IV: Sediments and Sedimentary Rocks

4.1. Sediments and Formation of Sedimentary Rocks
4.2. Types and Structures of Sedimentary Rocks
4.3. Textures of Sedimentary Rocks and Sedimentary Environments.

Unit-V: Metamorphism and Metamorphic Rocks

5.1. Causes and Consequences of Metamorphic Rocks
5.2. Formation and Types of Metamorphic Rocks
5.3. Structures and Textures of Metamorphic Rocks
5.4. Grades of Metamorphism and Metamorphic Facies

Unit-VI: Mass Wasting

6.1. Definition of Mass Wasting and Role of Water
6.2. Factors that Control Mass Wasting and Types of Mass Wasting
6.3. Mass Wasting Triggered by Earthquakes and Volcanoes and its Prediction

Unit-VII: Streams

7.1. Hydrological Cycle, Types and Sources of Streams
7.2. Characteristics of Streams, Perennial and Non-Perennial Streams
7.3. Drainage Basins, Crossings, Ability of Streams to Erode, Transport and Deposit Sediments

Unit-VIII: Plate Tectonics

8.1. Alfred Wegener and Origin of Idea, Rock Magnetism, Apparent Polar Wandering
8.2. Continental Drift, Sea Floor Spreading, Plates and Plate Tectonics
8.3. Divergent Plate Boundary, Convergent Plate Boundary, Transform Plate Boundary
8.4. Anatomy of a Plate, Causes of Plate Motion

Unit-IX: Deserts and Wind Action

9.1. Etymology and Types of Deserts
9.2. Weathering and Erosional Processes in Deserts, Depositional Environments in Deserts
9.3. Desert Landscape and Desertification
9.4. Physical, Ecology and Biogeography of Deserts

Unit-X: Glaciers and Glaciations

10.1. Introduction, Types, Formation of Glaciers
10.2. Glaciers of the World, Structure and Movement of the Glaciers
10.3. Glacial Erosion, Landform created by Glacial Deposition
10.4. The Ice Ages, Glacial Geology, Climate Change

Unit-XI: Mountains

11.1. Definition, Geology and Climate of Mountains
11.2. Mountains and Mountains Ranges, Plate Tectonics and Mountain Building
11.3. Deformation and Ruptures of Rocks, Geologic Structures
11.4. Island ARCS, The Building of Two Mountains Chains: Andes and Himalayas

Unit-XII Oceans and Coastlines

12.1. The Origin of Ocean, The Earths Ocean, Oceans Currents
12.2. Physical Properties, Chemical Composition of Seawater
12.3. Studying the Features, Sediments and Rock of Sea Floor, Continental Margins, Sea Water
12.4. The Sea Coast, Size, Formation, Types of Coastlines
12.5. Emergent and Submergent Coastlines, Beaches, Life in Sea, Mid Oceanic Ridges

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Plummer, C.C., Carlson, D., and Hammersley, L. (2021) *Physical Geology*, Mc Graw-Hill, USA.
2. Fletcher, C. (2019) *Physical Geology*: The Science of Earth, Wiley, 3rd Edition, pp.1-600.
3. Martin, R., (2018) *Earth's Evolving Systems*: The History of Planet Earth, Jones & Bartlett Learning, 2nd Edition, pp.1-593.
4. Murphy, B., and Nance, D. (2015) *Physical Geology Today*, Oxford University Press, 1st Edition, pp.1-769

Further Reading: As suggested by the Instructor.

ENSC-111: GENERAL GEOLOGY (PRACTICAL) (01 Credit hrs)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES

- This course will provide an introduction to the Geology to the students.
- The students will learn about the Rocks and Minerals.
- They will have the knowledge about the occurrences and importance of Geology.
- The students will get used to the different Geological Features.

CONTENTS

Unit-I: Practical-1

1.1. Identification of Minerals in Hand Specimen
1.2. Identification of rocks in Hand Specimen

Unit- II: Practical-2

2.1. Identification of Igneous rocks
2.2. Identification of Sedimentary rocks
2.3. Metamorphic Rocks in Hand Specimen.

Unit- III: Practical-3

3.1. Polarizing Microscope
3.2. Parts and Functions of microscope.

Unit- IV: Practical-4

4.1. Preparations of Thin Sections of Igneous, Sedimentary and Metamorphic Rocks in Laboratory.

Unit- V: Practical-5

5.1. Microscopic Study of Different Minerals

Unit- VI: Practical-6

6.1. Microscopic study of Igneous, Sedimentary and Metamorphic Rocks.

Unit- VII: Practical-7

7.1. Graphic Plotting of Igneous, Sedimentary, Metamorphic Rocks.

Unit- VIII: Practical-8

8.1. Salt Range, Stratigraphic Sequence of Salt Range.

Unit- IX: Practical-9

9.1. Detailed study of different Formations presents in Salt Range

Unit- X Practical-10

10.1. Maps, Geological and Topographic Maps, Contour Lines, Different Landforms

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Adams, A.E., Mackenzie, W.S., Guilford, C., (2014) *Atlas of Sedimentary Rocks under the Microscope*, Routledge, USA, pp.
2. Mackenzie, W.S. and Adams, A.E. (2011) *A Color Atlas of Rocks and Minerals in Thin Sections*, Manson Publishing, U.K., pp.1-189.
3. Heta, R.N. (2011) *Practical Approach to Petrology*, CBC Publishers & Distributors P0vt Ltd., pp.1-126.

Further Reading: As suggested by the Instructor.

ENSC-112: ENVIRONMENTAL CHEMISTRY (THEORY) (02 Credit hrs)

PRE-REQUISITE: ENSC-105

LEARNING OUTCOMES

Upon successful completion of the course the student 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)

CONTENTS:

Unit-1: Chemistry of Troposphere

1.1. Toxic gases
1.2. Oxides of Carbon their sources and effect
1.3. Oxides of sulfur their sources and effect
1.4. Oxides of Nitrogen their sources and effect
1.5. Tropospheric ozone
1.6. Smog and its types
1.7. Sulfurous smog
1.8. Photochemical smog
1.9. Acid Rain and its impact on different ecosystems
1.10. Particulate Matter

Unit-II: Stratospheric chemistry

2.1. Introduction to stratosphere
2.2. Ozone layer and its chemical depletion
2.3. Polar stratospheric clouds and Polar vortex.

Unit-III: Green House Effect and Global warming

3.1. The Greenhouse Effect and Global Warming
3.2. Greenhouse gases,
3.3. Earth energy emission and greenhouse effect.
3.4. Chemical reactions
3.5. Atmospheric residence time.

Unit-IV: Chemistry of water bodies

4.1. Dissolved Oxygen
4.2. Biological oxygen Demand
4.3. Chemical Oxygen demand

Unit-V: Indoor Pollutants

5.1. Radon Gas
5.2. Volatile organic compounds
5.3. Tabaco smoke
5.4. Pesticides
5.5. Biological indoor pollutants

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Overway, K.S. (2017)**.** *Environmental Chemistry*. An Analytical approach. John Wiley and Sons.
2. Sonwani, S. and Shukla, A. (2021). *Air borne Particulate Matter, Source, Chemistry and Health.* Springer Singapore
3. Colin B. and Michael C. (2012). *Environmental Chemistry*, Fifth edition. W. H. Freeman & Company.
4. Stanley M. (2017). *Environmental Chemistry.* CRC Press
5. Bhatti, N.H., and Noreen, S. (2017). *Principles of Environmental Chemistry*. The Carwan Book House, Lahore

Further Reading: As suggested by the Instructor.

ENSC-112: ENVIRONMENTAL CHEMISTRY (PRACTICAL) (01 Credit hrs)

PRE-REQUISITE: ENSC-105

LEARNING OUTCOMES

Upon successful completion of the course the student 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)

CONTENTS

Unit-I:

1.1. Dissolved Oxygen
1.2. Chemical Oxygen Demand
1.3. Biological Oxygen Demand

Unit-II:

2.1. Total Dissolved Solids
2.2. Total Suspended Solids

Unit-III:

3.1. Conductivity measurements
3.2. pH measurements

Unit-IV:

4.1. PM estimation in air

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Overway, K.S. (2017)**.** *Environmental Chemistry*. An Analytical approach. John Wiley and Sons.
2. Sonwani, S. and Shukla, A. (2021). *Air borne Particulate Matter, Source, Chemistry and Health.* Springer Singapore
3. Colin B. and Michael C. (2012). *Environmentdal Chemistry,* Fifth edition. W. H. Freeman & Company.
4. Stanley M. (2017). *Environmental Chemistry*. CRC Press
5. Bhatti, N.H. and Noreen, S. (2017). *Principles of Environmental Chemistry*. The Carwan Book House, Lahore

Further Reading: As suggested by the Instructor.

ENSC-113: SYSTEMATICS AND BIODIVERSITY (THEORY) (02 Credit hrs)

PRE-REQUISITE: ENSC-106

LEARNING OUTCOMES:

- Understanding the concepts of Biodiversity
- Explaining the importance of biodiversity
- Understanding the concept of conservation and its significance
- Underpinning the threats to biodiversity
- Understanding the ways to manage biodiversity
- Explaining the biodiversity and modern human challenges

CONTENTS

Unit- I: Introduction to systematics

1.1. Importance of taxonomy and classification in living organism
1.2. Systematics and biodiversity
1.3. Phyletic lineages
1.4. Cladogram

Unit-II: Biodiversity and its importance

2.1. Definitions and types of biodiversity
2.2. Species, genes and ecosystem diversity and their significance
2.3. Alpha, beta and gamma diversity
2.4. Economic, ecological, aesthetic, cultural and educational Values of biodiversity

Unit-III: Threats to Biodiversity

3.1. Extinction rate and extinction processes, IUCN red list of endangered species
3.2. Habitat loss, habitat fragmentation, pollution, desertification
3.3. Overexploitation and history of species extinction
3.4. Invasive species, disease, climate change

Unit-IV: Maintaining Biodiversity

4.1. Fundamentals of conservation biology
4.2. Ex-situ and in-situ conservation strategies
4.3. Protecting and managing ecosystems
4.4. Protecting and managing species and populations
4.5. Protected area, reserves and biodiversity conservation

Unit-V: Biodiversity and modern human challenges

5.1. Social factors and biodiversity
5.2. Economic factors, trade and biodiversity
5.3. Political factors and biodiversity

TEACHING – LEARNING STRATEGIES

- Lectures based examinations
- 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:

- Class participation,
- attendance,
- meeting deadlines of 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%	It takes place at the mid of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, deadlines of assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Gaston, K. J., & Spicer, J. I. (2013). *Biodiversity: an introduction*. John Wiley & Sons.
2. Gillespie, A. (2013). *Conservation, biodiversity and international law*. Edward Elgar Publishing.
3. Sodhi, N. S., & Ehrlich, P. R. (Eds.). (2010). *Conservation biology for all*. Oxford University Press.
4. Van Dyke, F. (2008). *Conservation biology: foundations, concepts, applications*. Springer Science & Business Media.
5. Primack, R. B., Primack, R. B., Primack, R. B., & Primack, R. B. (2008). *A primer of conservation biology* (No. QH75 P74 2000). Sunderland: Sinauer Associates.
6. Carroll, S. P., & Fox, C. W. (Eds.). (2008). *Conservation biology: evolution in action*. Oxford University Press.
7. Hunter Jr, M. L., & Gibbs, J. P. (2006). *Fundamentals of conservation biology*. John Wiley & Sons.

Further Reading: As suggested by the Instructor.

ENSC-113: SYSTEMATICS AND BIODIVERSITY (PRACTICAL) (01 Credit hrs)

PRE-REQUISITE: ENSC-106

LEARNING OUTCOMES:

- Understanding fundaments of biodiversity
- Identification, classification and nomenclature of lab specimens of plants and animals
- Collection/observation of plants (bryophytes, peteredophytes, angiosperm and gymnosperms), for their nomenclature, classification and understanding various systems
- Collection/observation of animals (amphibians, reptiles, birds, mammals) their nomenclature, classification and understanding various systems
- Understanding various ecological processes such as, pollination, competition, predation, parasitism in the field
- Underpinning threats to species, population and ecosystem
- Understanding management of biodiversity at Ex-situ and is-situ sites

CONTENTS

Unit- 1: Fundamentals of systematics and biodiversity

1.1. Demonstrating fundamental concept of systematics
1.2. Demonstrating fundamental concept of biodiversity
1.3. Explaining/demonstrating, genes, species, population, community and ecosystem
1.4. Evaluating values of different species

Unit- II: Plants and biodiversity

2.1. Collection/observation of various plants
2.2. Identification of various plants
2.3. Nomenclature, classification of plants
2.4. Understanding various systems in plants

Unit- III: Animal and biodiversity

3.1. Collection/observation of various animals
3.2. Identification of various animals
3.3. Nomenclature, classification of animals
3.4. Understanding various systems in animals

Unit- IV: Evaluation of threats to biodiversity

4.1. Considering some model plant species and evaluating its threats
4.2. Considering some model animal species and evaluating its threats
4.3. Evaluating threats to some model ecosystems

Unit- V: Biodiversity management

5.1. Visiting some ex-situ site (e.g. botanical gardens) and understating measures taken for species conservation
5.2. Visiting some in-situ site (e.g. national park) and understating measures taken for species conservation
5.3. Enlisting protected areas in Pakistan and their significance in biodiversity conservation

TEACHING – LEARNING STRATEGIES

- Lectures and practical performance based examinations
- Demonstrations,
- Field based learning
- 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:

- Class participation,
- attendance, practical performance
- meeting deadlines of 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%	It takes place at the mid of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, deadlines of assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Gaston, K. J., & Spicer, J. I. (2013). *Biodiversity: an introduction*. John Wiley & Sons.
2. Gillespie, A. (2013). *Conservation, biodiversity and international law*. Edward Elgar Publishing.
3. Sodhi, N. S., & Ehrlich, P. R. (Eds.). (2010). *Conservation biology for all*. Oxford University Press.
4. Van Dyke, F. (2008). *Conservation biology: foundations, concepts, applications*. Springer Science & Business Media.
5. Primack, R. B., Primack, R. B., Primack, R. B., & Primack, R. B. (2008). *A primer of conservation biology* (No. QH75 P74 2000). Sunderland: Sinauer Associates.
6. Hunter Jr, M. L., & Gibbs, J. P. (2006). *Fundamentals of conservation biology*. John Wiley & Sons.
7. Lindenmayer, D., & Burgman, M. (2005). *Practical conservation biology*. Csiro Publishing.

Further Reading: As suggested by the instructor

2nd YEAR, THIRD SEMESTER			
Code	**Course Title**	**C.H.**	**Course Type**
HQ-003	Translation of Holy Quran	Non Credit	Compulsory
ENSC-201	English III	3+0	Core Course
ENSC-202	Environmental Geology	2+1	Basic Course
ENSC-203	Biotechnology and Environment	2+1	Major Elective
ENSC-204	Plants and Environment	2+1	General Course
ENSC-205	Rock, Soil & Environment	2+1	Major Elective
ENSC-206	Environmental Law and Policies	2+0	Major Elective
	Total Credit Hrs Semester-III	**17**	

HQ-003: TRANSLATION OF HOLY QURAN (Non Credit)

PRE-REQUISITE: HQ-001, 002 Translation of Holy Quran

COURSE OUTLINE

سورة الاعراف تا سورة يونس

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after mid term 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

ENSC-201: ENGLISH-III (03 Credit Hrs)

PRE-REQUISITE: ENSC-108

LEARNING OUTCOMES:

- The student will be able to prepare presentations
- Deliver presentations on any topic
- Write comprehensively on any topic and in the proper format of an academic writing.

CONTENTS:

Unit-I: Presentation skills

1.1. Preparation of presentations
1.2. Delivery of presentations
1.3. Handling Questions after presentations

Unit-II: Essay Writing

2.1. Outline development
2.2. Structure of essay
2.3. Composition of essay
2.4. best essays examples

Unit-III: Academic writings

3.1. How to write a proposal for research paper/term paper
3.2. How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)
3.3. Technical report writing
3.4. Progress report writing

TEACHING – LEARNING STRATEGIES

- Lectures and practical performance based examinations
- Demonstrations,
- Field based learning
- 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:

- Class participation,
- attendance, practical performance
- meeting deadlines of 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%	It takes place at the mid of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, deadlines of assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Ricoeur, P. (2008). *Freud and philosophy: An essay on interpretation*. Motilal Banarsidass Publishe.
2. Van Emden, J., & Becker, L. (2016). *Presentation skills for students*. Macmillan International Higher Education.
3. Langan, J., (2004). *College Writing Skills.* McGraw-Hill Higher Education.
4. White, R., (1992). *Writing: Advanced. Oxford Supplementary Skills.* 3rd Impression. ISBN 0194354073 (particularly suitable for discursive, descriptive, argumentative and report writing)

ENSC-202: ENVIRONMENTAL GEOLOGY (THEORY) (2 Credit hrs)

PRE-REQUISITE: ENSC-111

COURSE LEARNING OUTCOMES:

- Students will be able to correlate paleo and present-day environments and to establish relationships and concepts between Geology and Environmental Sciences.
- They will know the occurrences of the Geological Process and their importance.
- identify common rocks and minerals and interpret how they form;
- Describe and interpret the development of landforms and geologic structures; and
- Construct and interpret geologic and topographic maps, cross-sections, and topographic profiles

CONTENTS

Unit-1: Fundamentals of environmental geology

1.1. Foundations of Environmental Geology
1.2. Why Environmental Geology
1.3. Planets
1.4. life on earth
1.5. Geology and Environmental Awareness
1.6. Geology and scientific methods
1.7. Environmental Ethics

Unit-II: Earth, Rocks and plate tectonics

2.1. Earth Materials and Processes
2.2. Minerals
2.3. The Rock Cycle
2.4. The Hydrologic Cycle
2.5. Biogeochemical Cycles
2.6. Rocks and Environment
2.7. Plate tectonic
2.8. Evidence of plate tectonics, seafloor spreading

Unit-III: Minerals and mining

3.1. Minerals and Rock resources
3.2. Igneous and Magmatic resources
3.3. Metallic and non-metallic minerals
3.4. Mineral's supply and Demand
3.5. Mining and waste disposal
3.6. Geological waste and environment

Unit-IV: Coastline

4.1. Coastal process and coastal zone
4.2. Coastal erosion
4.3. Coastal hazards
4.4. Geoengineering structures and mitigation
4.5. Human activity and coastal erosion
4.6. Perception of and adjustment to coastal hazards

Unit-V: Earth and Global changes

5.1. Global Change and Earth System Sciences
5.2. Tools for studying Global Change
5.3. Earth's Atmosphere and Energy Balance

5.4. Atmospheric Carbon Dioxide and Global Warming
5.5. Cryosphere Global Temperature Change

Unit-VI: Energy and Environment

6.1. Introduction to Energy and Environment
6.2. Energy Supply and Demand
6.3. Fossil Fuel and Acid Rain
6.4. Nuclear Energy
6.5. Geothermal Energy
6.6. Renewable Energy Sources
6.7. Energy Policy for the Future
6.8. Solar energy
6.9. wind energy

Unit-VII: Environmental Geochemistry

7.1. Introduction to Environmental Geochemistry
7.2. Potentially toxic metals and rock
7.3. toxic and economical level of trace metals
7.4. mode of occurrence of trace metals
7.5. Epidemiology

TEACHING– LEARNING STRATEGIES

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

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is a 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is a continuous assessment. It includes classroom participation, attendance, assignments, and presentation, homework, attitude and behavior, hands-on activities, short tests, quizzes, etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on a term paper, research proposal development, fieldwork, and report writing, etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Reichard, J. (2021). *Environmental Geology,* 4th Edition, McGraw-Hill, ISBN13: 9781260368277.
2. Montgomery, C. (2020) *Environmental Geology,* 11th Edition, McGraw-Hill ISBN10: 0078022959/ ISBN13: 9780078022951.
3. Plummer, C., Carlson, D., & Hammersley, L. (2019). *Physical Geology,* 16th Edition, McGraw-Hill Education, ISBN10: 1259916820/ ISBN13: 9781259916823.
4. Fossen, H. (2016). *Structural Geology 2nd Edi*, Cambridge University Press, ISBN-10: .ISBN-13: 978-1107057647. Pp 524 /1107057647
5. Guthrie, M. (2018). *Ground and Surface Water Hydrology*, Larsen and Keller Education ISBN-13: 978-1635496949
6. Ghuman, A. R. (2013). *Introduction to Hydrology*. Department of Civil Engineering, the University of Engineering & Technology, Taxila, Pakistan.
7. Siegel, F. R. (2002). *Environmental Geochemistry of potentially toxic metals,* Springer Berlin Heidelber, ISBN 3-540-42030, pp213.

Further Reading: As suggested by the instructor

ENSC-202: ENVIRONMENTAL GEOLOGY (Practical) (2 Credit hrs)

PRE-REQUISITE: ENSC-111

LEARNING OUTCOMES

- Students will be able to correlate paleo and present-day environments and to establish relationships and concepts between Geology and Environmental Sciences.
- They will know the occurrences of the Geological Process and their importance.
- identify common rocks and minerals and interpret how they form;
- escribe and interpret the development of landforms and geologic structures; and
- construct and interpret geologic and topographic maps, cross-sections, and topographic profiles

CONTENTS

Unit-I: Practical-1

1.1. Documentary of plate tectonics
1.2. Seafloor spreading Diagrammatically
1.3. Volcanic eruption Diagrammatically
1.4. Practically graphing and models

Unit-II: Practical-2

2.1. Identification of different rocks on maps
2.2. Stratigraphic code identification on maps

Unit-III: Practical-3

3.1. Recognition of joints, faults, and folds on the map and in the field.

Unit-IV: Practical-4

4.1. Structural features
4.2. Volcanic hotspots on maps

Unit-V: Practical-5

5.1. Development of Geological maps

Unit-VI: Practical-6

6.1. Interpretation of Geological maps

Unit- VI: Practical-7

7.1. Geological maps of Kanpur dams, Tarbela dam, Mangla dam

TEACHING– LEARNING STRATEGIES

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

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is a 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is a continuous assessment. It includes classroom participation, attendance, assignments, and presentation, homework, attitude and behavior, hands-on activities, short tests, quizzes, etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on a term paper, research proposal development, fieldwork, and report writing, etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Reichard, J. (2021). *Environmental Geology*, 4th Edition, McGraw-Hill, ISBN13: 9781260368277.
2. Montgomery, C. (2020) *Environmental Geology*, 11th Edition, McGraw-Hill ISBN10: 0078022959/ ISBN13: 9780078022951.
3. Plummer, C., Carlson, D., & Hammersley, L. (2019). *Physical Geology*, 16th Edition, McGraw-Hill Education, ISBN10: 1259916820/ ISBN13: 9781259916823.
4. Fossen, H. (2016). *Structural Geology 2nd Edi*, Cambridge University Press, ISBN-10: .ISBN-13: 978-1107057647. Pp 524 /1107057647
5. Guthrie, M. (2018). *Ground and Surface Water Hydrology*, Larsen and Keller Education ISBN-13: 978-1635496949
6. Ghuman, A. R. (2013). *Introduction to Hydrology*. Department of Civil Engineering, the University of Engineering & Technology, Taxila, Pakistan.
7. Siegel, F. R. (2002). *Environmental Geochemistry of potentially toxic metals*, Springer Berlin Heidelber, ISBN 3-540-42030, pp213.

ENSC-203: ENVIRONMENTAL BIOTECHNOLOGY (02 Credit hours)

PRE-REQUISITE: F.Sc. Or Equivalent

LEARNING OUTCOMES

Students will learn about:

- Basic concept of biotechnology, branches of biotechnology and role of biotechnology in environment
- Wastewater treatment using biotechnological tools
- Air pollution treatment with reference to environmental biotechnology
- Role of environmental biotechnology in agriculture and bioremediation of contaminants

CONTENTS

Unit-I: Introduction

1.1. What is biotechnology
1.2. Branches of biotechnology
1.3. Environmental biotechnology
1.4. Overview of air soil and water pollution abatement using environmental biotechnology

Unit-II: Air and water pollution remediation

2.1. Biological treatment of air pollutants
2.2. Biological treatment of water pollutants
2.3. GMOs for air and water pollution treatment

Unit-III: Xenobiotic compounds, hazardous wastes and their treatment

3.1. Introduction
3.2. Biotreatment of xenobiotic compounds
3.3. Detoxification methods

Unit-IV: Biotechnology and agriculture

4.1. Introduction
4.2. Transgenic plants for food security, nutrition and health care
4.3. Biofertilizers and biopesticides
4.4. Ethical problems

Unit-V: Pollutants removal by biosorption

5.1. Heavy metals
5.2. Organic pollutants
5.3. Enhanced biosorption using tailored sorbents

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Kumar, P., & Kumar, V. (2018). Textbook of Environmental Biotechnology. Woodhead Publishing India.
2. AThakur, I.S. (2016). *Environmental Biotechnology*. *Basic Concepts and Applications*. I.K.International Pvt.Ltd, New Delhi
3. Gothandam, K. M., Ranjan, S., Dasgupta, N., & Lichtfouse, E. (Eds.). (2020). *Environmental Biotechnology* Vol. 3. Springer International Publishing.
4. Sangeetha, J., Thangadurai, D., David, M., & Abdullah, M. A. (Eds.). (2016). *Environmental Biotechnology: Biodegradation, Bioremediation, and Bioconversion of Xenobiotics for Sustainable Development*. CRC Press.
5. Sobti, R. C., Arora, N. K., & Kothari, R. (Eds.). (2018). Environmental biotechnology: for sustainable future. Springer.

Further Reading: As suggested by the Instructor.

ENSC-203: ENVIRONMENTAL BIOTECHNOLOGY (01 Credit hr)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES

Students will learn about:

- Methods of heavy metals removal based on biological treatment
- Various case studies related to bioremediation of water and soil
- GMOs and their role in reducing environmental stresses in agriculture
- Degradation techniques for of organic pollutants

CONTENTS

Unit-I: Biosorption of pollutants

1.1. Chromium
1.2. Arsenic
1.3. Organic contaminants
1.4. Case studies

Unit-II: Biotechnological tools for environmental remediation

2.1. Biomaterials and enzymes
2.2. DNA extraction methods
2.3. Water and wastewater treatment

Unit-III: Genetically modified organisms for environmental pollution treatment

3.1. Case studies
3.2. Ethical and legal problems
3.3. Degradation of organic pollutants

Unit-IV: Microscopic treatment of wastewater

4.1. Bacteriology of drinking water
4.2. Microscopic studies
4.3. Case studies

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Glick, B. R., & Patten, C. L. (2017). *Molecular biotechnology: principles and applications of recombinant DNA* (Vol. 34). John Wiley & Sons.
2. Patra, J. K., Das, G., Das, S. K., & Thatoi, H. N. (2020). *A Practical Guide to Environmental Biotechnology*. Springer.
3. Sangeetha, J., Thangadurai, D., David, M., & Abdullah, M. A. (Eds.). (2016). *Environmental Biotechnology: Biodegradation, Bioremediation, and Bioconversion of Xenobiotics for Sustainable Development*. CRC Press.
4. Chrispeels M.J., Chopra V.L., Malik V.S. and Bhat S.R. 2016. Applied Plant Biotechnology, Oxford University Press.
5. Bruce, E. R. (2020). *Environmental biotechnology: principles and applications*. McGraw-Hill Education.
6. Gothandam, K. M., Ranjan, S., Dasgupta, N., & Lichtfouse, E. (Eds.). (2020). *Environmental Biotechnology* Vol. 3. Springer International Publishing.

Further Readings: As suggested by the Instructor.

ENSC-204: PLANTS AND ENVIRONMENT (THEORY) (02 Credit Hrs)

PRE-REQUISITE: ENSC-113

LEARNING OUTCOMES:

The learning objectives of this lecture course are:

- To strengthen student knowledge of concepts about environment and plant distribution.
- To give the student an understanding of the impact of various environmental factors on plants and the adaptations of plants in response to these factors.
- To enhance student knowledge of systems-level concepts, including interactions of Plants within environment and ecological cycles, so that students can explain how natural systems function and how humans and global changes impact vegetation at landscape and regional scales
- To further develop oral skills through presentations and group discussions

CONTENTS

Unit-I: Introduction to plant and environment:

1.1. Importance of plants in the biosphere.
1.2. Plant distribution in the biosphere,
1.3. Environmental factors influencing plant distribution.
1.4. Effect of latitudinal and altitudinal variations,

Unit- II: Plants, Water and mineral nutrition:

2.1. Uptake of water and mineral nutrients by plants,
2.2. Functions of mineral nutrients
2.3. Edaphic factors: Importance of Soil texture and structure
2.4. Classification of plants according to water availability
2.5. Adaptations of hydrophytes, xerophytes, succulents/cacti, halophytes, and mangroves.

Unit- III: Temperature, Light and humidity:

3.1. Temperature, and humidity as the regulating factors in plant distribution:
3.2. Factors affecting the variations in light and temperature.
3.3. Light and Plant Metabolism.
3.4. light, C3 and C4 plants and CAM
3.5. Ecological responses of plants to warm, chilling, and freezing temperatures.
3.6. Eco-physiological responses like Photoperiodism,
3.7. Thermo-periodism, Dormancy, Vernalization etc.

Unit- IV: Fire, Winds, and other Environmental factor:

4.1. Fire: Occurrence and types of fire.
4.2. Adaptations observed in plants in response to fire.
4.3. Wind as an environmental factor

Unit- V: Plant adaptations and establishments

5.1. Ecology of different plant growth forms,
5.2. Reproductive strategies of flowering plant,
5.3. Pollination and seed dispersal,
5.4. Regeneration, and establishment,

Unit- VI: Interactions between plants and other organisms;

6.1. Mycorrhiza, Nitrogen fixation,
6.2. Pathogens and endophytes,
6.3. Parasites, saprophytes and Carnivorous plants

Unit- VII: Human uses of plants;

7.1. food; construction, medicine,
7.2. bioremediation,
7.3. Tissue culture, Plant breeding,
7.4. Plant genetic engineering and biotechnology

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Reece, J. B. (2020). *Campbell Biology*. Pearson Education
2. Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. (2018). *Fundamentals of Plant Physiology*. Oxford University Press.
3. Reece, J. B. U., Cain, L. A., Wasserman, M. L., & Minorsky, S. A. (2018). *Investigating Biology Laboratory Manual*. 9th Ed. Amsterdam
4. Willey, N. (2018). Environmental plant physiology. Garland Science.

5. Mauseth, J. D. (2014). *Botany: an introduction to plant biology*. Jones & Bartlett Publishers
6. Berg, L. R., & Berg, W. M. (2008). *Introductory Botany: Plants, People, and the Environment*. Brooks/Cole.
7. Smith, T. M., & Smith, R. L. (2014). Elements of Ecology. 9th Ed., Benjamin Cummins, UK.
8. Schulz, E. D., Beck, E., & Muller-Hohenstein, K. (2005). *Plant Ecology*. Springer Verlag, Germany.
9. Soni, N. K. (2010). *Fundamentals of Botany* (Vol. 2). Tata McGraw-Hill Education.
10. Subrahmanyam, N.S., & Sambamurty, A.V. S. S. (2000). *Ecology*. Narosa Publishing House, New Delhi. 616 pp.
11. Lack, A., & Evans, D. (2001). *BIOS Instant Notes in Plant Biology*. Garland Science.

Further Reading: As suggested by the Instructor.

ENSC-204: PLANTS AND ENVIRONMENT (PRACTICAL) (01 Credit Hrs)

PRE-REQUISITE: ENSC-113

LEARNING OUTCOMES:

The learning objectives of this lecture course are:

- To strengthen student knowledge of concepts about environment and plant distribution.
- To give the student an understanding of the impact of various environmental factors on plants and the adaptations of plants in response to these factors.
- To enhance student knowledge of systems-level concepts, including interactions of Plants within environment and ecological cycles, so that students can explain how natural systems function and how humans and global changes impact vegetation at landscape and regional scales
- To further develop oral skills through presentations and group discussions

CONTENTS

Unit- I: Edaphology

1.1. To measure the abiotic factors like light, temperature & humidity under different ecological conditions

1.2. To investigate the soil texture and soil classification

Unit- II: Plant Morphology

2.1. To study the vegetative parts and their modifications in of the plants

2.2. To learns the basic terminology of flowers, description of different parts of the flowers in the plants

Unit- III: Plant Adaptation

1.1. To study of seed types and their adaptation for the survival

1.2. To examine the hydrophytes and Xerophyte's adaptations.

Unit- IV: Plant Identification and Diversity

1.1. To conduct the plant survey in CEES or any other place suggested by instructor for Shrubs, Saplings, and Vines and tree.

1.2. To evaluate the floristic composition of Vegetation (Seedlings and Herbaceous) of target area.

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Reece, J. B. (2020). *Campbell Biology*. Pearson Education
2. Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. (2018). *Fundamentals of Plant Physiology*. Oxford University Press.
3. Reece, J. B. U., Cain, L. A., Wasserman, M. L., & Minorsky, S. A. (2018). *Investigating Biology Laboratory Manual*. 9th Ed. Amsterdam
4. Willey, N. (2018). Environmental plant physiology. Garland Science.
5. Mauseth, J. D. (2014). *Botany: an introduction to plant biology*. Jones & Bartlett Publishers
6. Berg, L. R., & Berg, W. M. (2008). *Introductory Botany: Plants, People, and the Environment*. Brooks/Cole.
7. Smith, T. M., & Smith, R. L. (2014). Elements of Ecology. 9th Ed., Benjamin Cummins, UK.
8. Schulz, E. D., Beck, E., & Muller-Hohenstein, K. (2005). *Plant Ecology*. Springer Verlag, Germany.
9. Soni, N. K. (2010). *Fundamentals of Botany* (Vol. 2). Tata McGraw-Hill Education.
10. Subrahmanyam, N.S., & Sambamurty, A.V. S. S. (2000). *Ecology*. Narosa Publishing House, New Delhi. 616 pp.
11. Lack, A., & Evans, D. (2001). *BIOS Instant Notes in Plant Biology*. Garland Science.

Further Reading: As suggested by the Instructor.

ENSC-205: ROCK, SOIL AND ENVIRONMENT (THEORY) (02 Credit hrs)

PRE-REQUISITE: ENSC-111

LEARNING OUTCOMES

- This course will provide an introduction to the Soil to the students.
- The students will learn about the Soil and Rock Mechanics.
- They will have the knowledge about the Geological and Engineering Classification of Soil..
- The students will get used to the design of foundation of Dams, Highways and Civil Structures.

CONTENTS

Unit-I: Sieve Analysis

1.1. Introduction and Definition of Soil
1.2. Function of Soil
1.3. Soil Profile
1.4. Soil Horizons
1.5. Compaction, Permeability and Capillarity of Soil
1.6. Stress and Stress Distribution of Soil, Consolidation and Consolidation Settlement.

Unit-II: Soil properties

2.1. Soil Colors
2.2. Soil Processes
2.3. Composition of Soils
2.4. Soil Formation
2.5. Shear Strength of Soil, Laboratory Measurements of Soil Properties,

Unit-III: Soil and its role

3.1. Soil Fertility
3.2. Physical Properties of Soil
3.3. Soil Moisture
3.4. Soil Gas
3.5. Bearing Capacity of Soils, Shallow and Pile Foundation

Unit-IV: Soil Chemistry

4.1. Soil Matrix
4.2. Soil Chemistry
4.3. Soil Nutrients
4.4. Soil Organic Matter
4.5. Soil Improvement, Embankment Dams, Dynamic Loading of Soil

Unit-V: Soil types and movement

5.1. Soil Classification
5.2. Soil Uses
5.3. Soil Degradation
5.4. Soil Reclamation
5.5. Environmental Geotechnology

Unit-VI: Soil pollution

6.1. Soil Pollution
6.2. Geological Classification of Soil
6.3. Soil Structure
6.4. Soil Texture

Unit-VII: Rocks and soils

7.1. Rocks as an Aggregates
7.2. Description and Classification of Aggregates
7.3. Occurrences and Associations of Sources,
7.4. Field Investigation of Deposits.

Unit-VIII: Soil aggregates

7.1. Extraction of Aggregates
7.2. Sampling and Testing of Aggregates
7.3. Aggregates for Concrete
7.4. Processing of Aggregates
7.5. Environmental Issues related to Aggregates

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Sani, G.(2021) *Recycled Aggregates; Materials and Uses*, Nova Science Publishers.
2. Kumar, R., Kumar, R., and Kumar, S. (2017) *Rock as Construction Material*, Haldia Institute of Technology, India.
3. Brady, N.C. and Weil, R.R. (2013) *The Nature and Properties of Soils*, Dorling Kindersley, 14th Edition, India, pp.1-194.
4. Reddy, R.N. (2010) *Soil Engineering*: Testing, Design and Remediation, Gene-Tech Books, New Delhi, pp.1-271.
5. Raj, P.P (2009) *Soil Mechanics and Foundation Engineering*, Dorling Kindersley, India, pp.1-797.

ENSC-205: ROCK, SOIL AND ENVIRONMENT (PRACTICAL) (01 Credit hrs)

PRE-REQUISITE: ENSC-111

LEARNING OUTCOMES

- This course will provide an introduction to the Laboratory Test of Soil to the students.
- The students will learn about the Gradation and Density of the Soil.
- They will have the knowledge about the Engineering Test of Soil..
- The students will get used to the design of foundation of Dams, Highways and Civil Structures.

CONTENTS

Unit-I: Sieve Analysis of Soil

1.1. Definition and Apparatus of Sieve Analysis
1.2. Procedure, Results, Methods of Sieve Analysis
1.3. Types of Gradation, Types of Sieves
1.4. Limitations of Sieve Analysis, Properties and Engineering Applications of Sieve Analysis

Unit-II: Moisture Content Test of Soil

2.1. Definition and Apparatus of Moisture Content Test
2.2. Procedure, Results, Methods of Moisture Content Test
2.3. Measurements, Classification and Uses in Aggregates

Unit-III: Organic Content Test of Soil

3.1. Definition and Apparatus of Organic Content Test
3.2. Procedure, Results, Methods of Organic Content Test
3.3. Soil Organic Matter, Sources, Composition of Vegetal Detritus Decomposition
3.4. Humus and Function in Carbon Cycling

Unit-IV: Specific Gravity and Water Absorption Test of Soil

4.1. Definition and Apparatus of Specific Gravity and Water Absorption Test
4.2. Procedure, Results, Methods of Specific Gravity and Water Absorption Test

Unit-V: Liquid Limit Test of Soil

5.1. Definition and Apparatus of Liquid Limit Test
5.2. Procedure, Results, Methods of Liquid Limit Test

Unit-VI: Plastic Limit Test of Soil

6.1. Definition and Apparatus of Plastic Limit Test
6.2. Procedure, Results, Methods of Plastic Limit Test

Unit-VII: Modified AASHTO Soil Density Test

7.1. Definition and Apparatus of Modified AASHTO Soil Density Test
7.2. Procedure, Results, Methods of Modified AASHTO Soil Density Test
7.3. History and Theory of Soil Compaction
7.4. Comparison of Tests, Alternative Compaction Testing

Unit-VIII: Sand Replacement Method

8.1. Definition and Apparatus of Sand Replacement Method
8.2. Procedure, Results, Methods of Sand Replacement Method

Unit-IX: Core Cutter Method

9.1. Definition and Apparatus of Core Cutter Method
9.2. Procedure, Results, Methods of Core Cutter Method

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Mir, B.A.(2021) *Manual of Geotechnical Laboratory Soil Testing*, CRC Press, India.
2. Monnet, J. (2015) *In Situ Tests in Geotechnical Engineering*, Wiley, pp.1-398.

ENSC-206: ENVIRONMENTAL LAW AND POLICIES (02 Credit Hours)

PRE-REQUISITE: F.Sc. or equivalent

COURSE LEARNING OUTCOMES:

- be able to demonstrate an understanding of federal environmental laws and their importance in the protection of environmental quality
- have a thorough understanding of international treaties and conventions on environmental issues of global concern

CONTENTS

Unit-I: Fundamental of Environmental laws

1.1. Environment Protection in Pakistan,
1.2. Environmental Law,
1.3. Environmental law Environmental Consciousness in Pakistan,

Unit-II: Historical development of Environmental laws

2.1. Historical Development of Pakistani Environmental Laws,
2.2. History of International Environmental Law, Stockholm Conference,
2.3. World Charter for Nature, etc, Rio Declaration (UNECD)/ Earth Summit,
2.4. Agenda 21, Earth Charter and the International Covenant on Environment and Development

Unit-III: Human and Environmental Laws:

3.1. Environmental Rights and Human Rights,
3.1. Islam and the Environment, Pakistani
3.3. Environmental Laws, EIA under PEPA,
3.4. Trip to the Punjab Environment Department,
3.5. Environmental laws on water: Water quality and quantity,
3.6. Environmental laws on air and noise,
3.7. Environmental laws on conversation, forest, Environmental laws on waste

Unit-IV: National conservation strategies:

4.1. Review of National Conservation Strategy,
4.2. NGOs and the Environment,
4.3. Environmental Cases in Pakistan, From Stockholm to Rio to 21st Century.
4.4. International Environmental Law, what are international treaties?

Unit-V: Environmental laws in Pakistan

5.1. National Environmental Policy of Pakistan and its implementation,
5.2. All the environment related policies of Pakistan,
5.3. All the conservation strategies and National Conservation Strategies and Action Plans,
5.4. Global Collaborations, Environmental provisions in the constitution of Pakistan,
5.5. Environmental planning.

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Tan, A. (2002). *Historical Development of International Environmental Law*. Prof. Nicholas Robinson and Jawad Hassan, Comparative Environmental Law & Regulation, Chapter.
2. Hassan, P. and Hassan, J. (2002). *Environmental Laws in Pakistan.*
3. National Environmental Policy, (2005). National Drinking Water Policy, 2009, National Rangeland Policy, 2010, National Resettlement Policy, 2002, National Sanitation Policy, 2006, National Water Policy, National Forest Policy, World Conservation Strategy, 1980, National Conservation Strategy, 1992, Pakistan Water Sector Strategy, 2002, Global Collaborations, Stockholm Conference (1972), Montego Bay (1982), Montreal Protocol (1987), The Helsinki Declaration (1989), Earth Summit (1992), Copenhagen (1996), The Kyoto Protocol (1997)
4. Pakistan Environmental Protection Act, 1997 (Act No. XXXIV of 1997)
5. Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000

Further Reading: As suggested by the Instructor.

2nd YEAR, FOURTH SEMESTER			
Code	**Course Title**	**C.H.**	**Course Type**
HQ-004	Translation of Holy Quran	01	Compulsory
ENSC-207	English IV	3+0	Core Course
ENSC-208	Hydrological Systems and Environment	2+1	Major Elective
ENSC-209	Animals and Environment	2+1	General Course
ENSC-210	Environmental Microbiology	2+1	Basic Course
ENSC-211	Air and Noise Pollution	2+1	Major Elective
ENSC-212	Meteorology	2+0	General Course
ENSC-213	Environmental Field Studies I	01	Major Elective
	Total Credit Hrs Semester-IV	**19**	

HQ-004: TRANSLATION OF HOLY QURAN (Non Credit)

PRE-REQUISITE: HQ-003 Translation of Holy Quran

COURSE OUTLINE

سورة هود تا سورة الكهف

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after mid term 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

ENSC-207: ENGLISH-IV (03 Credit Hours)

PRE-REQUISITE: ENSC-201

LEARNING OUTCOMES:

By the end of the course, the students will have gained

- experience by developing and revising critical arguments,
- organizing Formal letters
- professional correspondence.

CONTENTS

Unit-I: Formal Letters

1.1. Letters to the editor,
1.2. Letter to public officials (Wapda, Wasa etc)

Unit-II: Advanced Reading and Comprehension:

2.1. Readings skills
2.2. Comprehension
2.3. Answering question from given prose

Unit-III: Picture Description

3.1. Analyze and describe pictures in correct English

Unit-IV: Job Interviews

4.1. How to handle Job Interviews through
4.2. Mock Interviews

Unit-V: Professional Correspondence

5.1. Applying for a job
5.2. follow up messages after the Job interviews

Unit-VI: Activities

6.1. Oral Presentations
6.2. Vocabulary Building Skills
6.3. Word root method, SMART BRAIN GRE
6.4. Group and Class Room Discussion

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Herta, A. and Murphy, H. W. (2009). *Effective Business Communication*. McGraw-Hill Publishing Co. Ltd, New Delhi.
2. Rise, B. and Axelrod, C. R., (1988). *The St. Martin's Guide to Writing.* St. Martin's Press. UK.
3. Idrees, M. (2011). *Guide for GAT General Test. SMART BRAIN. GRE (General, Local).* Dogar Publishers, Lahore.
4. Howe, D.H, Kirkpatrick, T. A, &Kirkpatrick, D.L.(1993).*English for undergraduates.* Oxford University Press, London.
5. Goatly, A. (2000). *Critical Reading and Writing: An Introductory Course.* Taylor & Francis, London.

Further Reading: As suggested by the Instructor.

ENSC-208: HYDROLOGICAL SYSTEM AND ENVIRONMENT (THEORY) (02 Credit hrs)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES

- This course will provide understanding of Hydrology and its system in Environmental sciences
- The students will learn about the surface water resources
- They will have the knowledge about the occurrences and importance of ground water resources and different water bearing formations
- The students will get used to the different methods for measurement of stream flow

CONTENTS

Unit-I: Introduction

1.1. Occurrence of Water on Earth
1.2. Physical and chemical properties of water
1.3. Importance of Water

Unit-II: Hydrology as a Science

2.5. Introduction to Hydrology, origin and history
2.6. Importance of Hydrology
2.7. Branches of Hydrology

Unit-III: Hydrological Cycle

3.1. Introduction and importance of hydrological cycle
3.2. Components of Hydrological Cycle
3.3. Global Water Budget
3.4. Hydrological Losses (Interception, Infiltration, Evaporation, transpiration)

Unit-IV: Surface Water

4.1. Occurrence of fresh Water on Earth on earth
4.2. Runoff Process and hydrological losses
4.3. Rivers
4.4. Lakes and reservoirs
4.5. Glacier
4.6. Surface water resources of Pakistan

Unit-V: Ground Water

5.1. Ground water resources, occurrence and importance
5.2. Aquifers and types of aquifers
5.3. Hydraulic properties of aquifers

Unit-VI: Streamflow Measurements

6.1. Stage measurement
6.2. Velocity measurements using different methods
6.3. Velocity-Area method for streamflow measurement
6.4. Stream gauges

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Davie, T., & Quinn, N. W. (2019). *Fundamentals of hydrology*. Routledge.
2. Max,G.,(2018) *Ground and Surface Water Hydrology* Larsen and Keller Education
3. Watson, I., & Burnett, A. D. (2017). *Hydrology: An environmental approach*.
4. Manning, J. C. (2016). *Applied principles of hydrology*. Waveland Press..
5. Ghuman, A. R. (2013). *Introduction to Hydrology*.

ENSC-208: HYDROLOGICAL SYSTEM AND ENVIRONMENT (PRACTICAL) (1 Credit hrs)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES

- This course will provide a demonstration about the different instruments used for recording hydrological data
- The students will learn about the practical aspects of the runoff measurement techniques
- They will have the knowledge about development and interpretation of unit hydrographs
- The students will get used to the concepts of frequency analysis of precipitation data
- They will become conversant with the different methods to measure infiltration

CONTENTS

Unit--1

1.1. Demonstration of weather recording instruments
1.2. practice in taking actual data from weather stations including a visit to weather station

Unit-2

2.1. Measuring Runoff in the field by different techniques

Unit-3

3.1. Development of and interpretation of hydrograph

Unit-4

4.1. Frequency analysis of rainfall data

Unit-5

5.1. Measuring infiltration rate in the field

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Max, G. (2018) *Ground and Surface Water Hydrology* Larsen and Keller Education ISBN-13: 978-1635496949
2. Watson, I., & Burnett, A. D. (2017). *Hydrology: An environmental approach*.
3. Manning, J. C. (2016). *Applied principles of hydrology*. Waveland Press..
4. Raghunath, H. M. (2006). *Hydrology: principles, analysis and design*. New Age International

ENSC-209: ANIMALS AND ENVIRONMENT (THEORY) (02 Credit Hrs)

PRE-REQUISITE: ENSC-113

LEARNING OUTCOMES:

Upon completion of syllabus, students will be able to understand

- the basic ecological principles with an emphasis on animal ecology and population biology.
- Population dynamics of animals and distribution of animals
- understand how critical factors influence behaviour of living organisms at population, and community scales

Unit- I: Introduction to Animals and environment:

1.1. Introduction and Historical Background of Animal ecology
1.2. Role of animals in food chain, web, and ecosystem

Unit- II: Zoogeography:

2.1. Factors affecting the global distribution of animals,
2.2. Zoogeographic regions and animal distribution

Unit- III: Animal Population:

3.1. Animal Population Demographics,
3.2. Population Size, Population Density and Distribution,
3.3. Age Structure, Population Size and Population dynamics

Unit- IV: Population Growth Models:

4.1. Exponential Growth
4.2. Logistic Growth
4.3. Density-Dependent Factors Density-Independent Factors
4.4. Life History Patterns
4.5. Human Population Growth.

Unit- V: Animal communities:

5.1. Competitive Interactions,
5.2. Resource Partitioning,
5.3. Predator–Prey Interactions,
5.4. Coevolution of Herbivores and Plants,
5.5. Parasites and Parasitoids, Parasitism Brood Parasites
5.6. Species Introduction, Loss, and Keystone Species

Unit- VI: Animal Behavior:

6.1. Instinct and Learning,
6.2. Instinctive Behavior,
6.3. Conditioned Responses,
6.4. Types of Learned Behavior

Unit- VII: Behavioral Ecology:

7.1. Evolution of Animal Communication,
7.2. Foraging and Territorial behaviour,
7.3. Reproductive Strategies,
7.4. Mating Systems, Parental Care,
7.5. Group Living, Benefits and Costs of Grouping

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Reece, J. B. (2020). Campbell biology. Pearson Education
2. Mason, K. A., Losos, J. B., Duncan, T., & Raven, P. H. (2020). *Biology*. 12th Ed. McGraw-Hill Education
3. Urry, L., Cain, M., Wasserman, S., Morgan, J., Reece, J., Minorsky, P., & Carter, M. E. (2017). *Investigating Biology Laboratory Manual*. 9th Ed. Pearson.
4. Narendran, T. C., & Balakrishnan, M. (2008). *Systematics and Biodiversity Conservation*. Riddhi International.
5. Wheater, C. P., Bell, J. R., & Cook, P. A. (2011). *Practical Field Ecology: A Project Guide*. Wiley-Blackwell
6. Gotelli, N. J. (2008). *A primer of ecology* (No. 577.88 G6). Sunderland, Massachusetts, USA: Sinauer Associates.
7. Pearl, M. C. (2000). *Research Techniques in Animal Ecology*. Publisher: Columbia University Press,

Further Reading: As suggested by the Instructor.

ENSC-209: ANIMALS AND ENVIRONMENT (PRACTICAL) (01 Credit Hrs)

PRE-REQUISITE: ENSC-113

COURSE LEARNING OUTCOMES:

Upon completion of syllabus, students will be able to understand

- the basic ecological principles with an emphasis on animal ecology and population biology.
- Population dynamics of animals and distribution of animals
- understand how critical factors influence behaviour of living organisms at population, and community scales

CONTENTS

Unit- I: Ecological Sampling techniques:

1.1. Sampling techniques for static organisms
1.2. Sampling techniques for mobile organisms (Direct observation, Behaviour, Capture techniques, Marking individuals and Radio-tracking)

Unit- II: Sampling techniques for Invertebrate Sampling:

2.1. Sampling of aquatic invertebrates (Netting, Suction sampling, Benthic coring, Drags, dredges and grabs, Wet extraction, Baited traps).
2.2. Study of the Insects using different techniques viz; Pitfall traps, sweep netting, Sticky traps, using chemical attractants, Light traps.

Unit- III: Population Studies of vertebrates:

3.1 Investigations of Fish population in a pond ecosystem
3.2. Survey of bird's population estimation using different direct or indirect techniques

Unit- IV Population Estimation and Diversity:

4.1. Population Estimation techniques for the study of Mammals.
4.2. Study of Animal diversity using different Indices viz; Species Richness, Diversity and Similarity Index

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Reece, J. B. (2020). Campbell biology. Pearson Education
2. Mason, K. A., Losos, J. B., Duncan, T., & Raven, P. H. (2020). *Biology*. 12th Ed. McGraw-Hill Education
3. Urry, L., Cain, M., Wasserman, S., Morgan, J., Reece, J., Minorsky, P., & Carter, M. E. (2017). *Investigating Biology Laboratory Manual*. 9th Ed. Pearson.
4. Narendran, T. C., & Balakrishnan, M. (2008). *Systematics and Biodiversity Conservation*. Riddhi International.
5. Wheater, C. P., Bell, J. R., & Cook, P. A. (2011). *Practical Field Ecology: A Project Guide*. Wiley-Blackwell
6. Gotelli, N. J. (2008). *A primer of ecology* (No. 577.88 G6). Sunderland, Massachusetts, USA: Sinauer Associates.
7. Pearl, M. C. (2000). *Research Techniques in Animal Ecology*. Publisher: Columbia University Press,

Further Reading: As suggested by the Instructor.

ENSC-210: ENVIRONMENTAL MICROBIOLOGY (THEORY) (02 Credit hrs.)

PRE-REQUISITE: ENSC-106

COURSE LEARNING OUTCOMES

- The students will learn about the ecology and diversity of microbial communities in soil, water and air
- Students will learn about ecological importance of microorganism
- Their roles in wastewater treatment and bioremediation of polluted environment
- Role of microorganisms in industry and agriculture sectors

CONTENTS

Unit-I: Environmental microbiology and microbial growth

1.1. Introduction, scope of environmental microbiology and brief history
1.2. Microbial metabolism and microbial growth in the environment
1.3. Physicochemical factors affecting the environmental fate of microorganisms
1.4. Microbial habitats and ecology (air, soil and water)

Unit-1I: Air, water and soil microbiology

2.1. Nature of microbial communities
2.2. Life at low nutrient concentrations
2.3. Occurrence and distribution of microbial communities in extreme environments
2.4. Air microbiology
2.5. Role of fresh water and marine water microorganisms
2.6. Microorganisms in different terrestrial habitats

Unit-1II: Industrial and agricultural microbiology

3.1. Microorganisms in sewage and sewage treatment
3.2. Role of microorganisms in biofuel production
3.3. Role of microbial enzymes in different industries
3.4. Soil Microorganisms of higher plants
3.5. Microorganisms and organic agriculture

Unit-IV: Ecological importance of microorganisms for environmental management

4.1. Microbial ecology
4.2. Symbiosis between plants and microorganisms (nitrogen fixation, mycorrhiza)
4.3. Microbial functions in biogeochemical cycles
4.4. Solid waste treatment by composting
4.5. Bioremediation of organic pollutants and heavy metals in soil and aquatic environments
4.6. Bioleaching and biomining

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Singh, A., Srivastava, S., & Rathore, D. (2021). *Environmental microbiology and biotechnology: volume 2: bioenergy and environmental health*. Springer Nature.
2. Di Prisco, G., Edwards, H. G., Elster, J., & Huiskes, A. H. (Eds.). (2020). *Life in Extreme Environments: Insights in Biological Capability*. Cambridge University Press.
3. Singh, C., Tiwari, S., Singh, J. S., & Yadav, A. N. (Eds.). (2020). *Microbes in agriculture and environmental development*. CRC Press.
4. Singh, J., Vyas, A., Wang, S., & Prasad, R. (2020). *Microbial Biotechnology: Basic Research and Applications*. Springer Singapore.
5. Mishra, B. B. (2020). *Frontiers in Soil and Environmental Microbiology*. CRC Press.
6. Goldman, E., & Green, L. H. (Eds.). (2015). *Practical handbook of microbiology*. CRC press.

Further Reading: As suggested by the Instructor.

ENSC-210: ENVIRONMENTAL MICROBIOLOGY (PRACTICAL) (01 Credit hrs)

PRE-REQUISITE: ENSC-106

LEARNING OUTCOMES

- The students will learn about the ecology and diversity of microbial communities in soil, water and air
- Students will learn about ecological importance of microorganism
- Their roles in wastewater treatment and bioremediation of polluted environment
- Role of microorganisms in industry and agriculture sectors

CONTENTS

Unit-I: Preparation of growth media

1.1. Preparation and sterilization of different microbial growth media

Unit-1I: Isolation and growth of microorganisms

2.1. Detection of microorganisms in the ground, water and air
2.2. Isolation of bacteria from different industrial effluents
2.3. Effects of different pH and temperatures on microbial growth

Unit-1II: Characterization of microorganisms

3.1. haracterization of microorganisms through morphological, gram staining and biochemical methods
3.2. Study of different growth media on bacterial growth curves

Unit-1V: Environmental implications of microorganisms

4.1. Plant growth promotion by microorganisms
4.2. Bioremediation of heavy metals by microorganisms

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Singh, A., Srivastava, S., & Rathore, D. (2021). *Environmental microbiology and biotechnology: volume 2: bioenergy and environmental health*. Springer Nature.
2. Di Prisco, G., Edwards, H. G., Elster, J., & Huiskes, A. H. (Eds.). (2020). *Life in Extreme Environments: Insights in Biological Capability*. Cambridge University Press.
3. Singh, C., Tiwari, S., Singh, J. S., & Yadav, A. N. (Eds.). (2020). *Microbes in agriculture and environmental development*. CRC Press.
4. Singh, J., Vyas, A., Wang, S., & Prasad, R. (2020). *Microbial Biotechnology: Basic Research and Applications*. Springer Singapore.
5. Mishra, B. B. (2020). *Frontiers in Soil and Environmental Microbiology*. CRC Press.
6. Goldman, E., & Green, L. H. (Eds.). (2015). *Practical handbook of microbiology*. CRC press.

Further Reading: As suggested by the Instructor.

ENSC-412: AIR AND NOISE POLLUTION (THEORY) (02 Credit hrs)

PRE-REQUISITE: ENSC-107

COURSE LEARNING OUTCOMES

- The purpose of this course is to give the students an overview of air and noise pollution.
- This course will provide an understanding of the sources and effects of air pollutants
- The students will have the knowledge about main causes and reasons of the air and noise pollution.
- The students will be able to answer why air pollution should be controlled.
- The students are expected to be familiar with methods for prevention, control, measures and management of the pollution.

CONTENTS

Unit-I: Introduction to air pollution

1.1. History of air pollution? Where, why and when?
1.2. Sources of air pollution
1.3. Types of air pollutants and pollution
1.4. Air emission estimates and measurements
1.5. Transport of pollutants
1.6. Air pollution Models/ Gaussian Plume Model
1.7. Effects of air pollution on Environment/Human health

Unit-II: Laws, regulations and control philosophies regarding air pollution

2.1. Air pollution laws and regulations around globe
2.2. Air quality guidelines
2.3. Air pollution rules and regulations in Pakistan
2.4. Air pollution control philosophies

Unit-III: Air pollution control

3.1. Organizations for air pollution control
3.2. Engineering control of air pollution
3.3. Air pollution control by devices
3.4. Control devices for particulates
3.5. Control devices for liquid or mist
3.6. Control devices for gaseous contaminants

Unit-IV: Specified control devices for selected air pollutants

4.1. Sulfur oxides (SOxs) control
4.2. Nitrogen oxides (NOxs) control
4.3. Carbon monoxide (CO) control
4.4. Carbon dioxide (CO_2) control
4.5. Hg, Dioxins and Furans control

Unit-V: Indoor air pollution

5.1. Sources
5.2. Transportation/Movement
5.3. Specific Health Effects
5.4. Control of indoor air pollution

Unit-VI: Noise pollution

6.1. Introduction, characteristics and kinds of noise
6.2. Introduction to noise pollution
6.3. Sources of noise pollution/man made noise

6.4. Health effects of noise pollution
6.5. Overview of laws and regulations of noise
6.6. Mitigation and control techniques of noise pollution

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,
- Class assignments
- Attendance, assignments and presentation,
- Attitude and behavior,
- Hands-on-activities,
- Short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, class assignments, attitude and behavior, hands-on-activities, short tests and quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Boubel, R. W., Vallero, D., Fox, D. L., Turner, B., & Stern, A. C. (2013). *Fundamentals of Air Pollution:* Elsevier Science.
2. Bragdon, C. R. (2016). *Noise Pollution: The Unquiet Crisis:* University of Pennsylvania Press, Incorporated.
3. Kutz, M. (2018). *Handbook of Environmental Engineering*: Wiley.
4. Sánchez-Triana, E., Enriquez, S., Afzal, J., Nakagawa, A., & Khan, A. S. (2014). *Cleaning Pakistan's Air: Policy Options to Address the Cost of Outdoor Air Pollution:* World Bank Publications.
5. Saxena, P., & Naik, V. (2018). *Air Pollution: Sources, Impacts and Controls*: CAB International.
6. Templeton, N. (2017). *Noise Pollution and Control:* Larsen and Keller Education.
7. Tiwary, A., & Williams, I. (2018*). Air pollution: measurement, modelling and mitigation:* CRC Press.
8. Wang, L. K., & Pereira, N. C. (2012). *Air and Noise Pollution Control*: Volume 1: Humana Press.
9. Yerramilli, A. (2019). *Air Pollution: Prevention and Control Technologies*: BS Publications.

ENS-412: AIR AND NOISE POLLUTION (PRACTICAL) (01 Credit hrs)

PRE-REQUISITE: ENSC-107

LEARNING OUTCOMES:

- This course will provide a demonstration about the different instruments used for monitoring air pollution.
- This course will provide a demonstration about the different instruments used for monitoring noise pollution.
- The students will learn about the practical aspects of noise survey.
- They will become conversant with the different methods to conduct monitoring and survey.

CONTENTS

Unit-1: Practical-1

1.1. Monitoring of ambient air pollution

Unit-II: Practical-2

2.1. Monitoring of ambient particulate matter

Unit-III: Practical-3

3.1. Stack monitoring
3.2. Vehicle exhaust monitoring.

Unit-IV: Practical-4

4.1. Monitoring of indoor air pollution

Unit-V Practical-5

5.1. Monitoring of sound pressure and sound levels.
5.2. Monitoring of traffic noise.
5.3. Measurement of reverberation time.
5.4. Measurement of sound absorption of materials.

Unit-VI Practical-6

6.1. Industrial noise survey

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, practical performance, assignments
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, performance, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Wang, L. K., & Pereira, N. C. (2012). *Air and Noise Pollution Control:* Volume 1: Humana Press.
2. Yerramilli, A. (2019). *Air Pollution: Prevention and Control Technologies:* BS Publications.
3. How to Monitor? – Monitoring Methods/Ministry of environment/ (https://www.mfe.govt.nz/publications/air/good-practice-guide-air-quality-monitoring-and-data-management-2009/4-how-monitor-–)
4. STRATEGIES FOR NOISE SURVEYS (https://www.who.int/occupational_health/publications/noise7.pdf)

ENSC-212: METEROLOGY (THEORY) (02 Credit Hrs)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES:

- This course will define the role of meteorology as an academic discipline and identify potential career opportunities.
- The student will learn to develop an elementary understanding of the complex interrelationships of the atmospheric environment and the weather-related impacts on human activities.
- They will be able to understand the mass and energy relationships between the atmosphere, hydrosphere, cryosphere, and biosphere.
- They will learn to develop methods of interpreting and using current environmental data from local and remote sources.

CONTENT

Unit--I: Introduction

1.1. Meteorology, Weather & Climate
1.2. Atmospheric Layers
1.3. Scope of studying Meteorology
1.4. Methods of forecasting
1.5. Physical Understanding
1.6. Numerical Weather prediction

Unit-II: Definitions & Structures

1.1. Common Units & conversions
1.2. Vertical Structure of atmosphere: Temperature
1.3. Temperature profile
1.4. Temperature Inversion
1.5. Vertical Structure: pressure

Unit-III: Water Movement in atmosphere

3.1. Water Cycle
3.2. Components of water cycle
3.3. Coalescence Process
3.4. Surface Tension
3.5. Storage components

Unit-IV: Precipitation

4.1. Forms of precipitation
4.2. Formation of precipitation
4.3. Weather systems for precipitation
4.4. Measurement of precipitation
4.5. Recording & No recording gauges
4.6. Radar measurements
4.7. Satellite measurements

Unit-V: Interpretation of Precipitation Data

5.1. Estimating missing data
5.2. Arithmetic Mean method
5.3. Normal Ratio method
5.4. Solved Examples

Unit-VI: Areal Precipitation

6.1. Analysis of precipitation data
6.2. Thiesson Polygon method
6.3. Isohyetal method
6.4. Exercises of the methods

Unit-VII: Meteorological Variables

7.1. Introduction to the variables
7.2. Synoptic Observations
7.3. Requirements of Meteorological station
7.4. Automatic weather stations
7.5. Factors affecting measurements
7.6. Diabatic Vs Adiabatic process
7.7. Thermometers & their types

Unit-VIII: Clouds Formations & Types

8.1. Atmospheric Stability
8.2. Clouds & their types
8.3. Cloud radiative effects
8.4. Cloud classification

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Ahrens, C.D. & Henson, R. (2018)**.** *Meteorology Today: An Introduction to Weather, Climate, and the Environment.* Cengage Learning. ISBN:1337616669.
2. Frederick K. L. (2018). **T***he Atmosphere: An Introduction to Meteorology*. Pearson publisher. ISBN 13:9780134801001.
3. Ahrens, C.D. (2017). *Essentials of Meteorology: An Invitation to the Atmosphere*. Cengage Learning. ISBN 13:9781337515399.
4. Harrison, G. (2015). Meteorological Measurements and Instrumentation**.** Wiley-Blackwell. ISBN 13:9781118745809.
5. Spellman, R.F. (2012). *The Handbook of Meteorology***.** Scarecrow Press. ISBN 13: 9780810886124.

Further readings: As suggested by the instructor

ENSC-213: ENVIRONMENTAL FIELD STUDIES-I (01 Credit hrs)

PRE-REQUISITE: F.Sc. or equivalent

LEARNING OUTCOMES:

- This course will provide information regarding Environmental Geology to the students in field.
- The students will learn about the different aspects of Geology, Biodiversity.
- They will have the knowledge about the Dams and Meteorology.
- The students will be able to identify rocks and minerals in the field.

CONTENTS

Unit-I: Environmental Geology

1.1. Identification of minerals and Igneous, Sedimentary and Metamorphic Rocks at Natural Formations in Salt Range, Islamabad, Galiat, Abbottabad and Mansehra Areas.
1.2. Sedimentary Structure, mainly Bedding, Cross Bedding, Ripple Marks, Fossils, Mud Cracks, Graded Bedding.
1.3. Color, Fabric, Texture OF Rocks, Identification of Joints, Faults and Cleavage.
1.4. A visit to Natural History Museum, Islamabad.
1.5. A visit to Bestway Cement Factory, Chakwal.
1.6. A visit to Dams
1.7. Study of Geologic Hazards, Visit to some Seismic Stations.
1.8. Visit to some Petroleum Drilling/Petroleum Sites.

Unit-II: Environmental Biology

2.1. Study of Vegetation, change in vegetation with altitudinal changes.
2.2. Study of Role of Vegetation in Controlling Soil Erosion
2.3. Study of Conditions Supporting Gymnosperm Growth.
2.4. Study of Animal Diversity of the visited Areas.
2.5. Study of Fauna and Flora of the visited Areas

Unit-III: Hydrological Measurements

3.1. Study of Dams
3.2. Study of Reservoirs
3.3. Study of Wetlands
3.4. Flow Measurements
3.5. Weather Stations
3.6. Seepage Control through Dams and Foundations, Power Houses, Spillways.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

- As suggested by the Instructor

3rd YEAR, FIFTH SEMESTER			
Code	**Course Title**	**C.H.**	**Course Type**
HQ-005	Translation of Holy Quran	Non Credit	Compulsory
ENSC-301	Statistics in Environmental Science	2+1	Core Course
ENSC-302	Analytical Chemistry	2+1	Basic Course
ENSC-303	Conservation Biology	2+0	Major Elective
ENSC-304	Water Pollution and Control	2+1	Basic Course
ENSC-305	Occupational Health and Safety	2+1	Major Elective
ENSC-306	Solid Waste Management	2+1	Major Elective
	Total Credit Hrs Semester-V	**17**	

HQ-005: TRANSLATION OF HOLY QURAN (Non Credit)

PRE-REQUISITE: HQ-04 Translation of Holy Quran

COURSE OUTLINE

سورة مريم تا سورة الفرقان

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after mid term 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

ENSC-301: STATISTICS IN ENVIRONMENTAL SCIENCE (THEORY) (02 credit hrs)

PRE-REQUISITE F.Sc. or equivalent

LEARNING OUTCOMES

- This course will provide an introduction to the basic concepts of statistics and its application in hydrology.
- The students will learn to perform various statistical analyses (consistency and homogeneity test, estimating the measures of central tendency, dispersion and symmetry etc.).
- The students will learn the concepts of probability and Probability Distributions The students will get used to the concepts of hypothesis testing.
- Students will learn about the correlations and regression analysis.
- The students will learn about time series analysis

CONTENTS

This course provides an introduction to the statistical theories, and probability theories and their applications in environmental sciences. This course will also provide an understanding of time series analysis, correlation and regression analyses as well as hypothesis testing.

Unit-1: Introduction and Basic Concepts of Descriptive statistics

1.1. Introduction of statistics
1.2. Data types, sampling and tabulation
1.3. Measure of central tendency of data (Mean Median, Mode quartile, range etc)
1.4. Measure of data Dispersion (Standard Deviation, variance, Skewness and Kurtosis)
1.5. Graphical presentation of data

Unit-2: Basic probability concepts and Probability distributions

1.6. Basic concepts of Probability
1.7. Rules of Probability
1.8. Event and space of event
1.9. Random variables
1.10. Discrete probability distribution
1.11. Continues probability distribution

Unit-3: Parameter estimation

1.1. Sampling distribution
1.2. Sampling errors
1.3. Confidence interval
1.4. Choice of estimator
1.5. Accuracy and bias of estimator

Unit-4: Correlation and Regression

1.1. Correlation Analysis, Serial or Auto-Correlation, Cross-Correlation, Inferences on Correlation Coefficient, Kendall's Rank Correlation Test
1.2. Simple Linear Regression, Estimation of Parameters, Goodness of Regression
1.3. Multiple Linear Regression, Estimation of Parameters, Goodness of Regression
1.4. Analysis of variance ANOVA
1.5. Model fit validation using diagnostic analysis

Unit-5: Hypothesis Testing

5.1. The t-distribution
5.2. Chi-Square Distribution
5.3. Tests Concerning Variances of Two Populations

Unit-6: Introduction to time series

4.6. Components of time series
4.7. Filtering and smoothing
4.8. Serial correlation
4.9. ARIMA Models
4.10. Advance modeling

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Al-Karkhi, A. F., & Alqaraghuli, W. A. (2019). *Applied statistics for environmental science with R*. Elsevier.
2. David, V. (2019). *Statistics in Environmental Sciences*. John Wiley & Sons.
3. Maity, R. (2018). Basic Concepts of Probability and Statistics. In *Statistical Methods in Hydrology and Hydroclimatology* (pp. 7-51). Springer, Singapore.
4. Rodda, H. J., & Little, M. A. (2015). *Understanding mathematical and statistical techniques in hydrology: an examples-based approach*. John Wiley & Sons.
5. Manly, B. F. (2008). *Statistics for environmental science and management*. Chapman and Hall/CRC.

ENSC-301: STATISTICS IN ENVIRONMENTAL SCIENCE (PRACTICAL) (01 Credit hr)

PRE-REQUISITES: F.Sc. or equivalent

LEARNING OUTCOMES

- This course will provide practical knowledge about the statistical applications in Environment
- The students will be able to calculate the measures of central tendency, dispersion and symmetry for different application in environment
- They will practice on distribution fitting and parameter estimation techniques.
- They will become conversant with different software packages and their applications in performing statistical analysis on environmental data.

CONTENTS

This course is designed to make student learn about various statistical analysis on environmental data along with the practical applications on probability distributions, correlation, regression and time series analysis. This course also includes practical applications of different software's packages for statistical analyses in environmental sciences.

Unit-1: Statistical Analysis of Data

1.1. Practical examples on measures of central tendency, dispersion and symmetry
1.2. Estimation of correlation of different variables
1.3. Practical applications of simple and multiple regression analysis

Unit-2: Probability Distributions

2.8. Distribution fitting
2.9. Parameter estimation problems
2.10. Comparisons of different frequency distributions goodness of fit analysis

Unit-3: Time series Analysis

1.3. Practical application of time series analysis regarding environmental variables
1.4. Modeling of environmental data
1.5. Future forecasting of environmental variables

Unit-4: Software Packages for Statistics

1.3. Statistical Analysis using MS Excel
1.4. Statistical Package for Social sciences (SPSS)
1.5. Introduction to R- Programming for Statically analysis

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Al-Karkhi, A. F., & Alqaraghuli, W. A. (2019). *Applied statistics for environmental science with R*. Elsevier.
2. David, V. (2019). *Statistics in Environmental Sciences*. John Wiley & Sons.
3. Maity, R. (2018). Basic Concepts of Probability and Statistics. In *Statistical Methods in Hydrology and Hydroclimatology* (pp. 7-51). Springer, Singapore.
4. Rodda, H. J., & Little, M. A. (2015). *Understanding mathematical and statistical techniques in hydrology: an examples-based approach*. John Wiley & Sons.
5. Manly, B. F. (2008). *Statistics for environmental science and management*. Chapman and Hall/CRC.

ENSC-302: ANALYTICAL CHEMISTRY (THEORY) (02 Credit hrs)

PRE-REQUISITES: ENSC-112

LEARNING OUTCOMES

Upon completion of this Unit-, students will have

- A clear idea about sampling procedures, precise measurement and analysis of environmental pollution using different Instruments.
- Understand and apply the fundamental principles of analytical chemistry
- Understand and follow standard documented procedure of analysis.

CONTENTS

Sampling procedures, Preservation and sample digestion**.** Analytical techniques in Environmental Sciences, Spectroscopic methods (UV/VIS, IR, AAS, FES), Chromatographic techniques and Gravimetric analysis.

Unit-1: Introduction to Analytical Chemistry

1.1. Role of Analytical chemistry in environment
1.2. Analytical process
1.3. Errors and its types
1.4. Qualitative and Quantitative analysis

Unit-2: Classical methods of analysis

2.1. Volumetric analysis and its types
2.2. Gravimetric analysis
2.3. Classical methods versus instrumental analysis

Unit-3: Instrumental methods of analysis

3.1 Types of instrumental analysis their advantages and disadvantage

Unit-4: Spectroscopic analysis

4.1. Electromagnetic spectra
4.2. Absorption and Emission phenomenon
4.3. Lambert Beer's law
4.4. Flame Emission photometry and its applications in environment
4.5. Atomic Absorption spectrophotometry
4.6. Molecular analysis UV/VIS and IR Spectrometry

Unit-5: Chromatographic analysis

5.1. Adsorption and Partition chromatography
5.2. Paper, Column and Thin Layer Chromatography
5.3. Principle and working of Gas chromatography and GCMS
5.4. High Pressure Liquid Chromatography (HPLC).

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Daniel, C. H., & Charles A. L. (2020). *Quantitative Chemical Analysis*. W.H. Freeman & Company, New York
2. Dunkle, M. N., & Winniford, W. L. (Eds.). (2020). *Analytical Techniques in the Oil and Gas Industry for Environmental Monitoring*. John Wiley & Sons.
3. Lucio, P. (2019). *Analytical Chemistry: Processes and Techniques*. Willford Press
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.

ENSC-302: ANALYTICAL CHEMISTRY (PRACTICAL) (01 Credit hr.)

PRE-REQUISITES: ENSC-112

LEARNING OUTCOMES

Upon completion of this Unit-, students will have

- A clear idea about sampling procedures, precise measurement and analysis of environmental pollution using different Instruments.
- Understand and apply the fundamental principles of analytical chemistry
- Understand and follow standard documented procedure of analysis.

CONTENTS

Sampling procedures, Preservation and sample digestion**.** Analytical techniques in Environmental Sciences, Spectroscopic methods (UV/VIS, IR, AAS, FES), Chromatographic techniques and Gravimetric analysis.

Unit-1: Sampling techniques for chemical analysis of Air, Water and Soil

Unit-2: Pre-concentration methods

Unit-3: Different digestion methods and sample preparation

Unit-4: Cationic estimation by Flame photometry

Unit-5: Estimation of metal ions by Atomic Absorption Spectrophotometer in different of samples

Unit-6: Determination of anions and other colored pollutants by UV/VIS Spectrophotometry

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Daniel, C. H., & Charles A. L. (2020). *Quantitative Chemical Analysis*. W.H. Freeman & Company, New York
2. Dunkle, M. N., & Winniford, W. L. (Eds.). (2020). *Analytical Techniques in the Oil and Gas Industry for Environmental Monitoring*. John Wiley & Sons.
3. Lucio, P. (2019). *Analytical Chemistry: Processes and Techniques*. Willford Press
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.

ENSC-303: CONSERVATION BIOLOGY (THEORY) (02 Credit hrs)

PRE-REQUISITES: ENSC-204, ENSC-209

LEARNING OUTCOMES

- Understanding the concepts of Biodiversity
- Explaining the importance of biodiversity
- Understanding the concept of conservation and its significance
- Underpinning the threats to biodiversity
- Understanding the ways to manage biodiversity
- Explaining the biodiversity and modern human challenges

CONTENTS

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.

Unit 1: Biodiversity and its importance

1.1. Definitions and types of biodiversity
1.2. Species, genes and ecosystem diversity and their significance
1.3. Alpha, beta and gamma diversity
1.4. Economic, ecological, aesthetic, cultural and educational Values of biodiversity

Unit 2: Threats to Biodiversity

2.1.1. Extinction rate and extinction processes, IUCN red list of endangered species
2.1.2. Habitat loss, habitat fragmentation, pollution, desertification
2.1.3. Overexploitation and history of species extinction
2.1.4. Invasive species, disease, climate change

Unit 3: Maintaining Biodiversity

3.1. Fundamentals of conservation biology
3.2. Ex-situ and in-situ conservation strategies
3.3. Protecting and managing ecosystems
3.4. Protecting and managing species and populations
3.5. Protected area, reserves and biodiversity conservation

Unit 4: Biodiversity and modern human challenges

4.5. Social factors and biodiversity
4.6. Economic factors, trade and biodiversity
4.7. Political factors and biodiversity

TEACHING – LEARNING STRATEGIES

- Lectures based examinations
- 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:

- Class participation,
- attendance,
- meeting deadlines of 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%	It takes place at the mid of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, deadlines of assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Gaston, K. J., & Spicer, J. I. (2013). *Biodiversity: an introduction*. John Wiley & Sons.
2. Gillespie, A. (2013). *Conservation, biodiversity and international law*. Edward Elgar Publishing.
3. Sodhi, N. S., & Ehrlich, P. R. (Eds.). (2010). *Conservation biology for all*. Oxford University Press.
4. Van Dyke, F. (2008). *Conservation biology: foundations, concepts, applications*. Springer Science & Business Media.
5. Primack, R. B., Primack, R. B., Primack, R. B., & Primack, R. B. (2008). *A primer of conservation biology* (No. QH75 P74 2000). Sunderland: Sinauer Associates.
6. Carroll, S. P., & Fox, C. W. (Eds.). (2008). *Conservation biology: evolution in action*. Oxford University Press.
7. Hunter Jr, M. L., & Gibbs, J. P. (2006). *Fundamentals of conservation biology*. John Wiley & Sons.

ENSC-303: CONSERVATION BIOLOGY (PRACTICAL) (01 Credit hr)

PRE-REQUISITES: ENSC-204, ENSC-209

LEARNING OUTCOMES

- Understanding fundaments of biodiversity
- Identification, classification and nomenclature of lab specimens of plants and animals
- Collection/observation of plants (bryophytes, peteredophytes, angiosperm and gymnosperms), for their nomenclature, classification and understanding various systems
- Collection/observation of animals (amphibians, reptiles, birds, mammals) their nomenclature, classification and understanding various systems
- Understanding various ecological processes such as, pollination, competition, predation, parasitism in the field
- Underpinning threats to species, population and ecosystem
- Understanding management of biodiversity at Ex-situ and is-situ sites

CONTENTS

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.

Unit-1: Fundamentals of Biodiversity and Conservation

1.1. Demonstrating fundamental concept of biodiversity
1.2. Explaining/demonstrating, genes, species, population, community and ecosystem
1.3. Evaluating values of different species

Unit-2: Plants and Biodiversity

2.1. Collection/observation of various plants
2.2. Identification of various plants
2.3. Nomenclature, classification of plants
2.4. Understanding various systems in plants

Unit-3: Animal and Biodiversity

3.1. Collection/observation of various animals
3.2. Identification of various animals
3.3. Nomenclature, classification of animals
3.4. Understanding various systems in animals

Unit-4: Evaluation of Threats to Biodiversity

4.1. Considering some model plant species and evaluating its threats
4.2. Considering some model animal species and evaluating its threats
4.3. Evaluating threats to some model ecosystems

Unit-5: Biodiversity Management

5.1. Visiting some ex-situ site (e.g. botanical gardens) and understating measures taken for species conservation

5.2. Visiting some in-situ site (e.g. national park) and understating measures taken for species conservation
5.3. Enlisting protected areas in Pakistan and their significance in biodiversity conservation

TEACHING – LEARNING STRATEGIES

- Lectures and practical performance based examinations
- Demonstrations,
- Field based learning
- 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:

- Class participation,
- attendance, practical performance
- meeting deadlines of 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%	It takes place at the mid of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, deadlines of assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Gaston, K. J., & Spicer, J. I. (2013). *Biodiversity: an introduction*. John Wiley & Sons.
2. Gillespie, A. (2013). *Conservation, biodiversity and international law*. Edward Elgar Publishing.
3. Sodhi, N. S., & Ehrlich, P. R. (Eds.). (2010). *Conservation biology for all*. Oxford University Press.
4. Van Dyke, F. (2008). *Conservation biology: foundations, concepts, applications*. Springer Science & Business Media.
5. Primack, R. B., Primack, R. B., Primack, R. B., & Primack, R. B. (2008). *A primer of conservation biology* (No. QH75 P74 2000). Sunderland: Sinauer Associates.
6. Hunter Jr, M. L., & Gibbs, J. P. (2006). *Fundamentals of conservation biology*. John Wiley & Sons.
7. Lindenmayer, D., & Burgman, M. (2005). *Practical conservation biology*. Csiro Publishing.

ENSC-304: WATER POLLUTION AND CONTROL (THEORY) (02 Credit hrs)

PRE-REQUISITES: ENSC-203

LEARNING OUTCOMES

- 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.

CONTENTS

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.

Unit-1: Introduction

1.1. Major Water pollutants
1.2. Polluted Rivers of the World
1.3. Chemical, Physical and Biological properties of polluted water
1.4. Acidity, alkalinity, electric conductivity (EC), Suspended Solids (TSS), Total Dissolved Solids (TDS), Dissolved Oxygen (DO)
1.5. Glossary of water pollution

Unit-2: Sources for water Pollution

2.1. Groundwater Pollution
2.2. Measure of water quality
2.3. Heavy metal pollution
2.4. Eutrophication
2.5. Characterization of polluted water

Unit-3: Flow measurement and essential calculations

3.1. Pollution load calculations
3.2. Chemical feed, dose, demand, residual, and chemical concentrations
3.3. Removal efficiency, detention time, and chemical blending
3.4. Surface loading rate, F/M and MCRT ratios

Unit-4: Water Pollution Control

4.1. NEQS
4.2. Testing methods (BOD, COD, TOC, etc)
4.3. Pollution reduction at source, effluent disposal
4.4. Preliminary treatment, Primary treatment, Secondary treatment, Advanced and tertiary treatment
4.5. Principle and types of aerobic and anaerobic treatment methods
4.6. Collection and transportation of wastes, Optimization, Recycling & Reuse

TEACHING – LEARNING STRATEGIES

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

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weight age 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. SpringerLink (Online service), Singh, A., Agrawal, M., & Agrawal, S. B. (2021). *Water pollution and management practices*. Springer.
2. Filho, L., & Witschel. (2020). *Clean Water and Sanitation*. Springer International Publishing.
3. Pandit, A. B., & Kumar, J. K. (2019). *Drinking water treatment for developing countries: Physical, chemical and biological pollutants*. Royal Society of Chemistry.
4. Furia, E. W., Pierson, J., & Tourbier, J. (2016). *Biological Control of Water Pollution*. University of Pennsylvania Press.
5. PALCI EBSCO books & Allin, C. W. (2012). *Water and water pollution*. Salem Press.
6. Woodard & Curran, Inc., Books24x7, Inc., & Woodard, F. (2006). *Industrial waste treatment handbook, second edition* (2nd ed.). Elsevier/Butterworth-Heinemann.

ENSC-304: WATER POLLUTION AND CONTROL (PRACTICAL) (01 Credit Hr)

PRE-REQUISITES: ENSC-203

LEARNING OUTCOMES

- This course will provide a demonstration about the different instrumentation used in the assessment of major water pollutants
- Students will learn about the practical aspects of domestic and industrial water pollution
- They will also get the working knowledge about standard testing protocols for evaluation of pollutants in water/wastewater

CONTENTS

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.

Unit-1: Introduction of water pollution laboratory, instrumentation, treatment set-ups, and sampling techniques

Unit-2: Determination of drinking water parameters

Unit-3: Determination of Total Suspended Solids (TSS), Total Dissolved Solids (TDS) and Dissolved Oxygen (DO)

Unit-4: Determination of pH, acidity and alkalinity and Electric Conductivity (EC) in water/wastewater

Unit-5: Calculation of pollution load in industrial discharges

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

Recommended Text Books / Suggested Readings

1. SpringerLink (Online service), Singh, A., Agrawal, M., & Agrawal, S. B. (2021). *Water pollution and management practices*. Springer.
2. Filho, L., & Witschel. (2020). *Clean Water and Sanitation*. Springer International Publishing.
3. Pandit, A. B., & Kumar, J. K. (2019). *Drinking water treatment for developing countries: Physical, chemical and biological pollutants*. Royal Society of Chemistry.
4. Furia, E. W., Pierson, J., & Tourbier, J. (2016). *Biological Control of Water Pollution*. University of Pennsylvania Press.
5. PALCI EBSCO books & Allin, C. W. (2012). *Water and water pollution*. Salem Press.
6. Woodard & Curran, Inc., Books24x7, Inc., & Woodard, F. (2006). *Industrial waste treatment handbook, second edition* (2nd ed.). Elsevier/Butterworth-Heinemann.

ENSC 305 OCCUPATIONAL SAFETY AND HEALTH (THEORY) (02 Credit hrs.)

PRE-REQUISITES: F.Sc. or equivalent

LEARNING OUTCOMES:

After successful completion of this course, students will be able to:

- 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
- review the principles for developing and implementing a successful occupational health and safety program and evaluation of a work site
- develop an occupational safety and health program based on national and international standards

CONTENTS

This course is a foundation of Occupational Health & Safety covering all basic areas of this discipline, such as occupational safety, industrial hygiene, ergonomics, etc.

Unit-1: Introduction

1.1. Introduction of occupational health & safety
1.2. History of health and safety
1.3. Evolution of health and safety standards
1.4. Industrial hygiene
1.5. Role of national/international agencies

Unit-2: Elements of Occupational Health and Safety

2.1. Elements of ILO-OSH 2001, elements of OHSAS 18001
2.2. Elements of ISO 45001
2.3. Features and contents of OHS policy,

Unit-3: Health & safety culture

3.1. Concept and significance of Health & safety culture
3.2. Factors influencing safety related behavior and improving such behaviors

Unit-4: Planning and Implementation

4.1. Principles and practice of risk assessment
4.2. Hierarchy of controls
4.3. Electrical safety
4.4. Confined spaces
4.5. Permit to work system
4.6. Impact of temporary works
4.7. Physical and psychological health hazards and risk control
4.8. Emergency preparedness
4.9. Personal protective equipment

Unit-5: Inspection and Audit system

5.2. Inspection system
5.3. Safety audits
5.4. Reporting systems
5.5. Management review

Unit-6: Special hazards

6.1. Hazardous substances and health effects
6.2. Toxicology and importance of material safety data sheet
6.3. Lock out/tag out

6.4. Work at height
6.5. Fire safety
6.6. Ergonomics/musculoskeletal disorders and risk control
6.7. Occupational noise control

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Hughes, P., & Ferrett, E. (2020). *Introduction to Health and Safety at Work: For the NEBOSH National General Certificate in Occupational Health and Safety*. Routledge.
2. Friend, Mark A., and James P. Kohn. (2018). *Fundamentals of Occupational Safety And Health*. Rowman and Littlefield.
3. David L. Geotech, (2015). *The Basics of Occupational Safety, 2nd Edition*, Pearson Education, Inc.
4. Kelloway, E. Kevin, Karina Nielsen, and Jennifer K. Dimoff, eds. (2017*). Leading to Occupational Health and Safety: How Leadership Behaviours Impact Organizational Safety and Well-Being*. John Wiley and Sons.
5. Brauer, Roger L. (2016). *Safety and health for engineers*. John Wiley and Sons.
6. N. Sesha Prakash, (2017). *Manual of Fire Safety*. CBS Publishers and Distributors.

ENSC-305: OCCUPATIONAL HEALTH AND SAFETY (PRACTICAL) (1 Credit hr)

PRE-REQUISITES: F.Sc. or equivalent

LEARNING OUTCOMES

- This course will provide a demonstration about the different instruments.
- The students will learn about the practical aspects of measuring and monitoring of occupational health and safety.

CONTENTS

Unit-1: Personal protective equipment

Unit-2: Monitoring

2.1. Noise level monitoring
2.2. Illumination level monitoring
2.3. Relative humidity and workplace temperature monitoring

Unit-3: Identification

3.1. Hazard identification and risk assessment techniques
3.2. Development of emergency response plan

Unit-4: Fire safety and development of emergency response plan

Unit-5: Biological monitoring

5.3. Workplace air and drinking water
5.4. First aid and Cardio Pulmonary Resuscitation (CPR)

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Hughes, P. and Ferrett, E., (2020). *Introduction to Health and Safety at Work: For the NEBOSH National General Certificate in Occupational Health and Safety*. Routledge.
2. Brauer, Roger L. (2016). *Safety and health for engineers*. John Wiley and Sons.
3. N. Sesha Prakash, (2017). *Manual of Fire Safety.* CBS Publishers and Distributors.

ENSC-306: SOLID WASTE MANAGEMENT (THEORY) (02 Credit hrs.)

PRE-REQUISITES: ENSC-203

LEARNING OUTCOMES

Upon completion of the course, students will be able to:

- Analyze a solid waste stream for its composition and properties
- Describe the processes involved in collection, transport, processing and disposal of waste
- Identify the waste management options from reduce to final disposal
- Identify the hazardous waste components

CONTENTS

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.

Unit-1: Introduction to Solid Waste Management

1.1. Definition of solid waste and Solid Waste Management
1.2. Types of solid waste
1.3. Properties of solid waste (Physical and chemical characteristics of solid waste)
1.4. Environmental and health impacts of solid waste
1.5. Their generation, Disposal and treatment
1.6. Six functional elements of Solid Waste Management (Generation, Storage, Collection, Transfer and Transport, Processing, Handling, Disposal)

Unit-2: Processing Techniques of Solid Waste

2.1. Mechanical Volume Reduction (Compaction)
2.2. Chemical Volume Reduction (Incineration)
2.3. Mechanical Size Reduction (Shredding)
2.4. Component Separation (Recycling)
2.5. Drying and dewatering (Moisture reduction)

Unit-3: Biological Treatment

3.1. Biogas
3.2. Composting techniques

Unit-4: Final Disposal

4.1. Landfilling and its types
4.2. Applications of landfilling

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Rao, M. N., Sultana, R., Kota, S. H., Shah, A., & Davergave, N. (2016). *Solid and hazardous waste management: science and engineering*. Butterworth-Heinemann.
2. 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.
3. 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.
4. Chang, N. B., & Pires, A. (2015). *Sustainable solid waste management: a systems engineering approach*. John Wiley & Sons.
5. Khan, I. H., & Ahsan, N. (2003). Textbook of solid waste management. *Satish Kumar Jain for CBS Publisher and Distributors, New Delhi, 608p*.

ENSC-306: SOLID WASTE MANAGEMENT (PRACTICAL) (1 Credit hr.)

PRE-REQUISITES: ENSC-203

LEARNING OUTCOMES

This course will provide a demonstration about the practical aspects of solid waste management. The students will be able to:

- Learn the waste sampling techniques.
- Perform compositional analysis.
- To have idea about waste to energy techniques.
- Determine waste generation rate and design the waste collection routes.

CONTENTS

This course deals with practical aspects of SWM such as physical and chemical analysis of solid waste and determination of solid waste generation rate.

Unit-1

1.1. Physical analysis of solid waste
1.2. Study of physical properties of solid waste

Unit-2

2.1. Chemical analysis of solid waste
2.2. Study of chemical characteristics of solid waste (Moisture Content, Proximate Analysis)
2.3. Preparation of representative solid waste sample
2.4. Solid waste digestion for chemical analysis

Unit-3

3.1. Generation rates of solid waste
3.2. Determination of generation rates of solid waste

Unit-4

4.1. Field Trips/ Visits
4.2. SWM Offices, Workshop, Hospital waste Incinerator facility, Compositing plant, Recycling facility, Landfill site)

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Rao, M. N., Sultana, R., Kota, S. H., Shah, A., & Davergave, N. (2016). *Solid and hazardous waste management: science and engineering*. Butterworth-Heinemann.
2. 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.
3. 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.
4. Chang, N. B., & Pires, A. (2015). *Sustainable solid waste management: a systems engineering approach*. John Wiley & Sons.
5. Khan, I. H., & Ahsan, N. (2003). Textbook of solid waste management. *Satish Kumar Jain for CBS Publisher and Distributors, New Delhi, 608p*.

3rd YEAR, SIXTH SEMESTER			
Code	**Course Title**	**C.H.**	**Course Type**
HQ-006	Translation of Holy Quran	01	Compulsory
ENSC-307	Natural Hazards and Disaster Management	2+0	Major Elective
ENSC-308	Chemistry of Indigenous Industrial Effluents	2+1	Basic Course
ENSC-309	Advanced Ecology	3+1	Major Elective
ENSC-310	Wastewater Treatment	2+1	Major Elective
ENSC-311	Environmental Impact Assessment	03	Major Elective
ENSC-312	Environmental Management Systems	2+1	Major Elective
	Total Credit Hrs Semester-VI	**19**	

HQ-006: TRANSLATION OF HOLY QURAN (01 Credit hr)

PRE-REQUISITE: HQ-001, 002 Translation of Holy Quran

COURSE OUTLINE

سورة الشعرا تا سورة ص

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after mid term 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

ENSC-307: NATURAL HAZARDS AND DISASTER MANAGEMENT (THEORY) (2 Credit hrs)

PRE-REQUISITES: ENSC-205

LEARNING OUTCOMES

- To identify potential areas of natural hazards, learn prevention strategies and disaster management.
- Describe common earth materials and their relationship to natural hazards
- Explain the causes and effects of Natural Hazards
- Use the above knowledge to discuss Natural Hazards and humans' activities

CONTENTS

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.

Unit-1: Disaster Management

1.1. Fundamentals of Disaster Management
1.2. Prevention and Mitigation
1.3. Preparation, Response, and Recovery
1.4. Disaster management cycle
1.5. Tools to assist Disaster management
1.6. Pak. Disaster Management Authority

Unit-2: Earthquake

2.1. Introduction to an earthquake
2.2. Faults and tectonic plates
2.3. Earthquake waves
2.4. Measurement of seismic waves
2.5. Earthquakes and humans
2.6. Earthquake prediction

Unit-3: River system and flooding

1.1. River Processes and flooding
1.2. Development of flooding
1.3. The nature and extent of flood hazards
1.4. The response to flood hazards
1.5. Floods causes and mitigation measure

Unit-4: Landslide

4.1. Introduction to landslides
4.2. Types of landslides
4.3. Human use and landslides
4.4. Minimizing the landslide hazard
4.5. Perception of the landslide hazard

Unit-5: Volcanism

5.3. Introduction to volcanic hazards
5.4. Volcanism and volcanoes
5.5. Volcanic hazards
5.6. Prediction of volcanic activity
5.7. Adjustment to and perception of the volcanic hazard

Unit-6: Atmospheric Hazards

1.1. Temperature Extremes
1.2. Severe Precipitation, Hailstorms, and Wind storms
1.3. Tornadoes and Hurricanes
1.4. Cyclones and Lightening

TEACHING – LEARNING STRATEGIES

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

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is a 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is a continuous assessment. It includes classroom participation, attendance, assignments, and presentation, homework, attitude and behavior, hands-on activities, short tests, quizzes, etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on a term paper, research proposal development, fieldwork, and report writing, etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Reichard, J. (2021). *Environmental Geology*, (4th ed.), McGraw-Hill
2. Montgomery, C. (2020) *Environmental Geology*, 11th Edition, McGraw-Hill
3. Plummer, C., Carlson, D., & Hammersley, L. (2019). *Physical Geology*, 16th Edition, McGraw-Hill
4. Keller, E. A., & DeVecchio, D. E. (2016). *Natural hazards: earth's processes as hazards, disasters, and catastrophes*. Routledge.
5. Montz, B. E., Tobin, G. A., & Hagelman, R. R. (2017). *Natural hazards: explanation and integration*. Guilford Publications.
6. Davis, G. H., Reynolds, S. J., & Kluth, C. F. (2011). *Structural geology of rocks and regions*. John Wiley & Sons.

Further Reading: As suggested by the Instructor.

ENSC-308: INDUSTRIAL POLLUTION AND ITS CONTROL (THEORY) (02 Credit hrs)

PRE-REQUISITES: ENSC-304

LEARNING OUTCOMES

This course will allow the students to:

- Develop a clear grasp on the processes and raw materials used in various manufacturing industries
- Understand the environmental impacts of industrial emissions and resource use.
- Understand how industrial waste can be avoided, reduced and managed in an environmental and economically sound manner
- Critically analyze technologies better suited for characteristic contaminants

CONTENTS

This course introduces students to selected major industries, chemistry of processes involved, types of wastes produced, and the techniques for the prevention, treatment and recycling of these wastes at international scale.

Unit-1: Introduction

1.1. Industrial pollution
1.2. National and international standards for various emissions
1.3. Concept of cleaner production

Unit-2: Unit- II Leather Tanning Industry

2.1. Tanning agents and other chemical used
2.2. Industrial process involved
2.3. Control of solid waste and odor issue
2.4. Control and removal of BOD and Chromium among other contaminants

Unit-3: Sugar Manufacturing Industry

3.1. Sugar production at national and global scales
3.2. Juice clarification processes, benefits and drawbacks of each with respect to chemicals
3.3. Production and reuse of bagasse
3.4. Technique suitable for effluent treatment

Unit-4: Unit- IV Fertilizer Industry

4.1. Raw materials used, types of fertilizers
4.2. Closed loop manufacturing, reuse of by-products
4.3. Hydrodynamic cavitation for ammonia removal
4.4. Waste Activated Sludge Stripping to Remove Internal Phosphorus

Unit-5: Unit- V Paper and Pulp Industry

5.1. Commonly used raw material and substitutes
5.2. Types of pulping processes, environmental impacts
5.3. Recycling of Paper
5.4. Reuse of solid by-products
5.5. Treatment techniques for effluent

Unit-6: Unit- VI Textile Industry

6.1. Production units and types of textiles
6.2. Chemicals and production process

6.3. Removal of dyes from effluent
6.4. Reuse of textile fibers in various applications (Case studies)

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Documentary and 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,
- Critical thinking interactive discussions
- Quizzes and Short tests

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. da Silva, F. J. G., & Gouveia, R. M. (2019). *Cleaner Production: Toward a Better Future*. Springer International Publishing.
2. Purkait, M. K., Mondal, P., & Chang, C. T. (2019). *Treatment of Industrial Effluents: Case Studies*. CRC Press.
3. Ranade, V. V., & Bhandari, V. M. (2014). *Industrial wastewater treatment, recycling and reuse*. Butterworth-Heinemann.
4. Bhattia, S. C., 2011. Environmental Pollution Control in Chemical Process Industries. Khanna Publishers, Delhi.
5. Wang, L. K., Hung, Y. T., Lo, H. H., & Yapijakis, C. (Eds.). (2005). *Waste treatment in the process industries*. CRC Press.

ENSC-308: INDUSTRIAL POLLUTION AND ITS CONTROL (PRACTICAL) (01 Credit hr)

PRE-REQUISITES: ENSC-304

LEARNING OUTCOMES:

- To enable the students to distinguish between different types of sampling techniques
- To enable the student to characterize pollutants of concern
- Help understand the use different lab equipment for the determination of physical parameters of industrial effluents
- To allow the students to detect and estimate different heavy metals present in effluents
- To critically analyze methods to remove heavy metals with different adsorbent media

CONTENTS

This course will provide the students with a practical exposure of sampling and analyzing industrial effluents. It will provide a hand on experience of preparing sample solution for the analysis of various heavy metals and use of adsorbent media to treat effluents.

Unit-1

1.1. Industrial wastewater sampling techniques

Unit-2

2.1. Characterization of pollutants

Unit-3

3.1. Determination of physical parameters of industrial effluents

Unit-4

4.1. Determination of heavy metals in industrial effluents through Atomic Absorption Spectrophotometer

Unit-5

5.1. Preparation of adsorbent media for heavy metal removal

Teaching – Learning Strategies

- Lecture based examination
- Laboratory participation
- Viva
- Class discussion

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/laboratory participation,
- attendance, assignments and presentation,
- attitude and cautiousness in laboratory
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Purkait, M. K., Mondal, P., & Chang, C. T. (2019). *Treatment of Industrial Effluents: Case Studies*. CRC Press.
2. Russell, D. L. (2019). *Practical wastewater treatment*. John Wiley & Sons.
3. Rubio-Rincón, F. J., Welles, L., Lopez-Vazquez, C. M., Nierychlo, M., Abbas, B., Geleijnse, M., ... & Brdjanovic, D. (2017). Long-term effects of sulphide on the enhanced biological removal of phosphorus: the symbiotic role of Thiothrix caldifontis. *Water research*, *116*, 53-64.
4. Einschlag, F. S. G., & Carlos, L. (Eds.). (2013). *WasteWater: Treatment Technologies and Recent Analytical Developments*. BoD–Books on Demand.

ENSC-309: ADVANCED ECOLOGY (THEORY) (03 Credit hrs)

PRE-REQUISITES: ENSC-303

LEARNING OUTCOMES

- Understanding the Basic concepts of Ecology
- Understanding basic ecological principles
- Studying climate and biomes of the world
- Understanding the dynamics of population ecology
- Understanding dynamics of community ecology
- Understanding the concept of behavioral ecology
- Understanding restorations of ecosystems and challenges

CONTENTS

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.

Unit-1: Introduction to Ecology and Ecological principles

1.1. Definition and types of ecology
1.2. Abiotic and biotic parts of the ecosystem and their interactions
1.3. Concept of flow of energy and recycling of nutrients
1.4. Ecological processes such as pollination, erosion, succession, desertification
1.5. Autecology and synecology

Unit-2: Climate and Biomes

2.1. Understanding climatic patterns of the world
2.2. Major terrestrial biomes Major aquatic biomes
2.3. Coral reefs, estuaries and coastline ecosystems including mangroves

Unit-3: Population Ecology

3.1. Explaining species and populations
3.2. Concept of subpopulation, meta populations and satellite population
3.3. Intraspecific and interspecific interactions
3.4. Population demography, growth, survivorship curve, decline, threats
3.5. Speciation, evolution, dispersal, natural and artificial selection

Unit-4: Community and Ecosystem Ecology

4.1. Understanding interactions among populations
4.2. Concept of food chain, food web, food pyramid, feeding guilds
4.3. Predation, competition, mutualism, parasitism
4.4. Concept of home range and territories
4.5. Role of Keystone species and resources in maintaining ecosystems

Unit-5: Behavioral Ecology

1.1. Difference between plants and animals' behavior
1.2. Social grouping in animals
1.3. Feeding, roosting, nesting perching, foraging behavior
1.4. Mimicry, camouflage and deceptive behavior against prey
1.5. Reproductive, breeding and territorial behavior and parental care
1.6. Communication and signals

Unit-6: Restoration ecology

6.1. Introduction to restoration ecology
6.2. Difference between afforestation and reforestation
6.3. Types and intensity of disturbances in natural ecosystems
6.4. Restoration challenges for major ecosystems

TEACHING – LEARNING STRATEGIES

- Lectures based examinations
- 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:

- Class participation,
- attendance,
- meeting deadlines of 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%	It takes place at the mid of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, deadlines of assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Keddy, P. A. (2017). *Plant ecology*. Cambridge University Press.
2. Rubenstein, D. I., & Wrangham, R. W. (2016). *Ecological aspects of social evolution*. Princeton University Pres.
3. Holl, K. (2016). *Foundations of restoration ecology*. Island Press.
4. Davies, N. B., Krebs, J. R., & West, S. A. (2012). *An introduction to behavioural ecology*. John Wiley & Sons.
5. Hone, J. (2012). *Applied population and community ecology: the case of feral pigs in Australia*. John Wiley & Sons.
6. Bell, W. J. (2012). *Searching behaviour: the behavioural ecology of finding resources*. Springer Science & Business Media.
7. Krebs, J. R., & Davies, N. B. (Eds.). (2009). *Behavioural ecology: an evolutionary approach*. John Wiley & Sons.
8. Agarwal, S. K. (2008). *Fundamentals of ecology*. APH Publishing.
9. Beeby, A., & Brennan, A. M. (2008). *First ecology: ecological principles and environmental issues*. Oxford University Press.

ENSC-309: ADVANCED ECOLOGY (PRACTICAL) (01 Credit hr)

PRE-REQUISITES: ENSC-303

LEARNING OUTCOMES

- Understanding fundaments of ecology
- Understanding ecological principles
- Measuring plants and animals' diversity
- Understanding various ecological processes such as, pollination, competition, predation, parasitism in the field
- Underpinning threats to species, population communities and ecosystem
- Understanding behavior of different organisms
- Studying any model ecosystem, measuring its plants and animal diversity, its temporal deterioration
- Evaluating the measures and challenges for restorations of ecosystems

CONTENTS

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. Understating various behavior such as breeding, nesting, roosting, perching, feeding, foraging and escaping from prey behavior will also be studied in this practical course. Finally, the practical will also intend to visit different model ecosystems for species conservation. Lastly, some model habitats will be studied to see the human impacts on natural ecosystems and species and possible restoration measures.

Unit-1: Fundamentals of ecosystems

1.1. Understanding interaction between living and non-living parts of ecosystem
1.2. Understanding various processes in ecosystem
1.3. Evaluating values of different ecosystem

Unit-2: Plants and Ecosystems

2.1. Measuring plants diversity
2.2. Use diversity indices and models for plants
2.3. Evaluating role of plant species in ecosystem
2.4. Studying behavior of different plant species

Unit-3: Animal and Ecosystem

3.1. Measuring animal diversity
3.2. Use diversity indices and models for animals
3.3. Evaluation of role of animal species
3.4. Studying behavior of different animal species

Unit- 4: Evaluation of threats to Ecosystems

4.1. Studying model aquatic and terrestrial ecosystems and evaluating its threats
4.2. Evaluating threats to some model ecosystems
4.3. Evaluation of natural and anthropogenic threats

Unit- 5: Ecosystem restoration

5.1. Investigating disturbances in model ecosystem
5.2. Evaluating extent of disturbance and spatial and temporal damage
5.3. Measures to restore models' ecosystems
5.4. Evaluation of challenges in restoration of ecosystems

TEACHING – LEARNING STRATEGIES

- Lectures and practical performance-based examinations
- Demonstrations,
- Field based learning
- 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:

- Class participation,
- attendance, practical performance
- meeting deadlines of 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%	It takes place at the mid of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, deadlines of assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Keddy, P. A. (2017). *Plant ecology*. Cambridge University Press.
2. Slingsby, D., & Cook, C. (2016). *Practical ecology*. Macmillan International Higher Education.
3. Rubenstein, D. I., & Wrangham, R. W. (2016). *Ecological aspects of social evolution*. Princeton University Pres.
4. Holl, K. (2016). *Foundations of restoration ecology*. Island Press.
5. Davies, N. B., Krebs, J. R., & West, S. A. (2012). *An introduction to behavioural ecology*. John Wiley & Sons.
6. Hone, J. (2012). *Applied population and community ecology: the case of feral pigs in Australia*. John Wiley & Sons.
7. Bell, W. J. (2012). *Searching behaviour: the behavioural ecology of finding resources*. Springer Science & Business Media.
8. Krebs, J. R., & Davies, N. B. (Eds.). (2009). *Behavioural ecology: an evolutionary approach*. John Wiley & Sons.
9. Agarwal, S. K. (2008). *Fundamentals of ecology*. APH Publishing.
10. Beeby, A., & Brennan, A. M. (2008). *First ecology: ecological principles and environmental issues*. Oxford University Press.

ENSC-310: WASTEWATER TREATMENTS (THEORY) (02 Credit hrs)

PRE-REQUISITES: ENSC-304

LEARNING OUTCOMES

- Students will understand various types of methods and technologies employed in wastewater treatment
- Students should be able to select an economical and effective wastewater treatment system for a specific application
- At the end of the course, the students will have a working knowledge of the water and wastewater industry, and have the skills to perform a preliminary design of a treatment plant

CONTENTS

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.

Unit-1: Introduction to Wastewater Treatment

1.1. Definition and levels of wastewater
1.2. Water Treatment Philosophy
1.3. Importance and goals of wastewater treatment
1.4. Evaluation and Selection of Treatment Systems

Unit-2: Wastewater Characterization

2.1. Domestic and industrial wastewater
2.2. Wastewater collection systems
2.3. Wastewater flow rates and Flow Equalization
2.4. Measurements and monitoring discharge

Unit-3: Wastewater treatment methods

3.1. Preliminary Treatments, Primary Treatments, Secondary Treatments, Tertiary Treatments
3.2. Trickling Filters, Activated Sludge Tanks, Oxidation Tanks, Constructed Wetlands
3.3. Anaerobic, suspended, and attached growth biological treatment processes
3.4. Adsorption, Chemical unit processes, Disinfection processes, disposal of solids, Treatment plant performance, Advanced oxidation processes

Unit-4: Re-use and recycling

4.1. Wastewater reuse guidelines, ZLD
4.2. Technologies, practices and examples: feasibility in Pakistan
4.3. Case studies of wastewater recycling; grey water reuse
4.4. Cost and economics analysis

TEACHING – LEARNING STRATEGIES

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

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weight age 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. SpringerLink (Online service), Inamuddin, Ahamed, M. I., & Lichtfouse, E. (2021). *Water pollution and remediation: Organic pollutants*. Springer.
2. ProQuest Ebook Subscriptions, Rene, E. R., Shu, L., & Jegatheesan, V. (2020). *Sustainable eco-technologies for water and wastewater treatment*. IWA Publishing.
3. Pandit, A. B., & Kumar, J. K. (2019). *Drinking water treatment for developing countries: Physical, chemical and biological pollutants*. Royal Society of Chemistry.
4. Chen, J., Luo, J., Luo, Q., Pang, Z., & Group, C. E. P. (2018). *Wastewater treatment: Application of new functional materials*. China Environment Publishing Group ; Walter de Gruyter.
5. Woodard & Curran, Inc., Books24x7, Inc., & Woodard, F. (2006). *Industrial waste treatment handbook, second edition* (2nd ed.). Elsevier/Butterworth-Heinemann.
6. Metcalf & Eddy, Tchobanoglous, G., Burton, F. L., & Stensel, H. D. (2003). *Wastewater engineering: Treatment and reuse* (4th ed.). McGraw-Hill.

ENSC-310: WASTEWATER TREATMENT (PRACTICAL) (01 Credit hr.)

PRE-REQUISITES: ENSC-304

LEARNING OUTCOMES

- This laboratory-based course will provide a demonstration about the different treatment methods for the removal of pollutants from water/wastewater

CONTENTS

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.

Unit-1

1.1. Physio-chemical treatments (coagulation, flocculation, settling, flotation, adsorption, membranes)

Unit-2

2.1. Color/COD/BOD/TSS removal of industrial and synthetic effluents using cheap absorbents, such as ash, charcoal, wood, saw dust, brick powder, etc.

Unit-3

3.1. Wastewater Treatment methods based on Microfilteration, Ozonation, Fenton, Electro-coagulation, and Reverse osmosis

Unit-4

4.1. Determination of wastewater flow rate (V-notch study)

Unit-5

5.1. Pollution load determination in wastewater

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. SpringerLink (Online service), Inamuddin, Ahamed, M. I., & Lichtfouse, E. (2021). *Water pollution and remediation: Organic pollutants*. Springer.
2. ProQuest Ebook Subscriptions, Rene, E. R., Shu, L., & Jegatheesan, V. (2020). *Sustainable eco-technologies for water and wastewater treatment*. IWA Publishing.
3. Pandit, A. B., & Kumar, J. K. (2019). *Drinking water treatment for developing countries: Physical, chemical and biological pollutants*. Royal Society of Chemistry.
4. Chen, J., Luo, J., Luo, Q., Pang, Z., & Group, C. E. P. (2018). *Wastewater treatment: Application of new functional materials*. China Environment Publishing Group ; Walter de Gruyter.
5. Woodard & Curran, Inc., Books24x7, Inc., & Woodard, F. (2006). *Industrial waste treatment handbook, second edition* (2nd ed.). Elsevier/Butterworth-Heinemann.
6. Metcalf & Eddy, Tchobanoglous, G., Burton, F. L., & Stensel, H. D. (2003). *Wastewater engineering: Treatment and reuse* (4th ed.). McGraw-Hill.

ENSC-311: ENVIRONMENTAL IMPACT ASSESSMENT (THEORY) (3 Credit hrs)

PRE-REQUISITES: F.Sc. or equivalent

LEARNING OUTCOMES

- This course will provide an introduction to the Environmental Impact Assessment to the students.
- The students will learn how to identify the physical, biological and cultural impacts
- They will have the knowledge about the role of EIA in decision making.
- The students will get used to how to manage different Environmental Impacts.

CONTENTS

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.

Theory

Unit-1: Introduction to EIA

1.1. Definition, Principles, Origin and Development of EIA
1.2. Purposes, Objectives, Scope and Effectiveness of EIA
1.3. Different types of impacts considered in EIA
1.4. Physical, Biological and Social Aspects.

Unit-2: Screening and Scoping in EIA

2.1. What is Screening and how is it done
2.2. Checklists for Screening and Project Categorization
2.3. Scoping, its Purpose, Objectives Guiding Principles
2.4. How Scoping is undertaken and Role of Public

Unit-3: Methods and Techniques for Assessment of Impacts

3.1. Methods and Techniques used for Assessing Impacts in EIA
3.2. The most Frequently used EIA Methods and Techniques
3.3. Moderately used Methods and Techniques
3.4. Low usage of Methods and Techniques

Unit-4: Public Participation and Consultation in EIA

4.1. Key Role of Public Participation and Consultation in the EIA Process
4.2. The Public and Public Interest, Stakeholders and their Representatives
4.3. History and Rationale of Public Involvement in EIA
4.4. Participation and Consulting Techniques, Public Participation in Pakistan

Unit-5: EIA Baseline Data Collection, Consideration of Alternatives and Mitigation

5.1. What Baseline Data need to be Collected and Reported in EIA
5.2. Role of Alternatives in EIA
5.3. The Importance of Avoidance, Mitigation, as well as Compensation Measures
5.4. EIA Requirement of the World Bank and the Asian Development Bank

Unit-6: EIA Reporting and EIA Report Quality Review

6.1. The EIA Report, Focus of an EIA Report
6.2. Pakistan Guidelines for Preparing Environmental Reports of Specific Sectors
6.3. The Importance of EIA Quality Review, EIA Report Quality Review Packages
6.4. The EIA Report in Pakistan
6.5. Exercises related to IEE/EIA

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Baharul, I.K.M., and Mahfooz, N.Z. (2021) Environment Impact Assessment: Precept & Practice, CRC Press.
2. Biswas, W. (2020) Environmental Impact Assessment of Buildings, Sciprofile.
3. Manyuchi, M. M., Mbohwa, C., Muzenda, E., & Sukdeo, N. (2020). *Environmental Impact Assessments and Mitigation*. crc Press.
4. Morrison-Saunders, A. (2018). *Advanced introduction to environmental impact assessment*. Edward Elgar Publishing.
5. Fisher, T.B., and Nadeem, O. (2014) Environmental Impact Assessment: Course Curriculum for Higher Education Institutions in Pakistan, National Impact Assessment Programm.

ENSC-312: ENVIRONMENTAL MANAGEMENT SYSTEM (THEORY) (02 Credit hrs)

PRE-REQUISITES: ENSC-305

LEARNING OUTCOMES

Students will learn to:

- define the concept of Environmental Management Systems
- know about the history of Environmental Management Systems
- do an in-depth interpretation of ISO 14001 EMS Standard
- understand the importance of each element of ISO 14001 Environmental Management System Standard requirements.

CONTENTS

This course is intended to provide an understanding on 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.

Unit-1: Introduction to EMS

1.1. Definition
1.2. History
1.3. Global perspective
1.4. Benefits of EMS
1.5. Elements of EMS
1.6. Certification of EMS

Unit-2: Introduction to ISO 14001

2.1. Clauses of ISO 14001
2.2. Planning the project
2.3. Policy and planning
2.4. Implementation and operation
2.5. Checking and corrective action
2.6. Management review

Unit-3: The Environmental Management Manual

3.1. Introduction
3.2. Purpose
3.3. Contents of the manual

Unit-4: Launch of EMS

4.1. Introduction
4.2. Management meeting
4.3. Planning document distribution

Unit-5: Internal environmental auditing and Assessment

5.1. Introduction
5.2. The audit programs
5.3. Selecting and training of auditors
5.4. Standards for environmental auditing

Unit-6: Other Environmental management tools

6.1. Auditing standards
6.2. Labeling standards
6.3. LCA
6.4. Corporate Social Responsibility (CSR), Eco-Balances

6.5. Environmental Performance Indicators EPIs
6.6. Environmental auditing and auditing procedures
6.7. Cleaner production

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. 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.
2. Will, M. (2019). *An Operations Guide to Safety and Environmental Management Systems (SEMS): Making Sense of BSEE SEMS Regulations*. Gulf Professional Publishing.
3. Davy, A. (2017). Environmental management systems: ISO 14001 issues for developing countries. In *ISO 14001 and Beyond* (pp. 169-182). Routledge.
4. 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.
5. 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.

ENSC-312: ENVIRONMENTAL MANAGEMENT SYSTEM (PRACTICAL) (01 Credit hr)

PRE-REQUISITES: ENSC-305

LEARNING OUTCOMES:

Students will learn:

- Development of EMS manuals and policy
- Implementation and operation of EMS and authority do an in-depth interpretation of ISO 14001 EMS Standard
- Case studies for environmental auditing
- The students will observe the operations of the selected site to identify aspects and impacts of each department, perform risk assessment and propose control measures

CONTENTS

This course is intended to provide an understanding on development of Environmental Management System and auditing techniques. This course will help students to apply elements of EMS for developing EMS (ISO14001) for any organization.

Unit-1: EMS Manual Development

1.1. Development of Standard Operating Procedures for General Requirements
1.2. Environmental Policy, Planning, Environmental Aspects, Legal and Other Requirements
1.3. Objectives and Targets
1.4. Essential contents

Unit-2: Environmental Policy and Auditing

2.1. Review of policies of different organizations
2.2. Development of environmental Policy for an organization
2.3. Case studies for environmental auditing

Unit-3: Field Assignments

3.1. Based on visit to an industry or organization
3.2. Educational institutions
3.3. Banks, super markets etc.

Unit-4: Risk Assessment

4.1. Observe the operations of the selected site to identify aspects and impacts of each department
4.2. Perform risk assessment and propose control measures for an organization
4.3. A visit of selected industries (EMS certified and non-certified to observe the difference)

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Will, M. (2019). *An Operations Guide to Safety and Environmental Management Systems (SEMS): Making Sense of BSEE SEMS Regulations*. Gulf Professional Publishing.
2. Davy, A. (2017). Environmental management systems: ISO 14001 issues for developing countries. In *ISO 14001 and Beyond* (pp. 169-182). Routledge.
3. 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.
4. Dentch, M. P. (2016). *The ISO 14001: 2015 implementation handbook: Using the process approach to build an environmental management system*. Quality Press.
5. Sheldon, C., & Yoxon, M. (2002). *Installing environmental management systems: a step-by-step guide*. Earthscan.

Further reading as suggested by the instructor.

4th YEAR, SEVENT SEMESTER			
Code	**Course Title**	**C.H.**	**Course Type**
HQ-007	Translation of Holy Quran	Non Credit	Compulsory
ENSC-401	Geological Resources of Pakistan	2+1	Basic Course
ENSC-402	Research Methods in Environmental Science	2+0	Basic Course
ENSC-403	Environmental and Health Risk Assessment	2+1	Basic Course
ENSC-404	GIS and Remote Sensing	2+1	Major Elective
ENSC-405	Environmental Economics and Sustainable Development	2+0	Major Elective
ENSC-406	Hazards of Heavy Metal Pollution	2+0	Major Elective
ENSC-407	Environmental Field Studies II	1	Major Elective
	Total Credit Hrs Semester-VII	**16**	

HQ-007: TRANSLATION OF HOLY QURAN (Non Credit)

PRE-REQUISITE: HQ-006 Translation of Holy Quran

COURSE OUTLINE

سورة الزمر تا سورة ق

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after mid term 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

ENS- 401: GEOLOGICAL RESOURCES OF PAKISTAN (THEORY) (02 Credit hrs.)

PRE-REQUISITES: ENSC-205

LEARNING OUTCOMES

- This course will provide an introduction to the Geological Resources to the students.
- The students will learn how to manage Geological Resources.
- They will have the knowledge about the occurrences and importance of coal, oil, gas, uranium.
- The students will get used to the Environmental Impacts of Geological Resources.

CONTENTS

This course provides an introduction to the resource management. This course will also provide basic knowledge about the geological resources.

Unit-1: Resource Management and Sustainable Use

1.1. Geological Resources and Reserve
1.2. Renewable and Non-Renewable Resources
1.3. Resources of Lithosphere, Atmosphere, Biosphere, Hydrosphere
1.4. Preservation, Conservation, Restoration, Values of Natural Resources.

Unit-2: Sustainability of Resources

2.1. Sustainability of different resources
2.2. Carrying Capacity, Maximum Sustainable Yield, Optimum Sustainable Yield
2.3. Reuse, Recycling, Substitution, Resource Economics

Unit-3: Coal as a Resource

3.1. Definition, Formation, Origin of Coal
3.2. Composition and Chemistry of Coal, Coal Bed Methane
3.3. Coalification, Gasification, Liquefaction of Coal
3.4. Coal Macerals, Types of Coal Mining and its Environmental Impacts

Unit-4: Oil and Natural Gas as a Resource

4.1. Origin and Formation of oil and gas
4.2. Traps of Hydrocarbons, Gas Hydrates and its Environmental Effects
4.3. Preservation of Organic Matter, Methogenesis, Crude Oil and Natural Gas
4.4. Oil Spills, Oil Shale, Tar Sands and their Environmental Impacts

Unit-5: Uranium as a Resource

5.1. Introduction to Nuclear Energy, Sediments hosted Uranium Deposits
5.2. Uranium in Rocks, Calcrete Deposits
5.3. Fission and Fusion Reactions, Breeder Reactors
5.4. Introduction to In Situ Leaching and Mining of Uranium

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Enger, E. D., Smith, B. F., & Barker, B. W. (1998). *Environmental science: A study of interrelationships*. McGraw Hill.
2. Chiras, D.D. (2012). *Environmental Science.* Jones & Bartlett Publishers.
3. Botkin, D.B., and Keller, E.A. (2012). *Environmental Science: International Student Version*. John Wiley & Sons.
4. Botkin, D.B., and Keller, E.A. (2012). *Environmental Science: Earth as a Living Planet*. John Wiley & Sons.
5. Keller, E.A., and Botkin, D.B. (2008). *Essential Environmental Science*. Wiley Plus.

ENSC-401: GEOLOGICAL RESOURCES OF PAKISTAN (PRACTICAL) (01 Credit hr)

PRE-REQUISITES: ENSC-205

LEARNING OUTCOMES

- This course will provide an introduction to the Industrial Minerals to the students.
- The students will learn how to manage Industrial Minerals.
- They will have the knowledge about the occurrences and importance of Industrial Minerals.
- The students will get used to the Environmental Impacts of Industrial Minerals.

Contents

This course provides an introduction to the industrial minerals. This course will also provide basic knowledge about the environmental impacts of industrial minerals.

Unit-1: Introduction to Industrial Minerals

1.1. Industrial Minerals and their Importance

Unit-2: Types of Industrial Minerals

2.1. Asbestos, its origin, occurrences, types, industrial uses, its environmental impacts
2.2. Barytes, its origin, occurrences, types, industrial uses, its environmental impacts
2.3. Mica, its origin, occurrences, types, industrial uses, its environmental impacts
2.4. Talc, its origin, occurrences, types, industrial uses, its environmental impacts
2.5. Bentonite and Fullers Earth, its origin, occurrences, types, industrial uses, its environmental impacts
2.6. Lithium Minerals, its origin, occurrences, types, industrial uses, its environmental impacts
2.7. China, Fire and Ball Clay, its origin, occurrences, types, industrial uses, its environmental impacts
2.8. Iron Ore, its origin, occurrences, types, industrial uses, its environmental impacts
2.9. Chromite, its origin, occurrences, types, industrial uses, its environmental impacts
2.10. Diamond, its origin, occurrences, types, industrial uses, its environmental impacts.

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Kucera, M. (2013) Industrial Minerals and Rocks, Elsevier Science.
2. Christidis, G. E. (Ed.). (2011). *Advances in the characterization of industrial minerals* (Vol. 9). The Mineralogical Society of Great Britain and Ireland.
3. Kogel, J.E., Trivedi, N.C., Barker, J.M., and Krukowski, S.T. (2006) Industrial Minerals &Rocks: Commodities, Markets, and Uses. Society for Mining, Metallurgy, and Exploration.

ENSC-402: RESEARCH METHODS IN ENVIRONMENTAL SCIENCES (02 Credit Hrs)

PRE-REQUISITES: ENSC-301

LEARNING OUTCOMES

- 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

CONTENTS

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.

Unit-1: Fundamentals of Research methods

1.1. Introduction to research and research methods in Environmental Sciences
1.2. Types of research in environmental sciences
1.3. Significance of research in environmental sciences

Unit-2: Research planning

2.1. Identification of research questions
2.2. Introduction to research synopsis
2.3. Literature review process
2.4. Pilot surveys

Unit-3: Research design

3.1. Qualitative and quantitative research
3.2. Deductive and inductive research
3.3. Descriptive, explanatory, predictive, empirical research

Unit-4: Data acquisitions in Environmental studies

4.1. Primary and secondary data
4.2. Environmental survey data
4.3. Experimental designs
4.4. Field sampling for water, dust, soil, air sampling
4.5. Sampling of living organisms
4.6. Ethics in sampling

Unit-5: Data analysis and report writing

5.1. Data input and analysis
5.2. Application of descriptive and inferential statistical tools
5.3. Mapping tools in Environmental studies
5.4. Contents of reports and reports compilations
5.5. Referencing

Unit- 6: Research Publications

6.2. Introduction to Research publication
6.3. Types of research publications
6.4. Preparation of Research publications
6.5. Introduction to Journals, publisher, impact factor, h-index etc.
6.6. Editorial process of research publications

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Tjora, A. (2018). *Qualitative Research as Stepwise-Deductive Induction.* Routledge Publisher.
2. Alley, M. (2018). *The Craft of Scientific Writing.* Springer-Verlag New York.
3. Bartels, K.P.R. and Wittmayer, J.M. (2018). *Action Research in Policy Analysis: Critical and Relational Approaches to Sustainability Transitions.* Routledge Publisher.
4. Smith, R.L., Nychka, D., Waller, L.A. and Schmidt, A. (2018). *Applied Environmental Statistics.* CRC Press, Taylor and Francis Group.
5. Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
6. Cook, E. R., & Kairiukstis, L. A. (Eds.). (2013). *Methods of dendrochronology: applications in the environmental sciences.* 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 York.
9. Manly, B.F.J. (2008). *Statistics for Environmental Science and Management.* Chapman and Hall/CRC Press.

ENSC-403: ENVIRONMENTAL HEALTH AND RISK ASSESSMENT (THEORY) (02 Credit Hrs)

PRE-REQUISITES: ENSC-311

LEARNING OUTCOMES

By the end of this course students will be able to

- Understand the process of hazard risk management and use risk assessment tool for the characterization of risks
- Understand differences between carcinogenic and non-carcinogenic risk assessment
- Understand how uncertainty affects risk assessment
- Analyze how benzene case study helped in establishing quantitative risk assessment

CONTENTS

This course provides an introduction to environmental health and risk assessment, its process and principles, addressing uncertainty in risk assessment, decision making, and role of agencies in risk management, benzene case study.

Unit-1: Basics of Risk Assessment

1.1. Introduction to Risks, Probability, and risk assessment process
1.2. Hazard Identification
1.3. Dose Response Assessment: Types of doses, their significance and application
1.4. Exposure Assessment: Exposure profiles, sampling plan, quantitative exposure estimates.

Unit-2: Risk Characterization

2.1. Risk Characterization: cancer risk (HI) and non-cancerous risks (ELCR)
2.2. Risk Management: Principles and strategies
2.3. Risk Communication
2.4. Applications of risk assessment

Unit-3: Uncertainties and Decision Making

3.1. Uncertainties and Variabilities
3.2. Worst Things first thinking, Precautionary Principle
3.3. Priority Setting in Decision Making

Unit-4: Role of Institutions in Risk Assessment

4.1. Role of EPA and OSHA in Risk Assessment with the help of examples
4.2. Differences between EPA and OSHA default risk assessment
4.3. Benzene and Methylene Chloride case study

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,
- attitude and behavior,
- Short projects
- Short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Rausand, M., & Haugen, S. (2020). *Risk Assessment: Theory, Methods, and Applications*. Wiley.
2. Ostrom, L. T., & Wilhelmsen, C. A. (2019). *Risk assessment: tools, techniques, and their applications*. John Wiley & Sons.
3. Asante-Duah, D. K. (2002). *Public health risk assessment for human exposure to chemicals* (Vol. 6). London: Kluwer Academic.
4. Gruiz, K., Meggyes, T., & Fenyvesi, É. (Eds.). (2017). *Engineering Tools for Environmental Risk Management: 3. Site Assessment and Monitoring Tools*. CRC Press.
5. Suter II, G. W. (2016). *Ecological risk assessment*. CRC press.

ENSC-403: ENVIRONMENTAL HEALTH AND RISK ASSESSMENT (PRACTICAL) (01Credit Hr)

PRE-REQUISITES: ENSC-311

LEARNING OUTCOMES

By the end of this course students will be able to

- Identify hazards, conduct dose and exposure assessment
- Make use of Event and Fault Tree analysis for the hazard and risk identification
- Make Qualitative and Quantitative Matrices for hazards
- Carry out carcinogenic and non-carcinogenic risk assessment

CONTENTS

This course has been designed to provide a practical insight into the process of risk assessment process, failure analysis, calculations involved, and models and assumptions used for carcinogens and non-carcinogens with the help of case studies

Unit-1: Hazard Characterization

1.1. Hazard identification
1.2. Probability assigning
1.3. Risk score calculations
1.4. Qualitative and Quantitative Risk Matrix

Unit-2: Failure and Risk Identification techniques

2.1. Fault tree Analysis
2.2. Event Tree Analysis

Unit-3: Dosage Calculation

3.1. Calculation of Chronic Daily Intake, Acceptable Daily Intake
3.2. Hazard Index, hazard Quotients
3.3. Concept of NOAEL, LOAEL, Safety Factor

Unit-4: Carcinogenic Risk Assessment

4.1. Classification of carcinogens
4.2. Models of carcinogenic risk assessment
4.3. Carcinogenic and non-carcinogenic risk assessment calculations, different coefficients

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,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Torres, J. A., & Bobst, S. (Eds.). (2015). *Toxicological risk assessment for beginners* (pp. 1160-1166). Switzerland: Springer.
2. Nielsen, E., Ostergaard, G., & Larsen, J. C. (2008). *Toxicological risk assessment of chemicals: A practical guide*. CRC Press.
3. Ostrom, L. T., & Wilhelmsen, C. A. (2019). *Risk assessment: tools, techniques, and their applications*. John Wiley & Sons.
4. Ricci, P. (2006). *Environmental and health risk assessment and management: principles and practices* (Vol. 9). Springer Science & Business Media.
5. Hsu, C. H., & Stedeford, T. (Eds.). (2010). *Cancer risk assessment: chemical carcinogenesis, hazard evaluation, and risk quantification*. John Wiley & Sons.

ENSC-404: GIS AND REMOTE SENSING (THEORY) (02 Credit hrs)

PRE-REQUISITES: ENSC-109

LEARNING OUTCOMES

The students will learn about;

- Spatial, non-spatial data including vector and raster datasets
- Georeferencing, Digitization and Topological techniques
- Digital cartography
- Freely available online spatial data platforms
- GIS and Remote sensing in Environmental sciences

CONTENTS

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

Unit-1: Fundamentals of GIS & RS

1.1. Introduction to Globe and Coordinate Systems
1.2. Raster and Vector models
1.3. Georeferencing and Spatial adjustment

Unit-2: Spatial Data Creation

2.1. Shapefiles and Geodatabases
2.2. Digitization and Topological errors
2.3. Attributes and Data joining and Geodatabases

Unit-3: Data Acquisition and Vector Analysis

3.1. Online freely available platforms
3.2. Spatial Data import and Export
3.3. Spatial Analysis

Unit-4: Digital Cartography

4.1. Digital Cartography
4.2. Cartography techniques
4.3. Large and Small-scale maps

Unit-5: Remote Sensing Science

5.1. Remote sensing resolutions
5.2. Electromagnetic Spectrum (EMR)
5.3. Remote sensing platforms, sensors, orbits

Unit-6: Raster Analysis

1.1. Imagery rectification and processing
1.2. Introduction to Digital Elevation Model
1.3. Satellite Imagery for Land use Landcover Classification

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Petrou, M. M., & Kamata, S. I. (2021). *Image processing: dealing with texture*. John Wiley & Sons.
2. 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.
3. Wise, S. (2018). *GIS fundamentals*. CRC Press.
4. Emery, W., & Camps, A. (2017). *Introduction to satellite remote sensing: atmosphere, ocean, land and cryosphere applications*. Elsevier.
5. Bolstad, P. (2016). *GIS fundamentals: A first text on geographic information systems*. Eider (PressMinnesota).
6. Fox, L. (2015). *Essential Earth imaging for GIS*. Esri Press.
7. Lavender, S., & Lavender, A. (2015). *Practical handbook of remote sensing*. CRC Press.
8. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote sensing and image interpretation.* John Wiley & Sons.

ENSC 404 GIS AND REMOTE SENSING (PRACTICAL) (01 Credit Hr)

PRE-REQUISITES: ENSC-109

LEARNING OUTCOMES

In this course students will get practical knowledge about;

- Georeferencing, Digitization and Topological techniques
- Large and Small-scale maps preparation
- Downloading of different freely available spatial datasets
- Image processing and classification

CONTENTS

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

Unit-1: Measurements on Globe and Google Earth

1.1. Working with Geographic and Projected Coordinate Systems
1.2. Understanding about different unit types of Geographic coordinate system
1.3. Working on Google Earth / Google Maps

Unit-2: Data Acquisition and Processing

2.1. Absolute and Relative Georeferencing
2.2. Digitization and Topological errors
2.3. Attributes and Data joining and Geodatabases
2.4. Data Downloading (DIVA GIS, USGS Earth Explorer)
2.5. Spatial Data import and Export (KMLs, Cad and Excel files)

Unit-3: Spatial Analysis and Digital Cartography

3.1. Buffer analysis, Masking, Clipping and querying
3.2. Vector and Raster Overlays OR Overlay analysis
3.3. Creation of Large and Small-scale maps

Unit-4: Satellite Image Analysis and Processing

4.1. Digital Elevation Model and Satellite Imagery Downloading and Processing
4.2. Elevation, Contours, Slope, Aspect extraction
4.3. Image classification using supervised and unsupervised techniques
4.4. Watershed and Hydrological analysis using DEM

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Petrou, M. M., & Kamata, S. I. (2021). *Image processing: dealing with texture*. John Wiley & Sons.
2. 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.
3. Wise, S. (2018). *GIS fundamentals*. CRC Press.
4. Emery, W., & Camps, A. (2017). *Introduction to satellite remote sensing: atmosphere, ocean, land and cryosphere applications*. Elsevier.
5. Bolstad, P. (2016). *GIS fundamentals: A first text on geographic information systems*. Eider (PressMinnesota).
6. Fox, L. (2015). *Essential Earth imaging for GIS*. Esri Press
7. Lavender, S., & Lavender, A. (2015). *Practical handbook of remote sensing*. CRC Press.
8. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote sensing and image interpretation.* John Wiley & Sons.

ENSC-405: ENVIRONMENTAL ECONOMICS AND SUSTAINABLE DEVELOPMENT (THEORY)

(03 Credit Hrs)

PRE-REQUISITES: F.Sc. or equivalent

LEARNING OUTCOMES

Upon completion of the course the students will be able to:

- Have an understanding of fundamental concepts of micro and macro economics
- Acquire knowledge base for understanding of environmental economics
- Understand the fundamental concepts of sustainability
- Address questions pertaining to the current development taking place in the country in land development, energy, and transportation sectors
- Frame appropriate questions to guide relevant study and research in development-oriented projects.

CONTENTS

This integrated course is designed specifically for students of Environmental Sciences to familiarize them with the basic concepts of economics as applied to solving environmental problems /issues. It will equip them with the knowledge of economic variables, economic laws and the relationship between micro and macro-economic. This course will form the basis for understanding environmental economics and practice of sustainable development.

Unit 1: Economics

1.1. Concept of scarcity and choice
1.2. Production possibilities frontier
1.3. Micro and Macroeconomics
1.4. Economic systems
1.5. Demand and supply
1.6. Market equilibrium
1.7. Price elasticity of demand and its determinants
1.8. Price elasticity of supply
1.9. Cross elasticity and income elasticity of demand

Unit 2: Environmental Economics

2.1. Economics versus environment
2.2. Basics of sustainable growth, measuring sustainable growth and costs problems
2.3. Externalities, market failure and the environment
2.4. Economic incentives to sustain the environment
2.5. Low cost of sustainability

Unit 3: Theory of production and consumer behavior

3.1. Indifference curves analysis
3.2. Concept of costs and revenues
3.3. Short run production relationships, short run production costs, long run production costs
3.4. ISO Cost line and ISO Quant curve, Producer's equilibrium
3.5. Pure competition; characteristics, equilibrium of a firm under short run and long run
3.6. Monopoly; characteristics, Equilibrium of a firm under short run and long run
3.7. Introduction to Macroeconomics, Macro-economic variables and functional relationships
3.8. Consumption, Investment, Savings
3.9. Concept of National Income and its measurement

3.10. Keynesian system of Macroeconomics
3.11. Aggregate demand and supply

Unit 4: Sustainable Development

4.1. Brundtland Commission & Agenda 21
4.2. Concept of ecological foot print
4.3. Principles of Sustainable Development
4.4. Applying the Principles of Sustainable Development to Human Systems
4.5. Systems and Principles of Sustainability Matrix
4.6. Indicators of sustainable development
4.7. Creating sustainable cities, Suburbs and Towns, Cities and Towns as Networks of Systems

Unit 5: Urbanization and Sustainable Development

5.1. Land use planning and Sustainability
5.2. Sustainable Transportation Systems
5.3. Urban growth boundaries, urban sprawl and control, densification of urban centers
5.4. Globalization and Impact on Sustainability
5.5. Millennium Development Goals, Melbourne Principles
5.6. Case studies on cleaner production, Boundary position
5.7. Third world problems in transition to sustainable development

Unit 6: Energy policy and Environment

6.1. Current global energy picture
6.2. Energy scenarios of the future
6.3. Technology options for electricity
6.4. Heat and transport (fuel efficiency and fuel switching)
6.5. Globalization and impact on sustainability
6.6. Population control and sustainability
6.7. Cleaner Technologies, Path to a sustainable future

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Pearce, D., Barbier, E., & Markandya, A. (2013). *Sustainable development: economics and environment in the Third World*. Routledge
2. Hussen, A. (2012). *Principles of environmental economics and sustainability: an integrated economic and ecological approach.* Routledge.
3. Chiras, D. D. (2009). *Environmental science*. Jones & Bartlett Publishers.
4. Perman, R., Ma, Y., McGilvray, J., & Common, M. (2003). *Natural resource and environmental economics*. Pearson Education.

Further Reading: As suggested by the instructor.

ENSC-406: HAZARDS OF HEAVY METAL POLLUTION (THEORY) (02 Credit hrs.)

PRE-REQUISITES: ENSC-205, ENSC-308

LEARNING OUTCOMES

By the end of the course, the student is expected to have:

- A clear understanding of the inorganic micropollutants, significance and associated environmental hazards
- An understanding of pharmacokinetics and environmental fate of different inorganic micropollutants
- Information about possible methods of controlling micropollutant contamination
- A critical grasp on public health and environmental burdens caused by inorganic pollutant

CONTENTS

The identification of inorganic micropollutants, heavy metals, cations, radioactive compounds etc. impacts on abiotic environment and biota, reversing toxicity

Unit-1: Introduction Micropollutants

1.1. Basic introduction to micropollutants
1.2. General mechanism of toxicity
1.3. Bioaccumulation, bioconcentration and biomagnification
1.4. Global disease burden caused by inorganic micropollutants

Unit-2: Mercury as Environmental Pollutant

2.1. Introduction to Mercury, its uses and sources
2.2. Historical incidents of mercury contamination
2.3. Metabolic pathways of mercury poisoning
2.4. Impacts on environment
2.5. Reversing mercury poisoning through chelation etc.

Unit-3: Arsenic and its Environmental Impacts

3.1. Introduction to Arsenic, its sources and sinks, applications
3.2. Historical arsenic contamination incidents
3.3. Movement of arsenic in groundwater
3.4. Carcinogenicity and permissible levels established by EPA-IRIS, WHO, PEQS.

Unit-4: Lead and Environmental Significance

4.1. Natural and anthropogenic sources of lead
4.2. Historic and industrial applications of lead
4.3. Health and environmental consequences, global disease burden
4.4. Global Alliance to eliminate lead

Unit-5: Cadmium and Environmental Impacts

5.1. Cadmium, its sources, historic and current day uses
5.2. Presence in various environmental media
5.3. Cadmium specific health effects (*Itai Itai* disease etc.)

Unit-6: Chromium and Environmental Impacts

5.4. Sources, speciation and toxic states of chromium
5.5. Specific diseases, bioaccumulation potential, contamination of abiotic and biotic factors
5.6. Reclamation of chromium contaminated soils etc.

Unit-7: Radioactive Elements

7.1. Radioactive elements, historical incidents
7.2. Background emissions, half-life
7.3. Uses and environmental impacts
7.4. Detection of radioactive elements, biological pathways etc.

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Documentaries
- 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,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Devi, P., Singh, P., & Kansal, S. K. (Eds.). (2020). *Inorganic Pollutants in Water*. Elsevier.
2. Kumar, V., Sharma, A. and Cerda, A. (2020). *Heavy Metals in the Environment.* Elsevier.
3. Anjum, N. A., Gill, S. S., & Tuteja, N. (Eds.). (2017). *Enhancing cleanup of environmental pollutants*. Springer.
4. Zaikov, G. E., Weisfeld, L. I., Lisitsyn, E. M., & Bekuzarova, S. A. (Eds.). (2017). *Heavy metals and other pollutants in the environment: biological aspects*. CRC Press.
5. Chen, J. P., Wang, L. K., Wang, M. H. S., Hung, Y. T., & Shammas, N. K. (Eds.). (2016). *Remediation of heavy metals in the environment*. CRC Press.
6. Coleman, N., Castrejon, A., Blaine, C., & Chemmachel, T. (2017). *The toxicology of essential and nonessential metals*. Lulu. com.
7. Corn, M. (2012). *Handbook of hazardous materials*. Academic Press.

ENSC-407: ENVIRONMENTAL FIELD STUDIES II (01 Credit Hr)

PRE-REQUISITES: ENSC-213

COURSE LEARNING OUTCOMES

- This course will provide information regarding Environmental Geology to the students in field.
- The students will learn about the different aspects of Geology, Biodiversity.
- They will have the knowledge about the Dams and Meteorology.
- The students will be able to identify rocks and minerals in the field.

CONTENTS

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.

Unit-1: Environmental Geology

1.1. Identification of minerals and Igneous, Sedimentary and Metamorphic Rocks at Natural
1.2. Formations in Salt Range, Islamabad, Galiat, Abbottabad and Manshera Areas
1.3. Sedimentary Structure, mainly Bedding, Cross Bedding, Ripple Marks, Fossils, Mud Cracks, Graded Bedding.
1.4. Color, Fabric, Texture OF Rocks, Identification of Joints, Faults and Cleavage.
1.5. A visit to Natural History Museum, Islamabad.
1.6. A visit to Bestway Cement Factory, Chakwal.
1.7. A visit to Dams
1.8. Study of Geologic Hazards, Visit to some Seismic Stations.
1.9. Visit to some Petroleum Drilling/Petroleum Sites.

Unit-2: Environmental Biology

2.1. Study of Vegetation, change in vegetation with altitudinal changes
2.2. Study of Role of Vegetation in Controlling Soil Erosion
2.3. Study of Conditions Supporting Gymnosperm Growth
2.4. Study of Animal Diversity of the visited Areas
2.5. Study of Fauna and Flora of the visited Areas

Unit-3: Hydrological Measurements

3.1. Study of Dams
3.2. Study of Reservoirs
3.3. Study of Wetlands
3.4. Flow Measurements
3.5. Weather Stations
3.6. Seepage Control through Dams and Foundations, Power Houses, Spillways.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

As suggested by the instructor

4th YEAR, EIGHTH SEMESTER			
Code	**Course Title**	**C.H.**	**Course Type**
HQ-008	Translation of Holy Quran	01	Compulsory
ENSC-408	Environment and Humanity	3+0	Basic Course
ENSC-409	Environmental Engineering	2+1	Major Elective
ENSC-410	Environmental Standards, Auditing and Project Management	3+0	Major Elective
ENSC-411	Optional Paper I	2+1	Major Elective
ENSC-412	Optional Paper II	2+1	Major Elective
ENSC-417	Research Project/Internship	6	Major Elective
	Total Credit Hrs Semester-VIII	**22**	

HQ-08: TRANSLATION OF HOLY QURAN (01 Credit hr

PRE-REQUISITE: HQ-07

COURSE OUTLINE

سورة الذريات تا سورة الناس

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after mid term 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

ENSC-408: ENVIRONMENT AND HUMANITY (THEORY) (03 Credit Hrs)

PRE-REQUISITES: ENSC-206

LEARNING OUTCOMES

Students will be in position to study

- Relationship between environment and humanity
- The interrelation between man and physical set up in various areas/regions
- Human interaction with the environment in the interests of solving environmental issues

CONTENTS

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.

Unit 1: Earth in space and time:

1.1. Definition, Solar system, Electromagnetic radiation, Earth's interior
1.2. Atmosphere, Lithosphere, Hydrosphere and Biosphere

Unit 2: Atmospheric circulation:

2.1. Hadley Cell, Polar Cell, Ferrel Cell
2.2. Diurnal wind changes in coastal areas
2.3. Walker circulation, El Nino, Southern Oscillation

Unit 3: Introduction to Landforms:

3.1. Brief introduction to landforms

Unit 4: Population and Space:

4.1. Population: Location, Distribution and Density
4.2. Processes and Cycles of population change
4.3. Demography and policies
4.4. Population expansion and environmental stress

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Cohen, J., & Foote, S. (Eds.). (2021). *The Cambridge Companion to Environmental Humanities*. Cambridge University Press.
2. Oppermann, S., & Iovino, S. (Eds.). (2016). *Environmental humanities: Voices from the anthropocene*. Rowman & Littlefield.
3. Emmett, R. S., & Nye, D. E. (2017). *The environmental humanities: A critical introduction*. MIT Press.
4. Heise, U. K., Christensen, J., & Niemann, M. (Eds.). (2017). *The Routledge companion to the environmental humanities*. Taylor & Francis.
5. Dodds, W. K. (2008). *Humanity's footprint: momentum, impact, and our global environment*. Columbia University Press.

Further Reading: As suggested by the instructor.

ENSC-409: ENVIRONMENTAL ENGINEERING (THEORY) (02 Credit hrs.)

PRE-REQUISITES: ENSC-203

LEARNING OUTCOMES

- The Environmental Engineering is structured to provide students with appropriate background in analysis and design tools necessary to address complex environmental engineering concerns.
- Students will be able for doing basic engineering calculations, various units' conversion for gases, liquids and solids and developing material balance equations which are used in the environmental sciences and engineering
- Instigate translation of acquired knowledge of environmental engineering into potential applied solutions of environmental problems of Pakistan in the areas of waste water treatment
- Students will learn about the engineering aspects of solid waste and air and noise pollution.

CONTENTS

This course provides a basic knowledge and applications of engineering principles for wastewater treatment engineering, solid waste management engineering, air and noise pollution control.

Unit-1: Introduction to Environmental Engineering and Basic Engineering Calculations

1.1. Introduction and Historical perspective of Environmental Engineering
1.2. Transitioning of knowledge of Environmental Sciences into Environmental Engineering
1.3. Principles of environmental engineering
1.4. Major issues of air, water and land pollution in Pakistan
1.5. An overview of the constraints of national industrial stakeholders to comply with NEQS of Pakistan at international, national and provincial level
1.6. Use of Environmental Engineering in designing sustainable development policy for major environmental issues of Pakistan
1.7. Units' conversion and Dimensions
1.8. Basic Engineering Calculations
1.9. Material balance equations in Environmental Engineering

Unit-2: Design Consideration in Water and Wastewater Treatment Plants

2.1. Methods and techniques for population forecasting
2.2. Introduction to Unit operation for wastewater treatment
2.3. Design and functioning equations of the waste water collection/pumping systems
2.4. Design of primary wastewater treatment system (screens, grit chamber)
2.5. Engineering aspects of secondary and tertiary treatment of wastewater
2.6. Design layout of a typical sludge treatment and handling system
2.7. Major constraints and extent of efficacy of the typical wastewater systems in case of Pakistan

Unit-3 Engineering Aspects of Solid Waste Management

3.1. Calculations of waste generation rates
3.2. Components of solid waste management system
3.3. Designing of incinerators
3.4. Designing of land filling system
3.5. Relationship between moisture contents, transport cost and leachate generation

Unit-4: Air Pollution Control Systems

4.1. Design and functioning equations of the major components of air pollution control
4.2. Abatement systems such as Gravity settlers, Cyclone separators
4.3. Electrostatic precipitators, Bag houses, Scrubbers, Catalytic converters
4.4. Calculations for noise measurement and designing of noise control systems
4.5. Major constraints and extent of efficacy of typical air pollution control and abatement systems in 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:

- 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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Kumar, S. (2020). *Municipal solid waste management in developing countries*. CRC Press.
2. Manyuchi, M. M., Mbohwa, C., & Muzenda, E. (2018). *Resource recovery from municipal sewage plants: An energy-water-Nutrients nexus for developing countries*. CRC Press
3. Wang, L.K.., and Sung, W.M. 2018. *Handbook of Environmental Engineering*. Springer Nature Switzerland AG.
4. Kutz, M. (2018). *Handbook of Environmental Engineering*. John Wiley & Sons.
5. Spellman, F. R. (2015). *Handbook of Environmental Engineering*. CRC Press.
6. Karl B. Schnelle, J., & Brown, C. A. (2016). *Air Pollution Control Technology Handbook*. CRC Press.
7. Karl B. Schnelle, J., & Brown, C. A. (2016). *Air pollution control technology handbook*. CRC
8. Jain, R., Urban, L., Balbach, B., and Webb, M.D. 2012. *Handbook of Environmental Engineering Assessment; Strategy, Planning, and Management, 1st Edition*. Elsevier Publishers.
9. Masters, G.M. and Ela, W.P., 2008. Introduction to Environmental Engineering and Science. 3rd Ed., Prentice Hall, Inc., UK.
10. Davis, M. and Masten, S., 2008. *Principles of Environmental Engineering and Science*. 2nd Ed., McGraw-Hill, New York.

ENSC-409: ENVIRONMENTAL ENGINEERING (PRACTICAL) (01 Credit hr)

PRE-REQUISITES: ENSC-203

LEARNING OUTCOMES

- Students will learn about sampling techniques for environmental monitoring.
- Students will learn about environmental monitoring tests for wastewater, solid waste and air.
- Students will be able to perform basic design calculations for wastewater treatment plant.
- Students will be able to perform engineering estimates for solid waste generation and leachate rates calculations for wastewater treatment plant.

CONTENTS

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.

Unit-1: Sampling Techniques in Environmental Engineering

1.1. Techniques and methods for representative sampling and characterization of solid waste
1.2. Techniques and methods for representative sampling of wastewater bodies
1.3. Techniques and methods for representative sampling of polluted ambient air

Unit-2: Quantitative and Qualitative Monitoring of Wastewater

2.1. Measurement of wastewater
2.2. Introduction to water quality standards
2.3. Estimation for physiochemical and biological characteristics of municipal and industrial waste water

Unit-3: Design Examples for Main Components of Wastewater Treatment Plant

3.1. Design practice on
3.2. Waste water collection system
3.3. Design calculations for preliminary wastewater treatment system
3.4. Design calculations Primary and secondary treatment system

Unit-4: Design Calculation for Solid Waste Management System

4.1. Practical regarding estimation of solid waste generation rates
4.2. Practical calculations for landfill design
4.3. Estimation of leachate

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXTBOOKS / SUGGESTED READINGS

1. Kumar, S. (2020). *Municipal solid waste management in developing countries*. CRC Press.

2. Chambers, P. (2019). *Standard methods for the examination of water and wastewater*. Scientific e-Resources.

3. Manyuchi, M. M., Mbohwa, C., & Muzenda, E. (2018). *Resource recovery from municipal sewage plants: An energy-water-Nutrients nexus for developing countries*. CRC Press

4. Wang, L.K.., and Sung, W.M. 2018. *Handbook of Environmental Engineering*. Springer Nature Switzerland AG.

5. Kutz, M. (2018). *Handbook of Environmental Engineering*. John Wiley & Sons.

6. Chen, G., & Youneng, S. (2017). *Environmental and Hydraulic Engineering Laboratory Manual*. J. Ross Publishing.

7. Baird, R., Rice, E. W., & Eaton, A. D. (2017). *Standard Methods for The Examination of Water and Wastewater*. American Water Works Association.

8. Baird, R., Rice, E. W., & Eaton, A. D. (2017). *Standard methods for the examination of water and wastewater*. American Water Works Association.

9. Aziz, H. (2015). *Control and treatment of landfill leachate for sanitary waste disposal*. IGI Global.

10. Gaur, R. C. (2008). *Environmental engineering laboratory manual*. New Age International Pvt. Limited, Publishers.

ENSC-410: ENVIRONMENTAL STANDARDS, AUDITING AND PROJECT MANAGEMENT (THEORY) (02 Credit hrs)

PRE-REQUISITES: ENSC-312

LEARNING OUTCOMES

After successful completion of this course, students will be able to:

- Know the various standards and types of auditing and environmental audits.
- Know how to conduct an audit according to ISO 14001 as well as to local management systems.
- Understand the project definition and project management tools.
- Understand the identification of stakeholders, the role of sponsors and the role of project manager.
- Know how to apply project life cycle to a project

CONTENTS

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.

Unit-1: Introduction to Environmental Standards

1.1. History of ISO 14000 Family
1.2. ISO 14001
1.3. Integrated management system

Unit-2: **Fundamentals of Auditing**

2.1. Introduction to ISO 19011 for auditing
2.2. Principals of Environmental Auditing
2.3. Local and international environmental auditing systems

Unit-3: Introduction to Environmental Auditing

3.1. History of Environmental Auditing
3.2. Types of environmental audits
3.3. Audit preparation and planning
3.4. Methods of Gathering Audit Evidence
3.5. Practical Audit Exercise
3.6. Audit communication and reporting system

Unit-4: Introduction to Project Management

4.1. Project Philosophy
4.2. Project methodologies
4.3. Project perspectives
4.4. Stakeholders Analysis and Participation
4.5. Project goal and scope management
4.6. Project life cycle

Unit-5: Project Life Cycle

5.1. Project initiation
5.2. Project planning,
5.3. Project execution and control
5.4. Project closure management
5.5. Communication and conflict management

5.6. Reasons for project success or failure
5.7. Planning commission proformas
5.8. Project planning and approval processes
5.9. Resource mobilization

Unit-6: Case Studies of Project management

6.1. Case Study-I Industrial Project
6.2. Case Study-II MS Project

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%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Das, T.K., (2020). *Industrial Environmental Management: Engineering, Science, and Policy*. John Wiley & Sons.
2. Meredith, J.R., Shafer, S.M., Mantel Jr, S.J. and Sutton, M.M., (2020*). Project management in practice*. John Wiley & Sons.
3. Turner, Rodney. (2016). *Gower handbook of project management*. Routledge Publishers.
4. Beasley, Mark S. (2015). *Auditing cases: An interactive learning approach*. Prentice Hall.
5. Hillary, R. (2017). *Introduction. In ISO 14001*. Routledge.
6. Prasad, A. (2018). *Environmental Performance Auditing in the Public Sector: Enabling Sustainable Development.* Routledge.

Checklist for a New Academic Program

Parameters	
1. Department Mission and Introduction	✓
2. Program Introduction	✓
3. Program Alignment with University Mission	✓
4. Program Objectives	✓
5. Market Need/ Rationale	✓
6. Admission Eligibility Criteria	✓
7. Duration of the Program	✓
8. Assessment Criteria	✓
9. Courses Categorization as per HEC Recommendation	✓
10. Curriculum Difference	☐
11. Study Scheme / Semester-wise Workload	✓
12. Award of Degree	✓
13. Faculty Strength	✓
14. NOC from Professional Councils (if applicable)	☐

Program Coordinator **Chairperson**