Pir Mehr Ali Shah

ARID AGRICULTURE UNIVERSITY RAWALPINDI

Self-Assessment Report 2012-14 (4th cycle)

Degree Programme: M.Sc. Environmental Sciences

DEPARTMENT OF ENVIRONMENTAL SCIENCES

Program Team

1. Prof. Azeem Khalid (Coordinator)
2. Dr. Audil Rashid (Member)
3. Dr. Shahid Mahmood (Member)

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Introduction

PMAS-Arid Agriculture University Rawalpindi introduced the department of Environmental Sciences in May 2007 as part of the faculty of Forestry, Range Management and Wildlife. Since then the Department is offering postgraduate degree programmes in the field of Environmental Sciences with research focus on climate change, carbon emission and sequestration, organic and inorganic pollution and bioremediation of contaminated sites.

The postgraduate degree course at the Department of Environmental Sciences is designed to produce scientists with a sound theoretical knowledge of the basic sciences and practical knowledge of pollution control technologies. It helps the students to recognize and understand the threats and conflicts in the environment today, understand the steps required to develop solutions and enable them to address the issues at local or global level in an effective manner.

The Master of Sciences (MSc) is a two year degree program including research work leading to their interest along with their training through seminars, workshops and national or international conferences. Field visits and study trips are also arranged frequently to strengthen student's practical knowledge and to open new research horizons.

The ultimate focus of degree programmes is to furnish students for careers in the full range of environmental professions, particularly in areas relating to environmental protection and management. Furthermore, curriculum for various degrees in Environmental Sciences has been developed according to the national and international requirements in order to prepare students for better environmental management, understanding the inter-relationship between sustainable economic development and environmental protection

A degree holder from this department would be able to understand contemporary issues in environmental management, knowledge of the interactions between processes operating in the physical environment and ecosystems, together with an awareness of the legislative and ethical frame work within which environmental scientists operate.

Following the Higher Education Commissions (HEC) outlined framework consisting of eight criteria the self assessment report (SAR) is prepared in order to improve improve and ensure high quality standard of education.

Criteria 1

PROGRAM MISSION, OBJECTIVES AND OUTCOMES

This section describes criteria 1 and its associated standards.

Standard 1-1: **The program must have documented measurable objectives that support Faculty / College and institution mission statements.**

Mission Statement

The mission of the program is to provide quality education and to prepare a workforce of capable, passionate thinkers trained in an interdisciplinary field who are determined to solve some of the current challenging environmental issues.

Objectives

1) Identification of local environmental issues with reference to public health, urban sustainability and interventions through effective teaching

2) Building capacity of students to understand inter-relationship between ecosystem harmony, sustainable development and environmental protection.

3) Train students to carry out impact assessment studies with reference to anthropogenic activities.

4) Enhance intellectual rigor among students to understand environmental problem from several perspectives, thoroughness, knowledge of the literature, the ability to effectively communicate, knowing how to choose and synthesize diverse strands of information, ethical integrity, self-critique, and collaborative inquiry.

Main elements of strategic plan to achieve mission and objectives

 Development of efficacious teaching program for degree awards

 Proposition of new course with improved curriculum with additional organizing field trips and research collaborations
 Publication of research papers
 Participation and presentation in national or international conferences

Table.1.1. Program Objectives assessment

S. No	Objectives	How measured	When measured	Improvement identified	Improvement made
1	Development of effective teaching and state of the art curriculum designing for Environmental Science	By evaluating Student's response and feedback. The curriculum is revised each year as per HEC guidelines and keeping in view curriculum of other universities.	Teaching methods are measured at the end of each semester, while curriculum at the end of each year.	Recent teaching aids and methods need to be incorporated. Courses of applied nature and related to most critical issues of Pakistan need further emphasis	A thorough revision has been made in teaching methods and now recent trends including presentations, assignments and discussion have been adopted. New and recent aspects are included in already existing scheme of study and some new courses related to energy cisis, renewable energy and conservation have been included.
2	Grooming of students for environment protection	Presentation and discussion by the students on crucial aspects of the environment. Conferences and workshops are also organized by the department almost each year	It is done in each semester and participation in conferences etc. is observed at the end of each year.	Students and faculty members must be encouraged to participate in national and international conferences to present their research work.	Several initiatives were taken to indulge students in seminar, workshops in which responsibility was given to them. Students are strongly encouraged to participate in the conferences. At the end of each year, a review is made in the presence of all faculty members, PhD and MPhil students and a strategy is discussed for the next year.
3	Capacity building of students for research	Through evaluation of research work done and thesis	Upon completion of research work and at the time of viva / thesis defense.	Some students need improvement in planning a research proposal based on current problems and present their work at national/ international level.	Research topics related to current issues were assigned to the students.
4.	Enable the students to carry out pollution assessment inquiries and develop innovative strategies through research	All the students present their synopsis in class	At the end of first semester or start of second semester	Students need to consult literature and they must plan their work on applied aspects and submit a paper on completion of research and thesis	Students were asked to write review papers on the topic related to their research work.

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

Program Learning Outcomes

All the students of Environmental sciences should possess following abilities after graduation

1. Self-discipline and presentation skills

2. Identification and monitoring of environmental hazards

3. Planning and execution of environmental impact and risk assessment programs

4. Research planning, project proposition skills and research publication skills

Table 1.2: Program outcomes and their relationship with objectives

Outcomes	Objectives				
		1	2	3	4
	1	++	++	++	++
	2	++	+++	++	+
	3	+++	++	++	++
	4	++	+++	+	++

+ = Moderately satisfactory ++ = Satisfactory +++ = Highly satisfactory

Program Assessment Results:

Teacher's evaluation

There are eight teachers in the department namely:

1. Prof. Dr. Tariq Mahmood Professor
2. Dr. Azeem Khalid Associate Professor
3. Dr. Audil Rashid Assistant Professor
4. Dr. Shahid Mahmood Assistant Professor
5. Ms. Aniqa Batool Lecturer
6. Ms. Beenish Saba Lecturer
7. Mr. Khurram Saeed Lecturer
8. Ms. Waqar-un-Nisa Lecturer

Table 1: Courses offered and evaluated during spring semester 2013 (M.Sc. 2nd)

S. No.	Course Code	Course title	Name of instructor
1	ENV-705	Environmental Analytical Techniques	Ms. Aniqa Batool
2	ENV- 713	Climatology	Prof. Dr. Tariq Mahmood
3	ENV-715	Public Health and Human Ecology	Dr. Audil Rashid
4	ENV-723	Physico-Chemical Processes for Wastewater	Ms. Beenish Saba

Table 2: Courses offered and evaluated during fall semester 2012 (M.Sc. 1st).

S. No.	Course Code	Course title	Name of instructor
1	ENV-701	Introduction to Environmental Sciences	Ms. Aniqa Batool
2	ENV-703	Environmental Microbiology	Dr. Shahid Mahmood
3	ENV-704	Research Planning and Report Writing	Prof. Dr. Tariq Mahmood

Table 3: Courses offered and evaluated during fall semester 2013-14 (M.Sc. 3rd)

S. No.	Course Code	Course title	Name of instructor
1	ENV-711	Agriculture Pollution Management	Dr. Shahid Mahmood
3	ENV-712	Environmental Law and Policy	Ms. Aniqa Batool

Table 4: Courses offered and evaluated during spring semester 2014 (M.Sc. 2nd)

S. No.	Course Code	Course title	Name of instructor
1	ENV-702	Environmental Chemistry	Mr. Khurram Saeed
2	ENV-705	Environmental Analytical Techniques	Ms. Waqar-un-Nisa

Table 5: Courses offered and evaluated during spring semester 2014 (M. Sc. 4th)

S. No.	Course Code	Course title	Name of instructor
1	ENV-799	Research and thesis	Respective Supervisor
2	ENV-720	Seminar	Dr. Shahid Mahmood

Table 6: Courses offered and evaluated during spring semester 2013 (M.Sc. 4th)

S. No.	Course Code	Course title	Name of instructor
1	ENV-799	Research and thesis	Respective Supervisor
2	ENV-720	Seminar	Ms. Aniqa Batool

Teachers Evaluation

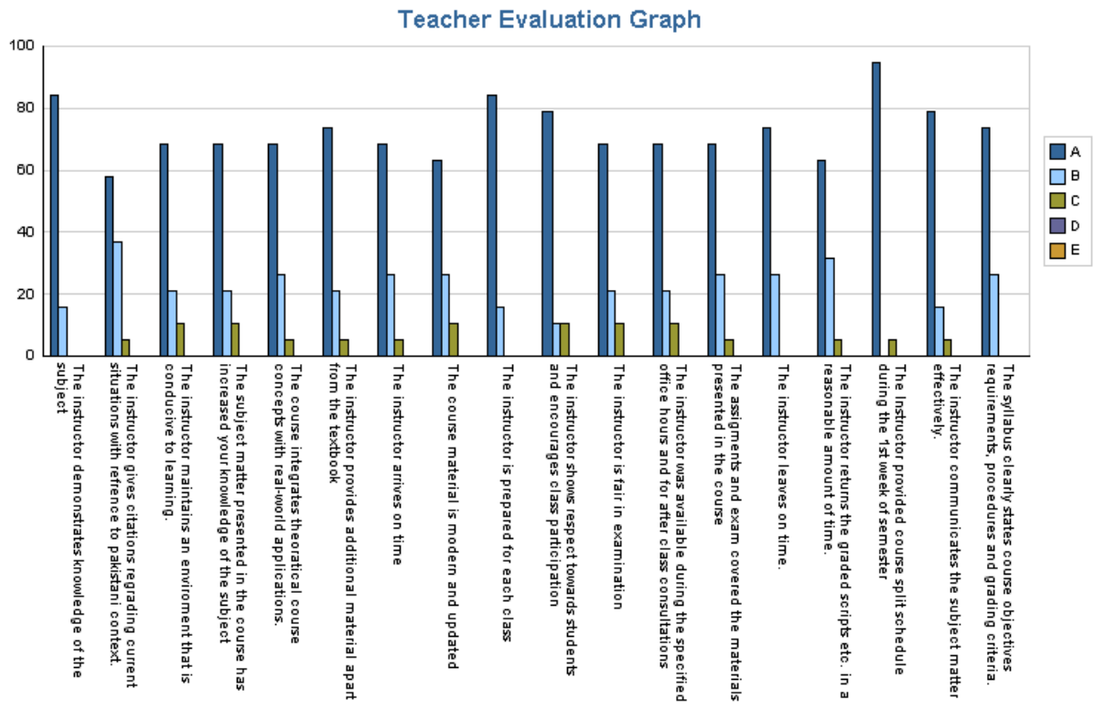
Performa 10

At the end of each semester the teachers were evaluated by the students in accordance with Performa 10.

Ms. Aniqa Batool (ENV-705)

The greatest achievement was that 95% of students reported that instructor provides course outline in 1st week of the semester. Only 10 % students were uncertain about teacher to give respect to students in class. Teacher's availability in specified office timings was reported by 65 % of the students.

Course Title: Environmental Analytical Techniques



A: Strongly Agree B: Agree C: Uncertain D: Disagree E: Strongly Disagree

General Comments of the Students about this Teacher

Weakness:

- Assignments were not returned on time.

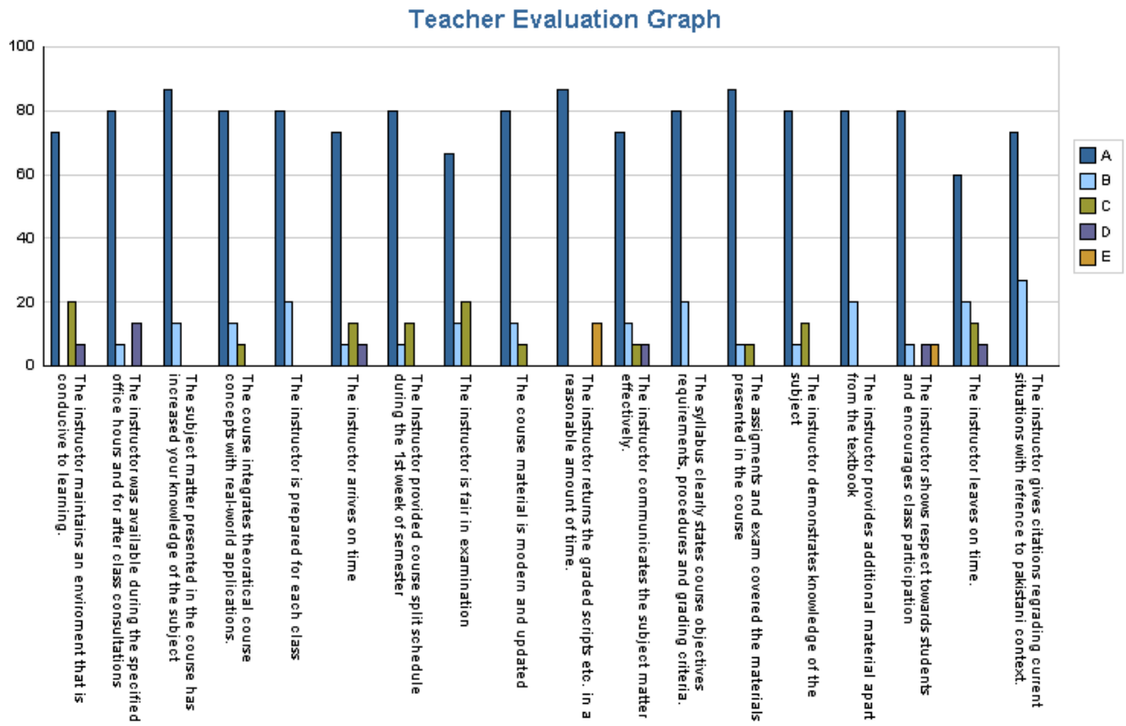
Strengths:

- Class participation was highly appreciated.

Prof. Dr. Tariq Mahmood (ENV-713)

Around 80% of the respondents showed excellent performance of the instructor in most of the subject categories. 70% of the students reported that the course integrates theoretical course concepts with real-world applications. Instructor didn't arrive on time was reported 5% of the students.

CourseTitle: Climatology



A: Strongly Agree B: Agree C: Uncertain D: Disagree E: Strongly Disagree

General Comments of the Students about this Teacher

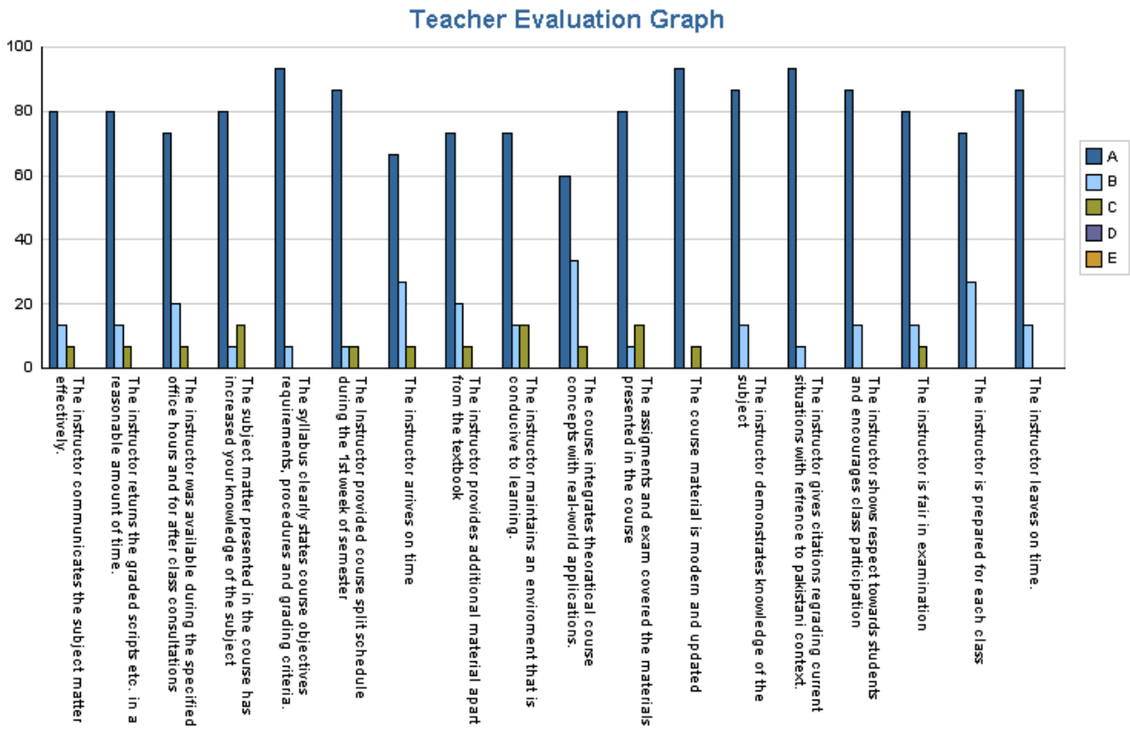
Strength:

Instructor was rated as hardworking, fair for all the students, having good knowledge of the subject, honest, punctual.

<u>Dr. Audil Rashid (ENV-715)</u>

Most of the responses were obtained in either excellent or good category. More than 62% students reported excellent preparedness of the instructor for the class. While more than 80% reported good assessment mechanism adopted.

Course Title: Public Health and Human Ecology



A: Strongly Agree B: Agree C: Uncertain D: Disagree E: Strongly Disagree

General Comments of the Students about this Teacher

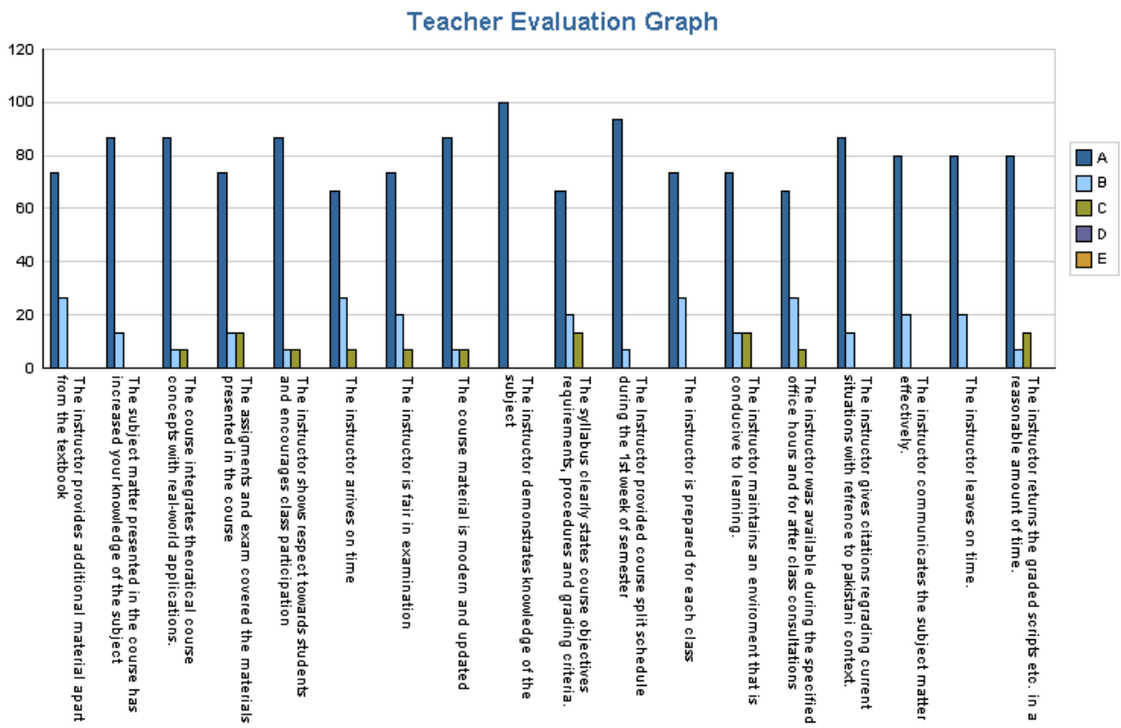
Strengths:

- Class participation is highly appreciated.
- Assignments were graded and returned on time.

Ms. Beenish Saba (ENV-723)

Most of the respondents were agreed or strongly agreed with the teaching method of the instructor. The best part of the course was relevance to Pakistani perspective and more than 90 % responses were obtained in this perspective. 60 % of the students reported that the instructor was available during the specified office hours for after class consultations.

Course Title: Physico-Chemical Processes for Wastewater



A: Strongly Agree B: Agree C: Uncertain D: Disagree E: Strongly Disagree

General Comments of the Students about this Teacher

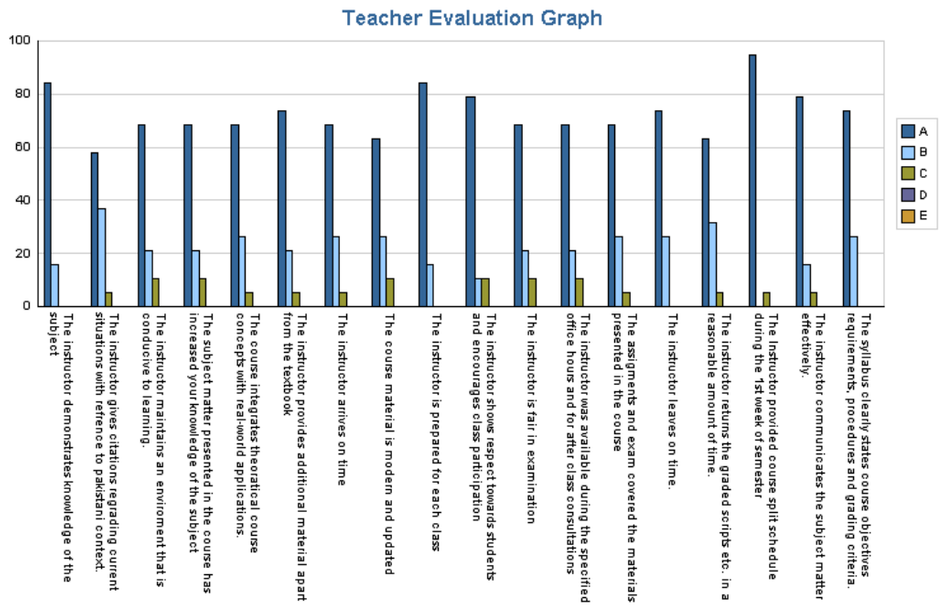
Strengths:

- Instructor provided course material related to Pakistani perspective.
- Class participation was highly appreciated.

Ms. Aniqa Batool (ENV-701)

Overall the behavior and response of the instructor was effective. Sixty percent of the students reported that the Instructor provides additional material apart from the textbook. About 75 % of the students were strongly agreed that the instructor communicates the subject matter effectively.

Course Title: Introduction to Environmental Sciences



A: Strongly Agree B: Agree C: Uncertain D: Disagree E: Strongly Disagree

General Comments of the Students about this Teacher

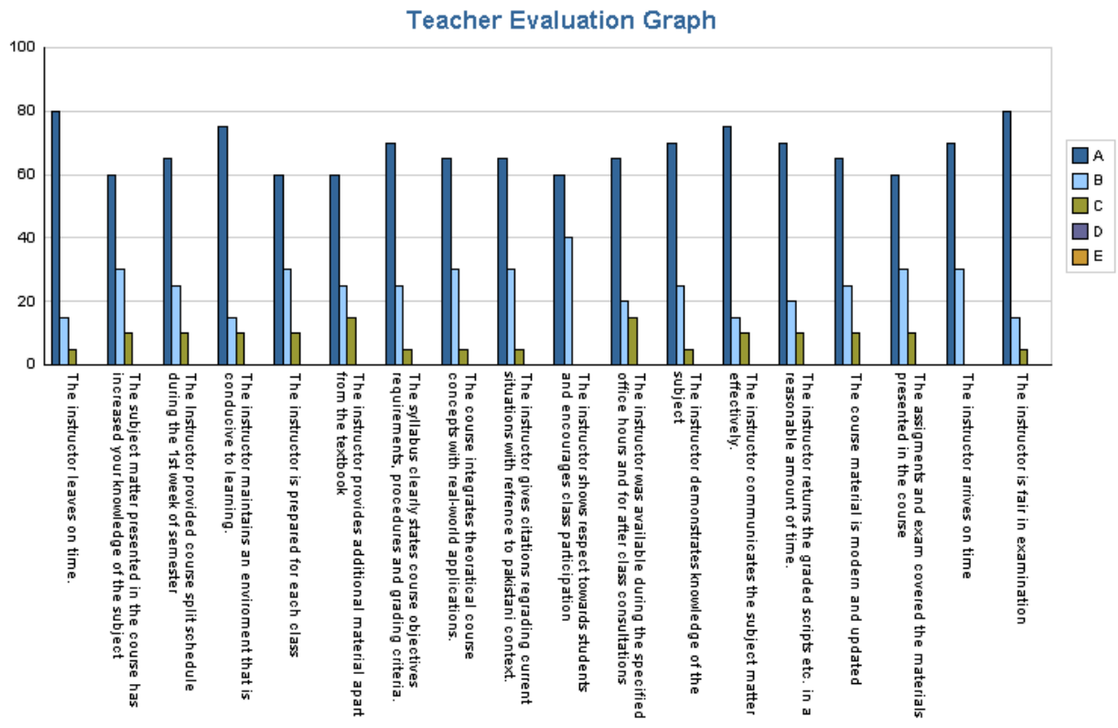
Strength:

- Class discussion was appreciated.

<u>Dr. Shahid Mahmood (ENV-703)</u>

Sixty six percent of the students reported that the teacher was well prepared for every class and delivered knowledge very effectively. 58 % of the students were strongly agreed that the course material was up to date. 50 percent of the students reported that the syllabus fulfills the course objectives.

Course Title: Environmental Microbiology



A: Strongly Agree B: Agree C: Uncertain D: Disagree E: Strongly Disagree

General Comments of the Students about this Teacher

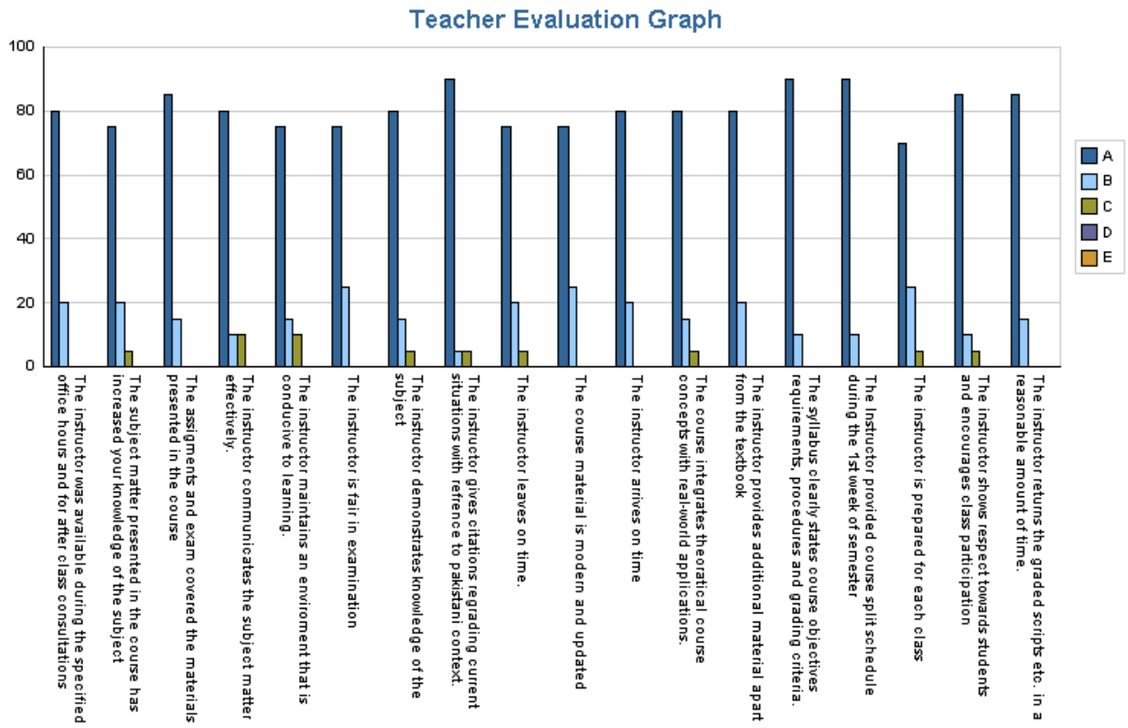
Strength:

- Course material was up to date
- Course objectives were clear

Prof. Dr. Tariq Mahmood (ENV-704)

Eighty percent of the students reported that the Instructor showed respect towards students and encouraged class participation. Similarly 70 % of the students were strongly agreed about preparedness of instructor for class.

Course Title: Research Planning and Report Writing



A: Strongly Agree B: Agree C: Uncertain D: Disagree E: Strongly Disagree

General Comments of the Students about this Teacher

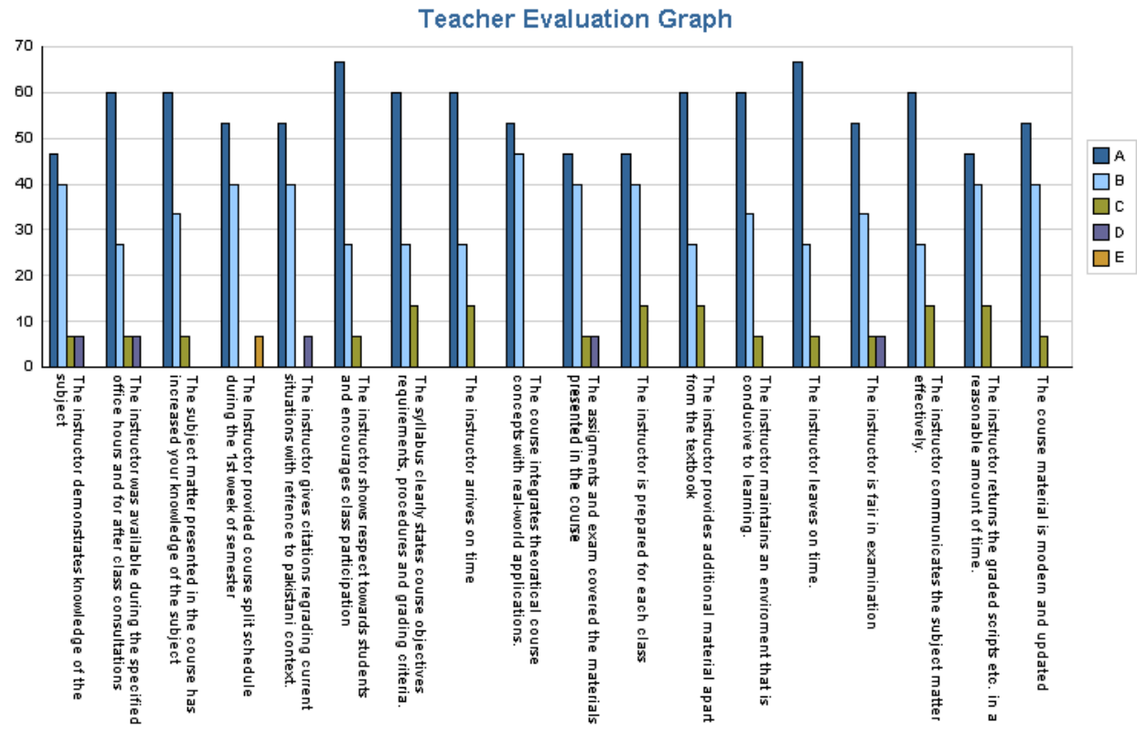
Strengths:

- Class participation was highly appreciated by the instructor.
- Instructor provided up-to-date material.

Mr. Khurram Saeed (ENV-702)

Fourty six percent of the students reported that instructor demonstrated the subject matter effectively. The clarity of the knowledge was the greatest strength of the course with 67% responses in excellent category reported by the students. 66 % of the students reported that the Instructor was available during the specified office hours and for after class consultations.

Course Title: Environmental Chemistry



A: Strongly Agree B: Agree C: Uncertain D: Disagree E: Strongly Disagree

General Comments of the Students about this Teacher

Weakness:

- Material provided by the instructor was not up-to-date.

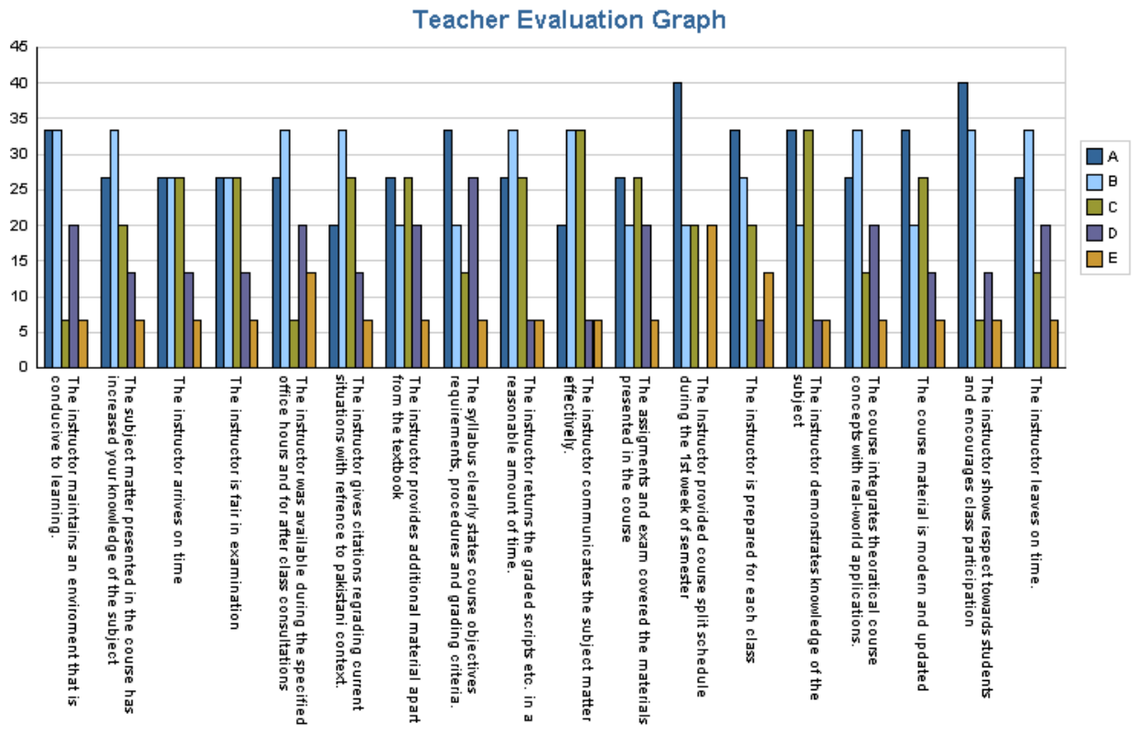
Strengths:

- Assignments were graded and returned on time.
- Method of teaching was appreciated.

<u>Ms. Waqar-un-Nisa (ENV-705)</u>

Thirty three percent of the students agreed that the Instructor gave knowledge according to current situations with reference to Pakistan context. Only 8 % of the students reported that the course material was not up to date.

Course Title: Environmental Analytical Techniques



A: Strongly Agree B: Agree C: Uncertain D: Disagree E: Strongly Disagree

General Comments of the Students about this Teacher
Weakness: 8 % of the students reported that course material was not up-to-date.

Course Evaluation

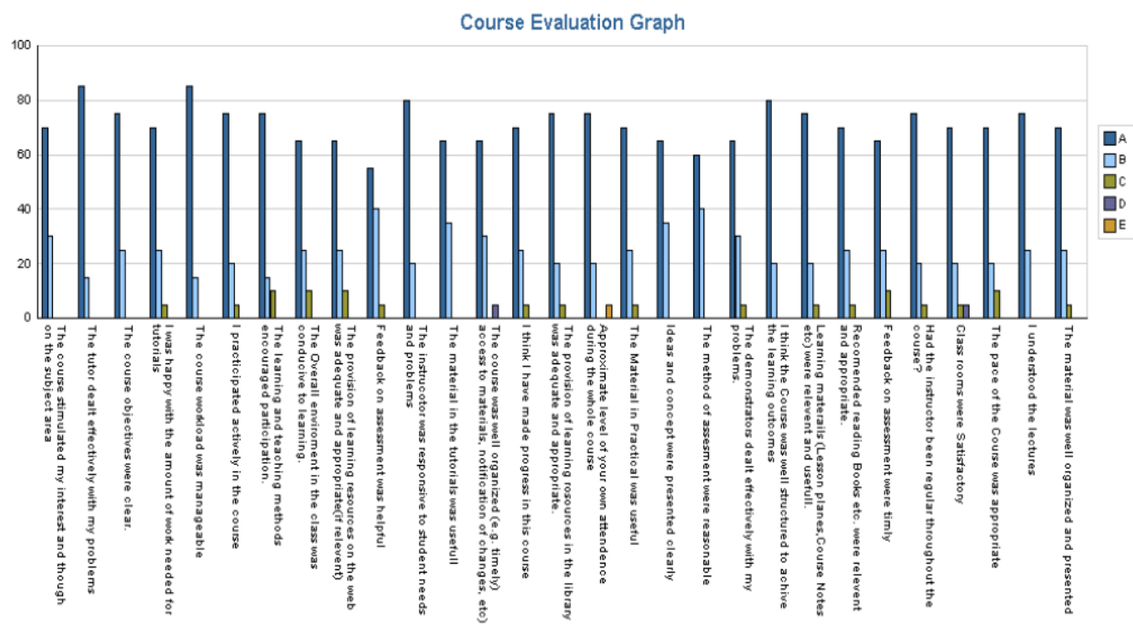
Performa 1

The courses of the respective teachers were evaluated through Performa 1.

Ms. Aniqa Batool (ENV-712)

The greatest achievement was the preparedness for the class where 80 % of students reported excellent preparedness of instructor for the class. Only 10 % of the students reported that relevance of course contents of Pakistani perspective was not highlighted.

Course Title: Environmental Law and Policy



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General Comments of the Students about this Teacher

Weakness:

- Assignments were not returned on time.

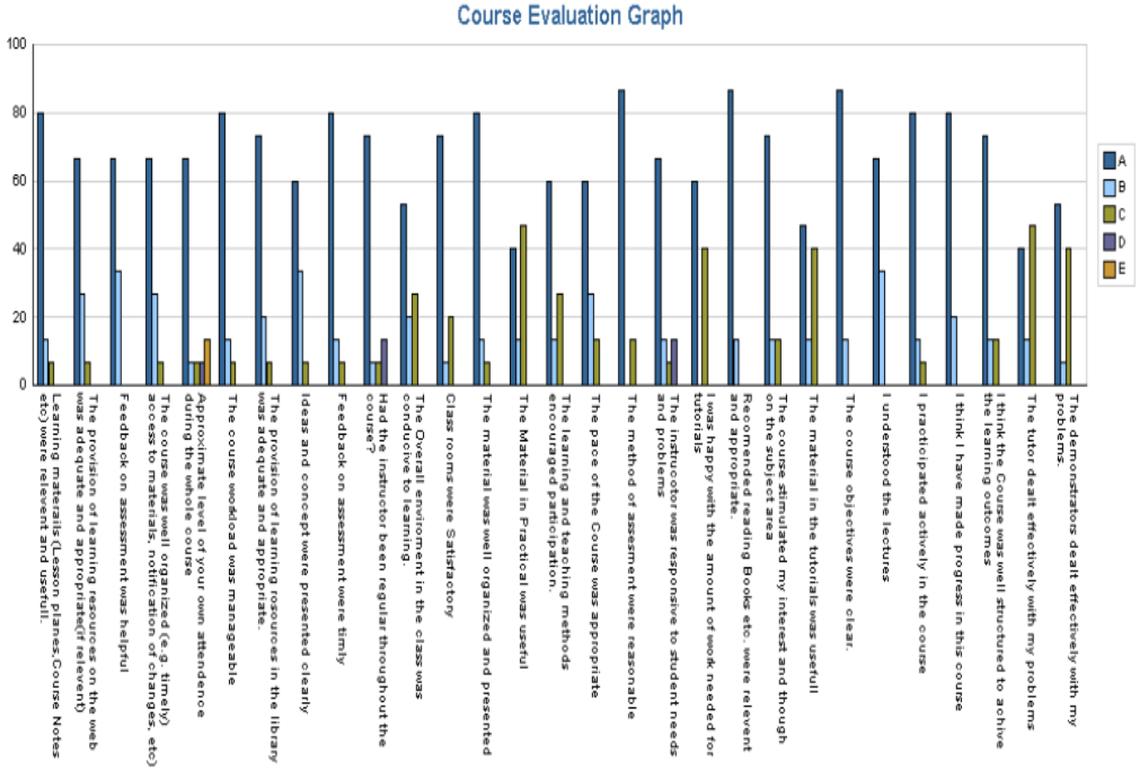
Strengths:

- Class participation was highly appreciated.

Prof. Dr. Tariq Mahmood (ENV-713)

About 60% of the respondents reported excellent performance of the instructor in most of the subject categories. 70 % of the students reported that the course integrated theoretical course concepts with real-world applications

CourseTitle:Climatology



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General Comments of the Students about this Teacher

Strength:

Instructor was rated as hardworking, fair with all the students, having good knowledge of the subject, honest and punctual.

Dr. Audil Rashid (ENV-715)

Most of the responses were obtained in either excellent or good category. More than 62% students reported excellent preparedness by the instructor for the class while more than 80% reported good assessment mechanism.

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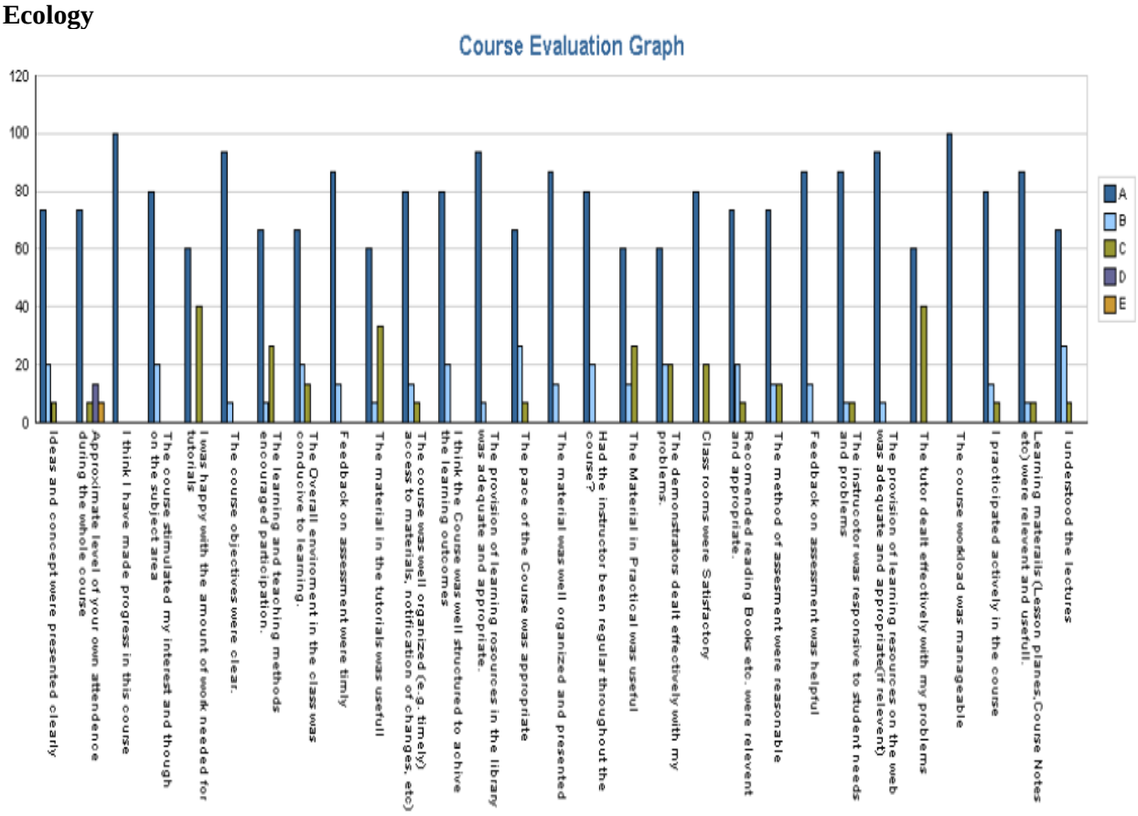

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General Comments of the Students about this Teacher

Strengths:

- Class participation was highly appreciated.
- Assignments were graded and returned on time.

Ms. Beenish Saba (ENV-723)

Most of the respondents were agree or strongly agree with the teaching method of the instructor. The best part of the course was relevance to Pakistani perspective and more than 90 % responses were obtained in this perspective. 60 % of the students reported that the Instructor was available during the specified office hours and for after class consultations.

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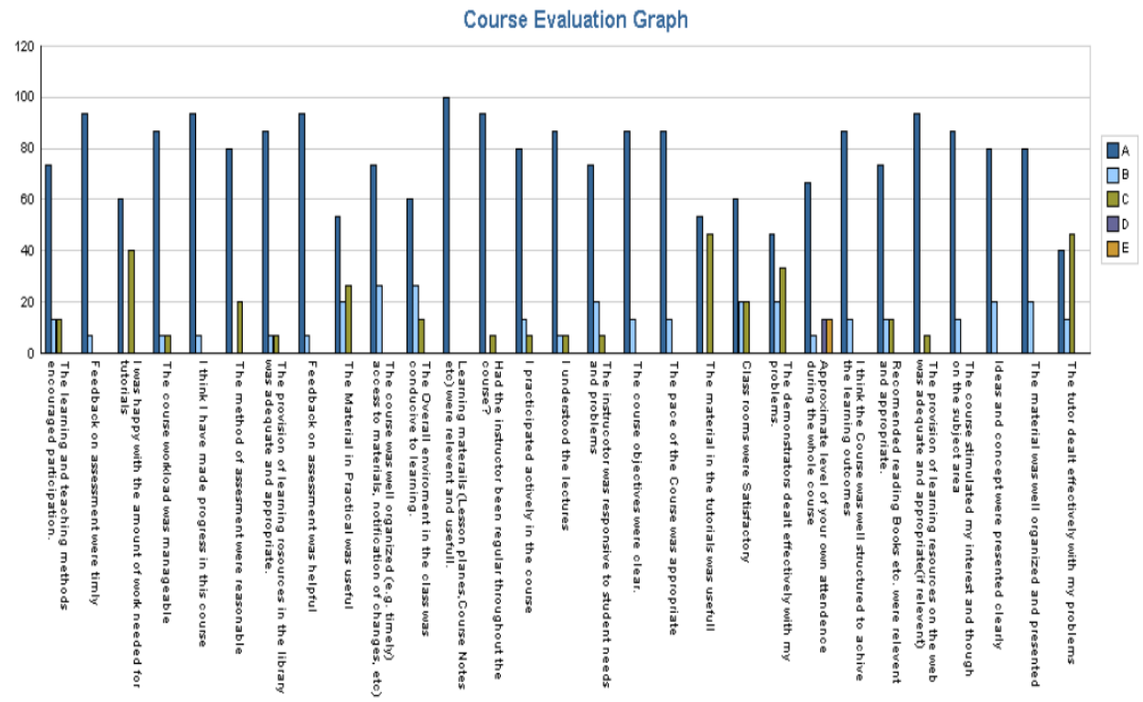

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General Comments of the Students about this Teacher

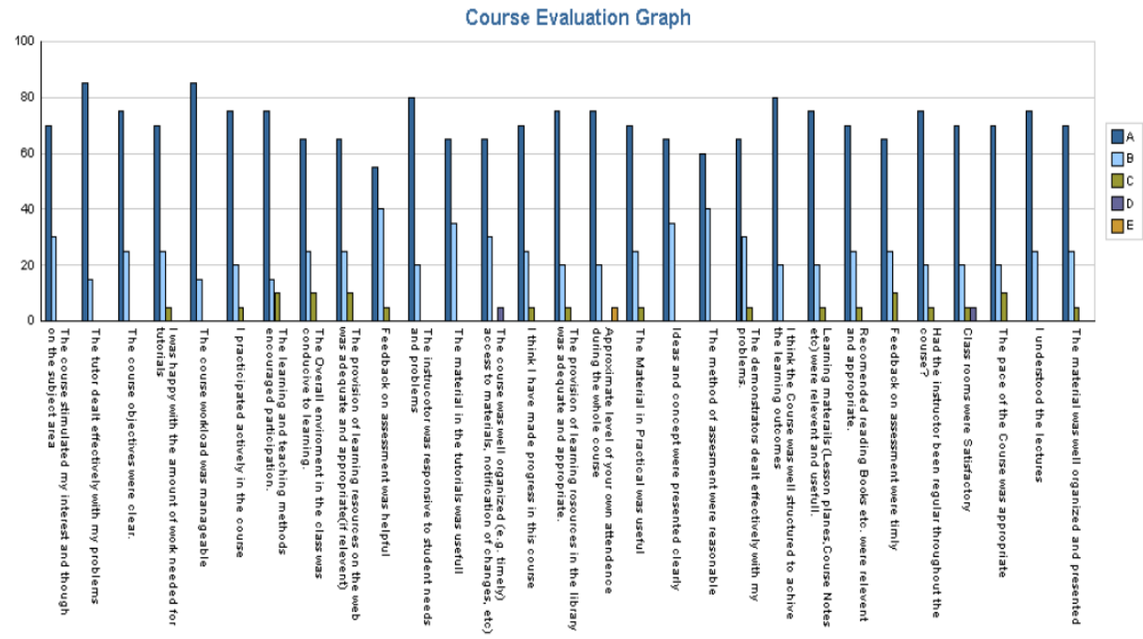
Strengths:

- Instructor provided course related to Pakistani perspective.
- Class participation was highly appreciated.

Ms. Aniqa Batool (ENV-701)

Overall the behavior and response of the instructor was effective. 60 % of the students reported that the Instructor provided additional material apart from the textbook. About 75 % of the students were strongly agreed that the instructor communicated the subject matter effectively.

Course Title: Introduction to Environmental Sciences



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General Comments of the Students about this Teacher

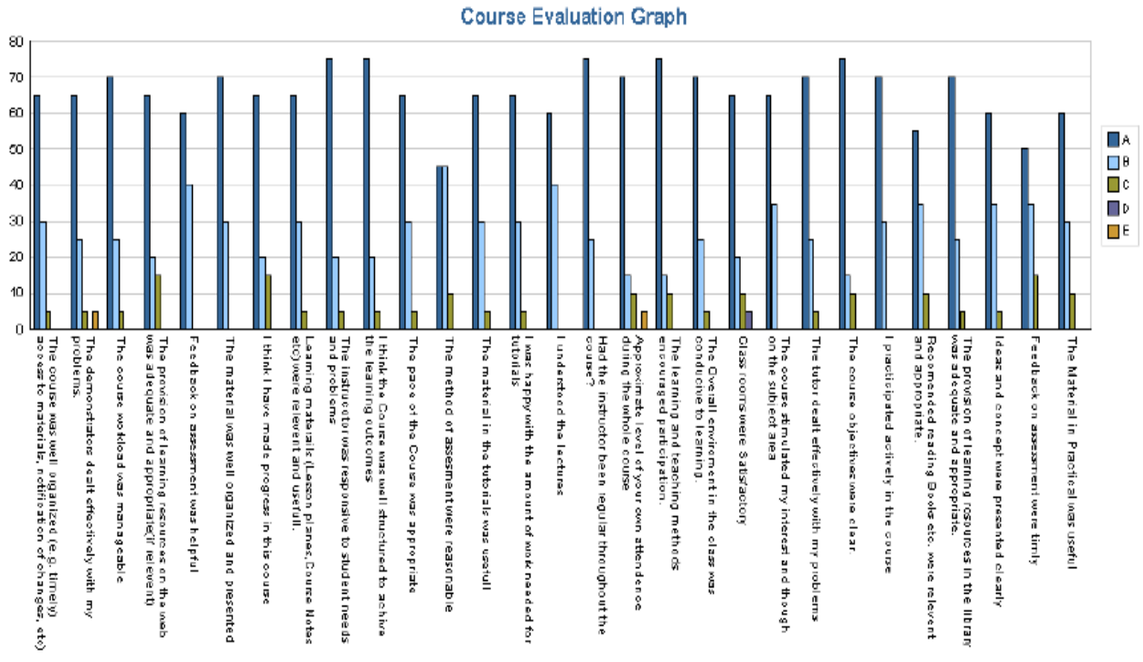
Strength:

- Class discussion is appreciated.

Dr. Shahid Mahmood (ENV-703)

Sixty six percent of the students reported that the teacher was prepared for each class and he delivered the knowledge very effectively. 58 % of the students were strongly agreed that the course material was up to date. 50 percent of the students reported that the syllabus met the course objectives.

Course Title: Environmental Microbiology



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General Comments of the Students about this Teacher

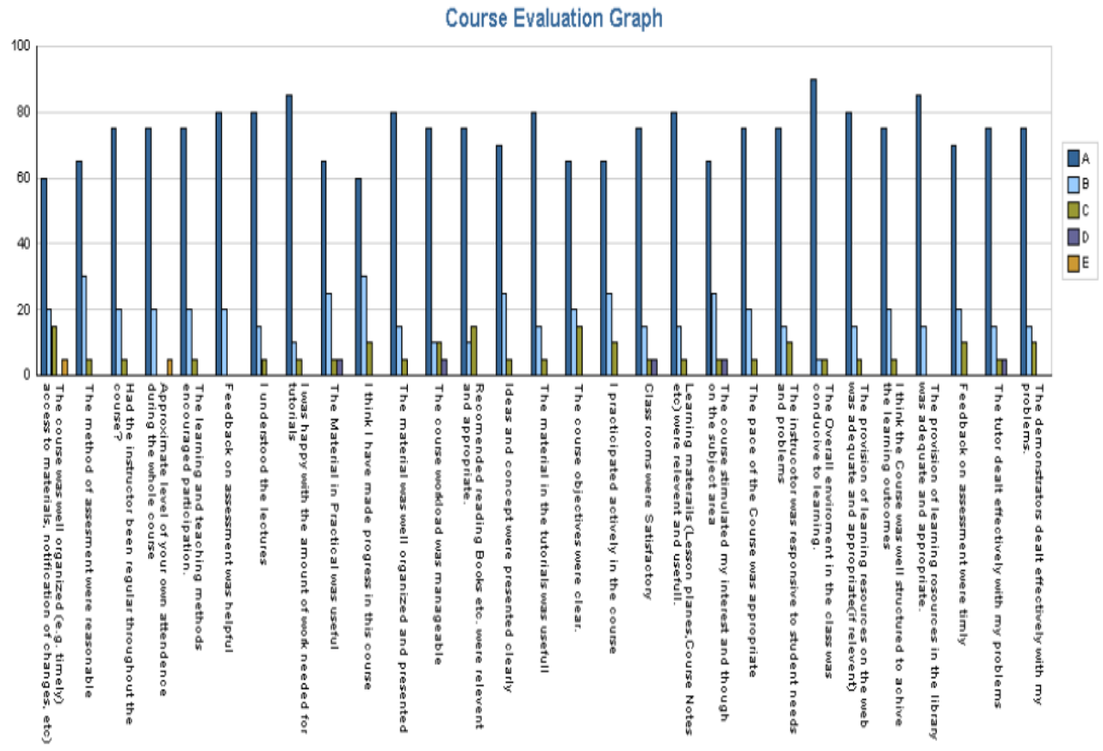
Strength:

- Course material was up to date
- Course objectives were clear

Prof. Dr. Tariq Mahmood (ENV-704)

50 % of the students reported that the Instructor showed respect towards students and encouraged class participation. Similarly 50 % of the students were strongly agreed about preparedness of instructor for class.

Course Title: Research Planning and Report Writing



A: Strongly Agree B: Agree C: Uncertain D: Disagree E: Strongly Disagree

General Comments of the Students about this Teacher

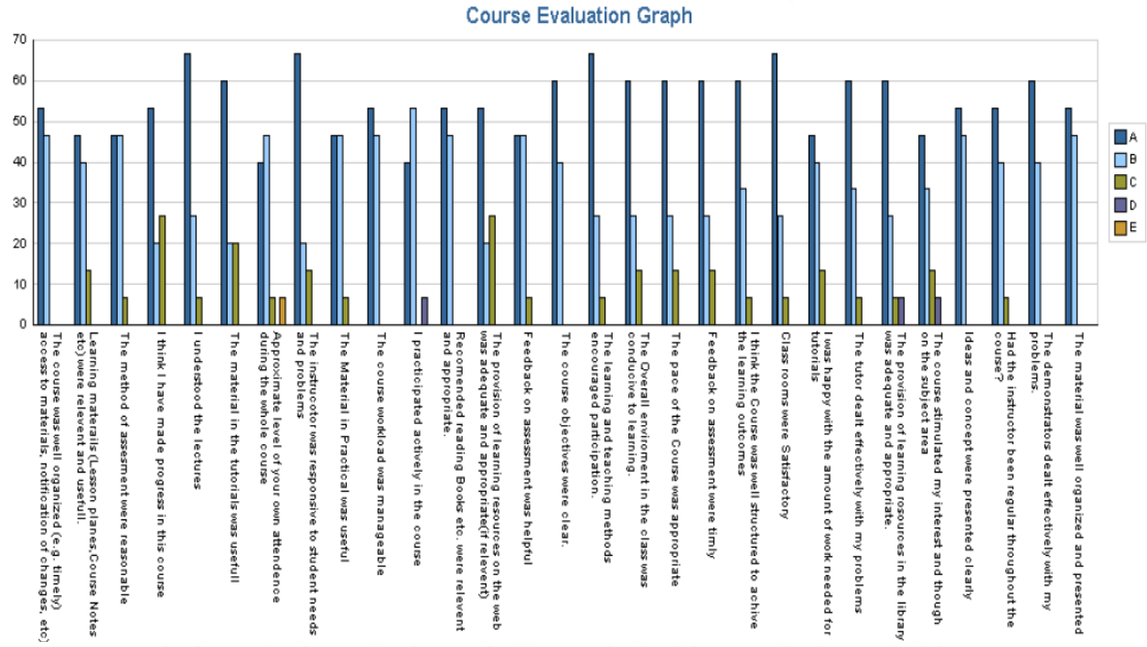
Strengths:

- Class participation was highly appreciated by the instructor.
- Instructor provided up-to-date material.

<u>Mr. Khurram Saeed (ENV-702)</u>

46% of the students reported that instructor demonstratd the subject matter effectively. The clarity of the knowledge was the greatest strength of the course with 67% responses in excellent category reported by the students. 66 % of the students reported that the Instructor was available during the specified office hours and for after class consultations.

Course Title: Environmental Chemistry



A: Strongly Agree B: Agree C: Uncertain D: Disagree E: Strongly Disagree

General Comments of the Students about this Teacher

Weakness:

- Material provided by the instructor was not up-to-date.

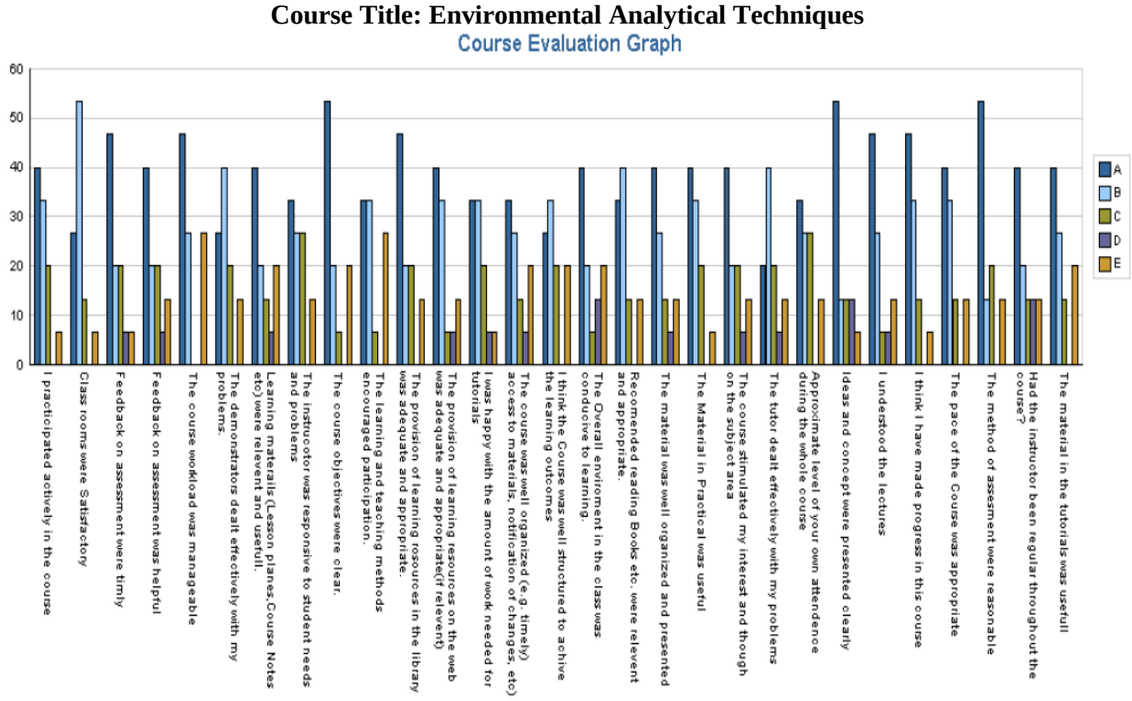
Strengths:

- Assignments were graded and returned on time.
- Method of teaching was appreciated.

Ms. Waqar-un-Nisa (ENV-705)

Sixty percent of the students were agreed that the Instructor gave knowledge regarding current situations with reference to Pakistani context. 8% of the students reported that the course material was not up to date.

Course Title: Environmental Analytical Techniques



A: Strongly Agree B: Agree C: Uncertain D: Disagree E: Strongly Disagree

General Comments of the Students about this Teacher

Weakness: 8 % of the students reported that course material was not up date.

Performa 2: Faculty course review report

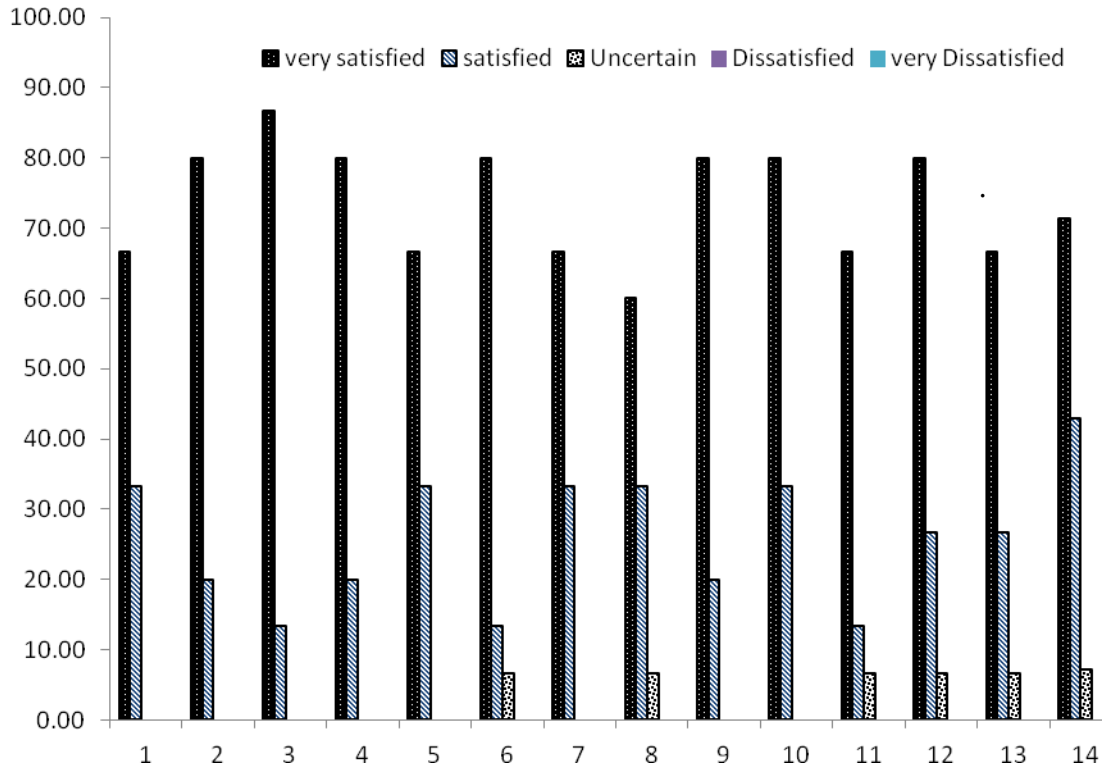
Questionnaire for the evaluation of faculty course review was filled and analyzed. It was observed from evaluation that the faculty was satisfied with curriculum. The evaluation was done through mid and final term examinations for all courses offered by the department. Some courses were lengthy and teachers suggested dividing them.

Table: Faculty course review report

Course code	Title	Credit value	Assessment methods	No. of students	Comments on curriculum	Any change in future in course	Semester	Course Instructor
ENV-701	Introduction to Environmental Sciences	3(3-0)	Midterm and Final	20	Interesting and informative		Fall	Ms. Aniqa Batool
ENV-702	Environmental Chemistry	3(2-2)	Midterm and Final	20	Course was well organized		Spring	Mr. Khurram Saeed
ENV-703	Environmental Microbiology	3(2-2)	Midterm and Final	20	Course was interesting	Should be divided	Fall	Dr. Shahid Mahmood
ENV-704	Research Planning and reporting	3(2-2)	Midterm and Final	20	Course was up to date		Fall	Dr. Tariq Mahmood
ENV-705	Environmental analytical techniques	3(2-2)	Midterm and Final	20	Relevant and informative		Spring	Ms. Waqar un Nisa
ENV-711	Agriculture Pollution Management	3(3-0)	Midterm and final	15	Good	Course material shoud be updated	fall	Dr. Shahid Mahmood
ENV-712	Environmental Law and Policy	3(3-0)	Midterm and final	15	Good		fall	Ms. Aniqa Batool
ENV-713	Climatology	3(2-2)	Midterm and final	20	Interesting and informative	Course material shoud be updated	Spring	Prof. Dr. Tariq Mahmood
ENV-715	Public health and human ecology	3(3-0)	Midterm and final	20	Informative		Spring	Dr. Audil Rashid
ENV-723	Physicochemical processes for waste water	3(2-2)	Midterm and final	20	Up to date		Spring	Ms. Beenish Saba

Performa 3: Survey of Graduating Students

The graduating students in the last semester were surveyed after thesis evaluation and results based on Performa 3 are represented in the given graph. Almost 90 % students showed their satisfaction regarding all the parameters on the average, whereas 20 % of the students were highly satisfied regarding all information asked.



Results of graduating student's survey

Best Aspects of the Program

- Highly qualified faculty
- Helping attitude of the chairman and the whole faculty for all students in research and extra-curricular activities
- Commencement of workshops and international conferences almost every year
- Study programs in collaboration

Weaknesses:

- There is need for the faculty to get foreign training for the discipline of toxicology and treatment techniques
- Laboratory equipment needs upgradation
- Computational facilities need extension

Performa 4: Research Students Progress Review

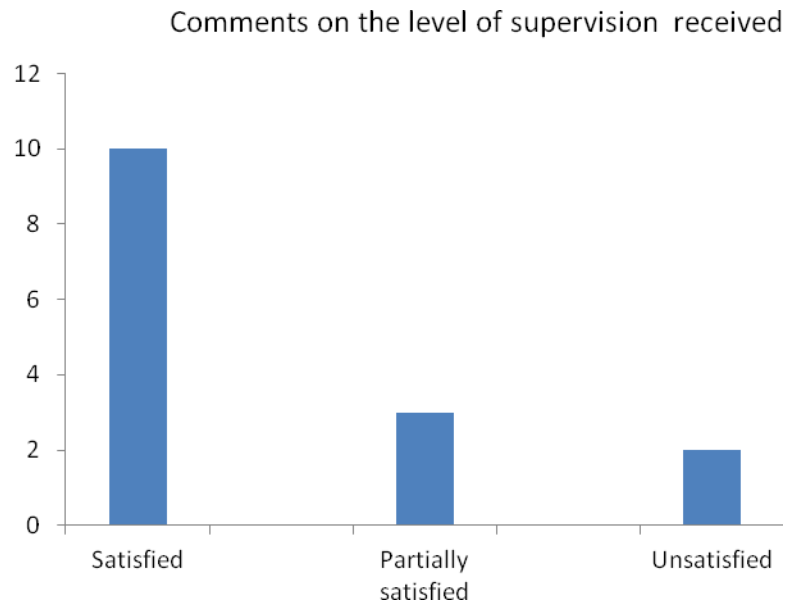


Fig. Comments on the level of supervision received by M.Sc students

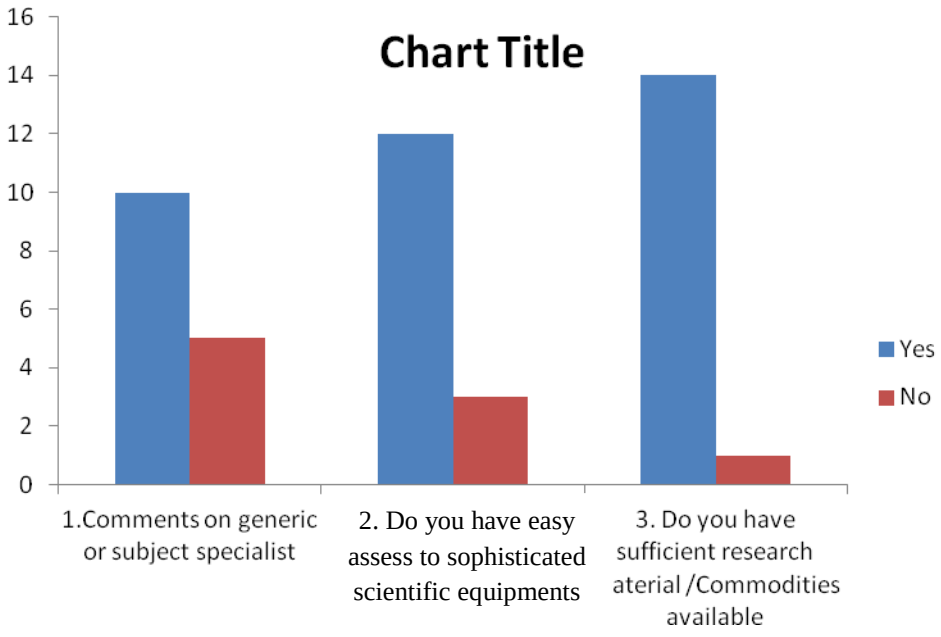


Fig. Responses of M.Sc students on some Misc. Issues

Performa 5: Results of faculty survey

The data regarding results of faculty survey showed that 50% of the students were very satisfied, 30% satisfied, 5% uncertain, 8% dissatisfied and 7% were very dissatisfied with their job clarity

about promotion process. However, most of the faculty members reported that they were highly satisfied with the admisintritaive support.

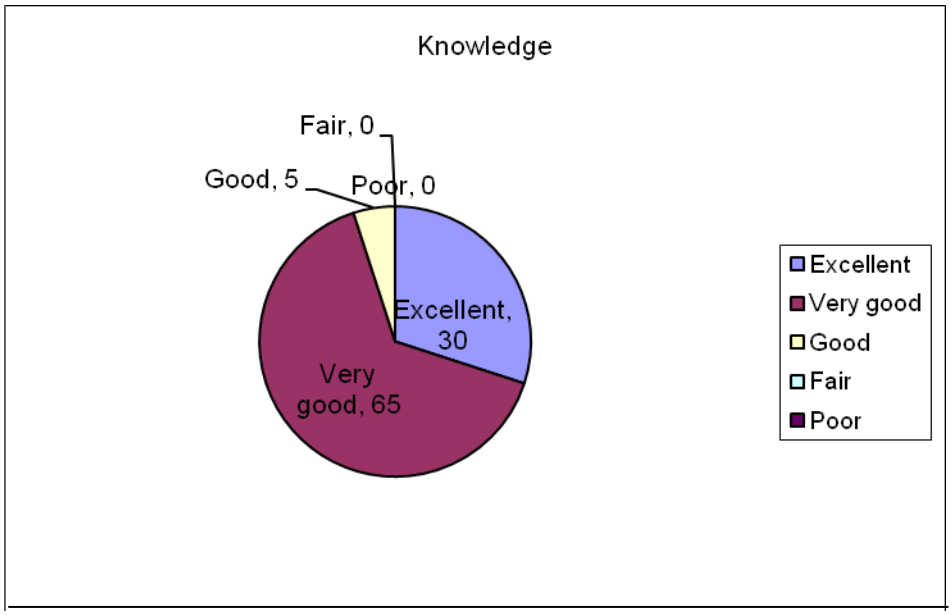
	Dr. Tariq Mahmood	Dr. Azeem Khalid	Dr. Audil Rashid	Ms. Aniqa Batool	Ms. Beenish Saba
Your mix of research, teaching and community service	A	A	B	B	B
The intellectual stimulation of your work	B	A	A	B	A
Type of teaching / research you currently do.	A	A	B	B	B
Your interaction with students	A	A	A	A	A
Cooperation you receive from Colleagues.	B	B	A	B	A
The mentoring available to you.	B	B	B	B	B
Administrative support from the department.	B	B	B	B	B
Providing clarity about the faculty promotion process.	A	B	B	B	B
Your prospects for advancement and progress	A	A	B	B	B

Performa 7: Alumni Survey Results

Department of Environmental Sciences was established in 2007. So far six batches of M.Sc. have been passed out. Proforma 7 was provided to students to get the required information and feedback. The overall results of program assessment by the Alumni are presented in Graph.

Questions: I: Knowledge

1. Math, science, humanities and professional discipline.
2. Problem formulation and solving skills
3. Collecting and analyzing appropriate data
4. Ability to link theory to practical
5. Ability to design a system component or process
6. IT knowledge.



Questions: I: Knowledge

Majority of the Alumni have rated the knowledge imparted by the department at grade B (very good). About 56 % of the students have placed the problem solving skills of the department in very good category.

***Questions: II: Communication Skills**

1. Oral communication
2. Report writing

3. Presentation skills

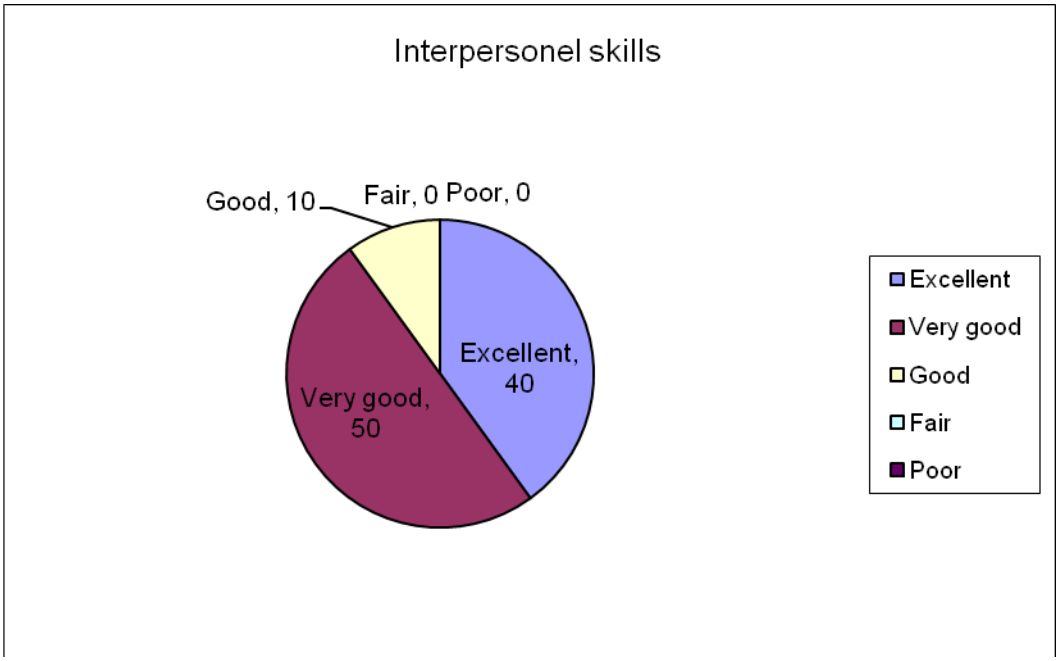
Questions: III:

Interpersonal Skills

1. Ability to work in teams

2. Independent thinking

3. Appreciation of ethical values



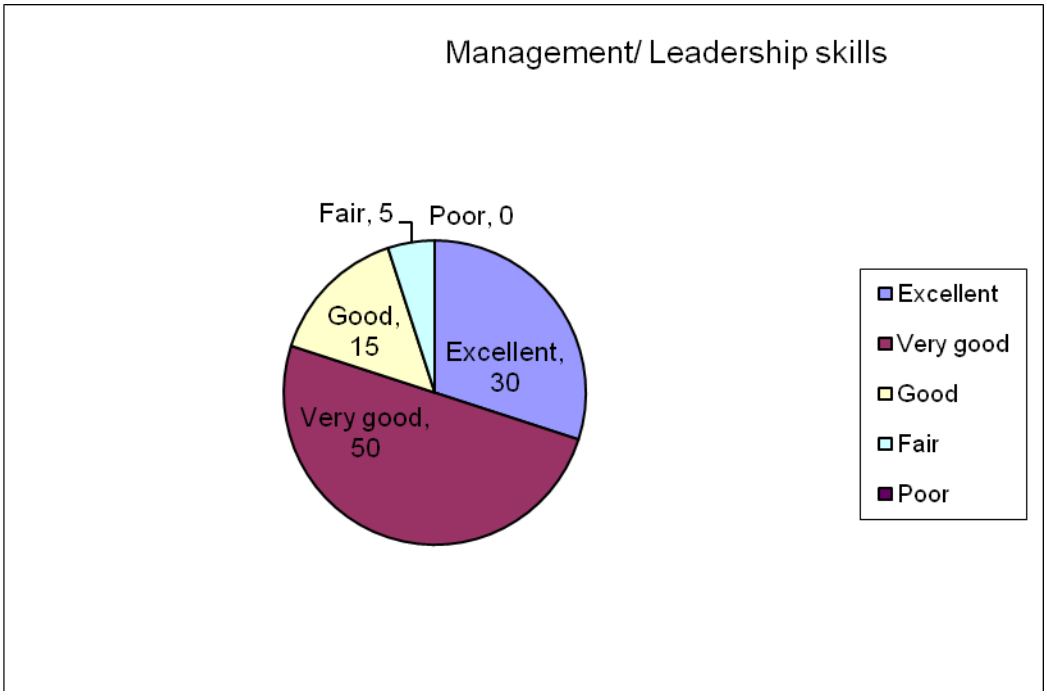
Interpersonal skills have been graded A by majority of the Alumini. Ability to work in team was placed in excellent category by 50 % of the students.

***Questions: IV: Management / Leadership Skills**

1. Resource and Time management skills

2. Judgment

3. Discipline



Regarding management and leadership skills majority of the alumini rated the responses at grade A and B. Resource and time management skills were placed in good category by 31 % of the students.

V: General comment

Vii: General comments

VII: Department Status

- 1. Infrastructure
- 2. Faculty
- 3. Repute at National level
- 4. Repute at international level

Regarding faculty 25 % of the students placed the responses in excellent category. Similarly regarding department infrastructure, 31 % of the responses were placed in good category.

Performa 8: Employer Survey

Uptill now 6 batches have completed their degrees from the department and are working under different organizations including Punjab information technology board, International Union for Conservation of Nature, Bahria University and Fatima Jinnah University. Performa 8 was sent to students working in

several other organizations and their feedback was recorded. These students are satisfied with the problem solving skills of the department. Thay are satisfied with all parameters regarding time management skills, ability to work in team as well as appreciation of ethical values etc. Some of the students highlighted that department should provide more research facilities.

Questions: I: Knowledge

1. Math, science, humanities and professional discipline.

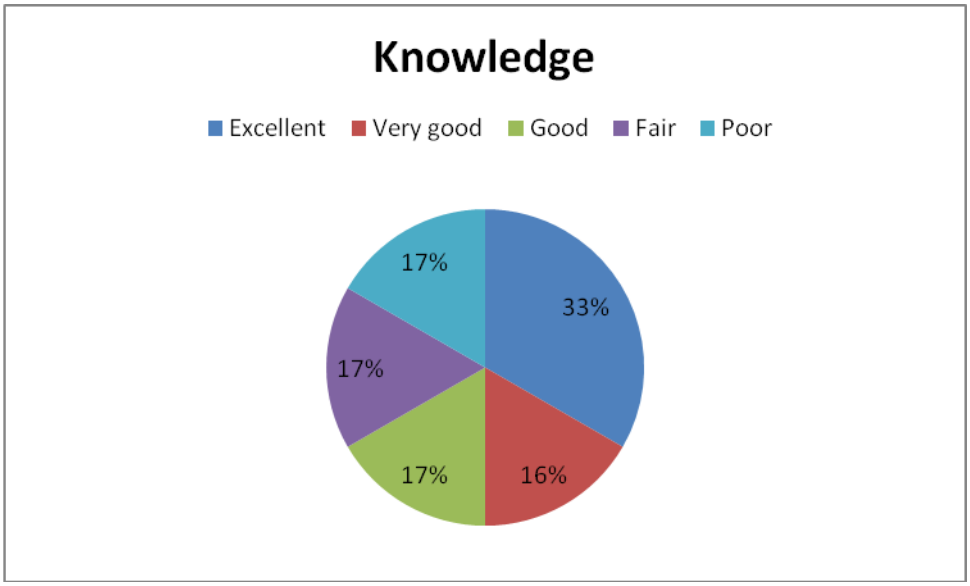
2. Problem formulation and solving skills

3. Collecting and analyzing appropriate data

4. Ability to link theory to practical

5. Ability to design a system component or process

6. IT knowledge.



Questions: I: Knowledge

Majority of the Alumni have rated the knowledge imparted by the department at grade B (very good). About 33 % of the students have placed the problem solving skills of the department in very good category.

***Questions: II: Communication Skills**

1. Oral communication

2. Report writing

3. Presentation skills

Questions: III:

Interpersonal Skills

1. Ability to work in teams

2. Independent thinking

3. Appreciation of ethical values

Interpersonal skills have been graded A by majority of the work places. Ability to work in team was placed in good category by 34 % of the students.

***Questions: IV: Management / Leadership Skills**

1. Resource and Time management skills

2. Judgment

3. Discipline

Regarding management and leadership skills majority of the institutions rated the responses at grade A and B. Resource and time management skills were placed in good category by 33 %.

V: General comment

Vii: General comments

VII: Department Status

- 1. Infrastructure
- 2. Faculty
- 3. Repute at National level
- 4. Repute at international level

Regarding faculty 25 % of the students placed the responses in excellent category. Similarly regarding department infrastructure, 31 % of the responses were placed in good category.

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

The main strength of the department is the availability of all expertise in the disciplines of Microbiology, Urban Health, Ecotoxicology, Treatment techniques, and Management, with full acquaintance of their respective subjects, having vast knowledge of local environmental problems and global perspective. Majority of the faculty members have international degrees and are experts in their fields and have published their research work in reputed national and nternational journals. They have also implemented national research projects and are highly conscious of the problems to be taken by the postgraduate students.

Weaknesses Identified in the Program

Advanced teaching and research is being handicapped due to lack of enough lab facilities and equipment. Latest literature and reviews are hardly available. There is a need for short term foreign

training to young faculty members. Green-house facilities for field trials are not enough for students. Lecture rooms, common rooms, post-graduate laboratories, library and survey/field diagnostic aids are also lacking. The students' work indicates that there is some opportunity for improving communication skills and the focusing on the practical aspects.

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

Performance of the faculty members pertaining to research activities indicates that there are 63 research papers and 5 projects during the year 2012-14.

Year 2012-14

Faculty	Publications	Projects	Others(Abstracts, reports etc)
Dr. Tariq Mahmood	13	_____	1
Dr. Azeem Khalid	21	3	7
Dr. Audil Rashid	7	2	6
Dr. Shahid Mahmood	7	_____	_____
Mr. Khurram Saeed	_____	_____	_____
Ms. Aniqa Batool	6	_____	_____
Ms. Beenish Saba	9	_____	_____
Ms. Waqar un Nisa	_____	_____	_____

Criterion 2

CURRICULUM DESIGN AND ORGANIZATION

Degree Title: M. Sc.

Intent: All the courses for degree program are approved by the Higher Education Commission, Pakistan prepared by a committee. When needed, curriculum for the Department of Environmental Sciences is revised/updated through different bodies. At department level, Board of Studies comprising of all faculty members, is responsible for updating the curriculum. This body is authorized to formulate syllabus and course content. The chairperson of the Department is the convener of this body. The courses are then sent to the Board of Faculty for approval. The Dean of the Faculty, who also acts as the convener, conducts meeting. After the approval from the Faculty Board courses are placed before the University Academic Council for their approval as per university rules.

Degree Plans

Presently three degree programs are organized by the department:

- M.Sc. in Environmental Sciences with research work, submission of thesis and evaluation by four committee members including one external
- M. Phil degree program consists of 2 academic years/ 4 semesters two semester course work and two semester research work with submission of thesis and evaluation by four committee members including one external.

- Ph.D. in Environmental Sciences with 2 semester course work and research work.

Pre-requisites: minimum academic requirements

A candidate seeking admission to the Course for the Degree of Master of Science in full and partial residence:

Must have passed the Bachelor Degree Examination (fourteen years education) in aggregate with 45% marks or its equivalent from a recognized institution in related subjects Botany/Zoology/Chemistry/ Geography/Physics/ Microbiology) or an equivalent qualification in relevant discipline from HEC recognized institution and as approved by admission committee. The candidates domiciled from any area of Pakistan are eligible for admission. The admission to the university is on merit which is determined on percent marks in last degree.

A candidate seeking admission to the Course for the Degree of M. Phil in full and partial residence:

I. Must have passed the Master Degree Examination (sixteen years education) in aggregate with at least 50% marks or its equivalent from a recognized institution in related subjects (Biological Sciences/ Physical Sciences/ Agriculture Sciences/Forestry/MBBS /BDS/ DVM /Pharmacy/B.Sc or B.E. Engineering) or an equivalent qualification in relevant discipline from HEC recognized institution.

II. The admission is offered on open merit basis with equal opportunity for male and female students.

III. The nominees of different departments/organizations with minimum of 2nd division or its equivalent in Bachelor degree are eligible.

Minimum Requirements for the Award of M.Sc & M. Phil Degrees:-

I. The duration of the Course for the Degrees of M.Sc. and M. Phil Environmental Sciences is 4 semesters for full time students and six semesters for part-time students/partial residents and not more than six and eight semesters respectively.

II. The requirements to be completed by each student for award of degree are:-

a. The M.Sc. degree is comprised minimum of 50 credits course work and 10 credits of thesis (Marks of thesis are not counted towards calculation of CGPA). The final semester includes research and thesis of 10 credit hours. Degrees are awarded after completing the required number of credit hours (courses) followed by thesis and its final evaluation by a viva examination.

b. The M. Phil degree is comprised of minimum 30 credits of course work and 10 credits of thesis (Marks of thesis are not counted towards calculation of CGPA). The last two semesters includes research and thesis of 10 credit hours. Degrees are awarded after completing the required number of credit hours (courses) followed by thesis and its final evaluation by a viva examination.

c. The requirements in (a) and (b) above are excluding the credits required for rectifying course deficiency, if any

iii) Nearly two-third of the credits for the course work is in the major field of study, and one-third in the minor field of study: on the basis of the minimum requirements; the minor fields may be one or two but do not exceed three. The ratio of one-third and two-third do not apply

to credits taken over and above the minimum requirements.

iv) All students in M.Phil. are required to pass a Comprehensive Examination after completion of their course work.

The following courses are compulsory:-

"Statistics Courses Stat-700, Stat-701" for all the M.Sc students. Advanced level courses are offered for M.Phil students. Seminar is mandatory for M.Sc and M.Phil students while special problem is applicable to M. Phil students only.

Examination and Weightage

a)Theory

In theory paper, students' evaluation is done by mid-term examination, assignments/ quizzes and final examination. Both the mid-term and final examinations are compulsory. A student who misses the mid-term examination is not allowed a make-up examination and is awarded zero marks in that examination. In case a student does not appear in the final examination of a course, he/she will be deemed to have failed in that course. In theory, weightage to each component of examination is as prescribed hereunder:

Mid Examination 30%
Assignments 10%
Final Examination 60%

b) Practical

For practical examination (if applicable) 100% weightage is given to practical final examination.

Eligibility for Examination

A student is eligible to sit for the examination provided that he/she has attended not less than 75 % of the classes in theory and practical, separately. The minimum pass marks for each course are 40% for M.Sc/M.Phil.

Supervisory Committee:-

1. Each student doing M.Sc/M.Phil will have a supervisory committee for his thesis to advise him in his Programme of studies and research.
2. The supervisory committee will be constituted during the Ist semester for M. Sc and M.Phil students and will consist of a minimum of 3 members.
3. The committee will be approved by the Advanced Studies and Research Board on the recommendations of the Chairman, Dean and Board of Studies.
4. The Supervisory Committee shall consist of at least three members of the faculty, two from major field and one from any department, provided that if an outstanding specialist in a major or minor field of study is available outside the University he may be appointed as a member/co-supervisor of the Supervisory Committee.
5. One of the teacher members from the major field of study will be designated as Chairman of the Supervisory Committee.

Academic Standing:-

- Grade Point Average

(a) Maximum grade point average: 4.00
(b) Minimum grade point average for Obtaining M.Sc/M.Phil Degree: 2.50

To remain on the roll of the University a student shall be required to maintain the following minimum GPA/CGPA in each semester:

Semester	**CGPA**
1st	1.50
2nd	1.75
3rd	2.00
4th	2.50

- A student, who obtains CGPA of 2.00 or above but less than 2.50, upon the completion of entire approved course work, may be allowed to repeat the courses of the previous semesters in which he had obtained the lowest grades, in order to improve the CGPA so as to obtain the minimum of 2.50 within the maximum time allowed for the award of degree, failing which he shall cease to be on the roll.
- A student will be required to repeat those courses of the previous semesters in which he/she had failed, at the first available opportunity, provided that his/her maximum workload, including the courses being repeated by him/her, will not exceed the normal workload.

Thesis:-

- A student shall be entitled to submit thesis for examination after he/she has passed all the final examinations in the approved courses and comprehensive examination provided he/she has also fulfilled the residential requirements.
- The thesis shall be prepared and presented in the manner laid down in the instructions approved by the Advanced Studies and Research Board.
- The unbound thesis shall be referred to the examiners for evaluation duly certified by the supervisory committee that the contents and form of the thesis are satisfactory for submission.

Evaluation:-

- There shall be 10 credit hours allocated for the thesis which shall not be counted towards calculation of CGPA.
- A Board of Examiners comprising members of the Supervisory Committee and one external examiner shall evaluate the thesis.
- The external examiner shall be appointed by the Vice Chancellor from the persons proposed by the Advanced Studies and Research Board, out of the panel of names recommended by the Board of Studies or any other expert in the major field of research.
- At least three members of the Board of Examiners of whom one must be an external examiner, shall for the purpose of evaluating the thesis, hold a viva-voce examination.
- The date, time and venue of thesis examination must be notified at least one week before the commencement. The faculty and students interested to participate in the oral presentation may be allowed. The notification to this effect may be made by the chairman of the Department concerned with intimation to the Director Advanced Studies and Controller of Examinations.
- The Controller of Examination shall get the thesis evaluated within three months after the date of its submission/resubmission in his office. Any delay beyond three months must be brought to the notice of the Vice Chancellor.

- All the members of Supervisory Committee present shall sign the thesis after the viva-voce examination after making necessary corrections and incorporating therein any suggestions by the Board of Examiners. The Board of Examiners in the letter grades as Pass/Fail shall evaluate the thesis.
- All the members of the Board of Examiners present shall sign the result sheet prescribed for this purpose at the end of the examination. The major supervisor will submit the results to the Controller of Examinations within 24 hours.
- In case of disagreement among the examiners regarding the acceptance of the thesis, it shall be referred to another external examiner appointed by the Vice Chancellor whose decision shall be final.
- If a candidate fails in the thesis examination, he/she may enroll again and submit a revised thesis on payment of the prescribed examination fee but he/she shall not be entitled to resubmit his/her thesis before the expiry of six months after the date of the declaration of the result of the last thesis examination. He/she can avail this chance only once.

Thesis Research:-

A student admitted to the Course in partial residence shall undertake research work in a laboratory or institute approved by the Syndicate on the recommendations of the Academic Council and Advanced Studies & Research Board.

Comprehensive Examination:-

- Comprehensive examination will consist of a written part followed by an oral part and cover both the major and minor field of studies after the completion of course work.
- The examination will be taken by the student on the dates to be decided by the Department and notified by the Controller of Examinations.
- Each department shall have its own committee of three members including Chairman of the Department who will also be the Chairman of the Examination Committee. In addition, the Director Advanced Studies or his nominee shall be the ex-officio member of the committee. One member will be nominated by the Vice Chancellor at the time of examination. The committee will be constituted by the Vice Chancellor on the recommendation of the respective department and Director Advanced Studies & Research. The committee shall be constituted for one year at the start of each academic year.
- If one member of the committee is not present due to some Emergency, Examination may taken in the presence of four members out of five, however presence of research supervisor is mandatory. The result announced will be valid.
- Comprehensive examination will be qualifying and the examination committee will separately evaluate the student on his/her performance in written and oral parts of the examination.
- If a student fails to qualify in the comprehensive examination, he/she will be eligible to reappear, once only in the comprehensive examination within the time given for the degree.

Scheme of Studies for the degrees of M.Sc./M.Phil/Ph.D in Environmental Sciences

S.No.	Title of the Courses	Credit hours
1	ENV–701 Introduction to Environmental Sciences	3(3–0)
2	ENV–702 Environmental Chemistry	3(2–2)
3	ENV–703 Environmental Microbiology	3(2–2)
4	ENV–704 Research Planning and Report Writing	3(2–2)
5	ENV–705 Environmental Analytical Techniques	3(2–2)
6	ENV–706 Environmental Impact and Risk Assessment	3(3–0)
7	ENV–707 Pollution Control Technologies	3(2–2)
8	ENV–708 Remote Sensing and GIS Applications in Environment	3(3–0)
9	ENV–709 Bioremediation of Environmental Contaminants	3(3–0)
10	ENV–710 Solid Waste Management	3(3–0)

.	11	ENV–711 Agricultural Pollution Management	3(3–0)
.	12	ENV–712 Environmental Law and Policy	3(3–0)
.	13	ENV–713 Climatology	3(2–2)
.	14	ENV–714 Eco-Health Management and Safety Approaches	3(3–0)
.	15	ENV–715 Public Health and Human Ecology	3(3–0)
.	16	ENV–716 Global Environmental Changes	3(3–0)
.	17	ENV–717 Wastewater Treatment Process Design	3(3–0)
.	18	ENV–718 Toxic Organics and Trace Metals in Ecosystem	3(2–2)
.	19	ENV–719 Special Problem	1(1–0)
.	20	ENV–720 Seminar – I, II	1(1–0)
.	21	ENV–721 Cleaner Production Technology	3(3–0)
.	22	ENV–722 Waste Reuse and Recycling	3(3–0)
.	23	ENV–723 Physico-Chemical Processes for Wastewater	3(2–2)
.	24	ENV–724 Advanced Processes for Wastewater Treatment	3(3–0)
.	25	ENV–725 Environmental Management Systems	3(3–0)
.	26	ENV–726 Environmental Biotechnology	3(2-2)
.	27	ENV–727 Impact of Natural Disasters on Global Environment	3(3-0)
.	28	ENV-728 Energy Conservation and Renewable Energy Resources	3(3-0)

Standard 2-1: The curriculum must be consistent and support the program's documented objectives

Table2.2: Shows that the curriculum of the department is consistent with the program objectives

Courses	1	2	3	4
Env-701, 702, 703,704,705,	+++	++	+++	+++
Env-711,712,713, 715, 723	+++	++	++	++
Env- 720	++	+++	+++	++

+ = Moderately satisfactory
++ = Satisfactory, +++ = Highly satisfactory

Assessment of the Environmental Sciences Curriculum

The assessment of curriculum given in Table 2.2 and the courses are cross tabulated according to the program outcomes.

- The curriculum satisfies the core requirements for the program, as specified the respective accreditation body.
- The curriculum satisfied the general arts and professional and other disciplines required for the program according to demands and requirements set by the Higher Education Commission of Pakistan.

Standard 2-2: The curriculum supports the program's documented objectives.

The curriculum fits very well and satisfies the core requirements for the program's documented objectives.

Standard 2-3: Theoretical backgrounds, problem analysis and solution design must be stressed within the program's core material.

Table-2.3 indicates courses that play vital role in building theoretical background, problem analysis and solution design.

Elements	Course code	Course name
Theoretical Background	Enve-706	Environmental Impact and Risk Assessment
	Env-707	Pollution Control Technologies
	Env-709	Bioremediation of Environmental Contaminants
	Env-710	Solid and Hazardous Waste Management
	Env-711	Agricultural Pollution Management
	Env-712	Environmental Law and Policy
	Env-714	Eco-Health Management and Safety Approaches
	Env-715	Public Health and Human Ecology
	Env-716	Global Environmental Changes
	Env-727	Impact of natural Disasters on Global Environment
	Env-701	Introduction of Environmental Sciences
Problem Analysis	Env-702	Environmental Chemistry
	Env-703	Environmental Microbiology
	Env-704	Research Planning and Report Writing
	Env-705	Environmental Analytical Techniques
	Env-713	Climatology

	Env-708	Remote Sensing and GIS application in Environment
	Env-718	Toxic Organics and Trace Metals in Ecosystem
	Env-726	Environmental Biotechnology
Solution Design	Env-717	Wastewater treatment process design
	Env-719	Special Problem
	Env-720	Seminar-I,II
	Env-721	Cleaner Production Technology
	Env-722	Waste Reuse and Recycling
	Env-723	Physico-chemical Processes for Wastewater
	Env-724	Advance Processes for Wastewater Treatment
	Env-725	Environmental Management Systems
	ENV-728	Energy Conservation and renewable energy resources

Standard 2-4: The curriculum satisfied the core requirement laid down by accreditation bodies

- Not Applicable

Standard 2-5: The curriculum satisfied the major requirement laid down by HEC.

- The curriculum satisfies the major requirement laid down by HEC

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

In curriculum preparation all aspects of information technology were considered and after a critical analysis, relevant aspects were integrated into the program as:

- Students enroll courses of GIS and Remote Sensing to fulfill the I.T. requirements for the students of M.Sc, M.Phil and PhD.

Standard- 2.7: Oral and written communication skills of the student must be developed and applied in the program.

Two seminars, each with one credit hour are compulsory at the Post-graduate level.

- Assignments are given to M.Sc, MPhil and Ph.D. students on specific titles (as part of the course) which are presented orally and are submitted as written report, to enhance their oral and written communication skills.
- Project presentations and Competitions are held to improve communication skills and presentation abilities especially on the celebration activities of International Days like World Environment Day, World Water Day, and Biodiversity Day etc.

CRITERION 3

LABORATORIES AND COMPUTING FACILITIES

The PMAS Arid Agriculture University, Rawalpindi is committed to provide support and valuable information to prospective students regarding admissions, scholarships and other related orientations. The University web portal has enough space to upload the information about the departments therefore the Department of Environmental Sciences has a detailed webpage of the department highlighting the related research and other activities of the students and faculty. The newly admitted dtudents are given the orientation lectures each year at the department level apart from the comprehensive welcome plus orientation outreach which is usually being arranged every year by the Directorate of Students Affairs of the university.

Standard-3.1: Laboratory manuals/documentation/instructions for experiments must be available and daily accessible to faculty and students.

Laboratory manuals for every subject (wastewater treatment, solid waste analysis, water analysis) are not available. In nutshell there are no proper security plan is available in case of emergency. The laboratories are not specious and inadequate. Some more equipments are required.

Standard-3.2: There must be support personal for instruction and maintaining the laboratories.

Only one laboratory attendant is available to maintain laboratory, equipment, glassware, chemicals, material etc. who has to assis all the research students in practicals, cleaning and washing. The laboratory attendant does not have the relevant knowledge and training. There is need of another Lab and technician with good laboratory skills.

Standard-3.3: The University computing infrastructure and facilities must be adequate to support program's objectives.

Computing facilities support: Few students have been granted laptops under the government scheme on merit basis.

Shortcoming in computing infrastructure: Computers with internet facilities should be available to all the postgraduate students

CRITERION 4

STUDENT SUPPORT AND ADVISING

In order to provide guidance and information regarding various educational and social issues, the staff of the Department has been directed to take the following steps:

a. To keenly observe the behavioral and study patterns of the students and to identify and resolve any issues that may have the potential to hamper their studies.
b. To expand the mental horizons of the students beyond the class room by arranging tours/visits to facilities and places related to their course work.
c. To keep the administration abreast of the progress of studies of all students.

Standard 4.1: Courses must be offered with sufficient frequency and number for students to complete the program in a timely manner.

a. Based on the recommendations of the Academic Council of the university concerning the scheme of studies, all the courses mentioned in the Prospectus are offered to students at the post graduate level in accordance with the guidelines provided by the HEC. The same policy is followed for M.Sc., M.Phil., and Ph.D. classes. However, the number of courses offered is dependent upon the teaching staff and facilities available to the Department.

b. During the teaching of every course the criteria laid down by the HEC are strictly followed.

c. The courses offered are specifically designed to fulfill the human resource requirements of public and private sector institutions/industries. In addition to that extensive consideration has been given to the applied nature of the subject (Environmental Sciences) hence each year the course contents/scheme of study is updated to meet the demands of time and enable the students to gain knowledge of most recent environmental issue and their practical solution.

Standard 4.2: Courses in the major areas of study must be structured to ensure effective interaction between students, faculty and teaching assistants

At the Environmental Sciences Department, the designing and structuring of course work is a continuous process in which the efficacy of the contents of each course is ensured through regular input by the teaching staff and the students. The following steps are taken to ensure the involvement of all tiers of the Department in the process of course work structuring:

I. The teaching staff periodically takes the input of the students regarding course structure and effectiveness through questionnaires as well as individual meetings.

II. Input from the senior students is also encouraged and welcomed in this regard.

III. Observations and opinions gathered in this manner are given due weightage during the process of restructuring and updating courses in the meetings of the board of studies.

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

The Department of Environmental Sciences fully realize the importance of the availability of proper educational guidance to the students and its role in shaping their future careers. The following steps have been taken to ensure the access of all students to qualified educational advice:

1. The teaching staff is directed to maintain awareness of the progress of all students and to keep in view their strengths and weaknesses. This is especially important since Environmental Science is a very broad discipline and students having different educational backgrounds, ranging from Geology, GIS and Remote Sensing to Chemistry. As a consequence, students often need qualified advice from their teachers regarding the choice of courses.

2. The teaching staff has also been directed to keep abreast of the changes taking place in the job market and to provide this information to their students periodically.

CRITERION 5

PROCESS CONTROL

Standard 5.1: 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 its objectives.

i. All admissions to the Environmental Sciences Department are made in strict accordance with the stipulations of the University Administration.

ii. Admission criteria for different courses are reviewed and, if deemed necessary, revised before the commencement of the admission process for the concerned semester.

iii. Advertisements for admission to various courses in the Department are properly placed in daily

newspapers having nation wide circulation so as ensure that people from all provinces/regions have access to admission information.

iv. The admission criteria for these degree programs are mentioned in the advertisement in exact terms so as to avoid any legal complications later on.

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.

i. Newly admitted students are registered at the commencement of their first semester. The students are issued Registration Numbers by the Registrar Office. The Registration Number is unique for each student and it remains specific for the respective student even if he/she completes the degree from the department and joins a new department for another higher degree.

ii. Merit for admission is determined by the concerned authorities using various criteria, such as percentage of marks achieved in the entry test, performance in previous educational career, etc

iii. During each semester, evaluation of the students is performed a number of times through different stages of examination. The evaluation may involve written tests, quizzes, projects and special problems. A student is promoted to the next semester only after he/she attains pass marks in each course, as prescribed by the concerned authorities.

iv. The admission process does not remain static. The performance of the admitted students is used as a yardstick for the measurement of the success of the admission system. Based on this criterion, recommendations are periodically submitted to the higher authorities for bringing about changes in the admission system for future semesters.

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 institution mission statement. These processes must be periodically evaluated to ensure that it is meeting with its objectives.

The recruitment policy followed by the University is in accordance with the recruitment guidelines set by the HEC. The process for induction of fresh faculty members is as follows:

i. Advertisements for new faculty admissions in the Environmental Sciences Department are placed in those newspapers which have national level circulation.

ii. Applications for these new faculty positions are received by the Office of the Registrar. The applicants are short-listed on the basis of their qualifications, experience, publications and any other criteria established by the University. Call letters are then issued to the selected candidates.

iii. The short-listed candidates are then interviewed by the University Selection Board and two candidates—principal candidate and alternate candidate—are then recommended against each post. Consequent upon final approval by the University Syndicate, selection letters are issued to the principal candidates directing them to join their respective posts within a stipulated time period.

iv. In case of non-availability of principal candidate, alternate candidates are issued selection letters.

v. The induction of new candidates is dependent upon the number of vacancies approved by the authorities.

vi. Owing to the financial limitations being currently faced by the Higher Education Institutions, it is not possible to set in place a mechanism for offering attractive incentives in order to retain the services of highly qualified faculty members. However, the HEC also supports the appointment of highly qualified faculty members as foreign faculty professors and National Professors in various Departments of the University.

Standard 5.4: The process and procedures 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.

I. The faculty members of the Environmental Sciences Department remain constantly engaged in the process of updating/revising curriculum and course contents on the basis of

the feedback received from the students and information received from a multitude of extra-institutional sources, for example, information obtained from other institutions of higher education, industries, government agencies, etc.

II. Environmental Sciences is a rapidly expanding discipline. In particular, climate change and the real-time assessment of the environmental impact of natural disasters are emerging at the forefront of environmental research. In view of these circumstances, the Department of Environmental Sciences keeps on adding new courses at various levels to keep pace with the changes internationally occurring within the discipline. The addition of courses like Climatology, Applications of GIS and Remote Sensing in Environment and Impacts of Natural Disasters on the Global Environment are a testimony to the Department's flexibility to intra-disciplinary changes.

III. In order to communicate teaching material more effectively to the students, various audio-visual aids, for example, Overhead Projectors and Multimedia are used as supplements to lectures.

IV. All possible efforts are made to ensure the availability of the latest journals, research papers and research reports, etc., to the students.

V. Regular meetings of the teaching staff are held to discuss and review the finer points of teaching methodology and student evaluation.

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.

The student evaluation procedures followed by the Department have been laid down by University authorities and ensure that the graduates of the Department have completed all the requirements of the program in which they had been enrolled. The various criteria used for the evaluation of the students are surprise tests, quizzes, written assignments, multimedia presentations, seminars, special problems, practicals, mid-term examinations and final examinations, with the maximum weightage being given to mid-term and final examinations. The additional evaluations (for example), surprise tests, special problems, presentations, seminars, etc.) are used to evaluate the performance of the students in supplement to mid-term and final examinations. Results are notified within 10-20 days of the examinations.

In theory, weightage to each component of examination is as prescribed here under:

Mid Examination	30%
Assignments	10%
Final Examination	60%

Grade points are as follows

Marks Obtained	Grade	Grade point Remarks
80-100 %	A 4	Excellent
65-79 %	B 3	Good
50-64 %	C 2	Satisfactory
40-49 %	D 1	Pass
Below 40 %	F 0	Fail

- Gold medals are awarded to the students who secure highest marks. Degrees are awarded to the students on the convocation that is held every year.

CRITERION 6
FACULTY

Standard 6-1: There must be enough full time faculties who are committed to the program to provide adequate coverage of the program areas/courses with continuity and stability. The interests and qualifications of all faculty members must be sufficient to teach all courses, plan, modify and update courses and curricula. All faculty members must have a level of competence that would normally be obtained through graduate work in the discipline. The majority of the faculty must hold a Ph.D. in the discipline.

Table 6.1 Faculty distribution of program areas

Specialized areas	Number of Faculty members	Number of Courses offered
Climate Change and plant physiology	1	4
Environmental Microbiology and biotechnology	1	5
Urban ecology and GIS analysis	1	4
Toxicology , Physicochemical processes for wastewater	1	4
Waste water toxicology, Drinking water quality	1	3

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 placed. Effective Programs for Faculty Development

Professional training and availability of adequate research and academic facilities are provided to the faculty members according to the available resources. Currently two faculty members have completed post docs. One member is going to USA for PhD under Fulbright fellowship program. One faculty has enrolled her PhD in the department while one faculty member already PhD, now have applied for post-doc. The faculty members have presented their research work in several national and international conferences.

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

The young faculty members are highly enthusiastic for research activities and participate in planning and execution of departmental activities. Avenues for research funding are provided through university research fund and national/international projects.

Results of faculty survey employing Performa 5 (Annexure-V) were summarized and are given Table in 6.2. The results showed high satisfaction of the teachers over most of the parameters. However, performance and merit based rewards policy must be opted for the faculty at university level.

Table 6.2: Results of Faculty Survey

S.No	Parameters	Dr. Tariq	Dr. Azeem	Dr. Audil	Ms. Aniqa	Ms. Beenish
1	Your mix of research, teaching and	A	A	B	B	B
2	The intellectual stimulation of your work	A	A	A	B	A
3	Type of teaching/research you currently do.	A	A	B	B	A
4	Your interaction with students	A	A	A	A	A
5	Cooperation you received from colleagues	A	A	A	A	A
6	The mentoring available to you	B	B	B	B	B
7	Administrative support from the department	A	A	A	A	A
8	Providing clarity about the faculty promotion Process	A	B	B	B	B
9	Your prospects for advancement and	NA	B	B	B	B
10	Salary and compensation packages	A	A	B	B	B
11	Job security and stability at the department	A	A	A	A	A
12	Amount of time you have for yourself and Family	A	B	B	B	B
13	The overall climate at the department	A	A	A	A	A
14	Whether the department is utilizing your experience and knowledge	A	A	B	B	A
15	What are the best programs/ factor currently available in your department that enhances your motivation and job satisfaction?	Cooperative attitude of staff and the students	Favorable academic/ research and writing environment	Cooperative Atmosphere	Sound climate for working and research, and cooperation of Chairman	Cooperation of the faculty member and students
16	Suggest programs/factors that could improves your motivation and job satisfaction	Research group establishment	Performance and merit based promotion.	Lab facilities improvement	More funding and facilitation	Lab facilities

A= Very Satisfied; B= Satisfied; C= Uncertain; D= Dissatisfied; E= Very Dissatisfied

CRITERION 7

INSTITUTIONAL FACILITIES

According to this criterion, the institution must have the infrastructure to support new trends in learning such as e-learning including digital publications, journals etc.

- The library must possess an up-to-date technical collection relevant to the program and must be adequately staffed with professional personnel. Insufficient library's technical collection of books. Recommended books and relevant journals of the programs are not available to the students.
- These aspects need to be strengthened in number and space.
- Class rooms must be adequately equipped and offices must be adequate to enable faculty to carry out their responsibilities**.**
- Standard wise description of this criterion is given a under

Standard- 7.1: The institution must have the infrastructure to support new trends in learning such as e-learning.

- The faculty has access to e-library which is very helpful for the high quality education and producing research of international standard. They also have access to the internet. However the department has the following shortcomings/problems:
- Breach of power intermittently, due to which research and academic work both are suffering.
- Untrained supporting staff.
- Scanty budget for consumables.

Standard- 7.2: The library must possess an up-to-date technical collection relevant to the program and must be adequately staffed with professional personnel.

The University Central Library had initially limited number of books, journals and periodicals. Now the department has recommended many new books for the library and some of these have been added to the stuff, yet facilities need to be improved to meet the standards of a University Library. However the department has a stock of few recently published books and these books are available to students for their assignments and learning. However, there is no separate library at the department level due to limited space available to the department.

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

Currently the class room is not enough for the all department degree programs and lab is also used for classes which affects the research activities. Practical lab space is not sufficient as only one lab that is used both for research and practical demonstrations. Renovation of one lab allocated to the department last year is pending. Budget was allocated but work has not been started even after one year.

CRITERION 8

INSTITUTIONAL SUPPORT

The university administration has been struggling hard to strengthen all the departments, upgrade them and establish new faculties and Institutes. The university is also trying to attract highly qualified faculty.

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 teachers and scholars.

At present department is having insufficient financial resource to maintain the present needs of the department. Individual research grants for students and faculty are mainly supporting the departmental research activities. There is a need for increasing the financial resources allocated to the department to establish a departmental library, laboratories and computer

facilities.

Suggestions and factors that can contribute to the motivation of the faculty are given as follows:

- Research grants for young faculty members may be allocated.
- Performance based incentives to the faculty

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

The intake of M.Sc. and M.Phil students is once in a year. However Ph.D. students are enrolled in each semester. A strict merit policy is applied during admission coupled with GRE/NTS or entry test.

Standard- 8.3: Financial resources must be provided to acquire and maintain library holdings, laboratories and computing facilities.

Total budget of the department for the financial year 2013-14 is about Rs. 50000, which hardly fulfills the departmental needs particularly for the purchase of chemicals for laboratories for practical purpose and books for the department library. Although faculty has some project and meets chemical requirements through research project but still a reasonable budget is required to meet the urgent needs of the department such as chemicals.

SUMMARY AND CONCLUSION

With a vision to promote environmental awareness among youth and train them as active environmentalist, PMAS-Arid Agriculture University Rawalpindi took a leading step in the year 2007 and established the Department of Environmental Sciences in the Faculty of Forestry, Range Management and Wildlife. Showing enormous determination and committee members, the faculty members, in consultation with Academic Council of the university, Three degree programs were simultaneously initiated which includes M.Sc., M.Phil. And Ph.D. in the subject of Environmental Sciences. Since then, the discipline has progressed remarkably and made considerable contribution in several aspects mainly the monitoring of water quality and urban health of twin cities. The department now provides degrees with specialization in climate change and stress physiology, environmental microbiology and biotechnology, ecohealth and GIS applications. A high level of technical competence is maintaining both at theoretical and research perspectives consequently several graduates of this department has now become the part of various universities, research institutes and private organizations. The self-assessment report of the department concisely narrates the departmental activities and current strategy to made further improvement in academic pursuit.

Although the department of environmental sciences is still in age of infancy, the specific objectives sought for this degree program, at the time of its inception, have been thoroughly visualized and reflected in the updated scheme of study. Among measurable and achievable objectives includes enhanced ability of students to understand the problems and consequences of current human behavior that affects our environment in general and environmental media such air, water and soil in particular. These were analyzed thoroughly in accordance with the criteria set by Higher Education Commission. The program mission objectives and outcomes are assessed and strategic plans are presented to achieve the goal, which are again measurable through definite standards. Programme outcomes appeared to be satisfactory. Teachers' evaluation revealed satisfactory standards and most of the students rated them in high category and they were satisfied by the level of education and training imparted by them. Alumni surveys

revealed variable results regarding knowledge, interpersonal skills, management and leadership skills. Resource constraints identified as major limitation in practical demonstrations along with some of the other weakness where there is room for improvement.

Well-planned curriculum, keeping in view the HEC guidelines, was adopted for this degree program. Pre-requisites are keenly observed at the time of enrollment. Course outcomes and teaching effectiveness was measured through different standards and it was found between satisfactory to highly satisfactory range. It was concluded that laboratory facilities are needed to further strengthen the research work. Proper steps are taken to guide the students for programme requirements, communication, meetings, tours, students-teacher interaction etc. They are well informed of relevant scientific societies, job opportunities and other such activities. As regards the process control covering admission, registration, recruiting policy, courses and delivery of material, academic requirements, performance and grading, university as well as Higher Education Commission have set forth proper rules, which are properly followed. Institutional facilities were measured through Criterion 3; infrastructure, library, class room and faculty offices and in each case, short comings and limitation are highlighted. Institutional facilities need to be strengthened. The department has identified following aspects for futher improvement.

- For practical demonstration, one laboratory specifically to be used for teaching and practical demonstration is imperative. Previously funds were allocated for the renovation of lab, the renovation is pending for the last one year.
- Provision of at least one more classrooms will facilitate students learning process and would create a better environment of learning.
- Refresher courses for supporting staff should be arranged to increase their level of expertise.
- An increase in financial allocation of annual budget for department needs to be enhanced.

Performa 9

Faculty Resume-1

<table>
<tr><td colspan="3">Dr. Azeem Khalid</td></tr>
<tr><td colspan="2">Associate Professor/ Chairman</td><td rowspan="3">  </td></tr>
<tr><td colspan="2">Ph.D. (Soil Microbiology) University of Agriculture, Faisalabad, Post-Doc Japan, USA</td></tr>
<tr><td colspan="2">Department of Environmental Sciences</td></tr>
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<tr><td>Email :</td><td colspan="2">azeemuaf@yahoo.com, azeem@uaar.edu.pk</td></tr>
</table>

Address :	Department of Environmental Sciences, PMAS- Arid Agriculture University Rawalpindi
Work Experience :	15 Year(s)
Research Interest :	• Plant-microbe interactions • Environmental microbiology & biotechnology
Projects: 2013-14	2 (on-going) 2 (submitted)
Students supervised (2013-14)	M.Sc./ M.Phil.= 13 PhD +04 (in progress)
Papers presented at national/international level (2013-14)	6
Total Publications :	121

Publications (2013-14)

1. Mahmood, S., **A. Khalid**, T. Mahmood J.C. Loyola-Licea and D.E. Crowley. 2014. Biotreatment of Reactive Black-5, aniline and CrVI by *Pseudomonas* sp. in biochar packed bioreactors. **Journal of Hazardous Material** (Under review).
2. Aslam, M., **A. Khalid**, T. Mahmood and B. Saba. 2014. Potential of *Staphylococcus* sp. for improving growth and biomass yield of maize (*Zea mays* L.) irrigated with dye-contaminated water. **Biomass & Bioenergy**. (Under review).
3. Imran, M., M. Arshad, D.E. Crowley, F. Negam, B. Shaharoona and **A. Khalid**. 2014. Yeast extract promotes decolorization of azo dyes by *Shewanella* sp. through its activity as redox mediator. **Applied Microbiology and Biotechnology** (under review).
4. Anjum, M., **A. Khalid** and T. Mahmood. 2014. Anaerobic co-digestion of catering waste with partially pretreated lignocellulosic crop residues. **Journal of Cleaner Production**. (Accepted with revision).
5. Chishti, Z., Khaliq-ur-Rehman, S. Hussain, **A. Khalid** and M. Arshad. 2014. Optimization of environmental factors affecting biodegradation of chlorpyrifos insecticide in soil slurry by *Enterobacter* sp. SWLC2. **World Journal of Microbiology and Biotechnology**. (Under review).
6. Saba, B., M. Jabeen, **A. Khalid**, T. Mahmood and I. Aziz. 2014. Effectiveness of rice agricultural waste, microbes and wetland plants in the removal of reactive black-5 azo dye in microcosm constructed wetlands. **International Journal of Phytoremediation** (Accepted).
7. Mahmood, S., A. Khalid. M. Arshad and R. Ahmad. 2014. Effect of trace metals and electron shuttle on simultaneous reduction of Reactive Black 5 azo dye and hexavalent chromium in liquid medium by Pseudomonas sp. Chemosphere DOI: 10.1016/j.chemosphere.2014.10.084..
8. Mehmood, A., M.S. Akhtar, K.S. Khan, **A. Khalid**, M. Imran and S. Rukh. 2014. Relationship of phosphorus uptake with its fractions in different soil parent materials. **International Journal of Plant & Soil Science** 4(1): In press.
9. Imran, M., M. Arshad, **A. Khalid**, S. Hussain, M.W. Mumtaz and D.E. Crowley. 2014. Decolorization of Reactive Black 5 by *Shewanella* sp. in the presence of metal ions and salts. **Water Environmental Research** 86: (//titan/production/w/waer/live_jobs/waer-86-12/waer-86-12-06/layouts/waer-86-12-06.3d in press).
10. **Khalid, A**., J. Arshad, S. Mahmood, I. Aziz and M. Arshad. 2014. Effect of chromium forms on the biodegradation of Reactive Black-5 azo dye by *Psychrobacter* and *Klebsiella* species. **International Journal of Agriculture and Biology (In press).**
11. Ali, U., R.N. Malik, J.H. Syed, C.T. Mehmood, L. Sánchez-García, **A. Khalid** and M.J.I. Chaudhary. 2014. Mass burden and estimated flux of heavy metals in Pakistan coast: Sedimentary pollution and eco-toxicological concerns. **Environmental Science and Pollution Research** DOI 10.1007/s11356-014-3612-2 (In press).
12. Abid J., T. Mahmood, **A. Khalid**, T. Siddique and I. Aziz. 2014. Optimization of pyrolysis yields of paper

mulberry (*Broussonetia papyrifera*) and application of biochar product for the improvement of maize growth. **International Journal of Agriculture and Biology** 16: 929-934.
13. Rashid, A., T. Mahmood, F. Mahmood, **A. Khalid**, B. Saba, A. Batool and A. Riaz. 2014. Phytoaccumulation, competitive adsorption, and evaluation of chelators metal interaction in lettuce plant. **Environmental Engineering and Management Journal** 13 (10): 1535-1544.
14. Shahzad, S.M., **A. Khalid**, M.S. Arif, and R. Kausar. 2014. Co-inoculation integrated with P-enriched compost improved nodulation and growth of Chickpea (*Cicer arietinum* L.) under irrigated and rainfed farming systems. **Biology and Fertility of Soils** 50: 1-12.
15. Mahmood, S., **A. Khalid**, T. Mahmood, M. Arshad and R. Ahmad. 2013. Potential of newly isolated bacterial strains for simultaneous removal of hexavalent chromium and reactive black-5 azo dye from tannery effluents. **Journal of Chemical Technology and Biotechnology** 88: 1506-1513.
16. Ud Din, I., A. Rashid, T. Mahmood and **A. Khalid**. 2013. Effect of land use activities on PAH on urban soils of Rawalpindi and Islamabad, Pakistan. **Environmental Monitoring and Assessment**. 85(10): 8685-8694.
17. **Khalid, A.,** B. Saba, H. Kanwal, A. Nazir and M. Arshad. 2013**.** Responses of pea and wheat to textile wastewater reclaimed by suspended sequencing batch bioreactors. **International Biodeterioration & Biodegradation** 85: 550-555.
18. Saba, B., A. Khalid, A. Nazir, H. Kanwal and T. Mahmood. 2013. Reactive black-5 azo dye treatment in suspended and attach growth sequencing batch bioreactor using different co-substrates. **International Biodeterioration & Biodegradation** 85: 556-562.
19. Shahzadi, I., **A. Khalid**, S. Mahmood, M. Arshad, T. Mahmood and I. Aziz. 2013. Effect of bacteria containing ACC deaminase on growth of wheat seedlings grown with chromium contaminated water. **Pakistan Journal of Botany** 45: 487-494.
20. Khaliq, S., **A. Khalid**, B. Saba, S. Mahmood, M.T. Siddique and I. Aziz. 2013. Effect of ACC deaminase bacteria on tomato plants containing azo dye wastewater. **Pakistan Journal of Botany** 45: 529-534.
21. Bangash, N., **A. Khalid**, T. Mahmood and M.T. Siddique. 2013. Screening rhizobacteria containing ACC deaminase for growth promotion of wheat seedlings under water stress. **Pakistan Journal of Botany** 45: 91-96.

Faculty Resume - 2

Prof. Dr. Tariq Mahmood

Professor

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Work Experience :	22 Year(s)
Research Interest :	• Climate Change • Carbon sequestration/stocking/Biochar • Heavy Metal Toxicity

Projects: 2013-14	2 (on-going) 1 (submitted)
Students supervised (2013-14)	M.Sc./ M.Phil. = 5 PhD = 3
Papers presented at national/international level (2013-14)	7
Total Publications :	47

Publications 2013-14

1. Mahmood, S., A. Khalid, M. Arshad, **T. Mahmood** and D.E. Crowley. 2014. Detoxification of azo dyes by oxido-reductase enzymes. Critical Reviews in Biotechnology (Accepted).
2. I. Aziz., N. bangash, T. mahmood and K.R. Islam. 2014. Impact of no-till and conventional tillage practices on soil chemical properties. Pakistan Journal of Botany (Accepted)
3. Irfan Aziz, **Tariq Mahmood** and Rafiq Islam Khandakar**. 2014.** Impact of long-term tillage and crop rotation on concentration of soil particulate organic matter associated carbon and nitrogen. *Pak. J. Agri. Sci., Vol. 51(3), 1-8; 2014*
4. Mahmood, S., A. Khalid, **T. Mahmood** J.C. Loyola-Licea and D.E. Crowley. 2014. Biotreatment of Reactive Black-5 azo dye, aniline and CrVI by *Pseudomonas* sp. in biochar packed bed bioreactors. Journal of Hazardous Materials. (Under Review)
5. Saba, B., M. Jabeen, A. Khalid, **T. Mahmood** and I. Aziz. 2014. Effectiveness of agro-waste, microbes and wetland plants in the degradation of reactive black-5 azo dye in microcosm constructed wetlands. Chemosphere (Under review)
6. Abid J., **T. Mahmood**, A. Khalid and M.T. Siddique. 2014. Optimization of pyrolysis yields of *Broussonetia papyrifera* (paper mulberry) and application of biochar product for the improvement of maize growth. International Journal of Agriculture and Biology (In press).
7. Mahmood, S., A. Khalid, **T. Mahmood**, M. Arshad and R. Ahmad. 2013. Potential of newly isolated bacterial strains for simultaneous removal of hexavalent chromium and reactive black-5 azo dye from tannery effluents. Journal of Chemical Technology and Biotechnology 88: 1506-1513.
8. Shahzadi, I., A. Khalid, S. Mahmood, M. Arshad, **T. Mahmood** and I. Aziz. 2013. Effect of bacteria containing ACC deaminase on growth of wheat seedlings grown with chromium contaminated water. Pakistan Journal of Botany 45: 487-494.
9. Rashid, A., **T. Mahmood**, F. Mahmood, A. Khalid, B. Saba, A. Batool and A. Riaz. 2013. Phytoaccumulation, competitive adsorption, and evaluation of chelators metal interaction in lettuce plant. Environmental Engineering and Management Journal. *http://omicron.ch.tuiasi.ro/EEMJ/*.
10. Ud Din, I., A. Rashid, **T. Mahmood** and A. Khalid. 2013. Effect of land use activities on PAH on urban soils of Rawalpindi and Islamabad, Pakistan. Environmental Monitoring and Assessment. 85(10): 8685-8694.
11. Saba, B., A. Khalid, A. Nazir, H. Kanwal and **T. Mahmood**. 2013. Reactive black-5 azo dye treatment in suspended and attach growth sequencing batch bioreactor using different co-substrates. International Biodeterioration and Biodegradation 85: 556-562.
12. Bangash, N., A. Khalid, **T. Mahmood** and M.T. Siddique. 2013. Screening rhizobacteria containing ACC deaminase for growth promotion of wheat seedlings under water stress. Pakistan Journal of Botany 45: 91-96.

Faculty Resume-3

Dr. Audil Rashid

Assistant Professor

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Address :	Department of Environmental Sciences, Pir Mehr Ali Shah, Arid Agriculture University Rawal	
Work Experience :	15 Year(s)	
Research Interest :	• Phytoremediation and rhizosphere microbiology • Eco-Health and global change assessment • Urban ecology and GIS analysis	
Projects: 2013-14	2 (on-going)	
Students supervised (2013-14)	M.Sc./ M.Phil.= 15 PhD = 2	
Papers presented at national/international level (2013-14)	17	
Total Publications :	20	

Publications 2013- 2014

1. Kamal, A. and **Rashid, A.** (2014). Benzene exposure among auto-repair workers from workplace ambience: a pioneer study from Pakistan. *International Journal of Occupational Medicine and Environmental Health*, 27(5):830–839.
2. Naseem, A., **Rashid, A.,** Kureshi, N., (2014). E-health: effect on health system efficiency of Pakistan. *Annals of Saudi Medicine*. 34, 59-64.
3. Amjad, M.S., Arshad, M., **Rashid, A**., Chaudhari, S.K., Malik, N.Z., Fatima, S., Akrim, F. (2014). Examining relationship between environmental gradients and Lesser Himalyan forest vegetation of Nikyal valley, Azad Jammu and Kashmir using ordination analysis. *Asian Pacific Journal of Tropical Medicine*, 7(1): S610-S616.
4. Kamal, A., Ali, U., Ramey, M.I., Younas, S.M.Z., Sumbul, S., Malik, R.N., **Rashid, A.** (2013) Principle component analysis of flue gas exhaust from a functional incinerator in the vicinity of Rawalpindi Pakistan. *Arabian Journal of Chemistry*. (Accepted: available online 24 August 2013).
5. Din, I.U., **Rashid, A**., Mahmood, T. and Khalid, A. (2013) Effect of land use activities on PAH contamination in urban soils of Rawalpindi and Islamabad, Pakistan. *Environmental Monitoring & Assessment*, 185(10): 8685–8694.
6. Mehmood, F., **Rashid, A**., Mahmood, T. and Dawson, L. (2013) Effect of DTPA on Cd solubility in soil, accumulation and subsequent toxicity to lettuce. *Chemosphere*. 90: 1805–1810.
7. Rehman, M.S. Saif, A., **Rashid, A**. and Mahmood, T. (2013) Chemometric classification of advanced oxidation processes for the degradation of pharmaceuticals and personal care products. *Environmental Engineering and Management Journal*. 12: 475–481.

Faculty Resume-4

Dr. Shahid Mahmood

Assistant Professor	

Ph.D. PMAS-Arid Agriculture University Rawalpindi	

Ms. Aniqa Batool

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Address :	Department of Environmental Sciences, Pir Mehr Ali Shah, Arid Agriculture University Rawal	
Work Experience :	5 Year(s)	
Research Interest :	• Wastewater Treatment • Toxicology	
Total Publications :	12	

Publications 2013-14

1. Khalid, A. and S. Mahmood. 2015. The biodegradation of azo dyes by Actinobacteria. p. 1-18. In: S.N. Singh (Ed.). Microbial degradation of synthetic dyes in wastewaters. Springer, Switzerland. DOI 10.1007/978-3-319-10942-8_13
2. Mahmood, S., A. Khalid, M. Arshad, T. Mahmood and D.E. Crowley. 2014. Detoxification of azo dyes by oxido-reductase enzymes. Critical Reviews in Biotechnology (Accepted).
3. Mahmood, S., A. Khalid. M. Arshad and Riaz Ahmad. 2014. Effect of trace metals and electron shuttle on simultaneous reduction of Reactive Black 5 azo dye and hexavalent chromium in liquid medium by Pseudomonas sp. Chemosphere (Accepted)
4. Khalid, A., J. Arshad, S. Mahmood, I. Aziz and M. Arshad. 2014. Effect of chromium forms on the biodegradation of reactive lack-5 azo dye by Psychrobacter and Klebsiella species. International Journal of Agriculture and Biology (Published online).
5. Mahmood, S., A. Khalid, T. Mahmood, M. Arshad and R. Ahmad. 2013. Potential of newly isolated bacterial strains for simultaneous removal of hexavalent chromium and reactive black-5 azo dye from tannery effluents. Journal of Chemical Technology and Biotechnology 88: 1506-1513.
6. Shahzadi, I., A. Khalid, S. Mahmood, M. Arshad, T. Mahmood and I. Aziz. 2013. Effect of bacteria containing ACC deaminase on growth of wheat seedlings grown with chromium contaminated water. Pakistan Journal of Botany 45: 487-494.
7. Khaliq, S., A. Khalid, B. Saba, S. Mahmood, M.T. Siddique and I. Aziz. 2013. Effect of ACC deaminase bacteria on tomato plants containing azo dye wastewater. Pakistan Journal of Botany 45: 529-534

Faculty Resume-5

Lecturer		
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Work Experience :	6 Year(s)	
Research Interest :	• Drinking water Quality • Heavy metal and other Contaminants in drinking and irrigation water • Waste water toxicology	
Students supervised (2013-14)	M.Sc./ M.Phil. = 9	
Total Publications :	12	

Publications 2013-14

1. Nafeesa, S., **Aniqa Batool**, S. S. Kazmi, S. Imad, M. A. Ghufran, M. Shafqat, T. Mahmood. 2014. Quality assessment of natural springs of Margalla Hills Islamabad Zone-III for drinking purpose. *Applied Water Science.* (Under Review)
2. Nousheen, R., **A. Batool**, M.S.U. Rehman, M.A. Ghufran., M.T. Hayat, T. Mahmood. 2014. Fenton-biological coupled biochemical oxidation of mixed wastewater. *Journal of the Taiwan Institute of Chemical Engineers*, 45: 1661–1665. (IF: 2.637)
3. Qadeer S., **A. Batool**, A.Rashid, A.Khalid, N. Samad, M.A. Ghufran. 2014. Effectiveness of biochar in soil conditioning under simulated ecological conditions. Soil Environment. 33(2): 149-158.
4. Rashid, A., T. Mahmood, F. Mehmood, A. Khalid, B. Saba, **A. Batool**, and A. Riaz. (2014) Phytoaccumulation, competitive adsorption and evaluation of chelators-metal interaction in Lettuce plant. *Environmental engineering and Management Journal*. 13(10) (IF 1.435).
5. Mehmood, C. T., **A. Batool** and Qazi I.A. 2013. Combined Biological and Advanced Oxidation Treatment Processes for COD and Color Removal of Sewage Water. *International Journal of Environmental Science and Development*. 4 (2).
6. Mukhtar Uddin, M.A. Ghufran, M. Idrees, M. Irshad, S. Jabeen, W. Ahmad, I. Malook, **A. Batool,** A. Rashid**,** M. Arshad and R. Naeem. (2012) Antibacterial Activity of Methanolic Root Extract of *Asparagus racemosus, Journal of Public Health and Biology*, 1(2): 32-35

Faculty Resume-6

Ms. Beenish Saba

Lecturer **M.S (Environmental Engineering) National University of Sciences & Technology.** **Department of Environmental Sciences**		
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Address :	Department of Environmental Sciences, Pir Mehr Ali Shah, Arid Agriculture University Rawalpindi	
Work Experience :	1 Year(s)	
Research Interest :	• Toxicology • Physicochemical processes for wastewater 3 M.Sc. 2 M.Phil students produced.	
Projects: 2013-14	1 (on-going)	
Students supervised (2013-14)	M.Sc./ M.Phil.= 6	
Papers presented at national/international level (2013-14)	4	
Total Publications :	15	

Publications 2013- 2014

1. Saba. B., Jabeen. M., Aziz. I., Khalid, A., and Christy, A. D., (2014) Role of agro-waste based activated biochar and microbes in reactive black dye degradation from microcosm constructed wetlands. International Journal of phytoremediation. (In press). (IF 1.466)
2. Saba. B., (2014). Potential treatment options for hydro fracking return fluids. Journal of Chemical and Biological Engineers. 1(6), 1-8.
3. Rashid, A., T. Mahmood, F. Mehmood, A. Khalid, B. Saba, A. Batool and A. Riaz (2014). Phytoaccumulation, competitive adsorption and evaluation of chelators-metal interaction in Lettuce plant. Environmental Engineering and Management Journal. 13(10). (In press) (IF 1.258). http://omicron.ch.tuiasi.ro/EEMJ/accepted.htm
4. Saba, B., B. Zaman., T. Mahmood., and S. Jamal Khan., (2014) Treatment of wastewater with a high c/n ratio in sequencing batch bioreactor (SBBR) containing biocarriers. Environmental Engineering and Management Journal. (In press) (IF 1.258).
5. Saba, B., Jabeen, M., Mahmood, M., and Aziz. I., (2014). Treatment comparison efficiency of microbial amended agro-waste biochar constructed wetlands for reactive black textile Dye. IPCBEE 65 (3), 13-16.
6. Saba, B., A. Khalid, A. Nazir, H. Kanwal and T. Mahmood. (2013). Reactive black-5 azo dye treatment in suspended and attach growth sequencing batch bioreactor using different co-substrates. International Bioter and Biodeger J. 85,556-562. (IF=2.235) http://dx.doi.org/10.1016/j.ibiod.2013.05.007.
7. Saba, B., T. Mahmood., B. Zaman., A. Khalid and S. Jamal Khan., (2012) Treatment of high strength wastewater in sequencing batch bioreactors (SBBRs) using suspended and attached growth configuration. International Journal of Agriculture and Applied Sciences 4(1) 1-7.
8. Rafique, U., B. Saba and A. Bashir., (2012), Identification, risk assessment and analysis of anionic surfactants in car wash effluents. International Journal of Agriculture and Applied Sciences 4(1) 63-68.
9. Khaliq, S., A. Khalid, B. Saba, S. Mahmood, M. T. Siddique. (2013). Effect of ACC deaminase bacteria on tomato plants containing azo dye wastewater. Pakistan Journal of Botany, 45(S1) 529-534 (IF 1.207) http://www.pakbs .org/pjbot/ tcontents/t content 45(S1)71-80.html