M.SC. ENVIRONMENTAL ENGINEERING PROGRAM

HEC SELF ASSESSMENT REPORT 2019-20

Submitted to:

Director

Quality Enhancement Cell

Submitted By

INSTITUTE OF ENVIRONMENTAL RESEARCH AND ENGINEERING

UNIVERSITY OF ENGINEERING AND TECHNOLOGY, LAHORE

Table of Contents

List of Figures

List of Tables

INSTITUTE OF ENVIRONMENTAL ENGINEERING AND RESEARCH

CRITERION-1: PROGRAM MISSION, OBJECTIVE AND OUTCOMES

1.1   Standard-1: The program must have documented measurable objectives that support faculty/college and institutional mission statements

1.1.1 *Introduction*

The Institute was established as Institute of Public Health Engineering and Research in the year 1972 because of the increasing awareness of the importance of environmental/public health engineering. However, a beginning in public health engineering studies was made earlier in 1961 when a post-graduate diploma course in the discipline was initiated and was upgraded to the master's level in 1962. The Institute has been renamed as Institute of Environmental Engineering and Research (IEER) in 1996.

1.1.2 *IEER Vision*

Become a world class institution and a **Think Tank** in the field of Environmental Engineering

1.1.3 *IEER Mission Statement*

To play a leading role as a University of Engineering and Technology in teaching, research, innovation, and commercialization that is internationally relevant and has a direct bearing on national industrial, technological, and socio-economic development.

1.1.4 *Program Educational Objectives (PEOs)*

The Institute of Environmental Engineering & Research seeks to educate graduates who will be ethical, productive, and contributing members of their profession and of society. This education should form the basis for professional and personal development after graduation, as encompassed by the following objectives:

- Postgraduate students will be able to solve **complex environmental engineering problems** by the application of **advanced knowledge** of science and engineering.

- Postgraduate students will use **innovative research methodologies** to provide **sustainable solutions** for environmental remediation.
- Postgraduate students will **lead** and implement **custom mitigation strategies** in **industries,** organizations at **national and international level** through their technical and engineering skills.

1.1.5 *Assessment/Evaluation of PEOs*

PEOs are identified and refined by the program in consultation with outside constituencies and current students. This is a cyclical process. The goal is to keep the PEOs current by having a process which identifies the needs of the program's various constituencies, critically assess the attainment of graduates, and periodically reassesses and updates of the objectives. Elements of this process are continuous in nature and will vary among different programs. The IEER faculty regularly assures a documented cycle of activity such that PEOs, as well as their linkage to PLOs, are re-evaluated at least every two to three years. Faculty recognizes the different constituents which may have competing needs and expectations. It also helps in to resolving potential conflicts while fulfilling as many of the needs as practically as possible.

The PEOs of IEER program can be assessed by using the following assessment tools:

- Alumni survey
- Employer survey
- Current Students

The alumni's and employer's survey contained five areas which define the PEOs. The five areas are: (1) Career, (2) Competency, (3) Competitive, (4) Life-long Learning, and (5) Contribution. Data gathered through these surveys will be accumulated and used as one key input to the PEOs as well as the PLOs. Based on the survey following statistical data was obtained and it showed that at least 70% PEOs are well in placed (Figure-1, Table-1)
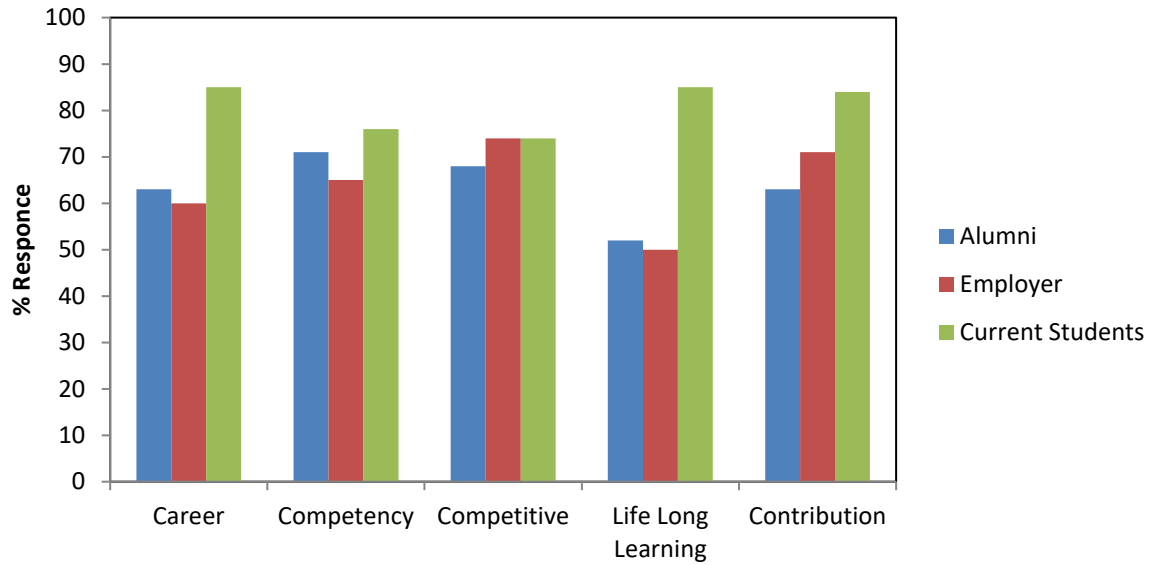
Figure- 1: The opinions of various stakeholders about PEOs

Table- 1: Table Showing Various Activities for the Assessment of PEOs

Program Objective	How measured	When measured	Improvement identified[1]	Improvement made[2]
1	Annexure-A	At the end of each academic year/program	Yes	Yes
2	-do-	At the end of each academic year/program	Yes	Yes
3	-do-	At the end of each academic year/program	Yes	Yes
4	-do-	At the end of each academic year/program	Yes	Yes

---

[1] Post Graduate program was evaluated for the first time as per QEC criteria
[2] Improvements are identified and are under process of implementation

Based on the information the syllabus and PEOs are revised after every 4 years. Currently the syllabus was revised in 2013. The details of syllabus will be discussed in coming sections.

1.2   Standard-2: The program must have documented outcomes for master students. It must be demonstrated that the outcomes support the program objective and that post-graduates are capable of performing these outcomes.

1.2.1 *Program Learning Outcomes*

Program learning outcomes (PLOs) are the narrower statements that describe what students are expected to know and be able to do by the time of post-graduation. These relate to the knowledge, skills, and attitude that the students acquire while progressing through the program. Following are the PLOs of MSc Environmental Engineering.

1. Engineering capabilities

Postgraduate students will be able to apply knowledge to the solution of complex environmental engineering problems by using appropriate technology and advanced engineering tools that meet specified needs for environmental considerations.

2. Environment and sustainability

Postgraduate students will be proficient in identifying, formulating, researching literature, and analyzing complex environmental engineering problems by demonstrating the knowledge relevant to health and safety issues and need for sustainable development.

3. Managing projects as individual/team member

Postgraduate students will be able to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects related to environmental engineering problems.

4. Professional ethics and communication

Postgraduate students will be prepared to apply ethical principles and commit to professional ethics and norms of environmental engineering practice. They will also be skilled at communication with the engineering community and with society.

5. Lifelong Learning

Postgraduate students will be capable of recognizing importance of and pursuing lifelong learning in the broader context of innovation and technological developments.

1.2.2 *Processes for Assessing, Evaluating and Reviewing of PLOs*

The PLOs of IEER M.Sc. Environmental Engineering program can be assessed by using the following assessment tools:

1.2.2.1   Direct Assessment

Following are a list of assessments tools by which students are evaluated.

- Quizzes
- Tests
- Mid Term Examination
- Final Examination
- Assignments
- Projects
- Master Thesis
- Lab Experiments
- Viva Voce

The results of evaluation of each student can be checked on www.lms.uet.edu.pk. The performance of every students and overall student's performance then be analyzed. Below is an example of student evaluation and performance of all students in terms of earned grades.

University of Engineering & Technology, Lahore

Web Based

Registration No.	2015-MS-EN-10		Session:	2015	
Student Name:	Saba Waheed		Program:	M.Sc. Environmental Engineering	
Father's Name:	Abdul Waheed				

Course Code	Course Title	CH	Grade	GPs
Spring 2015				
Env-E-501	Environmental Management and Impact Assessment (Th)	3.0	A+	12.0
Env-E-502	Physico-Chemical Process in Environmental System (Th)	3.0	A+	12.0
Env-E-504	Experimental Methods in Environmental Engineering (Pr)	1.0	A	3.7
	Experimental Methods in Environmental Engineering (Th)	2.0	A	7.4
Env-E-510	Ecology and Risk Assessment (Th)	3.0	A+	12.0

Semester CH: 12.00	Cum CH: 12.00	GPA: 3.925	CGPA: 3.925	Status: Promoted

Course Code	Course Title	CH	Grade	GPs
Fall 2015				
Env-E-503	Wastewater Treatment and Design (Th)	3.0	A+	12.0
Env-E-505	Industrial and Hazardous Waste Management (Th)	3.0	A+	12.0
Env-E-506	Water Supply and Wastewater Collection System (Pr)	1.0	A	3.7
	Water Supply and Wastewater Collection System (Th)	2.0	A+	8.0
Env-E-507	Environmental Chemistry and Microbiology (Pr)	1.0	A+	4.0
	Environmental Chemistry and Microbiology (Th)	2.0	A+	8.0

Semester CH: 12.00	Cum CH: 24.00	GPA: 3.975	CGPA: 3.950	Status: Promoted

Requirements Completed	Requirements for Degree	CGPA	Date of Issue
24 CH	CH	3.950	December 21, 2016

Figure- 2: Performance of a Student

Figure- 3 Grade sheet of students in Physio-Chemical Processes in Environmental Engineering

1.2.2.2   Indirect assessment

- Alumni survey

- Employer survey

These evaluation methods are then linked with Course Learning Outcomes (CLOs). These will be helpful in revising and evaluating the PLOs. Following is method by which IEER analyze the results of these assessments. Program outcomes are linked with the program objectives. The mapping of program outcomes to course learning outcomes was done in consultation with related faculty member. The details of direct and indirect assessment are provided in the form of course files of every subject of program. The course file contains all types of evaluation i.e. quiz, examination, assignment, projects etc. The annual meeting of Managing Committee evaluates and revises various prospects of the life.
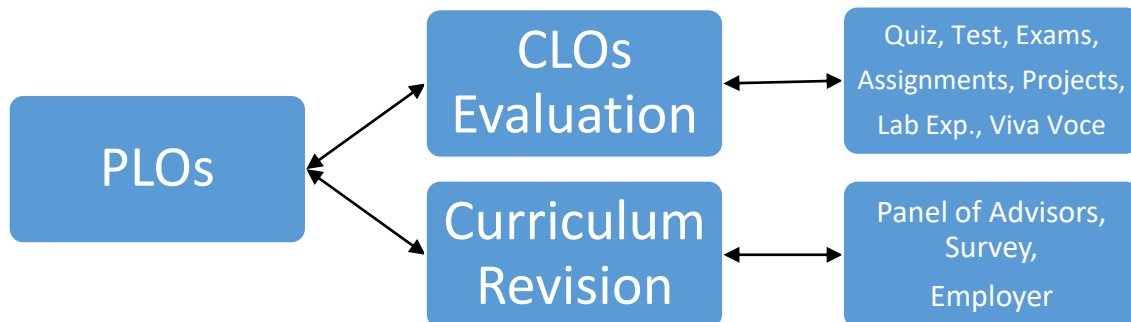
Figure- 4 Interrelation of PLC and CLOs

Table- 2 Mapping of PEOs to PLOs/Graduate Attributes

GRADUATE ATTRIBUTES	PROGRAM EDUCATIONAL OBJECTIVES (PEOS)		
	PEO1	PEO2	PEO3
Engineering Capabilities	✓		✓
Environment and Sustainability	✓	✓	
Managing Projects as Individuals/ Team Members		✓	✓
Professional Ethics and Communication			✓
Lifelong Learning	✓	✓	✓
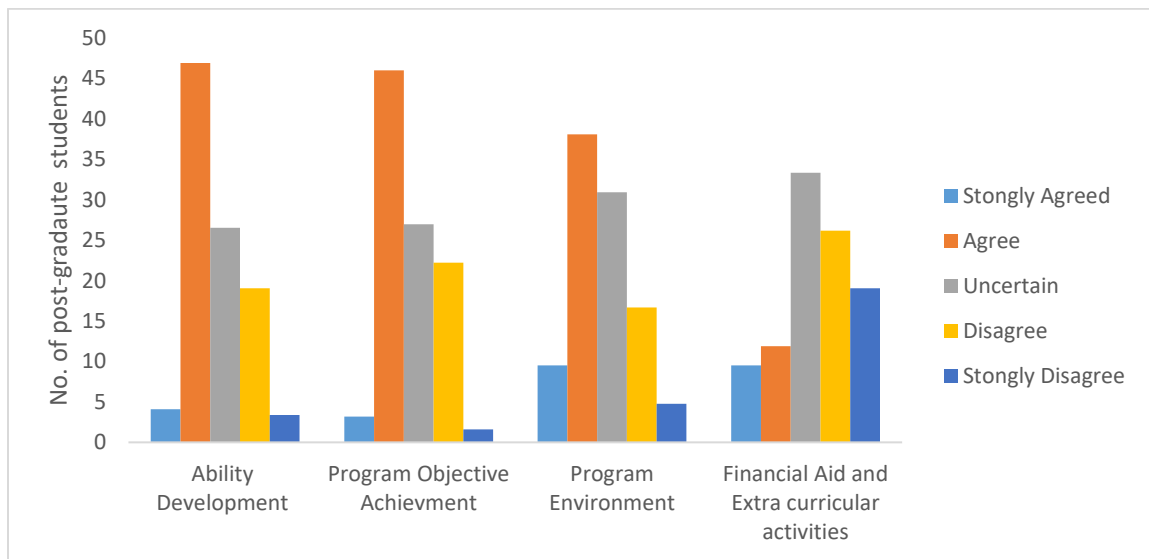
Figure-5: Survey result from Post Graduate Students of IEER. The questionnaire is available at Annexure-A

Through the post-graduate student survey, it was revealed that majority of post-graduate students have positive views regarding ability development, program's environment & objectives achievement and financial aid support program.

Q: Your ability to link theory to practice

No. of students
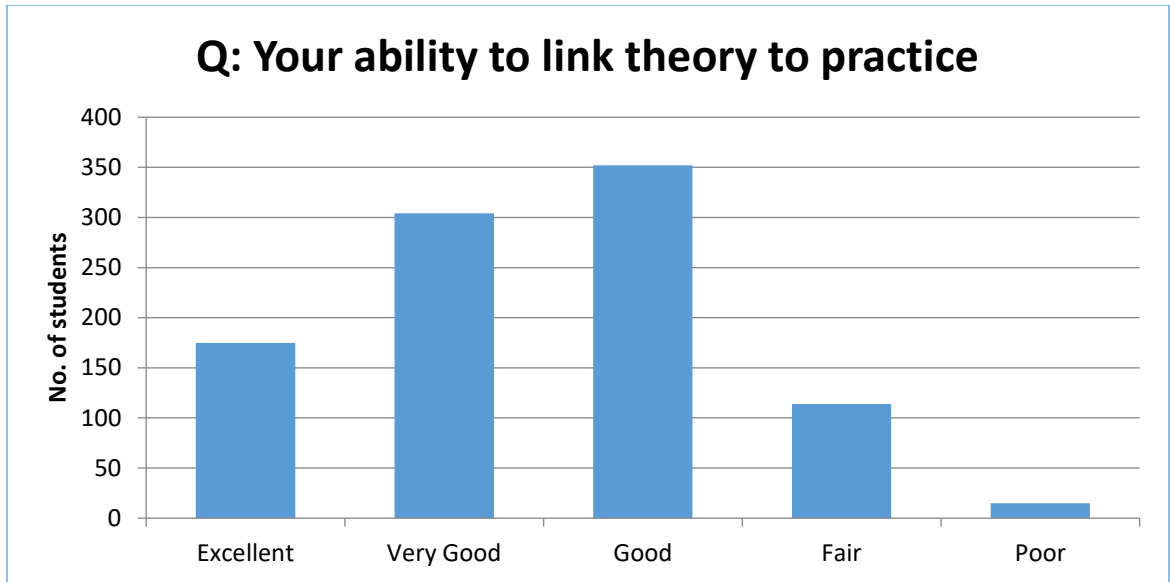
Figure- 6: Survey result of a Question from Alumni of IEER. The questionnaire is available at Annexure-A

Q: Are IEER graduates capable of collecting and analysing appropriate data?

Percentage Response
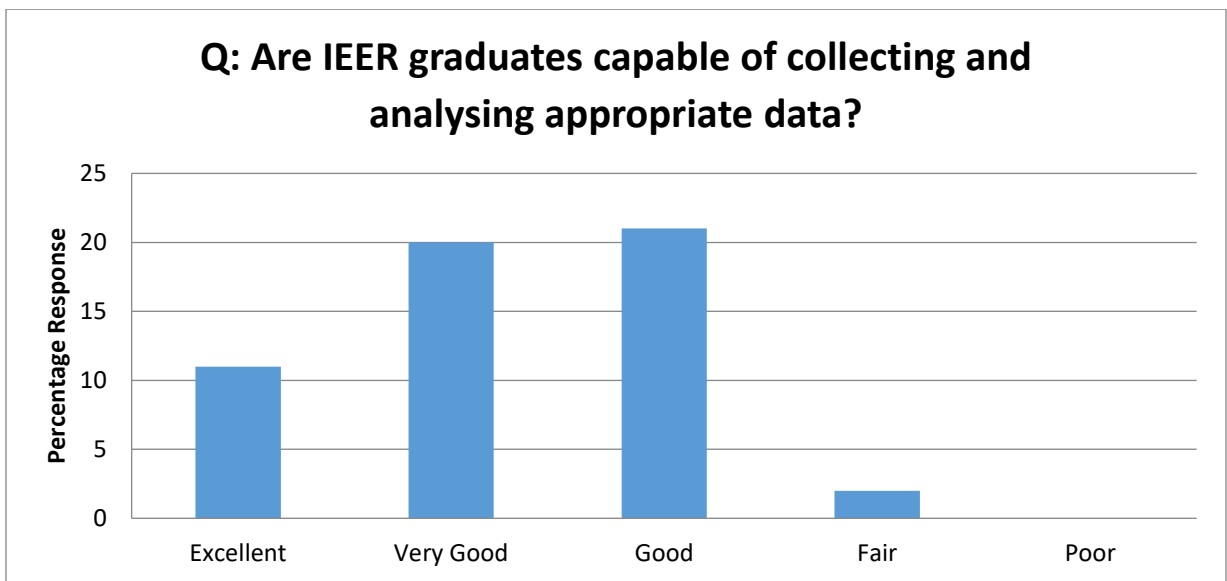
Figure- 7: Employer Survey result of a question for Graduates of IEER. The questionnaire is available at Annexure-A.

1.3   Standard-3: The results of program's assessment and the extent to which they are used to improve the program must be documented

Assessment Team Findings	Corrective Actions to be taken
The research and development element are missing in the program outcomes. The program objectives need to be reviewed and revised.	Program objectives has been revised **(Section: 1.1.4)**
The relationship between program outcomes and program objectives need to be reviewed and revised.	Mapping has been revises **(Table-2)**
Information regarding program assessment i.e. Faculty Course Review Report is missing in the report. Refer to proforma-2 of the Self-Assessment Manual for compliance.	Faculty course review report is available in course files.
It is required by the standard 1-4 of Self-Assessment Manual that the department shall monitor their performance. Some of KPIs required in Standard 1-4 of Self-Assessment Manual have not been addressed in the SAR.	Requirements has been incorporated **(Section 1-4)**
Department has the adequate number of laboratories but the number of support personnel in the lab are insufficient and need to be increased.	Three new members has been inducted.
Department is offering limited courses because of which the students have limited choice to pursue their career in different areas.	Induction of new PhD faculty is required to launch and teach variety of courses.

The progress of M.Phil. Students is neither documented nor being monitored regularly i.e. 100% after 6 months. It is required by the standard 5-2 of self-assessment manual and proforma Number 4.	M.Phil program started in 2018 and students are completing their course work. Once they are at research level, their progress reports will be collected and submitted.

1.3.1 *Strength, Weakness, Opportunity and Threats (SWOT)*

SWOT analysis of the IEER guides administration, faculty and staff involve in the analysis of effectiveness of Department academic procedures and administrative systems. SWOT is regularly used for all types of planning and scheduling activates which could affect future academic, management and financial decisions of the Department.

1.3.2 *Strengths*

1. Provide quality education at affordable price
2. Academic reputation and national ranking of the undergraduate program
3. High merit students prefer to join UET
4. Full-time dedicated and skilled Faculty
5. Chartered with HEC and Accredited from PEC
6. Good reputation in the external community
7. Attractive location (city and culture) for students
8. Discipline

1.3.3 *Weaknesses*

1. Inadequate capital funds to support all that we want to do
2. Limited resources for staff development
3. Maintenance and condition of the Institute
4. Lack of human resources
5. Lack of communication skills of little percentage of students because of diversity of background.

1.3.4 *Opportunities*

1. Scope for strong collaboration with industry

2. Scope for academic collaboration with international universities

3. Scope for creation of new research and development opportunities

4. Scope for advanced teaching and learning aids in the classrooms

5. Emergence of new approaches to education (e.g., OBE)

1.3.5 *Threats*

1. Risk of losing young PhD faculty for genuinely better opportunities at other universities

2. Growing competition from nearby public and private universities

3. Establishment of new private universities

4. Low quality of some percentage of intake students due to declining standard of Secondary and Higher secondary education level.

1.4 Standard-4: The department must assess its overall performance periodically using quantifiable measures.

1.4.1 *Average Grade Point Average*

Sr.	2018	2019	2020
Spring.	3.16	3.15	3.08
Fall	3.22	3.17	In process

1.4.2 *Average Time of Completion of Degree*

B.Sc.: Four Years

M.Sc.: 3 Years

Ph.D.: 7 Years

1.4.3 *Response of Employer Survey (Strongly Agree)*

PEO	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree	Sum
1	24.76	52.43	16.02	4.61	2.18	100

| 2 | 28.91 | 42.19 | 21.09 | 6.25 | 1.56 | 100 |
| 3 | 23.31 | 59.11 | 14.06 | 3.52 | 0.00 | 100 |

1.4.4 *Average Course Evaluation by Post Graduate Students*

Questions No.	Env-501	Env-502	Env-503	Env-504	Env-505	Env-506
1.	81%	100%	80%	100%	23%	82
2.	64%	75%	77%	80%	76%	82
3.	52%	96%	75%	82%	70%	82
4.	90%	75%	8%	75%	61%	80
5.	75%	89%	79%	75%	75%	17
6.	70%	75%	80%	91%	75%	83
7.	75%	86%	70%	91%	54%	82
8.	67%	87%	73%	50%	54%	83
9.	43%	68%	73%	50%	49%	80
10.	45%	50%	74%	78%	50%	82
11.	63%	76%	77%	86%	50%	82
12.	77%	77%	74%	96%	81%	85
13.	61%	92%	69%	75%	94%	82
14.	51%	75%	71%	75%	57%	77
15.	71%	74%	75%	25%	75%	80
16.	69%	75%	70%	75%	87%	86
17.	74%	90%	71%	88%	50%	82

Questions No.	Env-501	Env-502	Env-503	Env-504	Env-505	Env-506
18.	44%	93%	73%	76%	58%	80
19.	74%	88%	74%	70%	81%	82
20.	75%	76%	75%	91%	67%	82
21.	51%	68%	73%	76%	93%	83
22.	75%	86%	77%	100%	61%	80
23.	66%	80%	79%	80%	65%	82

1.4.5 *PhD Faculty Research Measurement (2019-20)*

Faculty Name	Thesis or FYP	Publication
Dr. Sajjad H. Sheikh	4	5
Dr. Amir Ikhlaq	4	11
Dr. Muhammad Umar Farooq	3	4
Dr. Muhammad Irfan Jalees	1	5
Dr. Mehwish Anis	1	3
Dr. Ghulam Hussain	2	3

1.4.6 *Students Enrolment*

Usually 30-40 students are admitted in the institute. The admissions were made strictly on merit. The lowest merit of the student admitted is **66.0240** which indicate that the quality of entering students is very good.

Table- 3 Student intake in session 2018, 2019 & 2020

Sr. No.	Year	Students Intake
1.	2018	29
2.	2019	27
3.	2020	25 (Morning) 18 (Weekend)

1.4.7 *Students faculty ratio*

Total students   =   29 (2018) + 27 (2019) + 43 (2020)

                                 =   89

Total Teachers (PhD faculty) =   6

                   Ratio

         Student: Teacher

89   :   6

15   :   1

CRITERION-2: CURRICULUM DESIGN AND ORGANIZATION

The genesis of any engineering program is the fusion of its stakeholders' perceptions. The academic curriculum of the M.Sc. Environmental Engineering program of IEER is designed as to facilitate/ensure the achievement of program outcomes by all students. It consists minimum of 2 and maximum of 4 years. This was achieved by preparing a balanced combination of technical and non-technical contents coupled with appropriate assessment and evaluation methods. It has a well-defined core of essential subjects which are supported by requisite compulsory as well as elective courses. It has invoked awareness and comprehension of societal problems amongst the students and motivates them to seek solutions for improving the quality of life. The theory content of the curriculum has supplemented with appropriate experimentation in laboratories.

The curriculum was developed by incorporating the inputs from all stakeholders, especially from the industry so as to keep the curriculum aligned with the program objectives and outcomes. The program structure covers the essential fundamental principles at the initial stages, leading to integrated studies in the final year of the program.

M.Sc. Environmental Engineering program is producing post-graduates who can engage in the professional practice of environmental engineering or a related professional discipline. These graduates have been meeting the growing need of competent and well-trained environmental engineers in the country, both in public and private sector. A brief overview of the program is given below;

Table- 4: System of instructions and examinations

Nature of academic	Semester	
No. of sessions (semester) in program (4/8/8/12)	8	
Duration of a session (in weeks)	Total: 18	Teaching: 15
Total number of courses in program	8	
Total number of courses in a session	Min.: 2	Max: 4
Total number of Credit Hours	30	
Number of Credit Hours (CH) per semester	16	

Nature of academic	Semester	
Total number of contact hours for theory course per session	Min: 45	Max: 45
Total number of contact hours for practical course per session	Min: 45	Max: 45
Number of Contact Hours per week	12-14	
Weekly contact hours for a theory class	Min: 2	Max: 3
Weekly contact hours for a practical class	Min: 3	Max: 3
Engineering Domain Courses	88%	
Non-Engineering Domain Courses	12%	

2.1 Academic Calendar

Table- 5 Academic Calendars for Sessions 2018, 2019 & 2020

Session-2018							
Semester-4				Semester-5			
Start	Mid term	End term	Break	Start	Mid term	End term	Break
23 Jan 20	2 Apr To 9 Apr 20	22 May To 29 May 20	---	29 Aug 20	25 Oct To 1 Nov 20	23 Dec To 03 Jan 21	4 Jan To 22 Jan 21
Session-2019							
Semester-2				Semester-3			
Start	Mid term	End term	Break	Start	Mid term	End term	Break
23 Jan 20	2 Apr To 9 Apr 20	22 May To 29 May 20	---	29 Aug 20	25 Oct To 1 Nov 20	23 Dec To 03 Jan 21	4 Jan To 22 Jan 21
Session-2020							
Semester-1							

Start	Mid term	End term	Break	Start	Mid term	End term	Break
29 Aug 20	25 Oct To 1 Nov 20	23 Dec To 03 Jan 21	---				

2.2   Grade Sheets (One Complete Year)

Table- 6: Grade Sheet of 1st Semester of Session 2019

No. of Students Securing Grades													
Sr.	Course Name	Total	A+	A	A-	B+	B	B-	C+	C	C-	D	F
1	Environmental Management & Impact Assessment	30	3	5	9	5	4	2	1	0	0	0	1
2	Physicochemical Processes in Environmental System	31	7	2	5	6	4	2	3	1	0	0	1
3	Experimental Methods in Environmental Engineering	31	1	3	9	9	1	5	2	0	0	0	1

Table- 7 Grade Sheet of 2nd Semester of Session 2019

No. of Students Securing Grades													
Sr. No.	Course Name	Total	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	F
1	Wastewater Treatment and Design	30	3	8	2	4	2	5	2	1	0	3	0	0
2	Water Supply and Wastewater Collection	28	0	3	4	4	6	6	3	2	0	0	0	0
3	Industrial and Hazardous Waste Management	30	0	3	3	6	5	2	0	6	0	2	2	1

2.3   Syllabus of M.Sc. Environmental Engineering

The M.Sc. Environmental Engineering syllabus consists of six compulsory courses, two elective courses and a research thesis. As per HEC policy a student can skip research thesis and take two special papers for the completion of 30 credit hour requirement.

Table- 8: List of Compulsory Subject

Ref. No.	Subjects	Credit Hours	Contact Hours	Pre-Requisite (if any)
Compulsory subjects				
Env-E-501	Environmental Management and Impact Assessment	3	3	Nil
Env-E-502	Physio-Chemical Processes in Environmental Engineering	3	3	Nil
Env-E-503	Wastewater Treatment and Design	3	3	Nil
Env-E-504	Experimental Methods in Environmental Engineering	2	2	Nil
Env-E-504L	Experimental Methods in Environmental Engineering	1	3	Nil
Env-E-505	Industrial and Hazardous Waste Management	3	3	Nil
Env-E-506	Water Supply and Wastewater Collection System	2	2	Nil
Env-E-506L	Water Supply and Wastewater Collection System	1	3	Nil
	Research Thesis[3]	6	18	Nil

Table- 9: List of Elective Subjects

Course No.	Subjects	Credit Hours	Contact Hours
Elective subjects			
Env-E-507	Environmental Chemistry and Microbiology	2	2
Env-E-507L	Environmental Chemistry and Microbiology	1	2
Env-E-508	Solid Waste Management	3	3
Env-E-509	Air and Noise Pollution Control	3	3

---

[3] 1 credit hour is equals to 3 contact hours as per HEC policy student can skip research thesis and take two special papers for the completion of 30 credit hour requirement.

Course No.	Subjects	Credit Hours	Contact Hours
Env-E-510	Ecology and Risk Assessment	3	3
Env-E-511	Environmental Health and Safety	3	3
Env-E-512	Water Quality Modeling	2	2
Env-E-512L	Water Quality Modeling	1	2
Env-E-513	Marine Pollution and Control	3	3
Env-E-514	Modeling of Environmental Systems	2	2
Env-E-514L	Modeling of Environmental Systems	1	2
Env-E-515	Agricultural Pollution and Control	3	3

2.4   Course break down in terms of engineering and Non-Engineering domain.

Table- 10: Non-Engineering Domain in M.Sc. Engineering Course

Knowledge Area	Name of Course	Lec CH	Lab CH	Total CH	Total Courses	Total Credits	% Area	Overall Area
Management Sciences	Ecology and Risk Assessment	3	0	3	1	3	50	5.9
Natural Sciences	Environmental Chemistry and Microbiology	2	1	3	1	3	50	5.9
	Sub -Total-I	5	1	6	2	6	100	12

Table- 11: Engineering Domain in M.Sc. Engineering Course

Knowledge Area	Name of Course	Lec CH	Lab CH	Total CH	Total Courses	Total Credits	% Area	Overall Area
	Water Quality Modeling	2	1	3	1	3	6.67	5.9
Engineering Foundation	Modeling of Environmental Systems	2	1	3	1	3	6.67	5.9
Major Based Core (Breadth)	Water Supply and Wastewater Collection System	2	1	3	1	3	6.67	5.9

Knowledge Area	Name of Course	Lec CH	Lab CH	Total CH	Total Courses	Total Credits	% Area	Overall Area
	Wastewater Treatment and Design	3	0	3	1	3	6.67	5.9
	Industrial and Hazardous Waste Management	3	0	3	1	3	6.67	5.9
	Air and Noise Pollution Control	3	0	3	1	3	6.67	5.9
	Solid Waste Management	3	0	3	1	3	6.67	5.9
	Experimental Methods in Environmental Engineering	2	1	3	1	3	6.67	5.9
	Environmental Health and Safety	3	0	3	1	3	6.67	5.9
	Environmental Impact Assessment and Management	3	0	3	1	3	6.67	5.9
	Physio-Chemical Processes in Environmental Engineering	3	0	3	1	3	6.67	5.9
Major Based Core (Depth)	Marine Pollution and Control	3	0	3	1	3	6.67	5.9
	Agricultural Pollution and Control	3	0	3	1	3	6.67	5.9
	Research Thesis	0	6	6	2	6	13.3	12
	Sub-TOTAL -II	35	10	45	15	45	100	88
	Grand Total (I+II)	40	11	51	17	51		100

2.5   Syllabus Outline

2.5.1 *Env-E-501 Environmental Management and Impact Assessment*

Objectives

1.   To have the knowledge of recent and upcoming issues.

2.   To have know-how of Pakistani current profile related to environmental economics, to know about standards, NEQ's & ISO-14000 international laws.

3.   To study the components of environmental assessment that includes screening, scoping, mitigation, baseline studies, prediction and auditing.

4.   To know the methodology of developing an EIA and risk assessment report.

5.   To have clear concepts of sustainable development.

Course Outline

Environment and Environmental Issues, Country Profile, Basic Environmental Economics Environmental Organizations, Legislations, Standards ISO-14000 and NEQS, Pollution Charges, Components for Environmental Assessment, Screening, Scoping, Baseline Study, Mitigation, Prediction and Auditing Environmental Impact Methodology, Environmental Impact Statements Concepts of Sustainable Development, Risk analysis

Recommended Books

1.   Environmental Impact Assessments by Canter, Mc Graw Hill, 2nd edition,1996.

2.   PEPA Guidelines by PEPA, M.O.E. Government of Pakistan, 2000.

3.   Environmental Management in Practice Vol 1,II, III by Nathe-Etal (1998) Rouledge Publisher, London.

2.5.2 *Env-E-502 Physio-Chemical Processes in Environmental System*

Objectives

1.   Introduction to stoichiometric, chemical equilibrium, kinetics and reactor theory.

2.   To acquire knowledge of physio chemical treatment processes to implement it on the developmental projects according to latest technologies.

Course Outline

Stoichiometry, Chemistry Equilibria and Kinetics, Reactors and Reactor Theory, Principles and Design of Physio-Chemical Treatment Processes, Sedimentation, Coagulation Flocculation Filtration and Disinfection, Membrane Processes Water Softening, Distillation, Ion Exchange, Adsorption, Corrosion, Sludge Management.

Recommended Books

1.   Water Treatment: Principle and Design by I.M. Montgomery Consulting Engineers, Wiley Inter -science New York,1985

2.   Integrated Design of Water Treatment Facilities by S. Kawamura, Wiley Inter-Science, New York, 2nd edition,2000

3.   Physico-Chemical Processes for Water Quality Control by W.J. Weber Jr John Wiley & Sons, 1972.

4.   Wastewater Engineering by Metcalf & Eddy, McGraw Hill, 5th edition (2013)

2.5.3 *Env-E-503 Wastewater Treatment and Design*

Objectives

1.   To make student skilful in designing of unit operations, related to wastewater treatment technologies.

2.   To develop competent skills in making the students recycle the wastewater according to current scenario.

Course Outline

Sources, Flow Estimation, Characteristics, Design of Unit Operations, Principles of Biological and Natural Treatment Processes and Design, Biochemical Reactors, Sludge Treatment and Disposal, Plant Hydraulics and Wastewater Reuse.

Recommended Books

1.   Wastewater Engineering by Metcalf & Eddy, McGraw Hill, 5th edition (2013)

2.5.4 *Env-E-504 Experimental Methods in Environmental Engineering*

Objectives

1.   Graduates will be taught the principles of physical, chemical and biological analysis of environmental processes. They will go through latest techniques to measure pollutants in air water wastewater and solid waste.

2.   Students will learn to interpret the results using statistical tools.

Course Outline

Principles of Physical, Chemical and Microbiological Analysis of Environmental Pollutants, Instrumental Techniques, Sampling Procedures for the Examination of Water, Wastewater, Air and Solid Waste, Laboratory Techniques and Field Monitoring for Parameters of Importance causing Environmental Pollution, Instrumental Techniques Using Atomic Absorption

Spectrophotometry, Gas Chromatography, Assessment and Interpretation of results using statistical tools.

Practical List (if any)

1.   Removal of copper "Cu" using process of coagulation and filtration

2.   Phosphate (PO_4^{-3}) estimation by using UV-Visible spectrophotometer

3.   Determination of organic matter in unsettled and settled sample of waste water using chemically oxygen demand "COD" technique

4.   Determination of organic matter by using biochemical oxygen demand "bod" technique

5.   Determination of equivalence point using pH curves

6.   Sulphate (SO_4^{-2}) estimation

7.   Estimation of organic nitrogen

8.   Sample preparation for analysis on atomic absorption spectrometer (AAS)

9.   Determination of percentage of total hardness removed from different water samples after coagulation and flocculation

Recommended Books

1.   Standard Methods for the Examination of Water and Wastewater by AWWA, WPCF Washington DC., Volume 4, 2013

2.   Principles of Environmental Sampling by Keith, CRC Press,1991

3.   Microbiology: A human perspective by W. Nester, McGraw Hill, 2007.

4.   Environmental Pollution Analysis by S.M. Khophar, New Age International CP Ltd. Publishers, New Delhi-London-Hong Kong, 1995

2.5.5 *Env-E-505 Industrial and Hazardous Waste Management*

Objectives

1.   Graduates will be able to apply knowledge of characteristics of industrial wastewater and techniques to minimize and eliminate the hazardous or industrial waste.

2.   Graduates can manage clinical waste, solid waste and hazardous waste collection, disposal, recovery, recycling and treatment processes.

Course Outline

Origin, Characteristics and Classification of Industrial and Hazardous Wastes, Hazards of Industrial Waste, Waste Audit Processes, Waste Minimization and Elimination Techniques, Engineering Principles and Processes for Pollution Prevention, Treatment, Recovery

Transportation and Disposal including Landfilling, Conversion, Safe Engineered Storage Case Studies of Various Industries, Climate Waste Management.

Recommended Books

1.   Environmental Engineering & Sanitation by Jospeh A. Salvate, Wiley Inter-Science,4th Edition,2004.

2.   Environmental Engineering: Environmental Health and Safety for municipal infrastructure, land use, planning and industry by N.L.Nemerow, Wiley Inter-Science, 2009.

3.   Industrial Water Pollution Control, W.W. Eckenfelder, Mc Graw Hill ,3rd Edition,2000

4.   Hazardous Management, M.D. Lagrega, P.L. Buckingham and I.C. Evans, Mc Graw Hill ,2nd Edition

2.5.6 *Env-E-506 Water Supply and Wastewater Collection Systems*

Objectives

1.   The graduates will be capable of designing water supply distribution system economically.

2.   They will be able to design sewerage system by different methodologies that will help them out in selecting the most economical methods.

Course Outline

Water Supply Storage Systems, Transmission Systems, Water Supply Distribution Systems Analysis and Design. Pipes and Appurtenances, Wastewater Collection and Disposal Works, Estimation of Sanitary Sewage and Storm Water Runoff, Formulation of Rainfall Intensity, Duration and Frequency Relationships and Drainage Systems, Design of Sanitary Sewers, Flow in Sewer, Transitions, Side Weirs, Agricultural Runoff and Drainage System Design.

Recommended Books

1.   Wastewater Engineering Treatment and reuse Metcalf and McGraw Hill Book Co., 5th edition (2013)

2.   Water supply and sewerage 6th edition T.J. Meghee, McGraw Hill Book. Co

3.   Water and wastewater Engineering Fair, Grayer ad Okum McGraw Hill Bool Co, 3rd edition

2.5.7 *Env-E-507 Environmental Chemistry and Microbiology*

Objectives

1.   The graduates will be capable of applying the knowledge on chemical treatment processes of properties of water, wastewater and air.

2.   The students are prepared for the applying the biotechnology concepts on pollution control and waste conservation.

Course Outline

Physical and chemical properties of water, wastewater, air and soil. Acid-base equilibrium, chemical kinetics, oxidation-reduction and solubility reactions, mechanism of coagulation, adsorption, precipitation, absorptions, disinfections, persistent organic pollutants (POP's), nuclear chemistry and biochemistry.

Basic, classification, nomenclature, morphology, physiology and growth mechanisms of microbes, energetic and interactions among biological populations, influence of environmental factors on growth and distribution of microbes, concepts of bio-technology as applied to the pollutants control and waste conservation.

Practical List (if any)

1.   Strength determination of a bleaching

2.   Study of chemical kinetics of chlorine used as a bleaching agent

3.   Determination of total coliform and fecal coliform by MPN method

4.   Preparation of Culture media

Recommended Books

1.   Environmental Chemistry by S.E. Manahan, CRC press ,8th edition,2004

2.   Wastewater microbiology by G Bitton, Willy inter-science new york,4th edition

3.   Chemistry of environmental engineers by C.D. Sawyer, Mcgraw Hill ,5th edition,2002

4.   Microbiology for sanitary engineering by R.E Mckinney Mcgraw Hill, lastest Edition,1962

2.5.8 *Env-E-508 Solid Waste Management*

Objectives

1.   The students can design a wide range of communities for maintaining the cleanliness in the respective city or community.

2.   The graduates will be able to extract the maximum amount of energy from the waste to apply zero waste strategy.

Course Outline

Sources, classifications, characteristics, generation onsite handling and storage, collection, transfer, recycling and disposal techniques of municipal solid waste (MSW), landfilling, site selection, investigation and design, thermal conversion, composting, concepts of integrated solid waste management, existing practices and their hazards, economic evaluation of the system, hospital waste management system.

Recommended Books

1.   Integrated solid waste management by G Tchobanoglous McGraw Hill ,2nd Edition, 1993

2.5.9 *Env-E-509 Air and Noise Pollution Control*

Objectives

1.   The graduates can implement the design on any scenario that can create problems related to air like industrial emissions etc.

2.   They will have a command on safety equipment and fire protection techniques.

Course Outline

Introduction, sources, classification and effects of air pollutants, sampling and monitoring techniques, indoor and outdoor (industrial and vehicular emissions), Air quality assessments, dispersion model, air pollution control techniques, air pollution laws and regulations.

Noise pollution, characteristics, sources, their effects and control measures.

Recommended Books

1.   Air pollution control Engineering by N.D Never , McGraw Hill, Waveland Pr Inc 2nd edition,2010

2.   Air pollution by H.C. Perkins, McGraw Hill ,1974

3.   Noise pollution by Tripathy Debipras , APH publishing,1999

2.5.10 *Env-E-510 Ecology and Risk Assessment*

Objectives

1.   To provide a general understanding of basic concepts of ecology

2.   To understand ecosystems, its types, its management, sustainability and biodiversity

3.   To enable the students to use these concepts and use in environmental engineering practice

Course Outline

Introductions, principle and concepts of eco-systems. Energy in eco-systems, biogeochemical cycles, principle pertaining to limiting factors, principles and concepts at the community and population levels, species in eco-systems, devolution and evolution of eco-systems., models in ecology, fresh water ecology, marine ecology, estuarine ecology, terrestrial ecology, concepts and principles in sustainable development and biodiversity, habitat, damage assessment, end point definition, qualification of uncertainty, predictive risk assessment, exposure, organism-level effects and case studies.

Recommended Books

1.   Fundamentals of Ecology by Odum, W.B. Sounders, Philadelphia ,5th edition,2004

2.   Ecological Engineering by Patrick C. Kangas, CRC Publisher ,2004

3.   Ecology, Concepts and Applications, Manual C Molles Jr, McGraw Hill Publishers, 4th Edition, 2015.

4.   Principles of terrestrial ecosystem ecology, F. Stuart Chapin, Springer Science Environmental Science by Y.K. Singh, New Age International Publishers 2nd Edition, 2011.

2.5.11 *Env-E-511 Environmental Health and Safety*

Objectives

1.   Describe the nature of the health effects associated with exposure to industrial agents

2.   Be familiar with the standards method for measuring and evaluating worker exposure to chemical and physical agents

3.   Apply and interpret health and safety standard and regulations for the work place environment

Course Outline

Principles of public health, communicable diseases, water borne, food borne, air borne and sanitation related diseases and control measures. Industrial hygiene and safety, accident prevention and elimination plans, fire protection techniques and safety equipment.

Recommended Books

1.   Environmental engineering & sanitation by salvata, wiley inter-science,4th edition,1992

2.   Environmental health engineering by S. Caeneross, Wiley inter-science,2nd edition,1993

3.   Economics by K.F.H. Murrell, Chapman & Hall international,2012

2.5.12 *Env-E-512 Water Quality Modeling*

Objectives

1.   The students will be able to model mathematically for water bodies to judge the water quality parameters.

Course Outline

Basic concept of modeling, hydrological considerations in water quality modeling, low flow frequency analysis, sources of pollution and types of wastes point and non-point sources.

General mathematical formulation of water quality models for streams and rivers. BOD, DO, Bacterial decay, Nitrification. Stream surveys for model calibration and verification. Application of river models for water quality management.

Development of estuarine water quality model, steady state lake models, ocean outfalls and mathematical models of wastewater dispersion in oceans.

Recommended Books

1.   Principles of surface water quality modelling and control by R.V. Thomann ,Harper and Row publishers New York, 1993

2.   Water quality modelling: A guide to effective practice by D.M. Palmer, the world bank, Washington DC, 2001

2.5.13 *Env-E-513 Marine Pollution and Control*

Objectives

1.   The students will be able to judge the stream pollution and manage the marine resources.

Course Outline

Effects of pollution discharges, oil spills, coastal development. Beach erosion, channel dredging and changing sea level on marine environment and control measures. Modelling for pollution dispersions. Study of marine biology (organisms, fisheries and mangroves), coastal geology and estuarine ecology, marine resources management and sea water pollution.

Recommended Books

1.   Introduction to earth systems science and global environmental change by fred T. Mackenzie, Prentice-Hall ,4th edition (2011)

2.   Case studies in oceanography and marine affairs by George Brows andEngela, Open university UK ,2013

3.   Ocean chemistry and deepsea sediments, open university UK, 1989

4.   Sea water, its composition, properties and behaviour, Evelyn Brown, Engela Collings ,2nd edition,2013

2.5.14 *Env-E-514 Modelling of Environmental Systems*

Objectives

1.   The students will be able to perform water quality modelling for surface and ground water.

2.   They will be able to plan environmental models for the sustainable development.

Course Outline

Basic concepts and definitions, environmental systems, modeling objectives and choices. Sensitivity analysis and sources of error, introduction to numerical methods, reaction type and orders of reactions, conservation of mass, energy and momentum. River/stream quality development of models, water quality models of river, lake, reservoirs, estuaries. Contaminants transport models for groundwater and soil, air pollution dispersion model, noise pollution models in urban centers and environmental planning models.

Recommended Books

1.   Process dynamics in environmental system by W.J. Weber and Digiano, Wiley inter science,1996

2.   Principles of surface water quality modelling and control by R.V. Thomann & J.A. Multama ,harper and row ,1987

3.   Environmental chemo dynamics movement of chemicals in air, water & soil by Louis J. Thibodeauz, John wiley & Sons ,2nd Edition(1996)

2.5.15 *Env-E-515 Agricultural Pollution and Control*

Objectives

1.   The students will excel in reusing the wastewater in agriculture.

2.   They will know the conservational practices to decrease the wastewater loads from water bodies.

Course Outline

Environmental issues in agriculture, types of farming systems, agro meteorology, water and nutrients requirements, types of fertilizers, pesticides and other agro-chemicals, soil and water conservative practices, water logging and salinity, causes and effects. Wastewater reuse in agriculture, management and control of agricultural waste, recycling and reuse.

Recommended Books

1.   Agricultural pollution; problems and practical solutions by G. Merrington spon's Environmental science & Engineering series, publisher Taylor and Francis ,1st edition 2002)

2.   Wastewater engineering treatment and reuse, Metcalf and Mcgraw Hill, Book Co,5th edition (2013)

2.6   Standard-1: The curriculum must be consistent and supports the program's PEOs

Table- 12 Mapping of curriculum with PEOs

Course code	Subject	PEOs		
		1	2	3
Env-E-501	Environmental Management and Impact Assessment	●	●	●
Env-E-502	Physio-Chemical Processes in Environmental Engineering	●		
Env-E-503	Wastewater Treatment and Design	●	●	
Env-E-504	Experimental Methods in Environmental Engineering	●	●	
Env-E-504L	Experimental Methods in Environmental Engineering	●		
Env-E-505	Industrial and Hazardous Waste Management	●	●	●
Env-E-506	Water Supply and Wastewater Collection System	●		

Course code	Subject	PEOs		
		1	2	3
Env-E-506L	Water Supply and Wastewater Collection System	●		
Env-E-507	Environmental Chemistry and Microbiology	●	●	
Env-E-507L	Environmental Chemistry and Microbiology	●		
Env-E-508	Solid Waste Management	●	●	
Env-E-509	Air and Noise Pollution Control	●		●
Env-E-510	Ecology and Risk Assessment	●	●	
Env-E-511	Environmental Health and Safety	●		●
Env-E-512	Water Quality Modeling	●		
Env-E-512L	Water Quality Modeling	●		
Env-E-513	Marine Pollution and Control	●		
Env-E-514	Modeling of Environmental Systems	●	●	
Env-E-514L	Modeling of Environmental Systems	●		
Env-E-515	Agricultural Pollution and Control	●	●	

2.7   Standard-2: Theoretical background, Problem analysis and solution design must be assessed within program's core material.

Table- 13 Table showing Courses deals with different elements i.e. Theoretical background, Problem analysis and solution design

Elements	Courses
Theoretical background	• Water Supply & Wastewater Collection System • Wastewater Treatment and Design • Industrial and Hazardous Waste Management • Air & Noise Pollution Control

Elements	Courses
	- Solid Waste Management - Experimental Methods in Environmental Engineering - Environmental Health & Safety - Environmental Management and Impact Assessment - Physio-Chemical Processes in Environmental System - Ecology and Risk Assessment - Environmental Chemistry and Microbiology - Water Quality Modelling - Marine Pollution and Control - Modelling of Environmental Systems - Agricultural Pollution and Control
Problem analysis	- Water Supply & Wastewater Collection System - Wastewater Treatment and Design - Industrial and Hazardous Waste Management - Air & Noise Pollution Control - Solid Waste Management - Physio-chemical Processes in Environmental System - Experimental Methods is Environmental Engineering - Water Quality Modelling - Modelling of Environmental Systems - Agricultural Pollution and Control - Project
Solution design	- Water Supply & Wastewater Collection System - Wastewater Treatment and Design - Industrial and Hazardous Waste Management - Solid Waste Management - Physio-chemical Processes in Environmental System - Water Quality Modelling - Modelling of Environmental Systems - Project

2.8 Standard-3, 4 and 5: The curriculum must satisfy the core requirement for the program as specified by the respective accreditation body.

Table- 14 Division of Engineering and non engineering domain in the form of percentages

Domain	Knowledge Area	NUST		Institute's Program Breakup	
		Total Cr.	Overall %	Total Cr.	Overall %
Non-Engineering	Management Sciences	30	54.54	3	12
	Natural Sciences	24		3	
	Sub Total	54		6	
Engineering	Engineering Foundation	9	45.45	6	88
	Major Based Core (Breadth)	12		18	
	Major Based Core (Depth)	24		21	
	Sub Total	45		45	
Total		99		51	100

2.9 Standard-6: Information technology component of the curriculum must be integrated throughout the program.

Following are some courses which deal with IT:

Ref. No.	Subject
Semester I	
EnvE-501	Environmental Management and Impact Assessment
Semester II	
EnE-506	Water Supply and Wastewater Collection System
Semester III-IV	
	Research Thesis

2.10 Standard-7: Oral and written communication skills of the students must be developed and applied in the program.

Following are some courses which deal with oral and written communication:

Ref. No.	Subject
Semester I	
EnvE-501	Environmental Management and Impact Assessment
EnvE-502	Physio-Chemical Processes in Environmental System
EnvE-504	Experimental Methods in Environmental Engineering
Semester II	
EnE-503	Wastewater Treatment and Design
EnE-505	Industrial and Hazardous Waste Management
EnE-506	Water Supply and Wastewater Collection System
Semester III-IV	
EnE-507	Environmental Chemistry and Microbiology
EnE-507L	Environmental Chemistry and Microbiology
EnE-510	Ecology and Risk Assessment
	Research Thesis

CRITERION-3: LABORATORY AND COMPUTING FACILITIES

3.1   Standard-1: Laboratory manual/documentation/instructions for the experimentation must be available and readily accessible to faculty and students.

3.1.1 *Laboratories details*

Every Laboratory has different number of work station depending upon the number of available instruments and class size. While a work station is a place where a group of students or single student can work.

3.1.1.1   Dimensions of Laboratories

Sr.	Name of Lab.	Length	Width
1.	Unit Process Laboratory	39`	30'6``
2.	Microbiology Lab.	38`9``	30'6``
3.	Instrumental/Air Pollution Lab.	14`3``	8'6``
4.	Water & Wastewater Analysis Lab.	38`9``	30'6``
5.	Environmental Chemistry Lab	38`9``	30'6``
6.	Computer Laboratory	30`	31'

3.1.1.2   Unit Process Laboratory

Sr.	Equipment	Qty	Experiment/Utilization
1.	COD apparatus	6	COD estimation
2.	COD Photometer	1	COD estimation
3.	Peristaltic Pump	2	Flow rate control
4.	Jar Test apparatus	3	Coagulation/flocculation, Dose, Time and pH for waste treatment
5.	Current flow meter	1	Velocity/Flow of river testing
6.	Spectrophotometer	2	Metals and Dyes concentration
7.	Weighing balance	1	Weighing for standard solutions
8.	Lagoon Tanks	6	For various lagoon experiments

3.1.1.3   Environmental Microbiology Lab

Sr.	Equipment	Qty	Experiment/Utilization
1.	Autoclaves	3	For sterilization of solutions
2.	Fridge	1	Storage of samples/solutions
3.	Weighing balance	1	Weighing for standard solutions
4.	Water bath	3	For Fecal coliform
5.	Drying cabinet	1	For drying of glass ware
6.	Microscopes	14	For microorganism identification
7.	Colony counter	1	Bacterial growth
8.	Hot Plate	3	Evaporation

Sr.	Equipment	Qty	Experiment/Utilization
9.	Incubators	3	For coliform and fecal coliform

3.1.1.4   Instrumental/Air Pollution Lab

Sr.	Equipment	Qty	Utilization/Experiment
1.	SO_2 sampler	1	Estimation of oxides of sulphur
2.	CO/CO_2 sampler	1	Estimation of oxides of carbon
3.	Noise meter	1	Estimation of noise
4.	High volume sampler	1	For air sampling (PM_{10})
5.	Atomic Absorption spectrophotometer	1	Heavy and toxic metals
6.	HPLC	1	Insecticides and pesticides analysis

3.1.1.5   Water and Wastewater Analysis Lab

Sr.	Equipment	Qty	Utilization/Experiment
1.	Aeration pump	1	For DO and BOD experiment
2.	Steam water bath	1	For solid estimation
3.	Desiccator	1	For drying in solid experiment
4.	Weighing balance	1	Weighing for solids and standard solution
5.	Oven	3	For drying and solid experiment
6.	Incubator	1	For BOD experiment
7.	Furnace	1	For volatile and organic solids
8.	pH meter	1	Estimation of pH
9.	Suction filtration	3	For solids
10.	COD apparatus	6	For COD estimation

3.1.1.6   Environmental Chemistry Lab

Sr.	Equipment	Qty	Utilization/Experiment
1.	Flame	1	For estimation of sodium and potassium
2.	Jar test apparatus	1	Coagulation/flocculation, Dose, Time and pH for waste treatment
3.	pH meter	1	Estimation of pH
4.	Turbidity meter	2	Turbidity estimation
5.	Milli Q	1	For distilled & Deionized water
6.	Conductivity	4	Estimation of sodium and potassium by conductivity meter
7.	Shaker	1	For standard solution
8.	Kjeldhal	2	Estimation of organic and inorganic nitrogen
9.	Balance	2	Weighing for standard solutions

3.1.2 *Labs and Lab Work*

No. of Laboratories of Institute: 06

Sr.	Lab(s) of Course(s) Conducted in the Lab.	Type(s) of Workstations (No. of each type)	Nature of Experiments	No. of Students per Workstation
1.	1. Experimental Methods in Environmental Engineering 2. Environmental Chemistry and Microbiology	COD Apparatus (06)	Practical	4-5
		COD Apparatus (01)	Practical	12-14
		Peristaltic Pump (02)	Practical	2
		Jar Test Apparatus (3)	Practical	4-5
		Current Flow Meter (1)	Practical/ Demonstration	2
		Spectrophotometer (1)	Practical	4-5
		Spectrophotometer (1)	Practical	4-5
		Titration Assembly (1)	Practical	3-4
		Adsorption column (2)	Practical	3-4
		Deionizer plant (1)	Practical	3-4
		Distillation Plant (1)	Practical	3-4
2.	1. Experimental Methods in Environmental Engineering 2. Environmental Chemistry and Microbiology	Water Bath (1)	Practical	2
		Microscopes (14)	Practical/ Demonstration	2
		Colony Counter (4)	Practical/ Demonstration	4-5
		Incubator (3)	Practical	4
3.	1. Experimental Methods in Environmental Engineering 2. Environmental Chemistry and Microbiology	SO_2 Sampler (1)	Practical	3
		CO & CO_2 Samples	Practical	2-3
		Noise Meter (1)	Practical	3-4
		High Volume Air Sampler (1)	Practical/ Demonstration	3-4
		Atomic Absorption Spectrophotometer (1)	Practical/ Demonstration	3-4

Sr.	Lab(s) of Course(s) Conducted in the Lab.	Type(s) of Workstations (No. of each type)	Nature of Experiments	No. of Students per Workstation
		HPLC (1)	Practical/ Demonstration	3-4
4.	1. Experimental Methods in Environmental Engineering 2. Environmental Chemistry and Microbiology	Distillation plant (1)	Practical	1
		Steam bath (1)	Practical	2
		Incubator (1)	Practical	2
		Furnace (1)	Practical	2
		pH meter (1)	Practical	2
		Vacuum Filtration assembly (1)	Practical	2
		COD apparatus (6)	Practical	3-4
		Titration assembly (20)	Practical	2-3
5.	1. Experimental Methods Environmental Engineering 2. Environmental Chemistry and Microbiology	Flame photometer (1)	Practical/ Demonstration	3
		Jar test apparatus (1)	Practical	3-4
		pH meter (2)	Practical/ Demonstration	2
		Turbidity meter (2)	Practical/ Demonstration	2-3
		Milli Q (1)	Practical	2
		Conductivity meter (1)	Practical/ Demonstration	2-3
		Titration Assembly (10)	Practical	
		Shaker (1)	Practical	2
		Kjaldhal Apparatus (2)	Practical	3-4

3.1.3 *Experimental Details*

3.1.3.1   Experimental Methods in Environmental Engineering

1.   Removal of copper "Cu" using process of coagulation and filtration

2.   Phosphate (PO_4^{-3}) estimation by using UV-Visible spectrophotometer

3.   Determination of organic matter in unsettled and settled sample of waste water using chemically oxygen demand "COD" technique

4.   Determination of organic matter by using biochemical oxygen demand "bod" technique

5.   Determination of equivalence point using pH curves

6.   Sulphate (SO_4^{-2}) estimation

7.   Estimation of organic nitrogen

8.   Sample preparation for analysis on atomic absorption spectrometer (AAS)

9.   Determination of percentage of total hardness removed from different water samples after coagulation and flocculation

3.1.3.2   Experimental Methods in Environmental Engineering

1.   Strength determination of a bleaching

2.   Study of chemical kinetics of chlorine used as a bleaching agent

3.   Determination of total coliform and fecal coliform by MPN method

4.   Preparation of Culture media

3.2   Standard-2: There must be adequate support personals for the instructions and maintenance of laboratory

3.2.1 *Laboratory Staff*

Sr.	Name of Staff	Designation	Qualification	Lab Handled	Joining Data
1.	Syed Imran Hussain Shamsi	Lab. Supervisor	B.A.LLB	Unit Process	1990
2.	Muhammad Mehmood	Lec Assis	Matric	Unit Process	2008

Sr.	Name of Staff	Designation	Qualification	Lab Handled	Joining Data
3.	Muhammad Fayyaz	Technician	Matric	Water and Wastewater	1997
4	Muhammad Waseem	Technician	B.A.	Computer Lab	2008
5	Abdullah Butt	Technician	B. Tech.	Microbiology	2017
6	Bakhtawal	Technician	B. Tech	Unit Process	2017
7	Shahzad	Lec Assist	FA	Water and Wastewater	2018
8	Abdul Sattar	Lab attendant	Matric	Environmental Chemistry	2019

3.3   Standard-3: The university computing infrastructure and facilities must be adequate to support program's objective.

3.3.1 *Computing experimentation*

Lab(s) of Course(s) Conducted in the Lab.	Type(s) of Workstations (No. of each type)	Nature of Experiments	No. of Students per Workstation
Water Supply & Wastewater Collection	EPANET (22)	Simulation model	1

3.3.2 *Computer Lab*

Sr.	Equipment	Qty	Utilization/Experiment
1.	Desktop PC	22	For software classes i.e. EPA net

CRITERION-4: STUDENT SUPPORT AND ADVISING

4.1   Standard-1: courses must be offered in sufficient frequency and number for student to complete the program in timely manner.

The semesters are offered in each semester i.e. Spring, Summer and Fall. Students can take a maximum of 12 credit hours in spring and fall semester. A balanced syllabus is there which consist of subjects within IEER. Students can choose whichever subject they want to study.

4.2   Standard-2: Courses in the major area of study must structure to ensure effective interaction between students and faculty and teaching assistants.

The faculty is assigned subjects/work load as per HEC/PEC guidelines so that each faculty member has maximum time to perform duties effectively.

4.3   Standard-3: Guidance on how to complete the program must be available to all students and access to adequate advising must be available to make course decisions and career choices.

For academic counseling the university has constituted different forums such as Student Tutorial and guidance Bureau / Placement Bureau. This Bureau is working efficiently and assists the student in solving their academic psycho-social problems to resolve any difficulty in coping with their academic roles and responsibilities.

CRITERION-5: PROCESS CONTROL

5.1   Standard-1: The process by which students are admitted to the program must be based on quantitative and qualitative criteria and clearly documented. This process must be periodically evaluated to ensure that it is meeting objectives.

5.1.1 *Admission Criteria*

Admissions are done at the departmental level.

5.1.2 *Eligibility*

An applicant for admission to any of the Master level degree offered by the university must fulfill the following requirements;

- Candidates should have passed PEC/PCATP accredited undergraduate degree in the relevant discipline, securing at least 60% marks under annual/ term system OR CGPA 2.5 on the scale of 4 under semester system.
- Clearance of NTS GAT will determine the eligibility of the candidate.
- The candidate should be a bonafide resident of the area from where he seeks admission.
- He should meet the standard of physique and eyesight laid down in the medical certificate.

5.1.3 *Merit*

The comprehensive merit of application will be determined on the basis of adjusted admission marks obtained by the candidate in these examinations;

Academic   40%

Subject Test   40%

Interview   20%

Note: A CGPA of 2.50 will be scaled to 60% and it will be shown as 36/60, while 4.00 will be scaled to 90% by the system and it will be shown as 54/60 in the list.

5.2 Standard-2: The process of recruiting and retaining high qualified faculty members must be in place and clearly documented.

5.2.1 *Faculty Induction Criteria for Engineering, Information Technology and Computing Disciplines*

Position	Minimum Qualification	Experience
Lecturer	Master's Degree/B.Sc(Engr.) (First Class) in the relevant field with no 3rd Division in the academic career from HEC recognized University/Institution.	No Experience required
Assistant Professor	Master's degree in relevant field till 2010. After 2010, 30% should be Ph.D's, after 2012, 60% should be PhDs and by the end of 2015, 100% should be PhDs in the relevant field from an HEC recognized University/ Institution	2-years teaching/research experience in a recognized institution/university/college OR 2-years professional experience in the relevant field in a national Or international organization.
	OR	
	PhD in the relevant field from HEC recognized University/Institution	No Experience is required for PhD degree holders.
Associate Professor	PhD in the relevant field from institution recognized by HEC in consultation with PEC	Till June 2012, 07-years teaching/research experience in a recognized institution/ college/university or 7-years professional experience in the relevant field in a national or international organization out of which 2- years must be teaching experience.

Position	Minimum Qualification	Experience
		Note: After 2012, 10-years teaching experience with at least 4-years' experience at the Post- PhD level in HEC recognized University or a post-graduate institution or professional experience in the relevant field in a National or International Organization will be required.
		OR
		5-years post PhD teaching/ research experience in an HEC recognized University or a post-graduate Institution or professional experience in the relevant field in a National or International organization.
Professor	PhD degree in relevant field, recognized by HEC in consultation with PEC	Till June 2012, 12-years teaching/research experience in a recognized institution/ college/university or 12- years professional experience in the relevant field in a national or international organization out of which 5-years must be teaching experience. Note: After 2012, 15-years teaching/research experience with at least 8-years' experience at the Post-PhD level in HEC recognized University or a postgraduate institution or professional experience in the relevant field in a National or International organization will be required.
		OR
		10-years post PhD teaching/ research experience in an HEC recognized University or a post-graduate Institution or

Position	Minimum Qualification	Experience
		professional experience in the relevant field in a National or International organization.

5.2.2 *Faculty Induction Criteria Excluding Engineering, Information Technology and Computing Disciplines*

Position	Minimum Qualification	Experience	Minimum Number of Publications
Lecturer	First Class Master's Degree OR equivalent degree awarded after 16 years of education in the relevant field with no 3rd Division in the academic career from an HEC Recognized University/Institution. Condition of no 3rd division shall not be applicable in the qualification of appointment as lecturer in Universities or Degree Awarding Institutions provided that the candidate holds a higher degree viz. M.Phil/PhD or equivalent degree with not more than one 3rd division in entire academic career. Furthermore, the candidate with 2nd Division in the Master's Degree but holding higher degree i.e. M. Phil/PhD or equivalent degree with 18 years of education could be Considered. *First division (1st Division) in Master of Arts in English is relaxed in favour of the second division (2nd Division) as the minimum eligibility condition for appointment of Lecturers in English for Annual System degree holders for a period of five years. w.e.f 24-02-2007.	No experience required	Nil

Assistant Professor	PhD in relevant field from HEC recognized University/Institution	No experience required	Nil
	OR		
	Master's degree (foreign) OR M.Phil(Pakistan) OR equivalent degrees awarded after 18 years of education as determined by the HEC in the relevant field from an HEC recognized University/Institution.	4-years teaching/research experience in a recognized university or a post-graduation Institution or professional experience in the relevant field in a National or International organization	Nil
Associate Professor	Ph.D in the relevant field from an HEC recognized University/Institution	10-years teaching/research in an HEC recognized University or a postgraduate Institution or professional experience in the relevant field in a National or International organization. Note: After 30th June, 2010, at least 4-years Post-PhD level experience in an HEC recognized University or post-graduate institution or professional experience in the relevant field in a National or International organization will be required	The applicant must have 8 publications (with at least 2 publications in last 5 years) up till 30th Sep. 2008 and 10 publications (with at least 4 publications in the last five years after 30th Sep. 2008 in the HEC recognized Journals.
		OR	
		5-years post-PhD teaching/ research experience in an HEC recognized University or a post-graduate Institution or professional experience in the	

		relevant field in a National or International organization.	
Professor	Ph.D from an HEC recognized Institution in the relevant field	15-years teaching/research in HEC recognized University or post-graduate Institution or professional experience in the relevant field in a National or International organization. **Note:** After 30th June, 2010, atleast 8 years Post Ph.D level experience in an HEC recognized University or postgraduate institution or Professional experience in the relevant field in a National or International organization will be required. OR 10-years post-PhD from a recognized University or a post-graduate Institution or Professional experience in the relevant field in a National or International organization.	The applicant must have 12 research publications (with at least 3 publications in last 5 years) up till 30th Sep. 2008, and 15 research publications (with at least 5 publications in the last 5 years) after 30th Sep. 2008, in HEC recognized Journals.

5.2.3 *Faculty Induction Criteria for Tenure Track System*

Position	Minimum Qualification	Experience	Minimum Number of Publications	TRP* Recommendations:
Assistant Professor	PhD Degree/ Terminal Qualification in the relevant field (from an HEC recognized Institution).	For PhD degree holders from Pakistan the Registrar must certify that the PhD thesis was evaluated by two foreign Experts as per HEC guidelines for award of PhD degree, in case foreign evaluation was not done then the candidate must provide evidence of two publications in Journals recognized by the HEC	--	--
Associate Professor	PhD Degree/ Terminal Qualification in the relevant field (from an HEC recognized Institution)	6-years Post-PhD or minimum of 4-years of post-PhD experience along with at least 6 years of experience prior to the PhD. (The experience to be counted is to be of teaching/research in a recognized University or a post-graduate Institution or	10 research publications (with at least 4 publications in the past 5 years) in Journals recognized for the purpose of appointment on Tenure Track by the Higher Education Commission, i.e. research papers published in Journals that fall under the	The applicant must have been recommended by at least two neutral foreign experts of TRP, in clear context of Tenure Track OR Tenure appointment.

		professional experience in the relevant field in a National or International Organization)	category W, X and Y for Social Sciences (till 30th June 2011) while for Science disciplines papers published in only W category (Impact Factor) Journals.	
Professor	PhD Degree/ Terminal Qualification in the relevant field (from an HEC recognized Institution).	11-years Post-PhD or minimum of 7-years of post-PhD experience along with at least 12 years of experience prior to the PhD. (The experience to be counted is to be of teaching/research in a recognized University or a post-graduate Institution or professional experience in the relevant field in a National or International Organization) OR 5-years post-PhD teaching/ research experience in an HEC recognized University or a post-graduate	15 research publications (with at least 5 publications in the past 5 years) in Journals recognized for the purpose of appointment on Tenure Track by the Higher Education Commission, i.e. research papers published in Journals that fall under the category W, X and Y for Social Sciences (till 30th June 2011) while for Science disciplines papers published in only W category (Impact Factor) Journals.	The applicant must have been recommended by at least two neutral foreign experts of TRP, in clear context of Tenure Track OR Tenure appointment. **

		Institution or professional experience in the relevant field in a National or International organization.		

** The Technical Review Panel (TRP) is to be constituted by the University, composed of eminent international academics and researchers in the relevant area, drawn only from technologically advanced countries. Following parameters must be observed while selecting TRP Members for each appointment (Professor /Associate Professor) to be made under TTS.

1. Should not have served as Supervisor/Co-Supervisor of the candidate under review.
2. Should not have been a student of the candidate
3. Should not have been a co-author of the candidate on any publication.
4. Must have the rank of an Associate Professor or above in a recognized university or equivalent position in a recognized research organization.
5. He/She also must not have a lower rank than the applicant.

5.3 Standard-3: The process and procedures used to ensure teaching and delivery of course material to the students emphasizes active learning.

Course learning outcomes are statements that describe significant and essential learning that learners have achieved and can reliably demonstrate at the end of a course. This means learning outcomes identify what the learner will know and be able to do by the end of a course. Course learning outcomes (CLOs) of M.Sc. Environmental Engineering are measurable and observable via cognitive, psychomotor and affective learning domains. In other words, CLOs reflect essential knowledge, skills and attitudes. It shows the minimum performance of a student to achieve to successfully complete a course. The faculty member (who is subject in charge) is responsible for course to maintain a detailed course syllabus which carefully delineates both the content and PLOs addressed by the course. These details can be found in course files. The course files contain all types of assessments along with course and lecture details. The CLOs assessment is continuous starting from the first week until the last week of lecture. The course learning outcome assessment is divided into 2 parts: after mod term examination (week 9) and after final examination (week 18). At the end of the course learning process and assessment, Faculty members evaluate course in terms of achievements of students for PEOs and PLOs revision. Following is flow chart used for the assessment of CLOs.

```
┌─────────────────┐          ┌─────────────────┐
│    Student      │          │ Student Learning│
│  Achievement    │          │   Evaluation    │
│   Evaluation    │          │                 │
└─────────────────┘          └─────────────────┘
        ↑                            ↑
        │    ┌──────────────┐        │  ┌──────────────────┐
        │    │ Quiz,Test,Mid│        │  │ Survey based on  │
        ├──→ │  term, Final │        │  │ course contenet, │
        │    │              │        ├─→│ feedback,teaching│
        │    └──────────────┘        │  │  and learning    │
        │                            │  └──────────────────┘
        │  ┌───────────────┐  ┌─────┐│
        │  │  CLOs Assesment│        │  ┌──────────────────┐
        │  └───────────────┘         │  │    PLOs and      │
        │    ┌──────────────┐        │  │     PEOs         │
        │    │ Assignments, │        ├─→│   interaction    │
        └──→ │Projects, Lab,│        │  │                  │
             │  Viva Voce   │        │  └──────────────────┘
             └──────────────┘
```
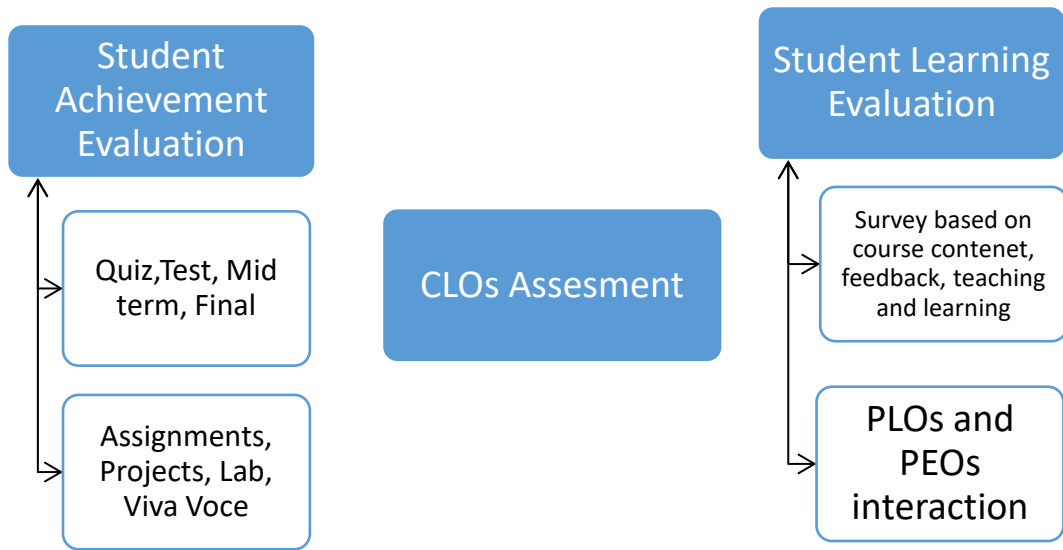
Figure- 8: Course learning Outcomes (CLOs) Assessment Method

CRITERAIN-6: FACULTY

6.1   Standard-1: There must be enough full-time faculty who are committed to the program to provide adequate coverage of the program areas/courses.

6.1.1 *Faculty strength*

Sr. No	Name	PEC No	Designation	Joining date	Details of qualifications			Specialization	Experience Teaching (Total) years	Dedicated/Shared	Cr. Hrs. Taught in the Current & Last semesters	
					Degree	Year	Institution				MS	BS
1.	Dr. Sajjad Haydar	Civil/12476	Professor	20-11-02	B.Sc Engg M.Sc Engg PhD Engg	1990 2004 2008	UET, Lhr. UET, Lhr. UET, Lhr	Civil Engg. Envir.Engg Envir Engg	18 (28)	Dedicated	0+3	3+3
2.	Dr. Amir Ikhlaq	-----	Associate Professor	30-3-06	M.Sc. M.Phil Ph.D.	2004 2007 2013	UET, Lhr UET, Lhr Huderfield, UK	Chemistry Chemistry Chemistry	14 (15)	Dedicated	3+3	1+2
3.	Dr. Muhammad Umar Farooq	-------	Associate Professor	17-10-11	M.Sc. Ph.D.	2004 2010	Punjab Univ Beijing Univ, China	Chemistry Chemistry	9 (10)	Dedicated	3+3	3+3
4.	Dr. Muhammad Irfan Jalees	-----	Assistant Professor	23-09-08	M.Sc. M.Phil Ph.D	2003 2006 2014	UET, Lhr UET, Lhr UET, Lhr	Chemistry Chemistry Chemistry	12 (14)	Dedicated	3+3	2+3
5.	Dr. Mehwish Anis	Chem/6311	Assistant Professor	16-02-09	B.Sc M.Sc Ph.D.	2007 2010 2019	UET, Lhr UET, Lhr UET, Lhr	Chem. Engg. Envir. Engg Envir. Engg	11 (13)	Dedicated	0+3	3+3

Sr. No	Name	PEC No	Designation	Joining date	Details of qualifications			Specialization	Experience Teaching (Total) years	Dedicated/Shared	Cr. Hrs. Taught in the Current & Last semesters	
					Degree	Year	Institution				MS	BS
6.	Dr. Ghulam Hussain	Enviro/22	Assistant Professor	15-09-09	B.Sc. M.Sc. Ph.D.	2009 2012 2019	UET, Lhr UET, Lhr UET, Lhr	Envir. Engg. Envir. Engg. Envir. Engg.	11 (11)	Dedicated	3+3	3+3

6.2   Standard-2: All faculty members remain in current in the discipline and sufficient time must be provided for scholarly activities.

6.2.1 *Faculty work load*

Sr.	Name	Degree Level	Current semester Loading			Last semester Loading		
			Credit hours		**Course titles**	**Credit hours**		**Course titles**
			Theory	**Practical**		**Theory**	**Practical**	
1.	Dr. Sajjad Haydar	BSc	3		Water Supply and Wastewater Engineering	3		Water and Wastewater Treatment Plant Design
		Ph.D/MSc						
2.	Dr. Amir Ikhlaq	BSc	3		Environmental Chemistry	2		Introduction to Environmental Engineering
		PhD/MSc	3		Research Methods	3		Environmental Chemistry
3.	Dr. Muhammad Umar Farooq	BSc	3		Air and Noise Pollution	3		Environmental Microbiology
		MSc	3		Ecology and Risk Assessment	2		Environmental Management and Impact Assessment
4.	Dr. Mr. Muhammad Irfan Jalees	BSc	2		Ecological Management	1	2	Environmental Engineering

Sr.	Name	Degree Level	Current semester Loading			Last semester Loading		
			Credit hours		Course titles	Credit hours		Course titles
			Theory	Practical		Theory	Practical	
								Laboratory Techniques
		PhD/MSc	2	1	Analytical Methods	2	1	Experimental Methods in Environmental Engineering
5.	Dr. Mehwish Anis	BSc	3		Solid Waste Management	3	1	Environment Impact Assessment
		PhD/MSc	3		Hazardous and Solid Waste management			
6.	Dr. Ghulam Hussain	BSc	3		Water Pollution Control	3		Principles of Water & Wastewater Treatment
		PhD/MSc	2	1	Water Supply and Wastewater Collection System	3		Physiochemical processes of water and wastewater

6.3 Standard-3: All faculty members should be motivated and have job satisfaction to excel in their profession.

6.3.1 *Faculty Training and Mentoring*

Faculty members often attend different training courses/practical for the improvement of personal skills.

Sr.#	TITLE of Course/Internship/Training Course	Duration	Dates of Attendant	Certificate/Diploma (write YES or NO)
	Dr. Amir Ikhlaq			
1.	International Workshop on Outcome Based Education (OBE) Implementation	1 day	26 Sep 2016	Yes
	Dr. Muhammad Umar Farooq			
1.	Training Session for Young Faculty Members Outcome Based Education (OBE) Curriculum Planning & Development Ingredients of a High Quality Course Semester Rules and Exam Regulations Traits of an effective Teacher	1 day	14th Nov, 2016	No
2.	International Workshop on Outcome Based Education (OBE) Implementation	1 day	26 Sep 2016	Yes
3.	Seminar on the working of Lahore Waste Management Company (LWMC)	1 day1	19th Oct, 2015	No
	Dr. Muhammad Irfan Jalees			
1.	Training Session for Young Faculty Members • Outcome Based Education (OBE) • Curriculum Planning & Development • Ingredients of a High Quality Course • Semester Rules and Exam Regulations • Traits of an effective Teacher	1 day	14th Nov, 2016	No
2.	International Workshop on Outcome Based Education (OBE) Implementation	1 day	26 Sep 2016	Yes

Sr.#	TITLE of Course/Internship/Training Course	Duration	Dates of Attendant	Certificate/Diploma (write YES or NO)
3.	Seminar on the working of Lahore Waste Management Company (LWMC)	1 day1	19th Oct, 2015	No
4.	Workshop on Teaching and Communication Skills	3 days	24-27 Aug 2012	Yes
5.	Advance Instrumental Training at TEXAS A & M University, TX, USA	06 months	Feb-2009 to Aug-Aug-2009	Yes
6.	Organic Geochemistry, OGTI, Islamabad	6 days	March 2006	Yes
7.	Internship at Rustum Sohrab Factory	6 Weeks	02 Jun to 13 July, 2002	Yes
Dr. Mehwish Anis				
1.	Training Session for Young Faculty Members • Outcome Based Education (OBE) • Curriculum Planning & Development • Ingredients of a High Quality Course • Semester Rules and Exam Regulations • Traits of an effective Teacher	1 day	14th Nov, 2016	No
2.	Seminar on the working of Lahore Waste Management Company (LWMC)	1 day1	19th Oct, 2015	No
3.	Interactive Workshop on CPD Framework for Professional Development of Engineers	1 day	18 March 2013	Yes
4.	Workshop on Teaching and Communication Skills	1 month	01 Aug to 31 Aug 2011	Yes
Dr. Ghulam Hussain				
1.	Training Session for Young Faculty Members Outcome Based Education (OBE) Curriculum Planning & Development Ingredients of a High Quality Course Semester Rules and Exam Regulations Traits of an effective Teacher	1 day	14th Nov, 2016	No

Sr.#	TITLE of Course/Internship/Training Course	Duration	Dates of Attendant	Certificate/Diploma (write YES or NO)
2.	International Workshop on Outcome Based Education (OBE) Implementation	1 day	26 Sep 2016	Yes
3.	Seminar on the working of LWMC	1 day1	19th Oct, 2015	No
4.	Interactive Workshop on CPD Framework for Professional Development of Engineers	1 day	18 March 2013	Yes
5.	Workshop on Teaching and Communication Skills	3 days	28-30 Aug 2012	Yes
6.	Workshop on Use of PICC Construction Cost Data	1 day	26 June 2012	Yes
7.	Workshop on Teaching and Communication Skills	3 days	28-30 Aug 2012	Yes

6.3.2 *Faculty Retention, Development and Career Planning*

The University has initiated a number of schemes for career building of faculty. Some of the important facilities are as follows.

- Scholarship of Rs. 5,000/= per month to the teacher doing M. Sc. at the University.
- On registration in Ph.D. program at the university the scholar gets Rs. 15,000/= per month in addition to all the other research facilities for conducting research.
- Scholarships are made available for faculty members for Ph. D. studies abroad through HEC programs.
- Faculty is encouraged for Post Doc. Research work abroad.

CRITERION-7: INSTITUTIONAL FACILITIES

7.1 Standard-1: The institute must have infrastructure to support new trends in learning.

7.1.1 *Infrastructure of the Institution*

7.1.1.1 *Buildings*

The department has its own building having class rooms, laboratories, faculty rooms, seminar room, drawing hall, administrative rooms and store. The details are as follows;

Sr.	Facility	Qty	Remarks
1	Class Rooms	4	All rooms have seating capacity of 60.
2	Drawing Hall	1	This hall is used for the designing procedure like water supply system, wastewater distribution etc.
3	Seminar Room	1	Used for B.Sc., M.Sc., and faculty seminars for various research topics. It has a searing capacity of 60.
4	Laboratories	6	These laboratories are used for experimentation work.
5	Office	2	Used for administrative purposes
6	Store	1	A proper store with inventory register is maintained. The store personal deals with all type of purchase for the Institute.
7	Girls Common Room (GCR)	1	GCR is used for the female students to spend their spare time.

7.1.1.2 *Laboratories*

The institute has well equipped laboratories with latest available techniques and instruments. There are 06 laboratories. A number of instruments are available. Details are given in pervious section.

7.2 Standard-2: The library must possess an up to date technical collection relevant to the program.

7.2.1 *Library*

The Central library of the university now named as "National library of Engineering Sciences" is major library in U.E.T. Lahore having a variety of books regarding the various disciplines of engineering and non-engineering subjects. In addition, the Institute has its own library. At present 110,000 books are available in the main library. Approximately 3% (3000) of the books are related to the field of Environmental Engineering. The institute has access to

international journals and books through central digital library. Students can also access and download journals and books through HEC digital library using institutional subscription through campus network.

IEER has its own library also. The detail of departmental library is given below;

Thesis	155 (B.Sc) + 193 (M.Sc) + 09 (Ph.D.)
Book Titles	1300
Reports	1000
Journals in Hard Copy	2900
Magazines	600

7.2.2 *Book Bank*

The book bank has been established in the University library. At present there are 34,730 books available for students and are fully utilized for their studies. Approximately 2% (600) of the books are related to the field of Environmental Engineering.

7.2.3 *Library Equipment*

The library is equipped to meet the standard requirements. Photocopier, computers, internet lab, scanner, printers, video and audio equipment, CD ROMs and computerized catalogue to find the relevant literature are available in the library.

7.2.4 *Access to National and International Data-Bases*

The institute is attached with Digital Library Program of University through web server. Using this web server, the institute has internet access to a large number of electronic data.

7.2.5 *Journals / International Publications*

The university regularly publishes its own research journal wherein the research works of all research departments of the university is published. It is HEC recognized journal. The institute staff also publishes some of its research work in this journal.

7.3   Standard-3: Classrooms must be adequately equipped and offices must be adequate to enable faculty to carry out their responsibilities.

7.3.1 *Class Rooms*

   Classrooms are equipped with white board, projector and multimedia. Window AC are installed in classrooms. Relaxed cushion armchairs are there for sitting of students.

7.3.2 *Faculty office*

   Each faculty office is provided with internet and telephone connection. Faculty members are provided with PC, scanner and laser printer to perform their work. Office floor is carpeted, and durable furniture is given to faculty office.

CRITERIOAN-8: DEPARTMENTAL SUPPORT

8.1 Standard-1: There must be sufficient support and financial resources to attract and retain quality faculty.

The University has initiated a number of schemes for faculty. Some of the important facilities are as follows.

- Scholarship of Rs. 5,000/= per month to the teacher doing M. Sc. at the University.
- On registration in Ph.D. program at the university the scholar gets Rs. 15,000/= per month in addition to all the other research facilities for conducting research.
- Scholarships are made available for faculty members for Ph. D. studies abroad through HEC programs.
- Faculty is encouraged for Post Doc. Research work abroad.
- PKR 10000 for publishing in local journal (HEC Recognize) and PKR 30,000 for publishing in international journal (ISI Index).
- 1-4 salaries are given as better incentive on the basis of performance of faculty member.
- Salaries of the teaching staff are fixed according to National pay scales of Govt. of Pakistan. Tenure track and better incentive scheme has been adopted by the University, due to which the teachers are getting benefits in addition to national pay scale.

8.2 Standard-2: There must be adequate number of high-quality graduate students, research assistant and Ph.D. students

Year	Master Student	Research Assistant	Ph.D. Student
2017	20	4	2
2018	29	4	2
2019	27	4	0
2020	43	2	3

8.3 Standard-3: Financial resources must be provided to acquire and maintain library holding, laboratory and computer facilities

Name of Post and Scale	No. of Posts		Budget Estimates 2018-2019 Rs (Million)	Budget Estimates 2018-2019 Rs. (Million)	Budget Estimates 2020-2021 Rs. (Million)
	2017-2018	2017-2018			
01101-PAY OF OFFICERS					
Director 40000-2600-76400 (B-21)	1	1	0.6116	0.6428	0.6428
Professors 40000-2600-76400 (B-21)	5	5	2.8218	2.9778	3.1698
Senior Public Health Engr. /Associate Profs. 36000-2350-68900 (B-20)	4	4	2.5282	2.6362	2.7802
Assistant Professor 31000-1600-63000 (B-19)	4	4	2.4046	2.4766	2.5726
Lecturers 20000-1500-50000 (B-18)	2	2	0.5446	0.5806	0.6286
Assistant Librarian 16000-1200-40000 (B-17)	1	1	0.2895	0.3039	0.3219
Total (01101)	17	17	9.200	9.618	10.156
01201-PAY OF STAFF					
Lab. Supervisor 10000-800-34000 (B-16/17)	1	1	0.1747	0.1843	0.1939
Network Administrator 10000-800-34000 (B-16)	1	1	0.1232	0.1328	0.1428
Personal Assistant 8500-700-29500 (B-15)	1	1	0.1693	0.1777	0.1861
Special pay @ Rs.160/-p.m.			0.0020	0.0020	0.0020

Stenographer 7000-500-22000 (B-12)	1	-	0.0883	0.0883	0.0000
Assistant 8000-610-26300 (B-14/15)	1	1	0.1461	0.1533	0.1605
Overseer 7000-500-22000 (B-13)	1	1	0.0923	0.0983	0.1043
Technicians 6600-460-20400 (B-11/13)	3	3	0.3267	0.3281	0.3295
Lecture Assistants 6600-460-20400 (B-11/13)	2	2	0.1896	0.1905	0.1914
Lab. Assistants 6200-380-17600 (B-9/11)	3	3	0.3058	0.3178	0.3298
Storekeeper 6000-350-16500 (B-8)	1	1	0.0643	0.0685	0.0727
Drivers 5400-260-13200 (B-8/10)	2	2	0.1842	0.1902	0.1962
Lab. Attendants 5400-260-13200 (B-5/7)	3	3	0.1958	0.2042	0.2126
Daftri 4900-170-10000 (B-2/5)	1	1	0.0719	0.0739	0.0759
Spl. Pay @ Rs.30/-p.m.			0.0010	0.0010	0.0010
Senior Naib Qasid 5050-200-11050 (B-3)	-	1	-	0.0630	0.0630
Naib Qasid 4900-170-10000 (B-2)	2	1	0.1071	0.0594	0.0594
Total (01201)	23	22	2.242	2.245	2.321
Total (01101 + 01201)	40	39	11.443	11.863	12.476
ALLOWANCES					
02100- Senior Post Allowance.			0.139	0.139	0.139
02200- House Rent Allowance.			1.400	1.400	1.400
02300- Conveyance Allowance.			1.327	1.327	1.327

02700- Integrated Allowance	0.005	0.005	0.005
02906- Qualification Allowance for Ph.D./M.Sc. Engr.	0.360	0.360	0.360
02907- Medical Allowance & 100%	0.126	0.126	0.126
02907- Medical Allowance 15% & 20%	1.067	1.067	1.067
02914- Entertainment Allow	0.103	0.103	0.103
02915- Spl. Additional Allowance	0.443	0.443	0.443
02915- Spl. Relief Allowance	0.859	0.859	0.859
02915- Adhoc Relief	0.859	0.859	0.859
02915- Adhoc Relief Allowance 15% & 20%	0.686	0.686	0.686
02915- Adhoc Relief Allowance 50%	2.318	2.318	2.318
02915- Dearness Allowance	0.975	0.975	0.975
02917- Tech. Teaching Allowance	0.300	0.300	0.300
03900- Allowance for Director IEE&R @ Rs.4000/-p.m.	0.048	0.048	0.048
Total (Allowances)	11.015	11.015	11.015
CONTINGENCIES			
03300-Remuneration for Post Graduate Evening Classes	--	---	0.500
22000-Post Graduate Research	0.0414	0.0416	1.5
22001-Seminar and Refresher Course	0.007	0.008	0.050
22002-Faculty Research	0.045	0.050	0.300
22003-Final Year Projects	0.540	0.594	1.5
43000-M & R to Furniture	0.004	0.004	0.200
44100-Minor Repair to Bldg	0.005	0.006	0.400
51300-P.O.L. for vehicle	0.047	0.051	0.099
51900-Instructional Tours/Internship	0.022	0.042	0.100
52100-Postage Stamps	0.002	0.002	0.002
54000- Stationary & Office Supplies	0.022	0.124	0.150
55000-Publication of Journals	0.002	0.002	0.002
56000-Purchase of Books Magazine etc. for Institute Library.	0.018	0.020	0.020
57000-Linen & Overalls	0.002	0.002	0.002
59800-OtherContingencies	0.049	0.936	0.090
59902-Lab. Apparatus. & Supply	0.083	0.841	0.400
68200-Contributory Allowance to WHO/UNDP etc. Equipment, Freight	0.009	0.010	0.010

Total (Contingencies)	0.896	2.837	5.373
51100-Travelling Allowance	0.056	0.056	0.056
66100-Pension Fund	1.728	1.791	1.884
GRAND TOTAL:- **(IEER)**	**25.138**	**27.562**	**30.804**

FACULTY RESUMES

Name	Prof. Dr. Sajjad Haydar
Personal	Professor, Director
Experience	28 Years
Honors and Award	---
Membership	PEC
Graduate Students Post Doc Under Graduate Honor Students	15 30
Service Activity	Teaching graduate and undergraduate students
Brief Statement of Research	Wastewater treatment Solid waste management
Publication	1. Haider, H., Ali, W. and **Haydar, S**. (2012), Evaluation of various relationships of reaeration rate coefficient for modeling dissolved oxygen in a river with extreme flow variations in Pakistan. Hydrological Processes. USA. doi: 10.1002/hyp.9528, 2012. 2. Haydar, S, Bari, A. J., Ashfaq, T., and Adeel, M. Evaluation of aerated lagoon for the treatment of domestic wastewater in Lahore and its comparison with wastewater stabilization ponds, Journal of Engineering and Applied Sciences, (HEC Recognized), Vol. 30, no.1, (2012) 3. Anis, M., **Haydar, S** and Bari, A. J., Adsorption of lead and copper from aqueous solution using unmodified wheat straw, Environmental Engineering and Management Journal (Internation Journal; Impact Factor=1.4) in press (2012) 4. **Haydar, S**., Haider, H, Bari, A. J. and Faragh, A. Effect of Mehmood Booti landfill site in Lahore on ground water quality, Pakistan Journal of Engineering and Applied Sciences, UET Lahore (HEC Recognized), Vol 10, no. 1, 51-56, (2012) 5. **Haydar, S.** and Bari, A., Characterization and study of correlations among major pollution parameters in textile wastewater, Mehran University Research Journal of Engineering and Technology (HEC

	Recognized), vol. 30, no. 4, 577-582, (2011)
	6. Namee, O., Hameed, R. and **Haydar, S.** (2012), "Critical Review of the Techniques and Guidelines for Public Participation in EIA of Projects in Developing Countries:A case study of Pakistan", Archives Des Sciences, Vol 65, No. 8, 77-95, International Journal (Impact factor=0.47)
	7. Ghulam Hussain, **Sajjad Haydar,** A.J. Bari, J.A. Aziz, Mehwish Anis, Zunaira Asif (2015),"
	8. Muhammad Fayyaz, **Sajjad Haydar,** Amanat Ali Bhattib, Abdul Jabbar Bari, (2014), "Application of artificial neural network for the prediction of biosorption capacity of immobilized Bacillus subtilis for the removal of cadmium ions from aqueous solution", Biochemical Engineering Journal, vol 84, 83–90 (Impact Factor = 2.5)
	9. Husnain Haider, Waris Ali, **Sajjad Haydar**, Solomon Tesfamariam and Rehan Sadiq, (2013), "Modeling Exposure Period for Solar Disinfection (SODIS) under Varying Turbidity and Cloud Cover Conditions", Clean Technologies and Environmental Policy, (DOI: 10.1007/s10098-013-0677-4) (Impact factor=1.8)
	10. Muhammad Fayyaz, **Sajjad Haydar**, and Tauqeer Qureshi, (2013), "Enhancement of biosorption of zinc ions from aqueous solution by immobilized Candida utilis and Candida tropicalis cells", International Biodeterioration & Biodegradation, vol. 83, 119-128 (Impact factor=2.1)
	11. Husnain Haider, Waris Ali, **Sajjad Haydar**, (2013), "Evaluation of Various Relationships of Reaeration Rate Coefficient for Modeling Dissolved Oxygen in a River with Extreme Flow Variations", Hydrological Processes. Vol. 27, 3949–3963. (DOI: 10.1002/hyp.9528) (Impact factor = 2.4)

	12. Mehwish Anis, **Sajjad Haydar**, and A. J. Bari, (2013), "Adsorption of lead and copper from aqueous solution using unmodified wheat straw", Environmental Engineering and Management Journal, Vol.12, No. 11, 2117-2124. (Impact factor = 1.4)
	13. Haider, H., Ali, W. and **Haydar, S**., (2012), "A review of dissolved oxygen and biochemical oxygen demand model for large rivers", Pakistan Journal of Engineering and Applied Sciences, UET Lahore (Accepted), [HEC recognized]
	14. **Haydar, S**., Ahmad, H. and Aziz, J. A. (2011), "Optimization of coagulation-flocculation in the treatment of canal water", Environmental Engineering and Management Journal, vol 9, no. 11, 1563-1570. International Journal (Impact factor = 1.4)
	15. Imran Meo, **Sajjad Haydar**, Obaidullah Nadeem, Ghulam Hussain, Haroon Rashid, (2014), "Characterization of Hospital Wastewater, Risk Waste Generation and Management Practices in Lahore", Proceeding of the Pakistan Academy of Sciences, (accepted) [HEC Recongnized, X category]
	16. **Sajjad Haydar**, Ghulam Hussain, Obaidullah Nadeem, Javed Anwar Aziz, A. J. Bari and Muhammad Asif, (2014), " Water conservation initiatives and performance evaluation of wastewater treatment facility in a local beverage industry in Lahore", Pakistan Journal of Engineering and Applied Sciences, vol 14, no. 1, 27-37 [HEC recognized, X category]
	17. **Haydar, S**, Haider, H., Nadeem O., Hussain, G., Jalees, I and Qadeer, A., (2014), " Effect of Hudiara drain on the quality of groundwater in the housing schemes of Lahore", Journal of Faculty of Engineering & Technology, vol. 21, No. 2, 119-134. [HEC recognized, Y category]

	18. **Sajjad Haydar,** Ghulam Hussain, Obaidullah Nadeem, Husnain Haider, A.J. Bari and Abdul Hayee, (2014), "Performance Evaluation of Anaerobic-Aerobic Treatment for the Wastewater of Potato Processing Industry: A Case Study of a Local Chips Factory", Pakistan Journal of Engineering and Applied Sciences, vol 14, no. 1, 27-37 [HEC recognized, X category]
	19. Obaidullah Nadeem, Rizwan Hameed and **Sajjad Haydar**, (2014), "Public Consultation and Participation in EIA in Pakistan and Lessons Learnt from International Practices", Pakistan Journal of Engineering and Applied Sciences, vol 14, no. 1, 73-84 [HEC recognized, X category]
	20. Hameed, R. Bhatti, N. A., Nadeem, O., **Haydar, S**., Arif, M. (2013), "Comparative Analysis of Emissions from Motor Vehicles Using LPG, CNG and Petrol as Fuel in Lahore", Journal of the Pakistan Institute of Chemical Engineers ,Vol 41, No 1 (2013) [HEC recognized]
	21. Nadeem, **S Haydar**, S Sarwar, M Ali, (2013) "Consideration of environmental impacts in the integrated master plan for Lahore-2021 Pakistan", Journal of Science, Vol. 65, No. 3 September , 201 3) [HEC recognized]
	22. Nadeem, R Hameed, **S Haydar,** A Naeem, (2013), "Institutional set-up for environmental governance through EIA in Pakistan: the case of public sector development projects Pakistan, Journal of Science, Vol. 65 No. 3, [HEC recognized]
	23. **Haydar, S.** and Masod, J. (2011), "Evaluation of kitchen waste composting and its comparison with compost prepared from municipal solid waste". Pakistan Journal of Engineering and Applied Sciences, UET Lahore, vol 8, no. 1, 26-34, [HEC recognized]
	24. Arooj, M. F., **Haydar, S**. and Ahmad, K. (2011), "Development of economical

polymer-modified concrete for repair of concrete structures in Pakistan", Pakistan Journal of Engineering and Applied Sciences, UET Lahore, vol 8, no. 1, 21-25., [HEC recognized]

25. **Haydar, S**. and Mohsan, S. (2010), "Impacts of Genetically Modified Foods/ Crops on Human Health and Environment: A Review", Journal of Engineering and Applied Sciences, UET Peshawar,vol. 28, no. 1, 27-35., [HEC recognized]

26. **Haydar S**., Aziz, J. A. and Arshad, M. (2009), "Evaluation of drinking water quality in urban areas of Pakistan: A case study of southern Lahore. ", Pakistan Journal of Engineering and Applied Sciences, UET Lahore, Vol. 5, no.2,16-23. [HEC recognized]

27. Haydar, S. and Aziz, J. A. (2009), "Coagulation flocculation studies of tannery wastewater using combination of alum with cationic and anionic polymers", Journal of Hazardous Materials ,vol. 168, 1035-1040. International Journal (Impact factor = 4.173)

28. **Haydar S.** and Aziz, J. A., (2009), "Kinetic coefficients for the biological treatment of tannery wastewater using activated sludge process", Pakistan Journal of Engineering and Applied Sciences, UET Lahore, Vol. 5, no.2, 39-43. [HEC recognized]

29. **Haydar, S**. and Aziz, J. A. (2009), "Characterization and treatability studies of tannery wastewater using chemically enhanced primary treatment (CEPT) - A case study of Saddiq Leather Works", Journal of Hazardous Materials , vol.163, no. 2-3, 1076-1083. International Journal (Impact factor = 4.173)

30. **Haydar, S**. and Aziz, J. A. (2009), "Coagulation-flocculation studies of tannery wastewater using cationic polymers as a replacement of metal salts", Water Science and Technology, vol. 59,

	no. 2, 381-390., International Journal (Impact factor = 1.24)
	31. **Haydar, S.** and Aziz, J. A. (2008), "Characterization and correlations of various pollution parameter in the wastewater from a local tannery", Mehran University Research Journal of Engineering and Technology , vol. 27, no. 4, 441-450, [HEC recognized]
	32. **Haydar, S.,** Aziz, J. A. and Ahmad, M. S. (2007), "Biological treatment of tannery wastewater using activated sludge process", Pakistan Journal of Engineering and Applied Sciences. Vol. 1, 61-66., [HEC recognized]
	33. **Haydar S**., Mohsan S. and Haider H. (2005), "Nuclear energy and the environment", Research Journal, University of Engineering and Technology, Lahore, vol 16, no 1-2, 7-13.
	34. Arooj M. F. and Haydar S. (2005). " Effect of change in area and position of inlet and outlet on the efficiency of storage tanks", Research Journal, University of Engineering and Technology, Lahore, vol 16, no 1-2, 81-85
	35. **Haydar S.** and Aziz J. A. (2004), "Aerated lagoons: An appropriate treatment technology for tannery wastewater", Engineering News, A Quarterly Journal of Pakistan Engineering Congress. Vol. 42, No. 2, 37-45.
	36. **Haydar S.** and Mohsan S. (2004), " Renewable energy sources- the best alternative to fossil fuels", Research Journal, University of Engineering and Technology, Lahore, vol 15, no 1-2, 27-33.
	37. **Haydar S.** (2004), "Water source protection", Engineering News, A - Quarterly Journal of the Pakistan Engineering Congress. Vol. 42, No. 2, 5-12
Research Grants and Contracts	---
Other research creative accomplishment	---

Selected professional Presentation	

Name	Dr. Amir Ikhlaq
Personal	Assistant Professor
Experience	16 Years
Honors and Award	---
Membership	---
Graduate Students Post Doc Under Graduate Honor Students	10 20
Service Activity	Teaching graduate and undergraduate classes
Brief Statement of Research	Environmental Chemistry Environmental catalysis Ozone water treatment Adsorption for water treatment
Publication	1. Mechanisms of catalytic ozonation on alumina and zeolites: formation of hydroxyl radicals, **Amir Ikhlaq**, David R. Brown, Barbara Kasperzyk-Hordern, Applied Catalysis B: Environmental, 123: 94–106, 2012 2. Comparative study of rice husk and peanut hull for the elimination of carcinogenic hydrocarbons in water, **Amir Ikhlaq**, F. Tahira, S. Riaz, M. Rustam, U. Aslam, Journal of the Pakistan Institute of Chemical Engineers, 43 (1), 2015 3. An Investigation on Modification and Characterization of Environment Friendly Wheat Gluten based Packaging Films, Moshin Kazmi, Nadeem Feroze, Humera Siddique, Masooma Rustam, **Amir Ikhlaq**, Journal of the Pakistan Institute of Chemical Engineers, 42: 107-115, 2014 4. Biosorption of Cr(VI) on Activated Carbon from Almond Shell, Sohail Shahzad, Mohsin Kazmi, Nadeem Feroze, Masooma Rustam, **Amir Ikhlaq**, Shafaq Muzammal, Journal of the Pakistan Institute of Chemical Engineers, 42 (2) 45-52, 2014

	5. Evaluation of Drinking water quality parameters in the areas of East-Lahore Pakistan: A case study, **Amir Ikhlaq**, Mosin Kazmi , Sajjad Hayder, Haroon Rashid Mian, Masooma Rustam, Ahmad Waqar Sulheri, Aneeqa Saeed, Published to Journal of Faculty of Engineering and Technology, Pakistan,23-3, 2014 6. Removal of Methylene Blue from Aqueous Solutions by using Rice Husk Ash and Peanut Shell Ash, **Amir Ikhlaq**, Sadaf Azhar, Mosin Kazmi , Naveed Ramzan,Rustam Rustam Saeed, Published in Journal of Faculty of Engineering and Technology, Pakistan,23-3, 2014
Research Grants and Contracts	---
Other research creative accomplishment	---
Selected professional Presentation	-----

Name	Dr. Muhammad Umar Farooq
Personal	Assistant Professor
Experience	5 Years
Honors and Award	----
Membership	----
Graduate Students Post Doc Under Graduate Honor Students	10 15
Service Activity	Teaching graduate and undergraduate classes
Brief Statement of Research	Adsorption of pollutants Development of analytical techniques Solution for air and noise problems
Publication	1. Hussain Tajamal, Munir Hifza, Mujahid Adnan, **Farooq Muhammad Umar**, Shehzad Khurram, Shah Asma Tufail, Ahmad Sana, Asghar Muhammad Tahir, (2014) Molecular Imprinted Titania Sol-Gel Layer for Conductometric Sensing of p-Nitrophenol, Sensor Letters, 12(11) 1682-1687. 2. Adnan Mujahid, Yaqoob Ali, Adeel Afzal, Tajamal Hussain, Asma Tufail Shah, Khurram Shehzad, **Muhammad Umar Farooq**, (2014) Rapid assay of the comparative degradation of acetaminophen in binary and ternary combinations, Arabian Journal of Chemistry, 7:522-524. 3. Khurram Shehzad, Zhi-Min Dang, Mirza Nadeem Ahmad, Rizwan Ur Rahman Sagar, Sajid Butt, **Muhammad Umar Farooq**, Tong-Biao Wang, (2013) Effects of carbon nanotubes aspect ratio on the qualitative and quantitative aspects of frequency response of electrical conductivity and dielectric permittivity in the carbon nanotube/polymer composites, Carbon, 45: 105-112. 4. Adnan Mujahid, **Muhammad Umar Farooq**, Ayesha Hameed, Tajamal Hussain, Asma Tufail Shah, Sana Ahmad, Khurram Shehzad, (2013),

Quantitative Degradation Monitoring in Core and Enteric Coated Aspirin Tablets, International Journal of Current Pharmaceutical Research, 5(4) 68-70

5. A.T. Shah, M. I. Din, **M. U. Farooq**, M. T. Z. Butt, M. Athar, M. A. Chaudhary, M. N. Ahmad, M. L. Mirza, (2012) Fabrication of Nickel nanoparticles modified electrode by reverse microemulsion method and its application in electrolytic oxidation of ethanol, Colloids and Surfaces A: Physiochemical Engineering Aspects, 405: 19–21

6. A.T. Shah, A. Mujahid, **M. U. Farooq**, W. Ahmad, B. Li, M. Irfan, M. A. Qadir, (2012) Micelle directed synthesis of $(C_{19}H_{42}N)_4H_3(PW_{11}O_{39})$ nanoparticles and their catalytic efficiency for oxidative degradation of azo dye, Journal of Sol-Gel Science and Technology, 63: 194-199

7. A.T. Mujahid, A. Afzal, M. N. Ahmad, **M. U. Farooq**, T. Hussain, K. Shehzad, A. T. Shah, (2012), Structurally modified poly (vinyl alcohol) ionic composites as efficient humidity indicators,

8. Polymer Composites, 33 (6): 1018-1024.

9. M. Usman Ghani, **M. Umar Farooq**, M. T. J. Khan, (2010) Phytochemical investigation and evaluation of antibacterial and irritant potential of different extracts of whole plant of Solanum Xanthocarpum Schrad and Wendl, Journal of Chinese Chemical Society, 57: 1257-1262.

10. Chunting Zhang, Ping Su, **Muhammad Umar Farooq**, Xiang Gao, E. Hongjun, (2010) Synthesis of polyamidoamine dendrimer-grafted silica with microwave assisted protocol, Reactive and Functional Polymers, 70: 129-133.

11. E. Hongjun, Ping Su, **Muhammad Umar Farooq**, Yi Yang, (2010)

	Microwave-assisted preparation of a β-cyclodextrin-based stationary phase for open tubular capillary electrochromatography, Analytical Letters, 43: 2372-2380.
	12. **Muhammad Umar farooq**, Ping Su, Yi Yang, (2009) Applications of a novel sample preparation method for the determination of sulfonamides in edible meat by CZE, Chromatographia, 69: 1107-1111.
Research Grants and Contracts	---
Other research creative accomplishment	---
Selected professional Presentation	---

Name	Dr. Muhammad Irfan Jalees
Personal	Assistant Professor
Experience	10 Years
Honors and Award	----
Membership	----
Graduate Students Post Doc Under Graduate Honor Students	10 24
Service Activity	Teaching graduate and undergraduate classes
Brief Statement of Research	Environmental chemistry Adsorption Chemistry Heavy metal removal and modeling Organic geochemistry
Publication	1. **Muhammad Irfan Jalees** and Zukhruf Asim, Statistical Modelling Of Atmospheric Trace Metals In Lahore, Pakistan For Correlation And Source Identification, Environmental Earth Sciences, 75 :842, 1-12, 2016. 2. Muhammad Asif, Fazeelat Tahira and **Muhammad Irfan Jalees** "Biomarker and stable carbon isotopic study of Eocene sediments of North-Western Potwar Basin, Pakistan", Journal of Petroleum Science and Engineering, 2014, Volume 122, 729-740 3. **Muhammad Irfan Jalees**, Thomas S Bianchi, Roger Sassen and Fazeelat Tahira, "Diamondoids and Biomarker: A novel parameter for microbial degradation and maturity of crude oils from Pakistan" Carbonates & Evaporites, 2011, Volume 26, pg 155-165, Springer Link, UK 4. Fazeelat Tahira, Muhammad Asif, **Muhammad Irfan Jalees**, Abdus Saleem, Hina Saleem, Shahid Nadeem, Shugafta Nasir, "Source correlation between biodegraded oil seeps and a commercial crude oil from the Punjab Basin-Pakistan" Journal of Petroleum Science and Engineering, 2011, Volume 77, pg 1-9, Elsevier B.V.

	5. Fazeelat Tahira, **Muhammad Irfan Jalees** and Thomas Bianchi, "Source rock potential of Eocene, Paleocene and Jurassic sediments of the Potwar Basin (northern Pakistan)", Journal of Petroleum Geology, 2010, Volume 33, Issue 1, pg 87-96, Wiley Inter science, UK 6. **Muhammad Irfan Jalees**, Fazeelat Tahira and Hina saleem, "Study on the geochemical correlation of crude oils of Paleocene and Jurassic ages from the Potowar Indus Basin in northern Pakistan" Chinese Journal of Geochemistry, 2010, Volume 29, pg 82-93, Springer Link, UK
Research Grants and Contracts	---
Other research creative accomplishment	----
Selected professional Presentation	----

Name	Dr. Mehwish Anis
Personal	Assistant Professor
Experience	10 years
Honors and Award	---
Membership	PEC
Graduate Students Post Doc Under Graduate Honor Students	4 23
Service Activity	Teaching graduate and undergraduate classes
Brief Statement of Research	Integrated solid waste management Environmental impact assessment
Publication	1. Ghulam Hussain, Sajjad Haydar, A.J. Bari, J.A. Aziz, **Mehwish Anis,** Zunaira Asif (2015) "Evaluation of plastic household biosand filter (BSF) in combination with solar disinfection (SODIS) for water treatment", Journal of the Chemical Society of Pakistan, 37(4). (Impact Factor = 0.612). 2. **Anis, M**., Haydar, S and Bari, A. J., Adsorption of lead and copper from aqueous solution using unmodified wheat straw, Environmental Engineering and Management Journal (Internation Journal; Impact Factor=1.4) in press (2012)
Research Grants and Contracts	----
Other research creative accomplishment	----
Selected professional Presentation	----

Name	Dr. Ghulam Hussain
Personal	Assistant Professor
Experience	6 years
Honors and Award	---
Membership	PEC
Graduate Students Post Doc Under Graduate Honor Students	4 20
Service Activity	Teaching graduate and undergraduate students
Brief Statement of Research	Water and wastewater treatment Water supply and wastewater collection system design Environmental impact assessment
	1. **Ghulam Hussain,** Sajjad Haydar, A.J. Bari, J.A. Aziz, Mehwish Anis, Zunaira Asif (2015),"Evaluation of plastic household biosand filter (BSF) in combination with solar disinfection (SODIS) for water treatment", <u>Journal of the Chemical Society of Pakistan,</u> 37(4). (Impact Factor = 0.612). 2. Sajjad Haydar, **Ghulam Hussain,** Obaidullah Nadeem, Muhammad Asif, (2015), "Water conservation initiatives and performance evaluation of wastewater treatment facility in a local beverage industry in Lahore", Pakistan Journal of Engineering and Applied Sciences, vol. 15 no. 1, [HEC recognized, X category] 3. Imran Meo, Sajjad Haydar, Obaidullah Nadeem, **Ghulam Hussain**, Haroon Rashid, (2014), "Characterization of Hospital Wastewater, Risk Waste Generation and Management Practices in Lahore", Proceeding of the Pakistan Academy of Sciences, 51(4), 317-329 [HEC Recognized, X category] 4. Haydar, S, Haider, H., Nadeem O., **Hussain, G**., Jalees, I and Qadeer, A., (2014), " Effect of Hudiara drain on the quality of groundwater in the housing schemes of Lahore", Journal of Faculty of Engineering & Technology, vol. 21, No. 2, 119-134. [HEC recognized, Y category]
Research Grants and Contracts	-----

Other research creative	-----
Selected professional Presentation	----

APPENDIX-1

Seven different types of surveys were conducted. The responses of surveys were used to analyse various aspects. Below is the list of surveys.

1. Survey of Alumni
2. Employer Survey
3. Student Course Evaluation Survey
4. Teacher Evaluation Form
5. Graduating Student Survey
6. Faculty Survey
7. Faculty Course Review Report

The details of survey conducted, responses and analysis of results are available within IEER and can be present at the time of visit. Here the master table showing responses of each question and some analysis results are given.

Alumni Survey

The result of questions provided to alumni has been compiled. An analysis of frequency distribution was conducted through SPSS software and following results were achieved which are presented in the table below;

Master Table showing Responses of Alumni Survey Questionaire (n=64)

Questions	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
Q1	26.67	66.67	3.33	3.33	0.00
Q2	21.67	61.67	13.33	3.33	0.00
Q3	31.67	56.67	8.33	0.00	3.33
Q4	11.67	55.00	25.00	6.67	1.67
Q5	25.00	58.33	11.67	5.00	0.00
Q6	18.33	65.00	13.33	3.33	0.00
Q7	18.33	56.67	8.33	13.33	3.33
Q8	48.33	40.00	10.00	1.67	0.00
Q9	45.00	45.00	6.67	3.33	0.00
Q10	23.33	50.00	13.33	8.33	5.00
Q11	11.67	50.00	18.33	15.00	5.00
Q12	41.67	43.33	6.67	8.33	0.00
Q13	41.67	43.33	6.67	8.33	0.00
Q14	30.00	53.33	11.67	1.67	3.33

Questions	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
Q15	26.67	61.67	8.33	3.33	0.00
Q16	23.33	46.67	13.33	13.33	3.33
Q17	15.00	45.00	16.67	15.00	8.33
Q18	6.67	56.67	28.33	8.33	0.00
Q19	6.67	71.67	8.33	13.33	0.00
Q20	31.67	58.33	6.67	3.33	0.00
Q21	26.67	58.33	11.67	3.33	0.00
Q22	41.67	40.00	13.33	5.00	0.00
Q23	41.67	33.33	21.67	1.67	1.67
Q24	53.33	43.33	3.33	0.00	0.00
Q25	38.33	33.33	18.33	10.00	0.00
Q26	21.67	38.33	16.67	11.67	11.67
Q27	48.33	50.00	0.00	0.00	1.67
Q28	46.67	46.67	5.00	1.67	0.00
Q29	38.33	53.33	8.33	0.00	0.00
Q30	31.67	48.33	11.67	5.00	3.33
Q31	50.00	46.67	1.67	1.67	0.00
Q32	45.00	50.00	3.33	0.00	1.67
Q33	36.67	55.00	8.33	0.00	0.00
Q34	30.00	51.67	11.67	3.33	3.33
Q35	25.00	63.33	8.33	3.33	0.00
Q36	15.00	28.33	26.67	10.00	20.00
Q37	10.00	41.67	21.67	20.00	6.67
Q38	13.33	38.33	18.33	16.67	13.33
Q39	25.00	48.33	13.33	10.00	3.33
Q40	11.67	55.00	16.67	6.67	10.00
Q41	11.67	50.00	21.67	10.00	6.67

Employer Survey

The result of questions provided to employer has been compiled. An analysis of frequency distribution was conducted through SPSS software and following results were achieved which are presented in the table below;

Master Table showing Responses of Employer Survey Questionnaire (n=16)

Questions	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
Q1	37.50	62.50	0.00	0.00	0.00
Q2	25.00	68.75	6.25	0.00	0.00
Q3	37.50	37.50	18.75	6.25	0.00

Questions	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
Q4	12.50	62.50	12.50	12.50	0.00
Q5	25.00	50.00	25.00	0.00	0.00
Q6	18.75	62.50	12.50	6.25	0.00
Q7	12.50	62.50	25.00	0.00	0.00
Q8	37.50	50.00	6.25	6.25	0.00
Q9	12.50	62.50	6.25	18.75	0.00
Q10	43.75	43.75	12.50	0.00	0.00
Q11	25.00	68.75	6.25	0.00	0.00
Q12	12.50	62.50	25.00	0.00	0.00
Q13	6.25	56.25	25.00	6.25	6.25
Q14	6.25	43.75	37.50	0.00	12.50
Q15	12.50	50.00	37.50	0.00	0.00
Q16	6.25	56.25	18.75	18.75	0.00
Q17	18.75	56.25	25.00	0.00	0.00
Q18	12.50	56.25	25.00	6.25	0.00
Q19	37.50	62.50	0.00	0.00	0.00
Q20	37.50	50.00	12.50	0.00	0.00
Q21	56.25	43.75	0.00	0.00	0.00
Q22	6.25	81.25	6.25	6.25	0.00
Q23	25.00	68.75	0.00	6.25	0.00
Q24	12.50	62.50	18.75	6.25	0.00
Q25	25.00	62.50	12.50	0.00	0.00
Q26	18.75	37.50	31.25	12.50	0.00
Q27	12.50	31.25	43.75	12.50	0.00
Q28	6.25	62.50	18.75	12.50	0.00
Q29	31.25	56.25	12.50	0.00	0.00
Q30	12.50	68.75	18.75	0.00	0.00
Q31	25.00	56.25	18.75	0.00	0.00
Q32	31.25	62.50	6.25	0.00	0.00
Q33	18.75	50.00	18.75	6.25	6.25
Q34	62.50	25.00	12.50	0.00	0.00

Student Course Evaluation

The results of Student Course Evaluation Form have been compiled. An analysis of frequency distribution was conducted through SPSS software and following results were achieved which are presented in the table below;

Master Table showing Responses of Student Course Evaluation Survey Questionnaire (n=284)

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
Q1	17.3	61.6	14.1	3.2	3.9
Q2	16.9	63.4	13.4	3.2	3.2
Q3	14.1	59.2	15.8	6.7	4.2
Q4	16.2	62.3	11.6	6.0	3.9
Q5	12.7	64.4	11.6	7.0	4.2
Q6	15.1	58.5	16.9	5.6	3.9
Q7	14.1	61.3	16.2	4.6	3.9
Q8	17.6	53.2	20.4	5.0	3.3
Q9	13.7	59.5	14.8	6.3	5.6
Q10	17.6	54.9	18.0	4.6	4.9
Q11	17.3	54.9	18.7	5.6	3.5
Q12	19.4	48.6	19.7	7.7	4.6
Q13	16.2	55.3	17.6	6.3	4.6
Q14	16.2	58.8	13.0	7.7	4.2
Q15	16.2	57.4	14.1	7.7	4.6
Q16	11.3	60.6	16.9	5.3	6.0
Q17	13.7	57.4	16.2	7.7	4.9
Q18	13.4	61.6	14.1	5.6	5.3
Q19	18.7	60.6	12.0	4.9	3.9
Q20	13.0	63.4	10.9	8.8	3.9
Q21	13.0	62.7	12.7	6.7	4.9
Q22	13.4	60.9	13.7	7.0	4.9
Q23	12.3	59.9	15.1	8.1	4.6
Q24	16.5	59.5	13.7	6.3	3.9
Q25	14.8	63.4	13.4	5.3	3.2
Q26	0.0	63.4	26.4	10.2	0.0
Q27	19.7	56.7	14.1	6.3	3.2
Q28	20.1	56.0	13.4	7.0	3.5
Q29	14.8	59.9	15.1	6.0	4.2
Q30	13.4	59.9	14.4	6.3	6.0
Q31	12.7	62.3	13.7	5.6	5.6
Q32	23.9	45.4	21.8	6.3	2.5
Q33	14.8	60.6	17.3	4.2	3.2
Q34	15.8	57.4	15.8	7.7	3.2
Q35	17.3	58.5	16.9	4.2	3.2
Q36	20.4	54.6	15.1	5.6	4.2
Q37	18.7	61.3	12.7	4.9	2.5
Q38	17.6	57.4	14.8	6.7	3.5
Q39	14.4	57.4	14.8	9.2	4.2
Q40	11.6	60.9	15.5	7.0	4.9
Q41	12.7	63.4	13.7	6.7	3.5
Q42	19.0	58.5	15.5	3.2	3.9

Q43	10.6	66.9	12.7	6.0	3.9
Q44	10.2	60.6	18.7	7.0	3.5
Q45	15.8	63.4	11.3	6.3	3.2

Teacher Evaluation

The results of graduating survey have been compiled. An analysis of frequency distribution was conducted through SPSS software and following results were achieved which are presented in the table below;

Master Table showing Responses of Teacher Evaluation Survey Questionnaire (n=26)

Questions	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
Q1	19.67	45.52	18.79	14.63	1.39
Q2	10.72	68.35	5.04	6.68	9.21
Q3	22.32	57.00	13.62	6.18	0.88
Q4	44.51	48.05	4.54	1.51	1.39
Q5	43.38	46.41	0.88	5.67	3.66
Q6	83.23	16.39	0.25	0.13	0.00
Q7	45.90	40.86	10.97	2.02	0.25
Q8	34.30	53.47	7.06	3.15	2.02
Q9	31.65	57.50	5.93	2.65	2.27
Q10	0.00	81.59	13.37	5.04	0.00
Q11	0.00	66.96	19.04	14.00	0.00
Q12	30.77	47.92	10.09	7.44	3.78
Q13	29.26	57.76	6.18	3.28	3.53
Q14	27.87	57.12	7.31	4.54	3.15
Q15	16.02	72.51	3.03	4.04	4.41
Q16	27.87	58.89	6.43	4.41	2.40
Q17	0.00	87.77	8.70	3.53	0.00
Q18	0.00	87.26	8.20	4.54	0.00
Q19	36.81	51.04	4.05	4.05	4.05
Q20	28.75	54.98	8.83	4.54	2.90
Q21	22.19	57.63	13.87	2.65	3.66
Q22	26.61	61.54	7.19	1.89	2.77
Q23	24.84	62.17	6.43	3.15	3.40
Q24	23.46	60.66	9.33	3.15	3.40
Q25	25.35	61.54	6.56	2.90	3.66
Q26	24.34	60.03	8.70	4.04	2.90

Graduating Survey

The results of graduating survey have been compiled. An analysis of frequency distribution was conducted through SPSS software and following results were achieved which are presented in the table below;

Master Table showing Responses of Graduating Student Survey Questionnaire (n=34)

Questions	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
Q1	11.76	73.53	8.82	2.94	2.94
Q2	8.82	67.65	20.59	0.00	2.94
Q3	20.59	67.65	8.82	0.00	2.94
Q4	14.71	38.24	38.24	2.94	5.88
Q5	2.94	47.06	35.29	11.76	2.94
Q6	32.35	58.82	2.94	5.88	0.00
Q7	5.88	64.71	23.53	5.88	0.00
Q8	8.82	55.88	17.65	14.71	2.94
Q9	2.94	41.18	44.12	8.82	2.94
Q10	8.82	47.06	29.41	8.82	5.88
Q11	32.35	50.00	11.76	2.94	2.94
Q12	11.76	47.06	26.47	5.88	8.82
Q13	47.06	52.94	0.00	0.00	0.00
Q14	41.18	55.88	2.94	0.00	0.00
Q15	17.65	58.82	14.71	8.82	0.00
Q16	17.65	73.53	5.88	0.00	2.94
Q17	14.71	70.59	8.82	2.94	2.94
Q18	23.53	61.76	5.88	2.94	5.88
Q19	29.41	47.06	8.82	11.76	2.94
Q20	35.29	52.94	5.88	2.94	2.94
Q21	17.65	41.18	17.65	14.71	8.82
Q22	8.82	23.53	41.18	14.71	11.76
Q23	5.88	35.29	32.35	11.76	14.71
Q24	17.65	58.82	20.59	2.94	0.00
Q25	11.76	55.88	20.59	5.88	5.88
Q26	11.76	61.76	17.65	8.82	0.00
Q27	26.47	50.00	20.59	2.94	0.00
Q28	20.59	41.18	20.59	17.65	0.00
Q29	8.82	44.12	26.47	14.71	5.88
Q30	11.76	47.06	26.47	11.76	2.94

Faculty Survey

The results of Faculty Survey have been compiled. An analysis of frequency distribution was conducted through SPSS software and following results were achieved which are presented in the table below;

Master Table showing Responses of Faculty Survey Questionnaire (n=6)

Question	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
Q1	0	10	60	20	10
Q2	10	60	10	20	0
Q3	0	30	60	10	0
Q4	0	70	20	10	0
Q5	0	20	30	50	0
Q6	30	50	10	10	0
Q7	0	20	40	30	10
Q8	0	20	20	60	0
Q9	0	0	20	50	30
Q10	0	50	30	10	10
Q11	0	20	30	20	30
Q12	0	60	20	20	0
Q13	0	30	20	50	0
Q14	10	60	10	10	10
Q15	0	50	20	30	0
Q16	0	20	60	20	0