

INTRODUCTION

The Institute of Environmental Studies was established in 1982. This is the oldest and pioneering Institute in the field, which offers M.Phil and Ph.D degrees. Keeping in view the acute shortage of specialists it has started offering M.Sc. Postgraduate Diploma and Certificate courses since 1996. Today the institute is recognized as a technical Focal Point on Environmental Health Activities of WHO/EMRO and has been organizing WHO sponsored Workshops related to various environmental health and pollution problems with the collaboration of the Ministry of Health.

The M.Sc. programme of the institute includes elements and fundamental principles of medicine, engineering and science for the solution of environmental problems and issues, which requires practical approach for solving environmental problems of developing countries. In general the M.Sc. degree in Environmental Science bridges the gap between courses in Community Medicine and Public Health and Environmental Engineering.

In order to control environmental pollution the Government of Pakistan has enacted Environmental Protection Act and has already implemented National Environmental Quality Standards (NEQS) with effect from 1st July, 1996. Karachi being the biggest industrial base with two major harbours has several thousand small and large industrial units and the city is facing acute environmental degradation and deterioration problems. Although most of these industries have the desire to improve the quality of their effluent but due to paucity of expertise and professionals they cannot do much to improve the situation. For checking and implementation of NEQS nearly 3000 environmental managers will be required in 10 years time.

Apart from regular teaching programs the Institute has been regularly organizing short term training activities for in-service personnel and for those who are involved in research and development programs.

The objectives of this programme; is to develop the skilled manpower as per its mission and national mandate. The Institute is equipped with the excellent air-conditioned lecture halls, environmental laboratories, library and audiovisual facilities for the students and staff.

This self Assessment report is about the M.Sc. in Environmental Studies(Morning Programme. The Institute is grateful to Prof. M. Sajidin, Director Quality Enhancement Cell for technical help and the staff of QEC for typing the report in the present format. The efforts of the members of the Self Assessment Team also deserve appreciation. The institute will continue its efforts in the field of quality teaching and research through self assessment programmes

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CRITERION-1

PROGRAM MISSION, OBJECTIVES AND OUTCOMES

Criterion-1 Program Mission, Objectives and Outcomes

Institutional Mission

- To improve the quality of environment, the quality of life and health of the people and planet Earth for both in developed and developing countries.
- To discover, disseminate, apply and use of knowledge of environment and related fields to meet basic needs improve environment quality and to meet Millennium Development Goals (MDG).

To achieve the mission, the Institute of Environmental Studies provides an environment for teaching and post graduate research. The Institute assures integration of specializations that address complex social, health and environmental issues. The mission is valuable as the Institute works involve different disciplines to improve the well being of individuals, families and communities. We believe, our Alumni would make the world a better place to live.

Program Mission (M.Sc.)

The mission of the M.Sc. programme is to equip the graduates with managerial, technical and consultative capabilities required by environmental regulatory and protection agencies, education and research organizations.

Standard 1-1: The Program must have documented measurable objectives that support college and Institution mission statements.

Program Objectives (M.Sc.):

1. To impart professional knowledge about environmental degradation and pollution problems and educate the graduates about economic cost and effects to the society.
2. To make the students capable to design a system component or process for controlling environmental degradation and pollution control through intensive knowledge in physical biological, biochemical, chemical and microbiological parameters.
3. To enable the students in applying theoretical knowledge in the practical field.
4. To equip the students with developing analytical techniques and problem solving skills required for conducting surveys and surveillance programme of communicable diseases etc.

Table: Program Objectives Assessment (M.Sc.)

S. No.	Objectives	How Measured	When Measured	Improvement Identified
1.	To impart professional knowledge about environmental degradation and pollution problems and educate the graduates about economic cost and effects to the society.	Surveys a) Employer's Opinion b) Regular Maser's Student	Nov 2008	The graduate possess adequate knowledge
2	To make the students capable to design a system component or process for controlling environmental degradation and pollution control through intensive knowledge in physical biological, biochemical, chemical and microbiological paramentsrs.	Surveys a) Employer's Opinion b) Regular Maser's Student	Nov 2008	The majority is capable to design system component and knowledge about required sciences.
3	To enable the students in applying theoretical knowledge in the practical field.	Employer's Opinion Suvery	Nov 2008	Majority was found to apply theoretical knowledge in the applied field.
4	To equip the students with developing analytical techniques and problem solving skills required for conducting surveys and survillience programme of communicable diseases etc.	Employer's Opinion Survey	Nov 2008	The students posses analytical techniques and problem solving skills.
<i>Surveys results are enclosed.</i>				

Standard 1-2: The program must have documented outcomes for graduating students. It must be demonstrated that the outcomes support the program objectives and that graduating students are capable of performing these outcomes.

PROGRAM OUTCOMES

1. The graduates of the Institute have intensive knowledge about environmental and pollution problems and understand the effects of these problems on the society.
2. The students have the ability to design a system component and process for controlling pollution/ environmental hazard as they are provided intensive knowledge in physics and chemistry.
3. 67% respondents from the survey reconds that discipline that the graduate are link theory with practice.
4. Majority of the graduates are capable in collecting and analyzing data and also possess problem solving skills.

Teachers Evaluation, Graduating Students and Employer Survey:

The following surveys were conducted by the Program Team of the Model Institute, Institute of Environmental Studies

- Employers Opinion Survey
- Graduating Students Survey (Master Students Survey)

Standard 1-3: The results of program's assessment and the extent to which they are used to improve the program must be documented.

a) Actions Taken

- Request for books has been made.
- Course on communication skills has been introduced at BS level.
- IT course need to be introduced.

b) Strengths and Weaknesses of the Program

i) Strengths

- By and large employers are satisfied with the output.

ii) Weaknesses

- The research output needs to be improved and strengthened.
- New editions and new books for various courses are required.

c) Future Development Plans

- Employer's Opinion Survey shall be repeated
- Teacher's Evaluation shall be conducted

Standard 1-4: The department must assess its overall performance periodically.

a) Student Enrolment in M. Sc. (Morning Programme)

Year	M.Sc. (Previous)	M. Sc (Final)	Total
2006-2007	19	19	38
2007-2008	11	11	22
2008-2009	14	-	14

b) i) Time for M.Sc. Minimum 2 Years

ii) Time for Ph.D Minimum 3 Years

c) The minimum student grade point (CGPA) Does not apply

The average student grade point (CGPA) Does not apply

d) Employer's Satisfaction

In response to questionnaire of the Employer's Opinion, the employers seem to be satisfied with respect to knowledge, communication skills, working and interpersonal skills as can be seen from the attached results and pie charts.

e) Research Activities

- Current climate change, vulnerability and hazards in coastal areas of Sindh- HEC funded 2009.
- Environmental Impact Assessment of Lyari River out fall, c/o Dean Faculty of Science, University of Karachi.

CRITERION-2

CURRICULUM DESIGN AND ORGANIZATION

Criterion-2 Curriculum Design and Organization

Program of Studies offered

The Institute of Environmental Studies is running its academic program through semester system of examination. The institute offers B.S., M.Sc. , Post Graduate Diploma (PGD) and Certificate Courses (Evening Programme), M.S./ M.Phil and Ph.D Degree Programs in the morning.

Research assignments and presentation of reports is an integral part of the M.Sc. courses of studies. A Ph.D dissertation must be based on original research output and is subject to examination and defence by the experts in the field. The expert for Ph.D. examination are approved by the Board of Advance Studies and Research of the University of Karachi out of three, two external examiners must be from technologically advance countries

The Institute offers research Programmes leading to M.S. and Ph.D. degrees. During the last decade the Institute has produced 8 Ph.D and about 15 M.Phil. students will be completing their Ph.D. degree in the near future. These students are registered first in M.Phil and later on satisfactory performance to Ph.D. programmes

Institute of Environmental Studies
University of Karachi

M. Sc. (Previous) and Post Graduate Diploma in Environmental Science

SEMESTER-1			SEMESTER-2		
Course no.	Course Title	Credit Hours	Course no.	Course Title	Credit Hours
ENV-501	Introduction to Environmental	2+1	ENV-502	Air & Noise Pollution	3+0
ENV-503	Environmental Chemistry	3+0	ENV-504	Environmental Geology	3+0
ENV-505	Environmental Microbiology	2+1	ENV-506	Biostatistics	2+1
ENV-507	Environmental Pollution Measurement & Assessment-1	0+3	ENV-508	Environmental Pollution Measurement & Assessment-2	0+3
ENV-509	Water and Wastewater Treatment	3+0	ENV-510	Environmental Toxicology	2+1
Non Credit Hour Courses	<ul style="list-style-type: none"> • Biological System (For Student with mathematical background) • Mathematical methods (For students with biological background) 				

M. Sc. (Final)

(Only 10 course to be selected. Five each in Semester 3 and 4)

SEMESTER-3			SEMESTER-4		
Course no.	Course Title	Credit Hours	Course no.	Course Title	Credit Hours
Compulsory			Compulsory		
ENV-601	Industrial Pollution & Control	2+1	ENV-602	Environmental Economics & Impact Assessment	2+1
ENV-603	Aquatic Pollution	3+0	ENV-604	Environmental Epidemiology & Medicine	2+1
ENV-605	Environmental Hygiene & Occupational Health	2+1	ENV-606	Environmental Pollution Measurement & Assessment-4	0+3
ENV-607	Environmental Pollution Measurement & Assessment-3	0+3	ENV-608	Environmental Biotechnology	3+0
Optional			Optional		
ENV-609	Solid Waste Management	3+0	ENV-610	Wild Life Ecology & Wetland Management	3+0
ENV-611	Pollution Effects on Plants	3+0	ENV-612	Population Dynamics & Environment	3+0
ENV-613	Atmospheric Physics	3+0	ENV-614	Ecosystem	3+0
			ENV-616	Environmental Remote Sensing	3+0

Thesis equivalent to 6 Credit Hours may be taken in lieu of two courses or project in lieu of one course. (3+0 is a theory course, 0+3 is lab course)

Ph.D. Degree

The Institute offers research Programmes leading to M.S. and Ph.D. degrees. During the last decade the Institute has produced 8 Ph.D and about 15 M.Phil. students will be completing their Ph.D. degree in the near future. These students are registered first in M.Phil. and later on satisfactory performance to Ph.D. programmes

M.S./M.Phil. PROGRAMME

Approved by Board of Studies

Course No.	Course Title	Cr.Hrs	Course No.	Course Title	Cr.Hrs
ENV-701	Environmental Modeling	3+0	ENV-708	Occupational and Analytical Epidemiology	3+0
ENV-702	Environmental Impact Assessment	3+0	ENV-709	Organic Pollutants	3+0
ENV-703	Environmental Instrumentation	3+0	ENV-710	Global Environmental Issues	3+0
ENV-704	Environmental Bioremediation	3+0	ENV-711	Climate and Climate Change	3+0
ENV-705	Environmental Management System	3+0	ENV-712	Physical Oceanography and Marine Environment	3+0
ENV-706	Industrial and Hazardous Waste Management	3+0	ENV-713	Air Pollution Meteorology	3+0
ENV-707	Environmental Health and Risk Assessment	3+0			

Total Credit Hours 39

Standard 2-1: The Curriculum must be consistent and support the program's documented objectives (M.Sc. Morning programme)

Courses	Program's Objectives			
	1	2	3	4
Major Courses	501,509, 502, 601,603, 605, 608	507, 508, 605, 606	602, 610, 616	509, 510
Elective Courses	609, 610	610	604, 616	611, 612
Practical (Field and Lab)	507, 508	507, 508, 605	606	605
Thesis/Dissertation	YES	YES	YES	YES
Course numbers indicate fulfillment of programme objectives.				

Standard 2-2: Theoretical background, problem analysis and solution design must be stressed within the program's core material.

The following table indicates the elements covered in core courses:

Elements	Courses
i) Theoretical Background	All courses offered by the Institute.
ii) Problem Analysis	All courses of the Institute alongwith Elective Courses & Thesis/Dissertation
iii) Solution Design	All courses of the Institute compulsory ,Elective and Thesis/Dissertation

Standard 2-3: The curriculum must satisfy the core requirements for the program, as specified by the respective accreditation body &

Standard 2-4: The curriculum must satisfy the major requirements for the program, as specified by the respective accreditation body/council.

The Institute follow HEC requirement for each Degree Program in Institute of Environmental Studies as per approved by academic council, competent authority and statutory body.

Standard 2-5: The curriculum must satisfy the general education, arts and other discipline requirements for the program as specified by the accreditation body.

Program	Math and Basic Sciences	Engineering Topics	General Education	Others
M.Sc.	Does not apply			

Standard 2-6: Information technology component of the curriculum must be integrated throughout the program.

Efforts are under way to introduce I.T. courses in BS and M.Sc. programmes.

Standard 2-7: Oral and written communication skills of the student must be developed and applied in the program.

A compulsory course on communication skills has been introduced at BS level.

CRITERION-3

LABORATORY AND COMPUTING FACILITIES

CITERION-3: Laboratory and Computing Facilities

Laboratory Facilities

- 1. Environmental Biochemistry & Chemistry Laboratories:**
Physical and chemical parameters related to water, wastewater, soil, food and air are analyzed in these laboratories.
- 2. Environmental Microbiology Laboratories:**
The microbiological work pertaining to environmental samples is done in these laboratories. These are equipped with safety cabinets/ Laminar Flow Hood where highly sophisticated work could be carried out with the maintenance of a very high degree of sterility.
- 3. Metal Analysis Laboratory:**
Environmental and biological samples for metal analysis are processed and analyzed in this laboratory using atomic absorption spectrophotometer.
- 4. Pesticide Detection Laboratory:**
Environmental and biological samples for pesticide detection are processed and determined in this laboratory using High Performance Liquid Chromatography.
- 5. Bioanalytical Laboratory:**
Samples for environmental toxicological studies and for bioassays are analyzed.
- 6. Instruments Room:**
All sophisticated equipment of the Institute are placed in this room where environmental samples after processing in the respective labs are further analyzed using appropriate equipment.

Computer Facilities

The Institute has one computer lab with only 3 PCs, with internet facility for the teachers and students. These are quite inadequate to meet the institute's requirements. The internet facility is available in computer lab and offices of teachers. A large number of international research journals are also available on HEJ's Digital library provided by Higher Education Commission and research article of interest can be downloaded from this library.

Standard 3-1: Laboratory manuals/ documentation instruction for experiments must be available and readily accessible to faculty and students

In view of the introduction of B.S. programme in 2007, these facilities are inadequate. The institute has proposed a proposal for enhancement of these facilities.

Standard 3-2: There must be adequate support personnel for instruction and maintaining the laboratories

At present only very limited staff is available and need to be increased.

Standard 3-3: The University computing infrastructure and facilities must be adequate to support program's objectives

i) Computing Facilities

The Institute of Environmental Studies has inadequate computer facilities/ services and administrative staff to support its faculty, students and staff in their academic and administrative activities. Two well equipped computer labs are required.

ii) Multimedia

The Institute of Environmental Studies has one multimedia and three overhead projectors.

iii) Website

The university website <http://www.uok.edu.pk> has a link on the Institute of Environmental Studies.

iv) Internet

Internet facility and a connection with main communication network of the University are available.

CRITERION-4

STUDENT SUPPORT AND ADVISING

Criterion-4 Student Support and Advising

Students of the Institute of Environmental Studies must have adequate support to complete the program in a timely manner and must have ample opportunity to interact with their teachers of respective courses and receive timely advice about program requirements and career development.

Standard 4-1: Courses must have been offered with sufficient frequency and number for students to complete the program in a timely manner.

Institute's Strategy for Course Offering

The Institute offers courses for M.Sc (Environmental Science), Diploma in Environmental Management and Health (DEM). The institute having its own time table for graduate programs. The time table is strictly followed to complete the program well in time.

Program	Classes per Week	Practical Classes per Week	Research Guidance
M.Sc	15	4	
PGD	-	-	
M.S/ M.Phil leading to Ph.D	12	-	
Certificate Courses			

Standard 4-2: Course in the major must be structured to ensure effective interaction between students, faculty and teaching assistants.

Course allocation is made in the meeting of the faculty members. The Director presides over the meeting.

Standard 4-3: Guidance on how to complete the program must be available to all students and access to academic advising must be available to make course decisions and career choices

- The Director of the Institute nominates a faculty member as 'Students Advisor' who is available to all students for course decision and career choices. The student advisor and the Director help the students in providing information to the students who have recently passed out about the career opportunities available for them.
- By providing facilities to the recruiting companies for on-campus recruiting.
- The Director places on the Notice Board the opportunities regarding membership in technical and professional societies.

CRITERION-5

PROCESS CONTROL

ADMISSION: M.Sc. (Morning Programme)

Eligibility

- With atleast 45% marks in B.Sc., B.E, B.Pharm, M.B.B.S, B.Sc –Nursing or Any other degree related to Sciece at the graduate level or equivalent

EVALUATION & GRADING SYSTEM:

- The examination held at the end of each semester after the completion of a course shall be known as Terminal Examination. It will carry 100 marks. This examination is a passing head i.e., a student for each course number obtains a minimum of 40 marks in this examination including prerequisite course. Courses with 3+0 credit hours shall have one passing held. Course with 2+1 CH shall have two passing heads students shall have to pass both the passing heads.

Rules Concerning the Promotion and Repetition

- The students passing at least 8 out of 11 courses in an academic year would be promoted to next higher class whereas students failing in more than 3 courses in a year shall not be eligible for promotion to the next higher class.
- Those students who could not clear all the courses may be allowed a chance to clear them after the declaration of final year results at the end of the 2nd year. Those students who could not take examinations in a particular semester due to short of attendance shall have to fulfill attendance requirement of that semester by repeating it.
- Those student who wish to convert their PGD into M.Sc. program may do so by passing at least 8 out of 11 courses with the submission of difference of fee dues.

The details of grade point average and relevant ranges are:

MARKS	GRADE	GRADE POINT	CREDITS
90 & above	A+	4.0	12.0
85-89	A	4.0	12.0
80-84	A-	3.8	11.4
75-79	B+	3.4	10.2
71-74	B	3.0	9.0
68-70	B-	2.8	8.4
64-67	C+	2.4	7.2
61-63	C	2.0	6.0
57-60	C-	1.8	5.4
53-56	D+	1.4	4.2
50-52	D	1.0	3.0
Below 50	F	0	0

$$\text{GPA} = \frac{\text{Total Grade Point Product}}{\text{Total Credit Hrs}}$$

Note:-

University rules apply for grading and passing marks.

Standard 5-2: The process by which students are registered in the program and monitoring of students progress to ensure timely completion of the program must be documented. This process must be periodically evaluated to ensure that it is meeting its objectives.

The M.Sc. students opt for specialization in the 2nd year.

Standard 5-3: The process of recruiting and retaining highly qualified faculty members must be in place and clearly documented. Also processes and procedures for faculty evaluation, promotion must be consistent with institutional mission statement. These processes must be periodically evaluated to ensure that it is meeting with its objectives.

HEC rules with approval by the University Syndicate are applied for appointment.

Appointments/ Promotion Procedure

Basic Pay Scale (BPS)

Appointments are based on HEC rules given below.

a. Lecturer (BPS- 18):

Minimum Qualification

Master's Degree (first Class) in the relevant field with no 3rd division in the Academic Career from HEC recognized University/Institution. During the next two years (i.e. until June 30th, 2008) if no candidate is available without 3rd division in the academic record, then the University may forward the case for appointment of a selected candidate to the HEC for consideration and approval.

No experience required

b. Assistant Professor (BPS- 19):

Minimum Qualification

Ph.D. in the relevant field from HEC recognized University/Institution, No experience required.

OR

Master's Degree (foreign) or M.Sc (Hons). (Pakistan) in the relevant field from HEC recognized University/Institutions, with 4 years teaching/research experience in a recognized university or a post-graduate Institution.

c. Associate Professor (BPS- 20)

Minimum Qualification

Ph.D. in relevant field from HEC recognized University / Institution.

Experience

10-years teaching / research in HEC recognized University or a post-graduate Institution or professional experience in the relevant field in a National or International Organization.

OR

5-years post Ph.D. teaching/research experience in HEC recognized University or a post-graduate Institution or professional experience in the relevant field in a National or International Organization.

Minimum Number of Publications

8 research publications (with at least 2 publications in last 5 years) in internationally abstract Journals recognized by the HEC.

d. Professor (BPS-21)

Minimum Qualification

Ph.D. from HEC recognized Institution in relevant field.

Experience

15-years teaching / research experience in HEC recognized University or post-graduate Institution or professional experience in the relevant field in a National or International Organization.

OR

10-years post-Ph.D teaching/research experience in a recognized University or a post post-graduate Institution or professional experience in the relevant field in a National or International Organization.

Minimum Number of Publications

12 research publications in internationally abstracted Journals recognized by the HEC.

Bases for Appointments / Promotions

Four main areas where a candidate is evaluated for Tenure Track Scheme;

- Teaching
- Research
- Service
- Personal Characteristics

General Criteria for Appointment on TTS

All faculty members in any discipline are eligible to apply for appointment provided they fulfill the following minimum eligibility conditions;

a. Assistant Professor

Minimum Qualification

PhD from a recognized University with excellent communication/presentation skills.

b. Associate Professor

Minimum Qualification

PhD with 6 years post - PhD teaching / research experience in a recognized University.

Minimum Number of Publications

10 research articles published in journals having impact factor.

c. Professor: Minimum Qualification

PhD with 11 years post-PhD teaching / research experience from a recognized University.

Minimum Number of Publications:

15 research articles published in journals having impact factor.

Faculty Evaluation Process

University rules are adopted.

Standard 5-4: The process and procedure used to ensure that teaching and delivery of course material to the students emphasizes active learning and that course learning outcomes are met. The process must be periodically evaluated to ensure that it is meeting its objectives.

1. Process to ensure teaching and delivery of course material:
 - a. Time table is strictly followed by all faculty members
 - b. Director of the institute frequently gets feed back from the students during the semester.

Standard 5-5: The process that ensures that graduates have completed the requirements of the program must be based on standards, effective and clearly documented procedures. This process must be periodically evaluated to ensure that it is meeting its objectives.

- a) The institute ensures that the graduates are punctual and fulfil the attendance requirement i.e. 75%.
- b) Survey report of Regular Master's Students Survey.

CRITERION-6

FACULTY

Criterion-6 Faculty

Faculty members of the Institute of Environmental Studies are active in teaching and research and have the necessary technical depth to support the program. Teachers attempt to cover the curriculum adequately and in case of need hold extra classes.

Standard 6-1: There must be enough full time faculty who are committed to the program to provide adequate coverage of the program areas / courses with continuity and stability. The interest of all faculty members must be sufficient to teach all courses, plan, modify and update courses. The majority must hold a Ph.D. degree in the discipline.

The Institute of Environmental Studies is currently having the services of 6 regular faculty members and 10 visiting faculty members. All are qualified to teach Masters Courses.

Standard 6-2: All faculty members must remain current in the discipline and sufficient time must be provided for scholarly activities and professional development. Also, effective programs for faculty development must be in place.

a) Faculty members of Institute of Environmental Studies are considered current in the discipline based on the following criteria:

- i) All teachers meet the HEC criteria for appointment in the respective cadre.
- ii) Teachers generally participate in seminars, conferences at National / International levels.
- iii) Teachers take interest in teaching and involve themselves in research. At present there is only 3 Ph.D. and all other regular staff ie enrolled in M.Phil/ Ph.D.

b) Faculty development program at department level

- i. The institute invites lectures from eminent scholars on various topics related to Environment, Climate Change and Global Environmental Issues.
- ii. Facilitate its faculty to acquire Advanced Trainings in the field of environmental studies.
- iii. University of Karachi has started Faculty Development Program with the help of HEC. Under this program non-Ph.D faculty are given opportunities to improve their qualification from technologically advanced countries of the world. Further, Post-Doc facilities will be available to the faculty holding Ph.D degrees. The University also helps to organize professional activities such as workshops, seminars and conferences.

Standard 6-3: All faculty members should be motivated and have job satisfaction to excel in their profession

To help the faculty of Institute of Environmental Studies in their progress to excel in their profession, the department and institution has devised the following strategies:

- i) The institute ensure fair, timely selection, appointment/promotion as per HEC criteria
- ii) Good working environment exists for research on commercial issues.

CRITERION-7

INSTITUTIONAL FACILITIES

Criterion-7 Institutional Facilities

Institutional facilities, including library, class rooms and offices are adequate enough to support the objectives of the program.

Standard 7-1: The Institution must have the infrastructure to support new trends in learning such as E-learning.

Computer and Internet Facility

The Institute of Environmental Studies has inadequate computer facilities/ services and administrative staff to support its faculty, students and staff in their academic and administrative activities. Two well equipped computer labs are required.

Standard 7-2: The library must possess on up-to-date technical collection relevant to the program and must be adequately staffed with professional personnel.

a) Main Library

Faculty members and students of the institute are allowed to use the main library even after normal working hours. The main library provides the following services;

- i. Course books
- ii. Digital library having access to journals and E-books

b) Seminar Library

The Seminar Library has a good number of books and collection of old and new journals covering a wide range of disciplines in environment, climate change and global environmental issues. Current editions of latest books are required.

Standard 7-3: Class rooms must be adequately equipped and offices must be adequate to enable faculty to carry out their responsibility.

Classrooms

Due to shortage of class rooms, the Institute also uses its computer labs for teaching purpose. The institute has white boards, black boards, overhead projectors and multimedia. It however needs four class rooms to cater the needs of its under-graduate and graduate students. Further, it also needs one conference room for organizing seminars and workshops.

Faculty Offices

The Institute of Environmental Studies is short of space to adequately accommodate its faculty and administrative staff. A Separate office for individual faculty and for Ph.D students are required.

CRITERION-8

INSTITUTIONAL SUPPORT

Criterion-8 Institutional Support

The institution's support and the financial resources for the program is sufficient enough to provide an environment in which the program can achieve its objectives and retain its strength.

Standard 8-1: There must be sufficient support and financial resources to attract and retain high quality faculty and provide the means for them to maintain competence as teacher and scholars.

The Institute of Environmental Studies has one computer lab(s) and a small seminar library for research. The financial resources for regular purchase of books are very limited which needs to be enhanced. The major financial source of the Institute is the University of Karachi which allocates budget for the Institute, whereas the University relies on HEC funding.

Standard 8-2: There must be an adequate number of high quality graduate students, research assistants and Ph.D. Students

The following Table shows the number of students enrolled in each program of the Institute of Environmental Studies.

Degree Program	Years		
	2007	2008	2009
M.Sc.	38	22	14
Post Graduate Diploma (PGD)	---	---	---
Certificate Course	N.A.	N.A.	1
M.S/ M.Phil. leading to Ph.D.	1	Nil	15

Standard 8-3: Financial resources must be provided to acquire and maintain library holding, laboratories and computing facilities.

The University of Karachi provides financial resources to maintain library and computing facilities. The institute, however, is not having the separate fund of its own to maintain and upgrade its library and computing facilities. HEC is also requested to provide additional financial resources for further strengthening of the institute of Environmental Studies.

COURSES & SYLLABUS

BIOLOGICAL SYSTEMS

(No credit hour)

(For students with mathematics background)

- a) Structural and functional organization of the cell: Cells, Tissues, Cell cycle: mitosis and meiosis, differentiation. Prokaryotic and eukaryotic cells.
- b) Biochemical organization: Essential nutrients, trace elements, intermediary metabolism of CHO, lipids, amino acids and proteins (brief account)
- c) Cellular organelles: Cell membrane and permeability, ER, golgi bodies, lysosomes, mitochondria and oxidative phosphorylation, Chloroplast and photosynthesis. Nuclear components, chromosomes, ribosome, nucleus, protein synthesis.
- d) Membrane and sensory physiology, joints types of muscles and contractility.
- e) Biological regulatory systems: Organization of CNS, nerves integration, special senses, physiology of behavior. Endocrine system: organization and regulation.
- f) Regulation of CVS, bloods, respiratory pigments and gas transport, aquatic and serial respiration.
- g) Nutrition and digestion, excretory organs, nitrogenous waste, osmotic and ionic regulation.
- h) Reproduction growth and development. Temperature and rate of biological activities. Behavioral adaptation to the environment.

MATHEMATICAL METHODS

(No credit hour)

(For students with biology background)

- a) **ELEMENTARY CONCEPTS**
Symbols, symbols of operation, algebraic expressions, brackets, coefficient, like terms, variable, domain addition, subtraction, multiplication exponents, laws of exponents, division.
- b) **SPECIAL PRODUCTS (Binomial Expansion)**
Product of two binomials, square of a binomial expression, cube of a binomial.
- c) **FACTORS**
Common factors, form of $x^2 + ax + b$, form of $ax^2 + bx + c$, perfect squares, difference of two squares, sum or difference of two cubes.
- d) **FRACTIONS**
Definition, fundamental principle of fractions, lowest common multiple, multiplication and division complex fractions.
- e) **SIMPLE EQUATIONS (Linear equations)**
Simple equation, stated problems
- f) **SIMULTANEOUS EQUATIONS**
- g) **QUADRATIC EQUATIONS**
Solution by factoring solution by completing the square, general formula for quadratic solution.
- h) **CO-ORDINATE GEOMETRY AND TRIGNOMETRY**

Location of co-ordinate, distance between two points, equation of lines and circles
Trigonometry identities.

- i) **MATRICES AND DETERMINANTS**
Addition, subtraction, multiplication of matrices, k-times a matrix, properties of multiplication, inverse, solution set of a system of linear equations, determinants, properties of determinants Cramer's rule.
- j) **EXPONENTIAL and LOGARITHMIC FUNCTIONS**
Exponential functions, logarithms, properties of logarithm, antilogarithm, and operations with logarithm which are negative.
- k) **DERIVATIVES**
Derivatives, differentiation of algebraic functions, technique of differentiation, marginal functions, higher order derivatives maximum, minimum and point of inflexion, Antiderivatives (Integration).
- l) **SEQUENCE AND SERIES**
- m) **BASICS OF STATISTICS, SAMPLING ETC.**

Credit Hour Courses

ENV-501 INTRODUCTION TO ENVIRONMENT (2+1 Credit hrs)

- a) Environmental systems: Atmosphere, lithosphere, hydrosphere, biosphere Origin and their interrelationship
- b) Environmental factors: Chemical, physical and biological
- c) Forests: Temperature and tropical; desertification
- d) Water management: Water cycle and eutrophication
- e) Uplands, wetlands and other major environmental systems
- f) Environmental ethics

ENV-503 ENVIRONMENTAL CHEMISTRY (3+0 Credit hrs)

- a) Chemical cycles: Cycles of matter
- b) Organic and inorganic pollutants
- c) Physical properties and principles
- d) Chemical reactions and mechanisms
- e) Surface chemistry and phase interactions
- f) Photochemical smog and atmosphere
- g) Soil chemistry
- h) Nature and sources of chemical wastes and their disposal
- i) Environmental chemistry and industrial pollution/production

ENV-505 Environmental Microbiology (2+1 Credit hrs)

- a) History of microbiology
- b) Microbial classification, growth and nutrition
- c) Useful and harmful activities of micro-organisms
- d) Microbial enzymes and metabolism
- e) Physical and chemical methods for the control of microbial population
In the environment including hospital environment

- f) Water, wastewater, soil and air borne micro-organisms
- g) Bio-degradation and bio-accumulation

ENV-507 Environmental Pollution Measurement and Assessment-1
(0+3 Credit hrs)

- a) Determination of physical characteristics of wastewater/biological system pH, Euphotic limits, Turbidity, total dissolved solids, suspend solids conductivity
- b) Determination of chemical characteristics of wastewater:/soil/ biological system Alkalinity, Hardness, Biochemical Oxygen Demand, Chemical Oxygen Demand, Ammonia-Nitrogen, Nitrate-Nitrogen, Nitrite-Nitrogen, Total Phosphate, Phenol, Cyanide Alkyl benzene sulphonate (ABS), Methylene blue active substances (MBAS), Sulphate, Sulphide, Chloride Fluorin

ENV-509 Water and Wastewater Treatment (3+0 Credit hrs)

- a) Methods of water treatment for potable and industrial use: Alum treatment, sedimentation, filtration, chlorination
- b) Agents for disinfection of water
- c) Health and engineering aspects of water and wastewater
- d) Characteristics of industrial and domestic wastewater treatment
- e) Mechanical and Biological methods of wastewater treatment
- f) Problems of water contamination in developing countries
- g) Advance wastewater treatment, recovery and recycling

Semester -2

ENV-502 Air and Noise Pollution (3+0 Credit hrs)

- a) Sources of air pollution: Stationary and mobile
- b) Biology and chemistry of contaminate air
- c) General adverse effects of air pollution
- d) Effects of air pollution on inert materials and living objects
- e) Visibility and air pollution
- f) Air pollution monitoring and control methods
- g) Nature, sources and effects of noise
- h) Methods for noise pollution control

ENV-504 Environmental Geology (3+0 Credit hrs)

- a) Origin and structure of the earth
- b) Physical features of earth, oceans and continents
- c) Agents and process changing the surface of the earth and coastal degradation
- d) Introduction to rocks, minerals and ores
- e) Characteristics of major rocks types
- f) Major structural features of rocks
- g) Impact of climate on weathering of rocks geomorphic features
- h) Ground water sources, accumulation, uses and pollution
- i) Geochemical cycle of elements and their role as contaminants

ENV-506 Biostatistics (2+1 Credit hrs)

- a) Descriptive statistics: Types of data. Frequency distribution, Graphical presentation
- b) Measure of central tendency: Mean, Median.
- c) Measure of dispersion: Variance, Standard deviation, Mean absolute deviation
- d) Linear regression and Correlation
- e) Probability: events, Sample space, Probability laws, Binomial, Poisson and Normal distribution: Properties and uses
- f) Testing of hypothesis: Level of significance, type I and type II errors Testing mean (Z test, t test for one and two population) and variance Test for association.
- g) Introduction to analysis of Variance: One and two way classifications

**ENV-508 Environmental Pollution Measurement and Assessment-2
(0+3 Credit hrs)**

- a) Determination of biological characteristics of wastes
- b) Isolation and identification of environmental pathogens from environmental samples (water, wastewater, foods)
- c) Microbiological quality of water
- d) Microscopic study of water borne parasites
- e) Effects of disinfectants on water and food borne micro-organisms
- f) Isolation and identification of bacteria from activated sludge
- g) Different methods for the isolation of micro-organisms from air
- h) Techniques to control biological pollution (plants and animals)

ENV-510 Environmental Toxicology (2+1 Credit hrs)

- a) Environmental toxic agents: Pesticides, solvents, metals, vapours, radiations and radioactive materials, plastics, food additives, contaminating, air, water and soil pollutants.
- b) Absorption, distribution and excretion of toxicants
- c) Metabolisms of toxic substances
- d) Systemic toxicology: Toxic responses of the central nervous system, liver, kidney respiratory system, eye, blood and reproductive system.
- e) Teratogenicity, mutagenicity and carcinogenicity
- f) Immunological considerations in toxicology
- g) Toxicity screening using microbial systems

M.Sc. (Final)

(Only 10 courses to be selected. Five each in Semester 3 and 4)

Semester -3

ENV-601 Industrial Pollution and Control (2+1 Credit hrs)

- a) Industrial development and environment
- b) Characteristics of industrial wastewater from different industries
- c) Methods of industrial wastewater treatment
- d) Treatment technologies and options for the following industries: Food industries, mining and metallurgical processes, oil and gas related industries, inorganic chemicals, organic chemicals, pulp and paper, textile, pharmaceuticals, leather and thermal power station
- e) Good house keeping practices for industrial units

ENV-603 Aquatic Pollution (3+0 Credit hrs)

- a) Overview of coastal management
- b) Sources and effects of aquatic pollution
- c) Relationship and chemical pollutants of aquatic environment and ecological changes
- d) Management of living aquatic resources
- e) Methods for the control of aquatic pollution

ENV-605 Environmental Hygiene and Occupational Health (2+1 Credit hrs)

- a) Definition and concept of environmental health, hygiene and sanitation
- b) Water and food contamination and environmental health problems
- c) Environmental sanitation and hygiene during food production, processing and preservation
- d) Health problems and issues related to different occupation
- e) Prevention and control of occupational diseases
- f) Ergonomics and safety
- g) Ergonomics investigations: Some problems and techniques

ENV-607 Environmental Pollution Measurement and Assessment-3 (0+3 Credit hrs)

- a) Methods for the study of environmental disease transmission
- b) Techniques for the study of biofouling and biodegradation
- c) Biological transformation and composting
- d) Techniques for the study of environmental sanitation and hygiene
- e) Methods for the determination of food contamination

Optional Course for 3rd Semester

ENV-609 Solid Waste Management (3+0 Credit hrs)

- a) Definition and classification of solid wastes
- b) Collection, storage and processing of solid wastes
- c) Hazardous wastes
- d) Chemistry of solid wastes
- e) Institutional wastes (hospital solid waste, industrial solid waste)
- f) Agricultural waste
- g) Composting: Basic principles and technology
- h) Sanitary landfill design and management
- i) Incineration of solid and liquid wastes

ENV-611 Pollution Effects on Plants (3+0 Credit hrs)

- a) Effects of gaseous and particulate matter pollutants on plants
- b) Acid rain and decline of forest
- c) Mechanisms of plant injury
- d) Industrial and sewage effluents and their effects on plants
- e) Fertilizers, pesticides and herbicides and their effects on plants
- f) Uptake and toxicity of metals on plants and human beings
- g) Pollution effects on nutritional quality of crops
- h) Distribution and tolerance in plants
- i) Biochemical effects of pollutants on plants
- j) Pollution and agricultural management
- k) Bioassay systems for monitoring
- l) Economic impact on country economy

ENV-613 Atmospheric Physics (3+0 Credit hrs)

- a) General description of the atmosphere
- b) Study of different types of atmospheres, troposphere, stratosphere, mesosphere, thermosphere, ionosphere, aurora, magnetosphere
- c) Atmospheric thermodynamics and vertical stability: Atmospheric systems, Main Processes in the atmosphere.
- d) Atmospheric dynamics: Different types of forces; the equation of motion and continuity equation; eddy motions; hydrostatic equilibrium; the thermal circulation of the atmosphere; the relationship between pressure, latitude circulation system.
- e) Radiations: Types of radiation, causes of radioactive pollution, disposal of radioactive waste
- f) Health hazards of radiations; Indoor and outdoor Radon and its health effects
- g) Management and release of radioactivity: Internal exposure models and derived concentrations in air, water and food.

Semester 4

ENV-602 Environmental Economics and Impact Assessment (2+1 Credit hrs)

- a) Introduction: Economics, environment and pollution
- b) Natural resources exploitation: Non-renewable resources and renewable resources
- c) Economics of resource recovery and recycling
- d) Human health and economic productivity
- e) Analytical tools for environmental planning
- f) Environmental impact analysis of water and air quality, energy, vegetation and wildlife
- g) Strategic planning for sustainable development and economic activity
- h) Preparation and development of environmental impact statement

ENV-604 Environmental Epidemiology and Medicine (2+1 Credit hrs)

- a) Basic concept of epidemiology
- b) Epidemiology models, ecological triad, wheel model and web causation
- c) Host and pathogen interaction: Concept of cause, establishing the cause of a disease, environmental risk assessment, association and causation in environmental epidemiology
- d) Survival of pathogens in the environment
- e) Epidemiology of communicable and non-communicable diseases
- f) Epidemiology and prevention. The scope and level of prevention
- g) Water and food borne diseases and their spread
- h) Environmental and occupational epidemiology

ENV-606 Environmental Pollution Measurement and Assessment-4 (0+3 Credit hrs)

- a) Biotechnology: Definition, principle and process
- b) Recombinant DNA technology; Genetics of Bacteria
- c) Methods of gene transfer in bacteria and construction of desired strains
- d) Biotechnology for pollution monitoring and control
- e) Bio-sensors: development and use for pollution monitoring
- f) Bio-absorption and Bio-accumulation of heavy metals; Mechanisms involved
- g) Biodegradation of toxic chemicals, genetics of biodegradation
- h) Phytoremediation; yeast, fungi, algae and plants for removal of pollutants
- i) Bio-reactors: types and construction
- j) Immobilization and bio-film formation: support systems, flow rate & efficiency.
- k) GEMS: their construction and use for cleaning the environmental release of GEMS in the environment, guideline and risk assessment

ENV-616 Environmental Remote Sensing

(3+0 Credit hrs)

- a) Introduction to the physics of remote sensing
- b) Effects of the atmospheric on remote sensing
- c) Instrumentation for remote sensing: Image devices, devices for analyzing photographic images
- d) Nonphotographic optical sensors: Sensor measurements, design consideration, infrared scanners, nonimaging sepektoradiometers, multispectral scanner
- e) Passive microwave systems: Radiometer systems, information, applications and active microwave system: Basic principles of raddar, radar scatter meter, imaging radar
- f) Landsat satellites
- g) Skylab
- h) Comparisons of qualitative and quantitative image analysis
- i) Remote sensing of cultivated and natural vegetation: Cropland and forest land
- j) Cultural and landscape interpretation
- k) Geologic applications of remote sensing: radar imagery, infrared scanner imagery
- l) Remote sensing for water resources
- m) Remote sensing in oceanography

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