Khushal Khan Khattak University, Karak Pakistan

SELF ASSESSMENT REPORT

(BS (H) Chemistry)

4 Years Degree Program

Submitted to

Directorate of Quality Assurance (DQA)

Khushal Khan Khattak University, Karak

Department of Chemistry
Khushal Khan Khattak University, Karak

Prepared by

Dr. Afrasiab Ur Rehman (Focal Person)

Dr. Atta Ur Rehman (Member)

Dr. Sher Ali (Member)

Mr. Latif Ur Rehman (Member)

Preface

Ever since its establishment in 2012 Khushal Khan Khattak University Karak has become one of the prestigious institutions of the country and is well regarded internationally also. The department of Chemistry is one of the newer department focused on contributing committed and knowledgeable Scholar to the public and private sectors.

This document includes a report of self-assessment of the Bachelor of Science (BS) in Chemistry Program. The report has been developed by the program team (PT) under the supervision of D quality enhancement cell (QEC) of this institution. Hopefully, this report will contribute in pointing out the department's strength and weaknesses so that actions may be taken to improve the set up.

The Program Team (PTs) consists of the following members:

1. **Dr. Afrasiab Ur Rehman** Visiting Lecturer
2. **Dr. Atta Ur Rehman** Visiting Lecturer
3. **Dr. Sher Ali** Visiting Lecturer
4. **Mr. Latif ur Rehman**

Executive Summary

Department: Chemistry
Program: BS-Chemistry

The Department of Chemistry was established in September 2019. Currently, the department has 89 students and five (05) visiting faculty members (5x Lecturers). To enhance the quality of education, QEC Cell of the university has established a QEC team comprising of Dr. Atta Ur Rehman, Dr. Afrasiab Ur Rehman and Dr. Sher Ali and Mr. Latif ur Rehman. The QEC cell has carried out the assessment of the department against the standards and criterion provided by HEC Quality Enhancement Cell. This assessment is carried out for spring semester 2023.

Major Findings

1. Four batches of BS-Chemistry i.e. (F2019-S2023), (F2020-S2024), (F2021-S2025) and (F2022-S2026) are being enrolled successfully.
2. A total of 89 students are currently enrolled in these programs.
3. Frequency of holding the BOS meetings is good which shows improvements in the schemes of program from time to time.
4. The curriculum highlights the scheme of studies as per HEC QEC assessment manual.
5. MPhil and PhD program are being planned which will be started from Spring 2024 semester.
6. The department follows the rules and regulations for admission, enrolment, migration provided by the University.
7. The department has four PhD qualified faculty members in Chemistry discipline on visiting bases.
8. The qualification and specialization of faculty members is not sufficient to teach all the courses, plan, modify and update the curricula and the department needs more faculty in multiple areas of Chemistry.
9. The majority of faculty members are not satisfied with the facilities provided by the University.
10. The institution facilities e.g. library, classrooms, offices, e-learning are not sufficient at this stage.
11. The department needs fast internet facility for faculty and students which is weak at the moment.

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Introduction

The Department of Chemistry at Khushal Khan Khattak University, Karak (KKKUK) was established in September 2019, which is housed in a three-story building in the newly established academic block in the main campus.

We offer BS programs titled as BS-Chemistry. The department has a multi-media arrangement of lectures and seminars. Laboratories on BS level are in pipeline. Seminars, workshop, industrial and study tours are arranged for students to update them of contemporary developments in Chemistry and related areas. The seminar library is well furnished and has more than 1500 books of Chemistry and related fields. The department lack computer facilities and need to be linked with the national/ international community through PERN. The department will be linked with the International universities such as Department of Chemistry, Federal Urdu University of Arts, Science and Technology, Key Laboratory of Functional Inorganic Material Chemistry, Ministry of Education. School of Chemistry and Material Science, Heilongjiang University, Harbin, P. R. China and Daqing Branch, Heilongjiang Academy of Sciences, Daqing, P. R. China through MoUs for facilitating its faculty and students in research and internships. The department is planning to offer M.Phil. and Ph.D. programs in various advanced research areas of Chemistry and Nanotechnology in the near future subject to the availability of required PhD faculty.

Criterion 1: PROGRAM MISSION, OBJECTIVES AND OUTCOMES

Standard 1-1: Mission Statement and Program Objectives

About the Program

BS - Chemistry is a four years' degree program having semester system of examination. The admission to BS - Chemistry advertised after the declaration of F.Sc result every year.

Vision Statement:

Provide quality education with matching professional skills, and ethical values to prepare competent and socially responsible chemist who can meet the present and future challenges and contribute positively towards economic development of the society. Department of Chemistry currently offers bachelor academic programs BS (Chemistry) for students intending to pursue scientific, technical, or professional careers in fundamentals of Chemistry on broader levels and special concentration on research as well.

Mission Statement of BS 4 Year Program:

The department of Chemistry, Khushal Khan Khattak University, Karak is dedicated to educating students with high standards at BS programs with specialization in emerging technological and multidisciplinary fields such as Physical Chemistry, Analytical Chemistry, Organic Chemistry, Inorganic Chemistry and Biochemistry.

In support of our mission, the Chemistry department faculty members endeavor to:

- Provide innovative, dedicated classroom instruction at both the graduate and undergraduate levels.
- Serve as good role models to students for safe and moral professional behavior.
- Provide high quality academic advising for all majors.

Program Objectives

- To prepare the students to understand the basic level of Chemistry.
- To be able to allocate the talents and knowledge learned through high quality teaching.
- Let them able to research in all related fields of chemistry.
- To enhance the ranking of the department at national and international level.
- To train the youth globally towards leadership in terms of in human development, excellence in education.

Salient Feature of the Program

❖ Total numbers of credit hours	131
❖ Duration	04 years: max 06 years
❖ Semester duration	14-16 weeks
❖ Semesters	08
❖ Course Load per Semester	15-18 Cr hr
❖ Number of Courses per Semester	5-6

COURSE STRUCTURE

Sr.No	Categories	No. of courses	Credit Hours
1	General Courses (Group A + B)	16	48
2	Core Courses, labs and projects	26	76
3	Elective Courses	04	12
	Total	46	131

Standard 1-2:

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

BS-Chemistry

Program Objectives	Outcomes
To prepare the students to understand the basic level of chemistry	To enable students to apply the basic theories and Laws of Chemistry in daily life
To Identify, analysis, and solve practical problem in chemistry.	To apply the basic mathematical tools commonly used in chemistry related areas.
To demonstrate in depth knowledge from traditional and emerging area of chemistry.	To use the basic laboratory data analysis techniques, including distinguishing statistical and systematic errors, propagating errors, and representing data graphically.
To develop the value and attitudes in them that lead to professionalism.	To apply scientific knowledge in the areas of Chemistry in the technological applications.

Criterion 2: CURRICULUM DESIGN AND ORGANIZATION

Definition of Credit Hour

Courses are defined into credit hours. In theory, a credit hour is an academic unit that represents one hour of lecture per week for one term. However for the laboratory work, one credit hour is equivalent to three contact hours of lab working in a week. Therefore courses represented as (2-1) consist of 2 hours of lectures in addition to three hours of lab-work during a week.

Course	Duration of Class
Theory Course of 03 Credit Hours	03 classes, each of 01 hour each per week Or 02 classes of 1.5 hour each per week Or 01 class of 03 hours per week
Practical (Lab) Work of 01 Credit Hour	03 contact hours per week

A course counted in calculation of GPA/CGPA is called **'Credit Course'**, while a course mandatory to pass but not counted in calculating GPA/CGPA is called **'Non-Credit Course**

Standard 1-2:

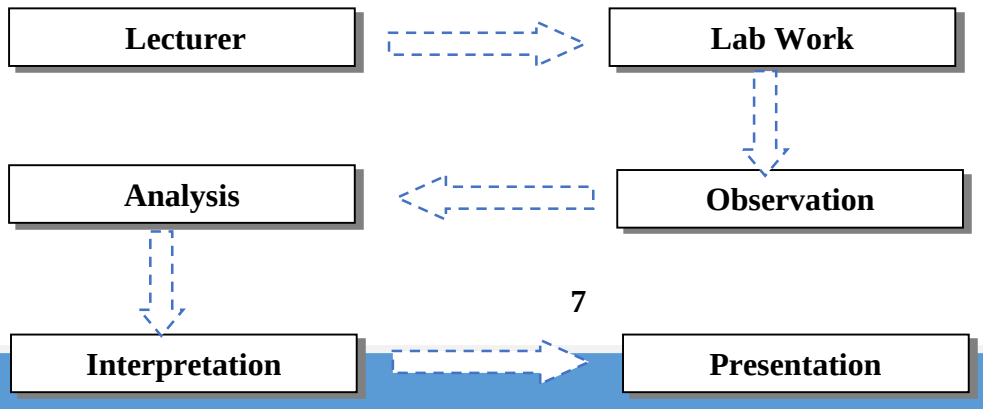
The program must have documented outcomes for graduating students. It must be demonstrated that the outcomes support of the program objectives and that graduating students are capable of performing these outcomes.

Learning Outcomes (BS Chemistry):

After completing the BS 4 Year program, the graduates will be able to:

1. Have understanding about the subjects and demonstrate their competency in scientific communication.
2. Have an outstanding concepts of Chemistry and more about their field of specialization.
3. Demonstrate will to employ critical thinking and efficient problem-solving skills in the basic areas of chemistry (inorganic, organic, biochemistry, analytical, and physical).
4. Knowledge of important reagents used in chemical industries.
4. Demonstrate their ability to perform quantitative measurements and analysis.
5. Well prepared to pursue higher education if desired/required.

Flow sheet diagram from demonstration to perform activities:



Standard 1-3:

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

The sample of program's assessment result for both the BS programs is given in table 1-2. The details are given in Annexure A and B.

Case Summary

Overall Course Evaluation shows percentage

No	Course Title	Mean
01	English-II (Composition Writing)	4.6
02	Pak Studies	4.6
03	Plant Systematic, Anatomy and Devolvement Embryology	4.5
04	Mathematics-II	4.5
05	Principles of Animal Life-II	4.35
06	Basic Organic Chemistry-I	4.5
07	Lab-II (Organic Chem)	4.4
08	Principles of Management/	4.7
09	Applied Physics-II (Basic Thermodynamics and Quantum Mechanics)	4.6
10	Geo-tectonics/	4.7
11	Analytical Chemistry-I	4.5
12	Applied Chemistry-I	4.7
13	Biochemistry-I	4.6
14	Lab-IV (Analytical Chem)	4.6
15	Inorganic Chemistry-II	3.6
16	Organic Chemistry-II	3.4
17	Physical Chemistry-II	4.6
18	Analytical Chemistry-II	3.5
19	Biochemistry-II	4.7
20	Lab-V (Biochem-Lab)	4.3
21	Spectroscopy	4.1
22	Quantum & Thermo Chemistry	4.6
23	Nuclear Chemistry	4.2
24	Group Theory/ Magneto Chemistry	4.3
25	Organometallics	4.0
26	Nuclear Chemistry	4.6
27	Lab-II (Research Students)	4.6
28	Spectroscopy	4.5

Strengths

Curriculum	Approved BS 4 year courses in all the six major Specialization along with all minor courses
Faculty	Well qualified Ph.D. faculty available on visiting basis
Laboratories	Research lab has some equipments for undergraduate projects
Digital Library	Access available

Weaknesses

Space	Limited space is available for classrooms and faculty offices
Faculty	Full-time regular faculty is not available
Laboratories	Chemicals and glassware's needed to perform experiments Specialization base laboratories needed.
Online literature	Partial access in some cases
Computer Lab	Available in university but need to be established in department
Library	Departmental seminar library needs to be established
Multimedia	Not available

Standard 1-4:

The department must assess its overall performance periodically using quantifiable measures

Present student's enrolment (undergraduate and graduate) during the last two years indicating percentages of honor students, student faculty ratio, average graduating grade point average per semester, average time for completing the undergraduate program and attrition rate.

Department's data

Year	Total No. of students enrolled	Total no. of undergraduate students (BS & M.sc)	Total no. of undergraduate students (BS)	Total No. of Graduate student (BS)	Student/Teacher ratio
2019	33	33	33	Nil	11 : 1
2020	58	58	58	Nil	14 : 1
2021	79	79	79	Nil	16:1
2022	89	89	89	Nil	18:1

Based on the above data, we expect that the student's strength will increase in future.

Year	Average GPA of students	*Percentage of honor students (Scholarship)	Attrition rate
2019	3.48	08/33x100= 24.00	6.06
2020	3.50	14/58x100 = 24.00	8
2021	3.47	22/79x100 = 27.84	8
2022	3.49	30/89x100 = 33.71	9.66

*Distinction CGPA 4.0

Criterion 2: CURRICULUM DESIGN AND ORGANIZATION

Standard 2-1:

The curriculum must be consistent and supports the program's documented objectives.

Degree Title: BS Chemistry

The curriculum for BS in Chemistry has been designed by the faculty members of the department which was discussed and improved by the Chemistry experts from renowned universities of the country. There is a Departmental Board of Studies, comprising of the following members:

Dr. Abdul Hakim Shah, Head–Department of Chemistry Convener

	KKKU, Karak	
Prof. Dr. Amin Badshah	Professor/Director Vice-Chancellor of University Bunir, KPK	Member
Prof. Dr. Abdul Naeem	National Center of Excellence in Physical Chemistry, University of Peshawar	Member
Dr. Ruqia Nazir	Associate Professor of Chemistry Kohat University of Science and Technology Kohat (KUST)	Member
Dr. Shahid Ali Shah	Assistant Professor of Chemistry Department of Chemistry, University of Haripur	Member
Dr. Imdad Ullah	Assistant Professor Govt. Post Graduate College, Karak	Member
Dr. Afrasiab Ur Rehman	Department of Chemistry, KKKU, Karak	Member
Mr. Abdul Samad	Department of Chemistry, KKKU, Karak	Member

Till now, four Board of Studies meetings have been conducted for time to time revisions/ modifications of BS chemistry schemes and panels of experts.

B: Definition of Credit Hour:

A "Credit Hour" is the unit of measuring educational credit, usually based on the number of class hours per week throughout a semester.

BS (Chemistry) - Total credit hours = 131

C: Degree Plan

The department of Chemistry offers BS Chemistry programs.

Name of Degree	**Pre-requisites**
BS (Chemistry)	Intermediates (F.Sc)/Diploma of Associate Engineering (DAE) or equivalent with Chemistry as one subject, having minimum second division (45 % marks)

Scheme of study

Course Title		**Credit hours**	
Year-1			
Course Code	**Semester-I**	**Theory**	**Remarks**
ELL-101	English-I (Reading and Writing)	3 (3-0)	
BOT-100	Diversity of Plants	3 (3-0)	
ZOO-101	Principles of Animal Life-I	3 (3-0)	
MATH-100	Mathematics-I	3 (3-0)	

ISL-100/ ETH-100	Islamic Studies/ Ethics	2 (2-0)	
CHEM-111	Basic Inorganic Chemistry-I	3 (3-0)	
CHEM-119	Lab-I (Inorganic Chem)	1(0-1)	
Total		18	
Course Code	**Semester-II**		
ELL-104	English-II (Composition Writing)	3 (3-0)	
PS-200	Pak Studies	2 (2-0)	
BOT-201	Plant Systematic, Anatomy and Devolvement Embryology	3 (3-0)	
MATH-200	Mathematics-II	3 (3-0)	
ZOO-100	Principles of Animal Life-II	3 (3-0)	
CHEM-122	Basic Organic Chemistry-I	3 (3-0)	
CHEM-129	Lab-II (Organic Chem)	1(0-1)	
Total		18	
Year-2			
Course Code	**Semester-III**	**Theory**	**Remarks**
ELL-201	English-III (Communication and Presentation Skills)	2 (2-0)	
CS-101	Introduction to Computing	3 (2-1)	
PHY-114	Applied Physics-I (Basic Mechanics and EMT)	3 (3-0)	
STAT-302	Statistics	3 (3-0)	
CHEM-231	Basic Physical Chemistry-I	3 (3-0)	
CHEM-232	Environmental Chemistry-I	3 (3-0)	
CHEM-239	Lab-III (Physical Chem)	1(0-1)	
Total		18	
Course Code	**Semester-IV**	**Theory**	**Remarks**
BBA-113/ ECO-400	Principles of Management/ Principles of Economics	3 (3-0)	
PHY-124	Applied Physics-II (Basic Thermodynamics and Quantum Mechanics)	3 (3-0)	
GEOL-245/ GEO-245	Geo-tectonics/ Geography	3 (3-0)	
CHEM-241	Analytical Chemistry-I	3 (3-0)	
CHEM-242	Applied Chemistry-I	2 (2-0)	
CHEM-243	Biochemistry-I	3 (3-0)	
CHEM-249	Lab-IV (Analytical Chem)	1(0-1)	
Total		**18**	
Course Title		**Credit hours**	
Year-3			
Course Code	**Semester-V**	**Theory**	**Remarks**
CHEM-351	Inorganic Chemistry-II	3 (3-0)	
CHEM-352	Organic Chemistry-II	3 (3-0)	
CHEM-353	Physical Chemistry-II	3 (3-0)	
CHEM-354	Analytical Chemistry-II	3 (3-0)	
CHEM-355	Biochemistry-II	3(3-0)	
CHEM-359	Lab-V (Biochem-Lab)	1 (0-1)	
Total		**16**	
Course Code	**Semester-VI**	**Theory**	**Remarks**
CHEM-361	Inorganic Chemistry-III	3 (3-0)	
CHEM-362	Organic Chemistry-III	3 (3-0)	
CHEM-363	Physical Chemistry-III	3 (3-0)	
CHEM-364	Applied Chemistry-II	3 (3-0)	

CHEM-369	Lab-VI (Advanced Instrumental Techniques)	1 (0-1)	
Total		**13**	
	Year-4		
Course Code	**Semester-VII:** Specialization (Inorganic/Organic/Physical/ Analytical/Biochemistry/Applied Chemistry/ Fuel Chemistry etc.)	**Theory**	**Remarks**
	Paper-I (*From the list of specialization*)	3 (3-0)	
	Paper-II (*From the list of specialization*)	3 (3-0)	
	Paper-III (*From the list of specialization*)	3 (3-0)	
CHEM-474	Research Techniques	3 (3-0)	
CHEM-475 CHEM-479	Research Project-I Special Practical-I	3 (3-0)	
	Total	**15**	
Course Code	**Semester-VIII:** Specialization (Inorganic/Organic/Physical/ Analytical/Biochemistry/Applied Chemistry etc.)	**Theory**	**Remarks**
	Paper-IV (*From the list of specialization*)	3 (3-0)	
	Paper-V (*From the list of specialization*)	3 (3-0)	
	Paper-VI (*From the list of specialization*)	3 (3-0)	
CHEM-484	Industrial Chemistry	3 (3-0)	
CHEM-485 CHEM-489	Research Project-II Special Practical-II	3 (3-0)	
	Total	**15**	

Total Credit Hours: 131

SPECIALIZATION (INORGANIC/ANALYTICAL/ORGANIC/PHYSICAL/BIOCHEMISTRY/APPLIED CHEMISTRY)

Inorganic chemistry

Course Code	Semester – VII & VIII	Credit hours	Remarks
CHEM-401	Molecular Spectroscopy	3	
CHEM-402	Atomic Spectroscopy	3	
CHEM-403	Organometallic Chemistry	3	
CHEM-404	Crystallography	3	
CHEM-405	Inorganic Polymers	3	
CHEM-406	Group Theory in Chemistry	3	
CHEM-407	Chemical Process Industries	3	
CHEM-408	Chromatography	3	
CHEM-409	Coordination Chemistry	3	
CHEM-410	Nano-Materials in Chemistry	3	
	Total:	30	

Note: - Three courses of nine (09) credit hours will be offered in each of the 7th and 8th semester.

Analytical Chemistry

Course Code	Semester – VII & VIII	Credit hours	Remarks
CHEM-411	Separation techniques	3	
CHEM-412	Electrochemical Analysis and Spectrophotometry	3	
CHEM-413	Spectroscopic Methods of Analysis	3	
CHEM-414	Chromatographic Methods of Analysis	3	
CHEM-415	Hyphenated Techniques	3	
CHEM-416	Advanced Chromatography	3	
CHEM-417	Atomic Spectroscopy	3	
CHEM-418	Nuclear Analytical Techniques	3	
CHEM-419	Food and drug analysis	3	
CHEM-420	Luminescence spectroscopy and Thermal analysis	3	
	Total:	30	

Note: - Three courses of nine (09) credit hours will be offered in each of the 7th and 8th semester.

Organic Chemistry

Course Code	Semester – VII & VIII	Credit hours	Remarks
CHEM-421	Chemistry of Heterocycles	3	
CHEM-422	Reaction Mechanism-I	3	
CHEM-423	Spectroscopic Methods in Organic Chemistry-I	3	
CHEM-424	Chemistry of Natural Products	3	
CHEM-425	Biochemistry	3	
CHEM-426	Name Reactions	3	
CHEM-427	Organic Polymer Chemistry	3	
CHEM-428	Synthesis and Mechanism–I	3	
CHEM-429	Stereochemistry	3	
CHEM-430	Quantum Organic Chemistry	3	
CHEM-431	Spectroscopic Methods in Organic Chemistry-II	3	
	Total:	33	

Note: - Three courses of nine (09) credit hours will be offered in each of the 7th and 8th semester.

Physical Chemistry

Course Code	Semester – VII & VIII	Credit hours	
CHEM-441	Polymer Chemistry	3	
CHEM-442	Molecular Spectroscopy	3	
CHEM-443	Chemical Kinetics	3	
CHEM-444	Solid State Chemistry	3	
CHEM-445	Electrochemistry	3	
CHEM-446	Nuclear and Radiation Chemistry	3	
CHEM-447	Surface Chemistry	3	
CHEM-448	Photochemistry	3	
CHEM-449	Thermodynamics	3	
CHEM-450	Solution Chemistry	3	
CHEM-451	Colloids and Surfactants	3	
CHEM-452	Quantum Chemistry	3	

CHEM-453	Numerical Methods and Computational Chemistry	3	
CHEM-454	Statistical Mechanics	3	
	Total:	42	

Note: - Three courses of nine (09) credit hours will be offered in each of the 7th and 8th semester.

Biochemistry

Course Code	Semester – VII & VIII	Credit hours	Remarks
CHEM-461	Biochemistry Related to Biomedical Sciences	3	
CHEM-462	Physical Techniques in Biochemistry	3	
CHEM-463	Molecular Biology	3	
CHEM-464	Physiological Chemistry and Chemotherapy	3	
CHEM-465	Micro-Biology and Immunology	3	
CHEM-466	Nutritional Chemistry	3	
CHEM-467	Bio-Nanotechnology	3	
CHEM-468	Advanced Spectroscopy	3	
CHEM-469	Bio-Membranes and Cell Signaling	3	
CHEM-470	Antimicrobials and Chemotherapeutics	3	
CHEM-471	Biochemistry of Body Fluids	3	
	Total:	33	

Note: - Three courses of nine (09) credit hours will be offered in each of the 7th and 8th semester.

Applied Chemistry

Course Code	Semester – VII & VIII	Credit hours	Remarks
CHEM-480	Common Industries-I	3	
CHEM-481	Agro-Based Industries	3	
CHEM-482	Common Industries-II	3	
CHEM-483	Organic Based Industries	3	
CHEM-486	Industrial Products	3	
CHEM-487	Metallurgy	3	
CHEM-488	Analytical Techniques and Online Analysis in Industries	3	
CHEM-489	Processing of Crude Oil	3	
CHEM-490	Textile dyeing	3	
	Total:	27	

Note: - Three courses of nine (09) credit hours will be offered in each of the 7th and 8th semester.

Standard 2-1:

The curriculum must be consistent and supports the program's documented objectives.

Each program at Department of Chemistry is designed in order to support its objectives and is consistent. Department follows a standardized course syllabus in order to ensure the consistency in

knowledge delivered to the students. Following matrices show the relevance of the individual courses to the program objectives.

Course versus program objectives – BS Chemistry

Semester and Courses		BS Program Objectives				
		To prepare the students to understand the basic level of Chemistry	To Identify, analysis, and solve practical problem in Chemistry	To demonstrate in depth knowledge from traditional and emerging area of Chemistry.	To develop the value and attitudes in them that lead to professionalism	To train the youth globally towards leadership in terms of in human development, excellence in science education(with emphasis on Chemistry)
Sem 1	ELL-101				X	X
	BOT-100		X			
	ZOO-101			X	X	
	MATH-100	X	X		X	
	ISL-100/ ETH-100	X	X		X	X
	CHEM-119	X	X		X	
Sem 2	ELL-104				X	X
	PS-200				X	X
	BOT-201	X	X		X	X
	MATH-200			X	X	
	ZOO-100	X	X		X	X
	CHEM-122	X			X	X
	CHEM-129	X	X		X	X
Sem3	ELL-201	X	X	X		
	CS-101 PHY-114	X	X	X		
	STAT-302	X				
	CHEM-231				X	X
	CHEM-232			X		
	CHEM-239	X	X	X	X	X
	BBA-113/ ECO-400	X	X	X	X	

Sem4	PHY-124			X	X	X
	GEOL-245/ GEO-245	X	X	X	X	X
	CHEM-241	X	X			
	CHEM-242	X	X			X
	CHEM-243 CHEM-249	X			X	
Sem5	CHEM-351				X	X
	CHEM-352	X	X	X	X	
	CHEM-353	X			X	X
	CHEM-354	X	X	X		
	CHEM-355	X	X	X		
	CHEM-359	X	X		X	X
Sem 6	CHEM-361	X	X	X	X	X
	CHEM-362	X			X	X
	CHEM-363	X	X		X	X
	CHEM-364	X			X	X
	CHEM-369	X		X	X	
		X	X			X
Sem 7	CHEM-474	X			X	X
	CHEM-475	X			X	X
	CHEM-479	X			X	X
	CHEM-401	X			X	X
	CHEM-402	X		X	X	X
	CHEM-403	X				X
Sem 8	CHEM-484	X			X	X
	CHEM-485	X			X	X
	CHEM-489	X		X	X	X
	CHEM-419	X			X	X
	CHEM-420	X			X	X

Standard 2-2:

Theoretical background, problems analysis and solution design must be stressed within the program's core material.

Problem solution	• Chromatographic Methods of Analysis • Analytical Chemistry • Applied Chemistry • Statistics • Basic Thermodynamics and Quantum Mechanics • Electrochemical Analysis and Spectrophotometry • Chromatographic Methods of Analysis • Nuclear Analytical Techniques • Food and drug analysis • Quantum Chemistry

Theoretical background	• Synthesis and Mechanism • Numerical Methods and Computational Chemistry • Statistical Mechanics • Biochemistry Related to Biomedical Sciences • Bio-Nanotechnology • Organic Based Industries • Separation techniques • Statistical Mechanics
Solution Design	• Labs • Research Projects

Standard 2-3:

The Curriculum must satisfy the core requirements for the program as specified by the respective accreditation body.

The curriculum for BS Chemistry is divided into the following groups regarding credit hours.

Program	Arts & Humanities Cr. Hrs	Chemistry Cr. Hrs	Maths & Basic Sciences Cr. Hrs	Others
BS Chemistry	15	83	33	Nil

Standard 2-4:

The curriculum must satisfy the major requirements for the program as specified by the respective accreditation body.

This standard is closely similar to that of above standard 2-3. Both have same requirements and credit hour distribution. For this purpose, we must be concerned about the above standard.

Standard 2-5:

The curriculum must satisfy the general education, arts, professional and other discipline requirements for the program as specified by the respective accreditation body.

The detail is as under;

S.No	Subjects	Remarks
1	Arts and Humanities	Satisfactory
2	Basic Sciences	Satisfactory
3	Tutorial	Satisfactory
4	Seminars	Satisfactory

Standard 2-6:

Information technology component of the curriculum must be integrated throughout the program

Information technology is very important for improving the standard of education nowadays. Latest technology made the education updated and distance learning too. Technology is an emerging tool in education. That's why HEC stressed the universities to make information technology as an important part of syllabus. Department of Chemistry has included following computer/IT oriented subjects in its curriculum for both the programs.

S. No	IT Courses	Credit hours
1	Introduction to Computer (software's like, MS Office, Adobe Photoshop, Latex, Origin) (Compulsory)	03
2	Computational Chemistry (Elective)	03

Standard 2.7:

Oral and written communication skills of the student must be developed and applied in the program.

Oral and written communication is very important in Chemistry. For the improvement of this technique some weekly seminars are arranged in the department of Chemistry. However, some subjects are also approved in the board of study 2020 regarding the improvement of oral and written communication skills, shown in the following table:

S.No	Subjects for oral written communication skills	Credit hour
1	English-I (Reading and Writing)	03
2	English-II (Composition Writing)	03
3	English-III (Communication and Presentation Skills)	02

Criteria 3. LABORATORIES AND COMPUTER FACILITIES

Currently the department has no computer laboratory because the department is in initial phase. Establishment of six (06) Chemistry and 01 computer laboratories will be soon tendered. However, for the time being, our students utilize the computer facilities of department of Computer Science.

Future plans: In future, the department of Chemistry is planning to establish the following laboratories.

- Computer lab (35 computers) and multimedia in each class room
- Nano-materials synthesis Lab.
- Physical Chemistry Lab.
- Inorganic Chemistry Lab.
- Analytical Chemistry Lab.

- Biochemistry Lab.
- Applied Chemistry Lab.
- Organic Chemistry Lab.

Criteria 4. STUDENT SUPPORT AND GUIDANCE

Khushal Khan Khattak University, Karak, encourages students in different curricular and co-curricular activities including sports and participation in literary and cultural societies. Activities are going on in all 08 societies. The names of the societies are as follows

1. Blood donor and medical society
2. Volunteer and social work society
3. Sports society
4. Literary society
5. Art and culture society
6. Female student's society
7. Religious affairs society
8. Character building society
9. Khushal Science Club

Department of Chemistry appreciates the healthy co-curricular activities arranged by and for the student to enhance their talent in every field of life. The tutorial classes are the part of the attempt to direct the students in their ethical and social problems which can affect their personality. The faculty members of the department help the students regarding scholarships, career opportunities and counseling of students. For this purpose, establishment of Khushal Science Club is in-line.

Standard 4-1:

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

- Subjects are weekly distributed to cover each topic. Weekly distribution is very effective technique in course completion
- Subjects are distributed in such a way that every subject is taught by subject expert faculty.
- Elective courses are designed according to the advances in the field of Chemistry, Nanotechnology, Life Sciences and related to the interest of individual student.
- Major courses are taught in pragmatic side.
- Proper time has been arranged for laboratory work.

Standard 4-2:

Courses in the major must be structured to ensure effective Interaction between students, faculty and teaching assistants.

Before commencement of each semester, a meeting of the departmental semester committee is held, in which the subjects and work load among the faculty members are distributed.

- The subjects are distributed on basis of mutual understanding and the interest of faculty members.

- The classroom environment is very suitable for learning as the students are treated politely and encouraged to ask questions during classes. They are also provided with guidance and supervision during office time when required.
- Students are strongly involved in discussion and research ideas.
- Students and faculty members are interacted with each other according to course discussions, latest technology and research.
- Visits to different scientific events will be arranged for students. But unfortunately due to Covid/Corona no visit has been arranged so far.
- Proper time has been arranged for lab in which students and faculty have enough time to discuss ideas.
- Students are encouraged to come to the offices for discussion and for solving their problem regarding the research.

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 decision and career choice.

Such orientations are already in practice on department's level.

Criterion 5: PROCESS CONTROL

Standard 5-1:

The process by which students are admitted to the program must be based on quantities criteria and clearly documented. This process must be periodically evaluated to ensure that meets its objectives.

The admission advertisements are announced in Daily leading newspapers and uploaded on the university official website by web admin as well. The admission process is carried out under the supervision of departmental admission committee, formed by Head of Department (HoD) to ensure merit and to follow university rules and regulations.

Criteria for admission:

Student who have passed the Intermediates (F.Sc)/Diploma of Associate Engineering (DAE) or equivalent with Chemistry as one subject, having minimum second division (45 % marks) are eligible for admission into BS Chemistry program.

Seat distribution:

The seat distribution which is approved by university academic council.

Open merit	40
Fata	2 %
Baluchistan	01

Others	01 Seat for each Province
Disable	01
Hafiz e Qur'an	01
Sports	02
Total	50

Migration Policy:

A student from other educational institution, who intends to migrate to University, shall meet the following requirements:

1. A genuine and plausible reason for migration.
2. Production of a certificate of good character from his/her parent institution.
3. Production of detailed marks certificate and syllabi of courses he/she studied for equivalence purposes.
4. Migration certificate from the institution/University last attended.

Students desiring to transfer their credits, earned at other institutions, will be accepted under the following conditions:

1. Credits have been earned from institutions recognized / accredited by HEC.
2. Original transcript is produced along with photocopy.
3. Course outlines, duly signed by the institution, should be produced for evaluation.
4. Credits will be acceptable for undergraduate courses passed with at least 'C' grade / 2.0 out of 4.0 GP or equivalent.
5. Credits from other institution will be evaluated by the equivalence/evaluation committee on a course to course basis with the courses offered by the University.
6. Letter grades / grade points of the transferred courses will not be counted towards CGPA of courses of the University.
7. The transferred courses will appear in the full transcript of the University.
8. Character certificate, from the last attended institution, stating that the student has not been expelled on misconduct, indiscipline, undesirable activities, may be produced.
9. Students should not assume that their academic qualifications will allow them transfer of credits till written confirmation has been given.

In case of acceptance and willingness of the student for admission, he will have to produce migration certificate from the last attended institution.

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 meets its objectives.

- After taking admission in BS Chemistry students are required to register their courses on the university registration Proforma. This practice is carried out every semester.
- Internal evaluation of the students throughout the semester is done on the basis of their performance in quizzes, assignments, presentations, attendance.
- Promotion to the next semester is granted on the basis of student's collective performance in internal grades, midterm exam and final semester exam.
- Practical knowledge of the students is examined on the basis lab performance of field reports which are arranged in every semester.

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 meets with its objectives.

The University follows the following procedure in recruitment of faculty members.

- First of all, posts are advertised in three leading daily newspapers of the region and also uploaded on university website. After the closing date of advertisement, the establishment section of the university scrutinizes the application form and if there is any deficiency in the application form, the applicant is properly informed to overcome the deficiency in the given time.
- After the proper scrutiny by the scrutiny committee, the university has the proper selection board.
- After the selection board the case is forwarded to the syndicate for approval.
- The candidates selected are informed by office orders, and they have to join in specific time.

Standard 5-4:

The process and procedures used to ensure that teaching and delivery of course material to the students emphasizes active learning and to meet the course learning outcomes. The process must be periodically evaluated to ensure that meets its objectives.

- Recently the department of Chemistry has conducted first board of studies to approve its curriculum in which the courses for BS Chemistry programs have been finalized as per HEC criteria.
- Beside the available reference books and course materials, some reference books and course materials have been suggested which will be purchased / arranged for department library.

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 examination section has divided the examination and evaluation into the following categories.

- Quizzes
- Assignments
- Mid and Final examinations
- Oral presentations
- Practical viva/voce

The exam scheduled by the controller of examination and marks of the subject are distributed in the following pattern.

S.N0	Marks	Weightage
1	Assignments, presentation + quiz + attendance + behavior	20%
2	Mid Term Examination	30%
3	Final Term Examination	50%

Grading standard:

Percentage marks	Letter Grade	Grade point
100	A+	4.00
80-89	A	3.67
70-79	B+	3.33
65-69	B	3.00
56-64	C+	2.50
50-55	C	2.00

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.

Currently the Chemistry department has 06 faculty members. Details of the faculty members are as following:

S.No.	Name	Designation	Qualification
1	Dr. Abdul Hakim Shah	Assistant Professor/ HoD	Ph.D.
2	Dr. Afrasiab Ur Rehman	Visiting Lecturer	Ph.D.
3	Dr. Sher Ali	Visiting Lecturer	Ph.D.
4	Dr. Atta Ur Rehman	Visiting Lecturer	Ph.D.
5	Mr. Latif Ur Rehman	Visiting Lecturer	M.Phil.
6	Mr. Ikram Ullah	Visiting Lecturer	M.Phil.

The faculty Resumes are available in Annexure A.

Standard 6-2:

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

The courses are distributed on the basis of relevant expertise and in accordance of existing workload. Faculty members are selected on the basis of criteria, laid down by HEC.
Currently 8th, 6th, 4th and 2nd Semesters of BS Chemistry are in progress

Standard 6-3:

Results of the faculty survey:

- **Please refer to annexure C for Question's detail.**

S.No	A Strongly agree	B agree	C Uncertain	D Disagree	E strongly disagree
Q1	34	09	03	07	02
Q2	20	19	05	08	03
Q3	27	16	05	05	02
Q4	23	17	08	11	03
Q5	21	14	08	06	06
Q6	24	21	02	03	05
Q7	14	23	09	01	08
Q8	23	11	03	12	06
Q9	14	19	01	08	13
Q10	10	29	11	02	04
Q11	22	13	01	17	02
Q12	20	14	10	08	03
Q13	31	12	06	07	06
Q14	18	10	11	10	06

Criterion 7: INSTITUTIONAL FACILITIES

Regarding this Criterion, University should have updated system for students' learning like newspapers, libraries like digital library, departmental and central library, online books and publication. Photocopy, scanner, printer and plotter will be available very soon.

Standard 7-1:

The institution must have the infrastructure to support new trends in learning such as E-learning, Supportive Infrastructure and Facilities in learning.

Khushal Khan Khattak University, Karak, is newly established university but in very short time, the university achieved most targets regarding education standard.

a. Khushal Khan Khattak University is going to update laboratories for the students. Three (03) labs, computer lab and media lab will be developed soon. Pakistan Education Research Network facilities also now available for students and faculty for the research purpose. It will make the research work very accessible for students.
b. Six (06) labs for department of Chemistry will be approved and tendered soon.

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.

Khushal Khan Khattak University, Karak, has the central library of latest books and journal. The university has arranged the book fair events in 2015 and 2016. A qualified librarian with a well-trained supporting staff is responsible to manage the library in an efficient manner. Approximately 1500 books related to Chemistry have been stocked in library and purchase of remaining books is in pipeline.

Standard- 7-3:

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

Currently, department of chemistry is jointly placed with the Physics department. There are shared offices for lecturers in the department. These offices are having basic facilities.

a. Furniture
b. Internet
c. Washrooms

Faculty members needs latest laptop for

- Research work.
- Presentations

Criterion 8: INSTITUTIONAL SUPPORT

Khushal Khan Khattak University, Karak, has supporting administration team. This team facilitates the faculty in different way. They also help and support the students in different activities and provide many services.

Administration team is very important partner in achieving Khushal Khan Khattak university vision, mission, and goals by providing standard financial and administrative support services to faculty. This team is also important for students to facilitate them in scholarships etc.

The university budget office is a supporter for the effective and capable use of Khushal Khan Khattak university resources through planning, analysis, liability and arrangement of resources to significances.

The Registrar is responsible for support to the academic as well as administrative purposes of the University. At Khushal Khan Khattak University, registrar provides services in the recruitment, placement and development of University's teaching and administrative staff as well as admission of students.

Khushal Khan Khattak University's Transportation Services provides management in developing and implementing complete, reasonable, flexible, well-organized, and supportable programs to facilitate the faculty and students in pick and drop.

This section of the university provides all necessary things to the employees and students. This section of our university is very cooperative and active and provides all accessories to the departments without delay.

Technical staff members of the Khushal Khan Khattak University are very supporting for the employees and students too. They properly deliver the technical services to the departments and other administrative offices.

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.

Khushal Khan Khattak University provides best financial resources to facilitate its employees. The university is situated in the remote area and due to this reason; the University has attractive salary packages as compared to other universities. The financial resources are managed by the finance section of the university.

University gets funds for the Research Projects from HEC and other organizations to the faculty members through ORIC department.

The university provides transport facility to the students and employees.

Faculty Development			Research Support
Workshops / Seminars	Conferences	Labs	Financial resources
Skills on teaching methodology improved through workshops and seminars arranged by university /HEC. (National Faculty Development Program	Participation in National and International Conferences.	Labs are in progress with basic infrastructure to carry out research activities.	No University Research Fund available for M.Phil/Ph.D. program. Faculty is encouraged to get funding from external sources.

Supporting staff/office equipment	Existing	Required
Secretarial Support • Superintendent • Clerk • Office Assistant • Computer Operator		 Required Required Required Required
Technical staff • Lab Assistants • Lab Attendants		 Required Required
Librarian		Required
Instrument Engineer/Technician		
Office equipment's Computers Internet facility Printers, Scanners		 Required Required

Standard 8-2:

There must be an adequate number of high quality graduate students, Research Assistants and Ph.D. students.

Khushal Khan Khattak University is newly established and is motivated to promote the research capabilities of the students, scholars and faculty. BS students are engaged in different projects and scientific events under the supervision of faculty members.

For M.Phil. and Ph.D. scholar's better resources will be provided in their research needs due to the placement of three IPFP fellows with Start-Up Research Grant Program (SRGP).

Standard- 8-3:

Financial resources must be provided to acquire and maintain Library Holdings, laboratories and computing facilities.

Khushal Khan Khattak University is in its initial stages; but the support and positive sense of honorable Voice Chancellor (VC) has made it possible to achieve main targets related to academics, and provide all facilities to students for learning.

KKKUK is providing financial resources to maintain library through departmental budget. The central library has a stock of almost 200 books related to chemistry which is not an enough number for students. Therefore, there is a need to purchase more books in latest fields of chemistry. Departmental library is required to be established containing books on various fields of chemistry.

The list of chemicals, glass wares has been already forwarded for purchasing.

No financial resources available for computing facilities, however internet connection through WiFi is available in the department.

SUMMARY AND CONCLUSIONS

The Department of Chemistry, Khushal Khan Khattak University, Karak, is a department of higher learning and research. It was established in September 2019 with the aim to explore specific approaches to solve problems and to apply knowledge from different areas of Chemistry to independent research projects. The department is going to launch a strong experimental research program in various fields of Chemistry in the near future. The main focus of the Department is to establish well equipped labs. The department is in initial stages and offering only BS Chemistry program. The Department offers admissions in fall semester. The department has recently 58 students in BS Chemistry.

It should be a matter of satisfaction to all concerned that the Department has been successful in the pursuit of the aims and objectives for which it was established. The curriculum is designed by the faculty members of the department and has been approved by the Board of Studies, comprising of prominent Chemists across the country.

The department of Chemistry is in the phase of development and currently has planned to establish BS level labs is in channel. Students are currently involved in final year research projects of BS level due to initial stage of the department.

Curriculum design Updation is based upon approved criteria. The university Examinations and academic are scheduled semester-wise. Tutorial classes are also weekly arranged.

Institutional facilities are measured through labs, library, administration, infrastructure, class rooms and faculty offices. However, there are some short comings and limitations.

The Chemistry department of the university can be advanced if the following suggestions are fulfilled.

The classrooms of the department need effective techniques of learning like use of multimedia. Classrooms must be the platform of open discussion and presentations.

- The department of Chemistry needs Labs and computer lab for students.
- Students of the department need Internet facility.

- Students of the department need Library.
- Sufficient space must be provided for the research labs.

Anx "A"

Proforma: 9

Faculty Resume

Name	**Dr. Abdul Hakim Shah**
Personal	Department of Physics and Chemistry, Khushal Khan Khattak University, opposite Tableeghi Markaz district, Karak, Province, Khyber Pakhtunkhwa, Pakistan. **Cell: +92-**03335477966 **E-mail: dr.abdulhakim@kkkuk.edu.pk**
Experience	Sep 2015 till Date, Working as Assistance Professor Khushal Khan Khattak University, Karak.
Honor and Award	1st position among outstanding graduates of Wuhan University of Technology for the year 2015 Merit scholarship during M.Phil at Quaid-i-Azam University Islamabad
List of Supervise Students	**Year** **Degree** **Name** 2019-2023 Undergraduate: Jan Musadaq group (03 students) Shazai Kalsoom (03 students) Sanodia (04 groups) Nedawal (03 strudents) Muhammmad Mudassir (03 students)
Memberships	1. WHUT Academic association (10 Nov 2012- Aug 2015) 2. Board of Studies, Department of Physics, UST Bannu 3. Director ORIC KKUK Karak (Feb 2017-March 2019) 4. ASRB Board KKKU Karak (Feb 2017-March 2019)
Brief Statement of Research Interest	Nanotechnology for gas sensors, Solar cells Energy materials

Publications	**1. <u>Abdul Hakim Shah</u>**, T.Z. Rizvi, *Improvement in electrical and thermal behavior of polystyrene/multiwalled carbon nanotubes nanocomposites*, **Measurement, 2013, 46: 541–1550**. **2. <u>Shah Abdul Hakim</u>**, Yueli Liu, Yu Lu and Wen Chen, *Room temperature highly selective ethanol sensing behavior of hydrothermally prepared Te-V_2O_5 nanorod nanocomposites*, **Materials Science in Semiconductor Processing**, **2015, 31: 630-638**. **3. <u>Shah Abdul Hakim</u>**, Y. Liu, S. Yang, G. S. Zakharova & W. Chen, *Synthesis and ethanol sensing properties of V_2O_5 hierarchical microspheres*, **Ferroelectrics**, **2015, 477, 77-83**. **4. <u>Shah Abdul Hakim</u>**, Yueli Liu, Galina S. Zakharova and Wen Chen, *Synthesis of vanadium pentoxide nanoneedles by physical vapour deposition and their high sensitive behavior towards acetone at room temperature*, **RSC Advances**, **2015, 5(30), 23489-23497.** **5. <u>Abdul Hakim Shah</u>**, Yueli Liu, Wei Jin, Wen Chen, Mehmood Ikhtisham and Van Tu Nguyen, *Highly selective ethanol sensing properties of hydrothermally synthesized cerium orthovanadate ($CeVO_4$) nanorods*, **Material Letters, 2015, 54, 144-147.**

Faculty Resume

Name	Dr. Afrasiab Ur Rehman
Personal	Department of Chemistry, Khushal Khan Khattak University, opposite Tableeghe markaz district, Karak, Province, Khyber Pakhtunkhwa, Pakistan. Cell: +923490574199 E-mail: dr.afrasiab@kkkuk.edu.pk
Experience	September 2022 to June 2023, Working as Visiting Lecturer, Khushal Khan Khattak University, Karak. 31st May 2021 to 30th May 2022, Working as Assistance Professor (IFPF) Khushal Khan Khattak University, Karak. September 30, 2019 till 31st May 2021, Working as Visiting Lecturer, Khushal Khan Khattak University, Karak.
Honor and Awards	❖ The 6th International and 16th National Chemistry Conference under the auspices of the Chemical Society of Pakistan, certificate (April 06-08, 2006). ❖ Certificate of appreciation, in honor of outstanding performance in the mega event of ISMO 2011. PAKTURK INTERNATIONAL CAG EDUCATIONAL FOUNDATION (PTISC/STU/377). ❖ Khyber Pakhtunkhwa Science Fair 2011-2012, in collaboration with Intel Education Initiative and Federal Ministry of Science and Technology. Government of Pakistan. (28th November to 30th November 2011). ❖ Certificate from National academy of Higher Education (NAHE), HEC, Pakistan 2020-21.

Memberships	Chinese Government Scholarship (CSC 2014-2018).
Graduate Students Postdocs Undergraduate Students Honour Students	**Year** **Degree** **Name** 2019-2023 Undergraduate Bushra Usman, Maryam Nawaz, Shehar Yar and Muhammad Juniad (BS-Chemistry) 2019-2023 Undergraduate Akhtar Zaman, Hina Ihsan, Muhammad Zahoor and Ahad Ullah (BS-Chemistry) 2016-2020 Undergraduate Sana and Azmat Baigum (BS-Physics)
Service Activity	Focal Person and Co-ordinator Undergraduate Program Department of Chemistry Khushal Khan Khattak University Karak (2020-2021)
Brief Statement of Research Interest	• Precipitation Inhibition processes by the use of anionic homopolymeric and copolymeric inhibitors. • Design fabrication, characterization and morphology tailoring of hierarchical structured nanocomposites and their chemical or biological sensor application (NOx, COx, H_2, NH_3 etc.) • Graphitized carbon* (MOx) based biological sensor and water sensor. • Graphene (GS), thin expanded graphite (EG), graphene oxide (GO), the reduced graphene oxide (RGO) • Graphene oxide/metallic oxide/conducting polymers as electrochemical sensor for simultaneous as well as individual detection of heavy metal ions.

Publications	List publications in standard bibliographic format with earliest date first. **Afrasiab Ur Rehman,** Muhammad Fayaz, He Lv, Yang Liu, Jiawei Zhang, Yang Wang, Lijuan Du, Ruihong Wang, Keying Shi. Controllable Synthesis of a Porous PEI-Functionalized Co3O4/rGO Nanocomposite as an Electrochemical Sensor for Simultaneous as Well as Individual Detection of Heavy Metal Ions. *ACS Omega*. **2022**, *7(7)*, 5870-5882. https://doi.org/10.1021/acsomega.1c05989 **Afrasiab Ur Rehman**, Jiawei Zhang, Jiao Zhou, Kan Kan, Li Li, Keying Shi, Synthesis of mesoporous K_2O-In_2O_3 nanowires and NOx gas sensitive performance study in room temperature, *Microporous and Mesoporous Materials* **2017**,*240*, 50-56. https://doi.org/10.1016/j.micromeso.2016.11.006 **Afrasiab Ur Rehman**, Abbas Khan, Muhammad Humayun, Gulnaz Bibi, Keying Shi and Fazal Raziq, Effect of biocides and anionic homopolymeric inhibitors on the precipitation behavior of calcium fluoride, *Bull. Chem. Soc. Ethiop.* **2017**, *31(1)*, 115-126. DOI: 10.4314/bcse.v31i1.10 **Afrasiab Ur Rehman,** Muhammad Humayun, Abbas Khan, Amir Zada & Liqiang Jing, Effect of biocides on the precipitation of calcium fluoride in the presence of anionic copolymeric inhibitors, *Toxicological & Environmental Chemistry* **2016**, *98(7)*, 748-758. DOI: 10.1080/02772248.2015.1124107 **Afrasiab Ur Rehman,** Muhammad Ikram, Kan Kan, Yiming Zhao, Wei Jun Zhang, Jiawei Zhang, Yang Liu, Yang Wang, Lijuan Du, Keying Shi, 3D interlayer nanohybrids composed of reduced graphene oxide/SnO_2/PPy grown from expanded graphite for the detection of ultra-trace Cd^{2+}, Cu^{2+}, Hg^{2+} and Pb^{2+} ions, *Sensors & Actuators: B. Chemical* **2018**, *274,* 285-295. https://doi.org/10.1016/j.snb.2018.08.004 He Xu, Jiawei Zhang, **Afrasiab Ur Rehman**, Lihong Gong, Kan Kan, Li Li, Keying Shi, Synthesis of NiO@CuO nanocomposite as high performance gas sensing material for NO_2 at room temperature, *Applied Surface Science* **2017**,*412*,

230-237.

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Linlin Wang, **Afrasiab Ur Rehman**, Hongyuan Wu, Baofeng Wu, Li Li and Keying Shi, Submicrochains composed of massage ball-like WO_3@$CuWO_4$ composites for high-efficiency CO_x gas sensing applications at room temperature, *RSC Adv*. **2016**, *6*, 69999-70007.

Jiao Zhou, Jiawei Zhang, **Afrasiab Ur Rehman**, Kan Kan, Li Li and Keying Shi, Synthesis, characterization, and ammonia gas sensing properties of Co_3O_4@CuO nanochains, *J. Mater Sci.* **2017**, *52*, 3757-3770.

Jiao Zhou, Muhammad Ikram, **Afrasiab Ur Rehman**, Jing Wang, Yiming Zhao, Kan Kan, WeiJun Zhang, Fazal Raziq, Li Li, Keying Shi, Highly selective detection of NH_3 and H_2S using the pristine CuO and mesoporous In_2O_3@CuO multijunctions nanofibers at room temperature, *Sensors and Actuators B* **2018**, *255(2)*, 1819-1830.

https://doi.org/10.1016/j.snb.2017.08.200

D. Hong, J. Zhang, **A. U. Rehman**, L. Gong, J. Zhou, K. Kan, L. Li and K. Shi, One-step synthesis of hierarchical Ni-Fe-Al layered doublehydroxide with excellent sensing properties for NO_x at room temperature, *RSC Adv.* **2016**, *6*, 103192-103198.

DOI: 10.1039/C6RA21645E.

Yang Liu, Yang Wang, Muhammad Ikram, He Lv, Jingbo Chang, Zhengkang Li, Laifeng Ma, **Afrasiab Ur Rehman**, Ganhua Lu, Junhong Chen, Keying Shi. Facile Synthesis of Highly Dispersed Co_3O_4 Nanoparticles on Expanded, Thin Black Phosphorus for a ppb-Level NO_x Gas Sensor, *ACS Sens.***2018**, *3(8)*, 1576-1583.

DOI:10.1021/acssensors.8b00397

Siyu Liu, Lei Teng, Yiming Zhao, Zhi Liu, Jiawei Zhang, Muhammad Ikram, **Afrasiab Ur Rehman**, Li Li, Keying Shi.Facile Route to Synthesize Porous Hierarchical Co_3O_4 /CuO Nanosheets with High Porosity and Excellent NOx Sensing Properties at Room Temperature,*Applied Surface Sci*. **2018**, *450*, 91-101.

	https://doi.org/10.1016/j.apsusc.2018.04.150 Hongyuan Wu, Haitao Huang, Jiao Zhou, Dahai Hong, Muhammad Ikram, **Afrasiab Ur Rehman**, Li Li, Keying Shi.One-step Synthesis of Ordered Pd@TiO_2Nanofibers Array Film as Outstanding NH_3 Gas Sensor at Room Temperature, *Sci. Rep*. **2017**, *7*, 14688. DOI: 10.1038/s41598-017-15319-3 Muhammad Ikram,Yiming Zhao,**Afrasiab Ur Rehman**, Kan Kan, WeiJun Zhang, Jiawei Zhang, Yang Liu, Yang Wang, Keying Shi.Multilayer flower like MoS_2 conjugated with thin layer $In(OH)_3$ for high-performance NO_x gas sensor at room temperature, *Journal of Alloys and Compounds* **2018**,*735*,1439-1448. https://doi.org/10.1016/j.jallcom.2017.11.229 And so on
Research Grants and Contracts.	**Date Title Agency / Organization Total Award Amount** 31/05/2021, (SRGP Fund) Higher Education Pakistan Rs = 1000000 But not utilized by the higher authority?
Other Research or Creative Accomplishments	Nil.
Selected Professional Presentations	Nil.

Faculty Resume

Name	Dr. Sher Ali
Personal	Department of Chemistry, Khushal Khan Khattak University, opposite Tableeghe markaz district, Karak, Province, Khyber Pakhtunkhwa, Pakistan. Cell: +923135456257 E-mail:sheraliqau@yahoo.com
Experience	Date= 31/5/2012 Title= Assistant professor (IPFP) Institution = Khushal Khan Khattak University Karak
Honor and Awards	Chines government scholarship (CSC 2014-2018).
Memberships	The Innovative Research Project of Key Laboratory of Functional inorganic Material Chemistry (Heilongjiang University), Ministry of Education. Higher Education Commission of Pakistan and Quaid-i-Azam University, Islamabad, Pakistan. National Natural Science Foundation of China (No. 11874169, 11574106, 61771448, and 51635007), the Double **fi**rst-class research funding of China-EU Institute for Clean and Renewable Energy (ICARE-RP-2018-SOLAR-003), and the China Postdoctoral Science Foundation
Graduate Students Postdocs Undergraduate Students Honour Students	Nil
Service Activity	Teacher

Brief Statement of Research Interest	Selective catalytic reduction (SCR) of NO_x with NH_3 at low temperature. Catalyst designing for visible light-driven hydrogen evolution and pollutant degradation

Publications	○ Muhammad Humayun, Minming He, Wenbai Feng, Chengyao Jin, Zichen Yao, Yongcheng Wang, Wenbo Pi, **Sher Ali**, Abbas Khan, Mei Wang, Zhiping Zheng, Qiuyun Fu, Hui Xia, Wei Luo, Enhanced photocatalytic performance of novel MIL53Sr metal-organic framework (MOF) for RhB dye degradation and H2 evolution by coupling MIL53Fe, **Solar Energy** 215 (2021) 121-130 ○ **Sher Ali**, Muhammad Humayuna, Wenbo Pia, Yang Yuana, Mei Wanga, Abbas Khanc, Pang Yued, Lang Shua, Zhiping Zhenga, Qiuyun Fua, Wei Luoa, Fabrication of $BiFeO_3$-g-C_3N_4-WO_3 Z-scheme heterojunction as highly efficient visible-light photocatalyst for water reduction and 2,4- dichlorophenol degradation: Insight mechanism, **Journal of Hazardous Materials** 397 (2020) 122708 ○ Muhammad Humayun, Habib Ullah, Junhao Cao, Wenbo Pi, Yang Yuan, **Sher Ali,** Asif Ali Tahir, Pang Yue, Abbas Khan, Zhiping Zheng, Qiuyun Fu1, Wei Luo, Experimental and DFT Studies of Au Deposition Over WO_3/g-C_3N_4 Z-Scheme Heterojunction, **Nano-Micro Lett.** Nano-Micro Letters, 12 (2019) 7. ○ Syed ul Hasnain Bakhtiar, **Sher Ali,** Xiaotong Wang, Fulong Yuan, Zhibin Li, Yujun Zhu, Synthesis of sub-micrometric SAPO-34 by a morpholine assisted two-step hydrothermal route and its excellent MTO catalytic performance, **Dalton Trans,** 48(2019) 2606-261 ○ Syed ul Hasnain Bakhtiar, **Sher Ali,** Yongli Dong, Xiaotong Wang, Fulong Yuan, Zhibin Li , Yujun Zhu, Selective synthesis of the SAPO-5 and SAPO-34 mixed phases by controlling Si/Al ratio and their excellent catalytic methanol to olefins performance , Journal of Porous Materials **25, (2018) 1455–1461**

	○ **Sher Ali**, Liqiang Chen, Zhibin Li, Tianrui Zhang, Syed ul Hasnain Bakhtiar, XuesongLeng, Fulong, Yuan, XiaoyuNiu, Yujun Zhu, Promotional effects of Nb addition on selective catalytic reduction of NO with NH_3 over Fe_x-$Nb_{0.5-x}$-$Ce_{0.5}$ (x = 0.45, 0.4, 0.35) catalysts, Molecular Catlysis **461(2018) 97-107** ○ **Sher Ali,** Liqiang Chen, Zhibin Li, Tianrui Zhang, Rui Li, Syed ul Hasnain Bakhtiar, Xuesong Leng, Fulong, Yuan, XiaoyuNiu, Yujun Zhu,Cu_x-$Nb_{1.1-x}$(x = 0.45, 0.35, 0.25, 0.15) bimetal oxides catalysts for the low temperature selective catalytic reduction of NO with NH_3, Appl. Catal. B Envior. **236 (2018) 25-35** ○ Syed ul Hasnain Bakhtiar, Xiaotong Wang, **Sher Ali**, Fulong Yuan, Zhibin Li, Yujun Zhu, CTAB-assisted size controlled synthesis of SAPO-34 and its contribution toward MTO performance, **Dalton Trans., 47(2018) 9861-9870** ○ **Sher Ali**, Liqiang Chen, Fulong Yuan, Rui Li, Tianrui Zhang, Syed ul Hasnain Bakhtiar, Xuesong Leng, Xiaoyu Niu,Yujun Zhu, Synergistic effect between copper and cerium on the performance of Cu_x-$Ce_{0.5-x}$-$Zr_{0.5}$ (x = 0.1–0.5) oxides catalysts for selective catalytic reduction of NO with ammonia, Appl. Catal. B Envior. **210 (2017) 223-234** ○ Muhammad Ikram, Afrasiab Ur Rehman, Sharafat Ali, **Sher Ali,** Syed Ul Hasnain Bakhtiar Sultan Alam The adsorptive potential of chicken egg shells for the removal of oxalic acid from waste, Journal of Biomedical Engineering and Informatics**, 2 (2016) 2** ○ **Sher Ali,** Zia-Ur-Rehman, Muneeb-Ur-Rehman, Muhammad Imran, Syed Niaz Ali Shah, Rana Faryad Ali, Afzal Shah, Amin Badshah, Kamran Akbar & Francine Bélangerd Rana Faryad Ali, Afzal Shah, Amin Badshah,

	Kamran Akbar & Francine Bélangerd "New bioactive homobimetallic organotin(IV) dithiocarbamates as potent antileishmanial agents J.organo metallic chemistry **67 (2014) 20**
Research Grants and Contracts.	Nil
Other Research or Creative Accomplishments	PUBLICATION 2019-11-22 PATENT NUMBER # CN107042112A
Selected Professional Presentations	Nil

Faculty Resume

Name	Dr Atta ur Rehman
Personal	Department of Chemistry, Khushal Khan Khattak University, opposite Tableeghe markaz district, Karak, Province, Khyber Pakhtunkhwa, Pakistan.

	Cell: +92341-8153107 E-mail: atta@chemist.com, atta2977@gmail.com
Experience	1) 31st May, 2021, Assistant Professor IPFP, Khushal Khan Khattak University, Karak. 2) August, 2019, Honorary Lecturer, Federal Govt. College Karachi, Cant. 3) September, 2017, Research Supervisor (B.Ed 1.5), Allama Iqbal Open University, Karachi. 4) January 2014, Inspector in Academic Monitoring & Development Cell, Pakistan Navy Education Trust (PNET).
Honor and Awards	○ Successfully completed **"Four-week online National Facility Development program 2020 under HAHE, HCE".** ○ Presented One-day workshop on **"Importance & strategies to solve the numerical questions"** organized by Academic Monitoring & Development Cell **(PNET)** (September 2014). ○ Presented seminar on **"Cancer prevalence in Karachi city by use of smokeless tobacco products"** (27^{th} August, 2014). ○ 09 days' Workshop on **Current Analytical and Computational Techniques in Chemistry** in FUUAST (Training on Atomic Absorption Spectrophotometer PE-A Analyst 700 and Flame Photometer) as a R**esource Person** (June 17^{th} – 27^{th}, 2014). ○ Two-day **work shop on inpage learning** & writing organized by Academic Monitoring & Development Cell **(PNET)** (June 22^{nd} – 23^{rd}, 2014) as a Resource Person. ○ 1st National Seminar on **"Green Chemistry and Environmental Effects"** organized by Department of Chemistry, Federal Urdu of Arts, Science & Technology, Karachi. ○ On line workshop on, **"How to Write A Wining Scientific Research Proposal?"** organized by H.E.J. Research Institute, University of Karachi. ○ 1st National Seminar on "**Chemistry Education and Industrial Requirements: It's Impact on Economy of Pakistan"**, organized by Federal Urdu of Arts, Science & Technology, Karachi. ○ 2^{nd} National Seminar on **"Chemicals & Pharmaceuticals for Research and Development",** organized by Federal Urdu of Arts, Science & Technology, Karachi.
Memberships	*Nil*
Graduate Students *Postdocs* *Undergraduate Students*	*Nil*

Honour Students	
Service Activity	*Teaching,* *Supervision,* *Academic Monitoring and development*
Brief Statement of Research Interest	My key interest of research is metal risk assessment and management in foods, non-foods products and environmental components. While also exploring the toxic metal effects on human health and the environment. My recent publication explores the use of a wide bandgap Ag/MgO@ Fe3O4 nanocomposite as magnetic sorbent for Cd (II) in water samples. A procedure is developed to remove the Cd (II) from water samples by using the nanoparticle. I received my PhD degree in Analytical chemistry from the department of chemistry, Federal Urdu University of Arts, Science and Technology, Karachi, Pakistan. My PhD thesis was based on the estimation of metals risks associated with the use of smokeless tobacco products and measurement of cancer risk with its use. During this tenure I was also working as a research assistant in atomic absorption laboratory in the same university and provide help in the sample collection, sample treatment and method development for analysis. Also conducted different workshops on the use of modern analytical instruments. Participated as a member of an organizing stuff and presented a lecture on "Health risk of As in Smokeless Tobacco Products" in 16th International and 28th National Chemistry Conference Organized by Department of Chemistry, Federal Urdu University of Arts, Science and Technology, Karachi and Chemical Society of Pakistan.

Publications	**Articles published by refereed journals.** 1. Estimation of potential risk of carcinogenic arsenic in smokeless tobacco products, Atta ur Rehman, Kousar Yasmeen, Iftekhar Saeed and Muhammad Zubair Khan, New J. Chem., 2022, Advance Article 2. A Wide Bandgap Ag/MgO@ Fe_3O_4 Nanocomposite as Magnetic Sorbent for Cd (II) in Water Samples. M Hanif, K Yasmeen, H Muhammad, F Shah, S Hussain, M Masab, ST Ali, Current Analytical Chemistry 16 (3), 332-340 3. Trace metals health risk appraisal in fish species of Arabian Sea. K Yasmeen, MA Mirza, NA Khan, N Kausar, A Rehman, M Hanif, SpringerPlus 5 (1), 1-7 4. Assessment of Source of Contamination of Heavy Metals and Estimation of Metals Risk in Smokeless Tobacco

	Products. ATTA-UR-REHMAN, K YASMEEN, S MOHIUDDIN, L BASHIR, S NAZ, Asian Journal of Chemistry 28 (7) 5. Concentration of Cd, Cu, Pb and Zn in Blood Serum of Cancer Patients and Patients and Comparison with Healthy Person by Atomic Absorption Spectroscopy. M Hafsa, K Yasmeen, F Shah, S Jahangir, Atta-ur-Rahman, A Manzar, Current Analytical Chemistry 13 (5), 425-429(5) 6. Composition and Sensorial Characteristics of Tap and Bottled Drinking Water in Pakistan. K Yasmeen, I Saeed, Atta-ur-rehman, MA Versiani, S Jahangir, MA Mirza, Asian Journal of Chemistry 28 (1), 75 7. Assessment of Heavy Metals Pollution and Estimation of DImetal Values in Vegetables Impacted by Translocation and Geological Location. K Yasmeen, I Saeed, S Ambreen, S Jahangir, IA Tahiri, Atta-Ur-Rehman, ... Journal of the Chemical Society of Pakistan 37 (3), 579-587 8. Investigation of Copper and Lead in Healthy and Cancerous Serum (Human) by using Anodic striping Voltammetry. Hafsa, Kousar Yasmeen, Atya Hassan, Iftikar Ahmed Tahiri, Sobia Tahir, Atta-ur-Rehman and SyedTahir Ali. **(In press)**. 9. Presented a lecture on **"Health risk of As in Smokeless Tobacco Products"** in **16th International and 28th National Chemistry Conference Organized** by Department of Chemistry, Federal Urdu University of Arts, Science and Technology, Karachi and Chemical Society of Pakistan (20th – 22nd November, 2017).
Research Grants and Contracts.	*NiL*
Other Research or Creative Accomplishments	*NiL*
Selected Professional Presentations	*Nil*

Name	Latif Ur Rehman
Personal	Adress: Department of Chemistry, Khushal Khan Khattak University, opposite Tableeghe markaz district, Karak, Province, Khyber Pakhtunkhwa, Pakistan. Cell: +923365646034 *E-mail: latifurrehman1997@gmail.com*
Experience	6 months
Honor and Awards	
Memberships	QEC member
Graduate Students Postdocs Undergraduate Students Honour Students	
Service Activity	
Brief Statement of Research Interest	

Publications	Nil
Research Grants and Contracts.	Nil
Other Research or Creative Accomplishments	Nil
Selected Professional Presentations	Nil

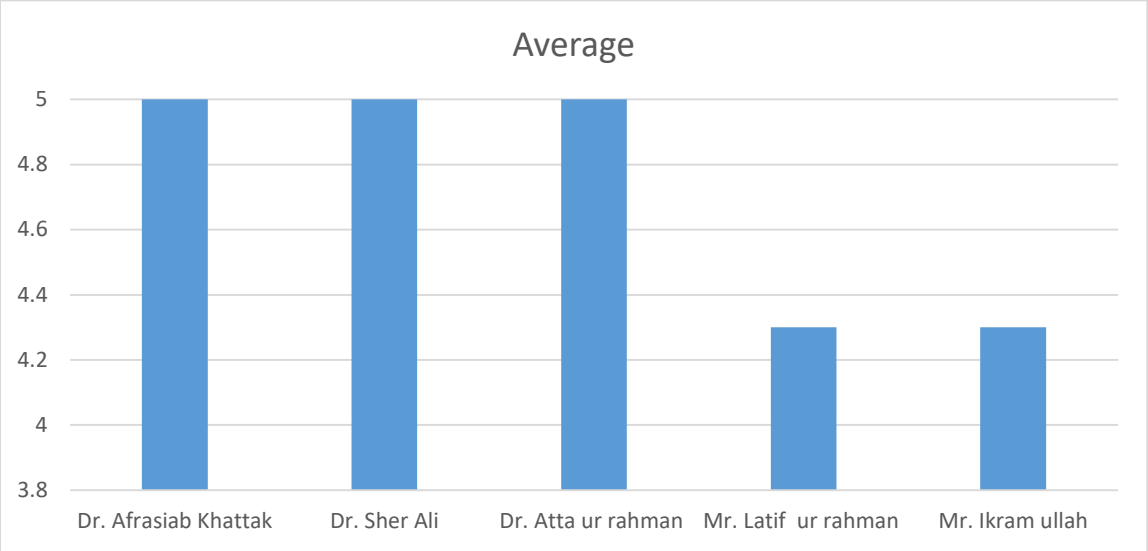
Faculty Resume

Name	Mr. Ikram Ullah
Personal	Address: Department of Chemistry, Khushal Khan Khattak University, opposite Tableeghe markaz district, Karak, Province, Khyber Pakhtunkhwa, Pakistan. Cell: +92-3450991282 *E-mail: ikramktk987@gmail.com*
Experience	02 (Two) Years' experience is visiting Lecturer Department of Chemistry, Khushal Khan Khattak University
Honor and Awards	US-Pakistan Universities Partnerships Grants Program 2022-23.
Memberships	QEC member
Graduate Students Postdocs Undergraduate Students Honour Students	
Service Activity	
Brief Statement of Research Interest	

Publications	Nil
Research Grants and Contracts.	Nil
Other Research or Creative Accomplishments	Nil
Selected Professional Presentations	Nil

Annexure B

Teacher Evaluation Bar Chart



Anova: Single Factor

Teachers Evaluation Survey

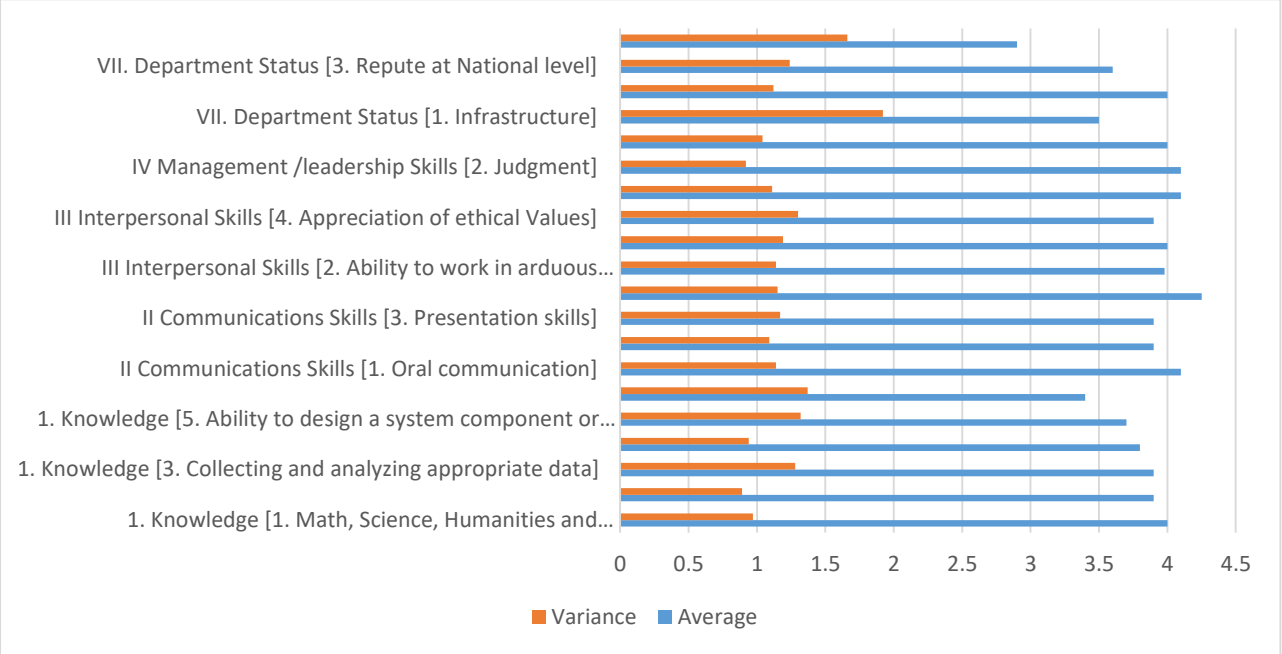
Groups	*Count*	*Sum*	*Average*	*Variance*
Dr. Afrasiab Ur Rehman	18	90	5	0
Dr. Sher Ali	18	90	5	0
Dr. Atta Ur Rahman	18	90	5	0
Mr Latif Ur Rehman	18	90	4.3	0
Mr. Ikram Ullah	18	90	4.3	0

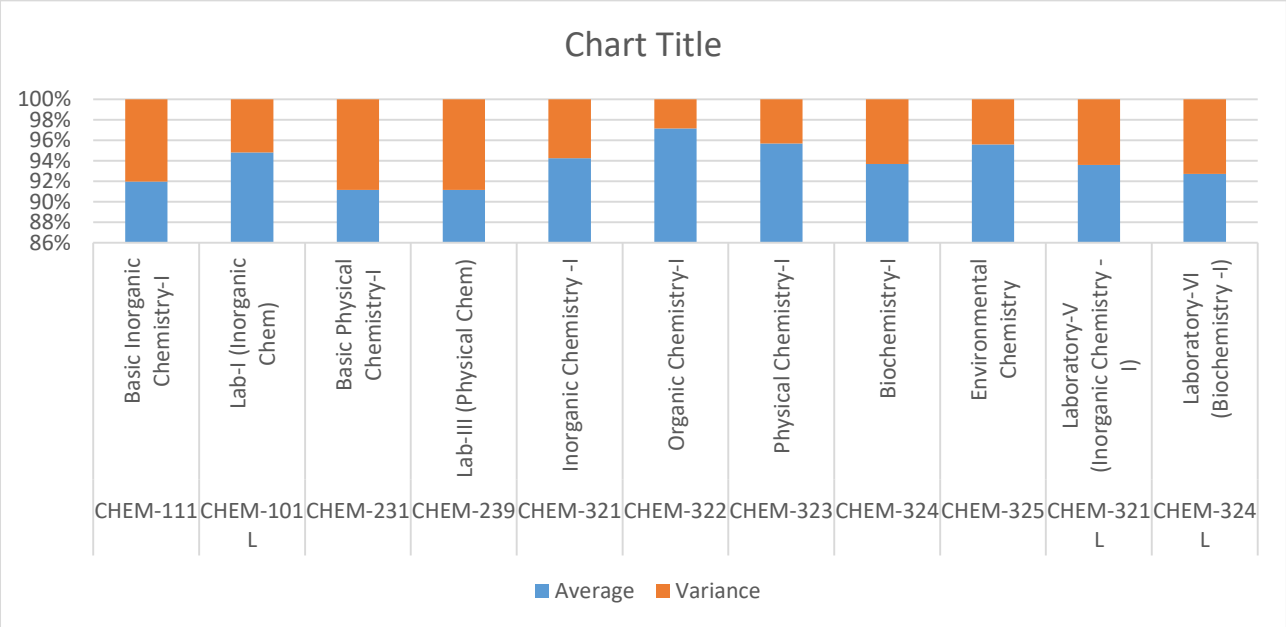
Alumni Survey

Groups	**N**	**Mean**	**Var.**
1. Knowledge [1. Math, Science, Humanities and professional discipline, (if applicable)]	48	4.0	0.97
1. Knowledge [2. Problem formulation and solving skills]	49	3.9	0.89
1. Knowledge [3. Collecting and analyzing appropriate data]	46	3.9	1.28
1. Knowledge [4. Ability to link theory to practice.]	49	3.8	0.94
1. Knowledge [5. Ability to design a system component or process]	49	3.7	1.32
1. Knowledge [6. IT knowledge]	49	3.4	1.37
II Communications Skills [1. Oral communication]	47	4.1	1.14
II Communications Skills [2. Report writing]	48	3.9	1.09
II Communications Skills [3. Presentation skills]	47	3.9	1.17
III Interpersonal Skills [1. Ability to work in teams.]	47	4.25	1.15
III Interpersonal Skills [2. Ability to work in arduous /Challenging situation]	49	3.98	1.14
III Interpersonal Skills [3. Independent thinking]	48	4.0	1.19
III Interpersonal Skills [4. Appreciation of ethical Values]	49	3.9	1.30

IV Management /leadership Skills [1. Resource and Time management skills]	49	4.1	1.11
IV Management /leadership Skills [2. Judgment]	49	4.1	0.92
IV Management /leadership Skills [3. Discipline]	49	4.0	1.04
VII. Department Status [1. Infrastructure]	49	3.5	1.92
VII. Department Status [2. Faculty]	49	4.0	1.12
VII. Department Status [3. Repute at National level]	47	3.6	1.24
VII. Department Status [4. Repute at international level]	49	2.9	1.66

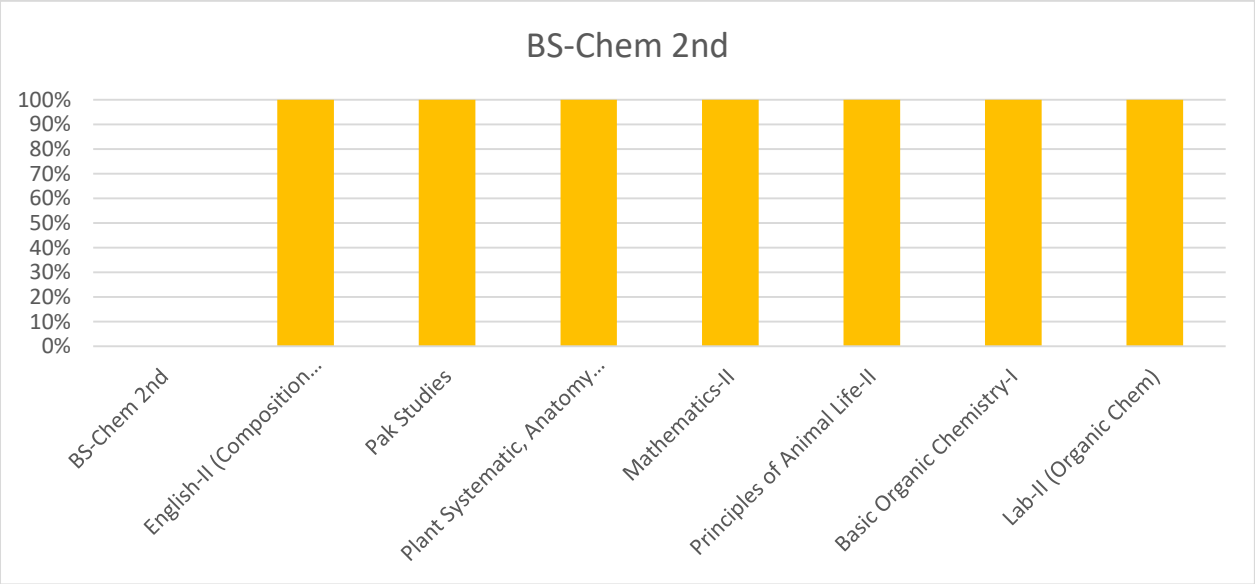
Figure
Alumni Survey

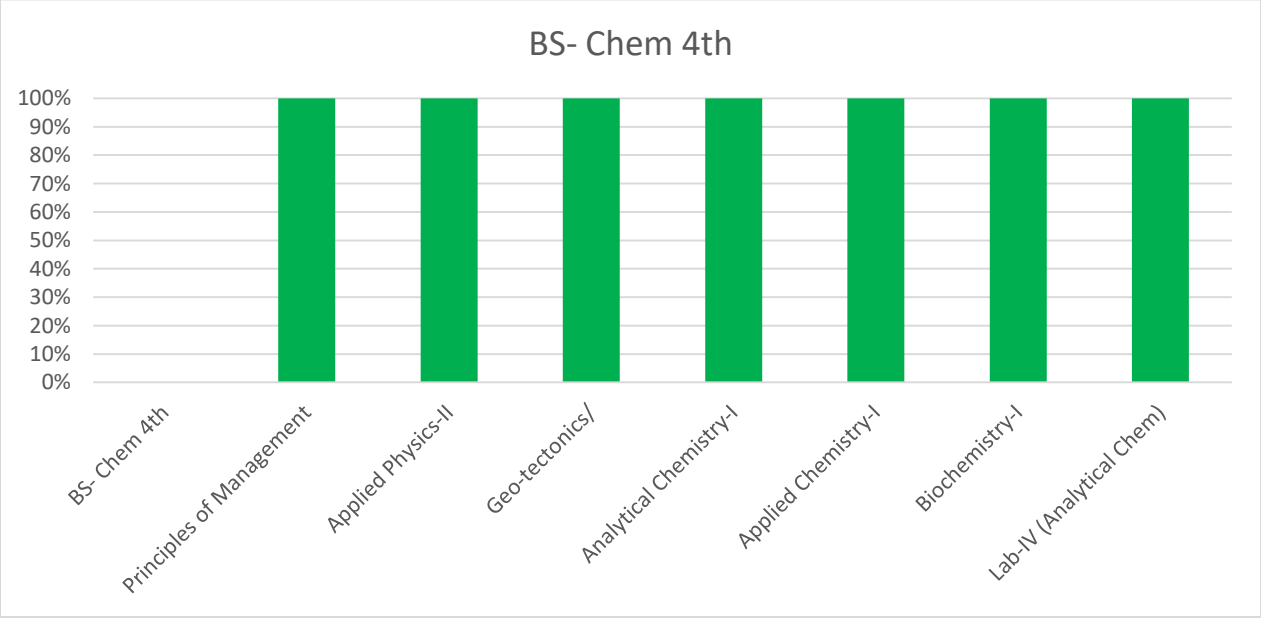


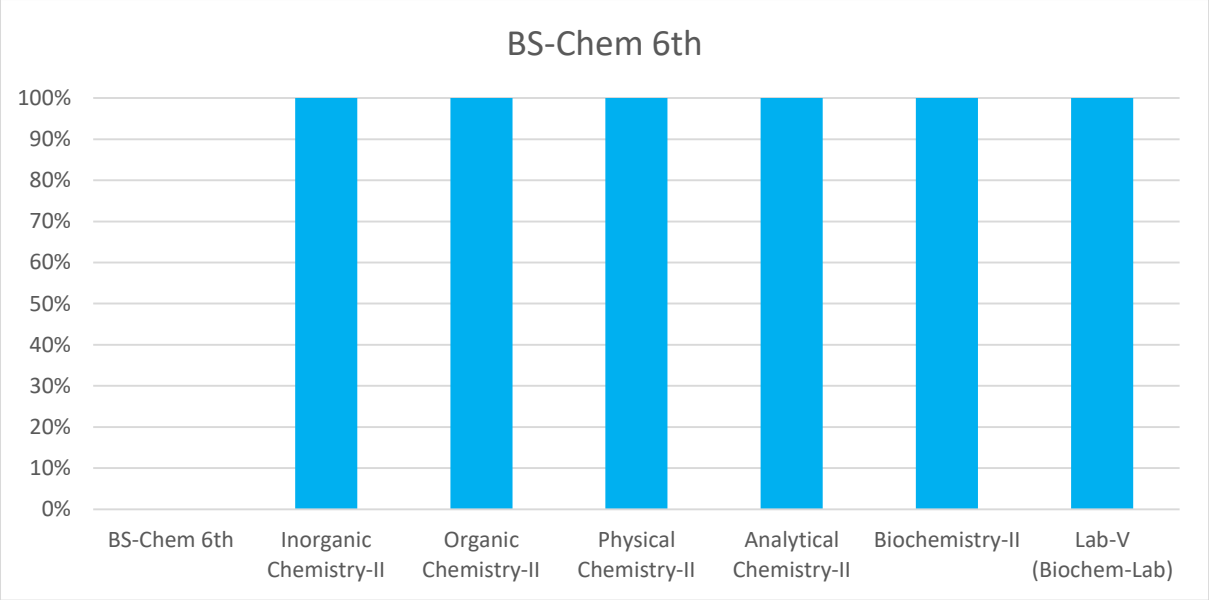


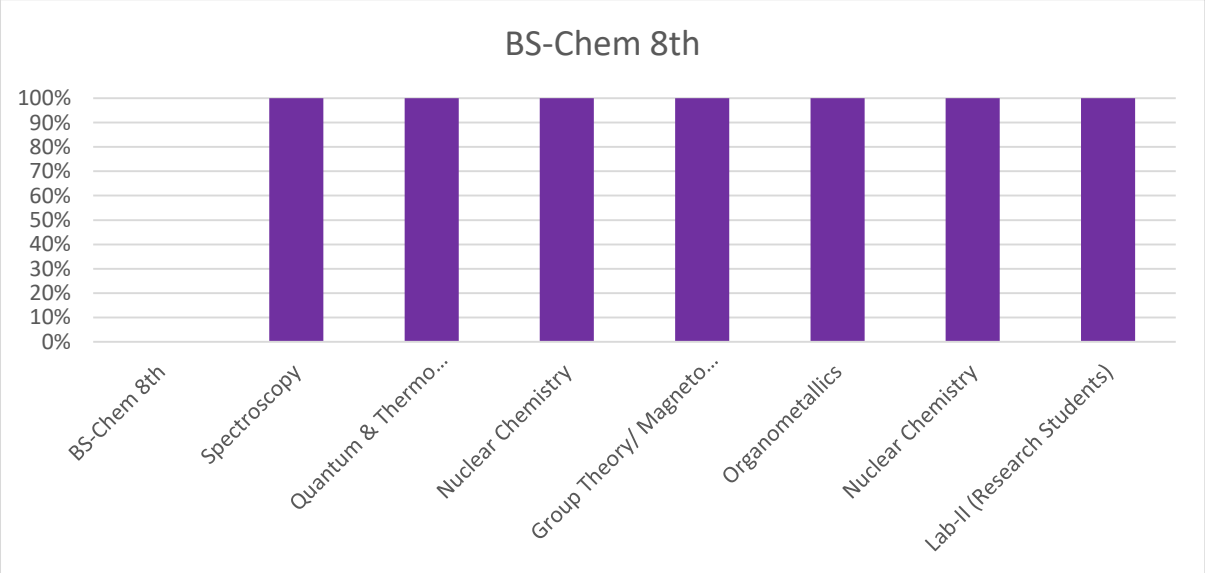
Annexure C

Course Evaluation Bar Chart






BS-Chem 6th
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
BS-Chem 6th
Inorganic Chemistry-II
Organic Chemistry-II
Physical Chemistry-II
Analytical Chemistry-II
Biochemistry-II
Lab-V (Biochem-Lab)


BS-Chem 8th
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
BS-Chem 8th
Spectroscopy
Quantum & Thermo...
Nuclear Chemistry
Group Theory/ Magneto...
Organometallics
Nuclear Chemistry
Lab-II (Research Students)

Annexure D

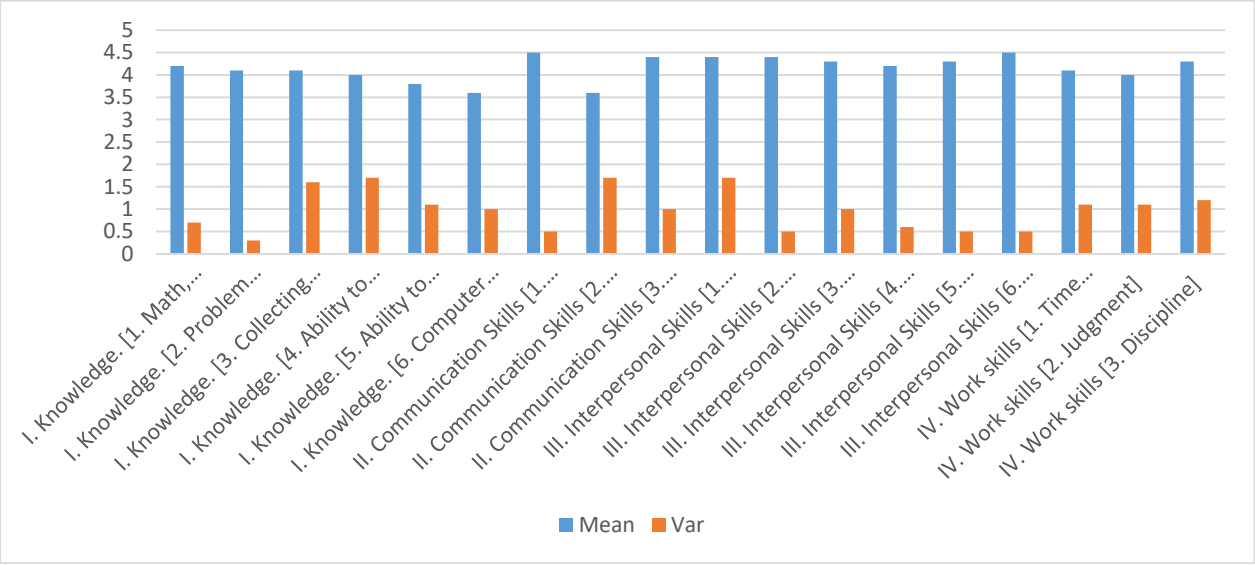
Teachers Survey

Employer Survey

Groups	N	Mean	Var
I. Knowledge. [1. Math, Science, Humanities and professional discipline, (if applicable)]	9	4.2	0.7
I. Knowledge. [2. Problem formulation and solving skills]	9	4.1	0.3
I. Knowledge. [3. Collecting and analyzing appropriate data]	9	4.1	1.6
I. Knowledge. [4. Ability to link theory to Practice]	9	4	1.7
I. Knowledge. [5. Ability to design a system component or process]	9	3.8	1.1
I. Knowledge. [6. Computer knowledge.]	9	3.6	1
II. Communication Skills [1. Oral communication]	9	4.5	0.5
II. Communication Skills [2. Report writing]	9	3.6	1.7
II. Communication Skills [3. Presentation skills]	9	4.4	1.0
III. Interpersonal Skills [1. Ability to work in teams]	9	4.4	1.7
III. Interpersonal Skills [2. Leadership]	9	4.4	0.5
III. Interpersonal Skills [3. Independent thinking]	9	4.3	1
III. Interpersonal Skills [4. Motivation]	9	4.2	0.6
III. Interpersonal Skills [5. Reliability]	9	4.3	0.5
III. Interpersonal Skills [6. Appreciation of ethical values]	9	4.5	0.5
IV. Work skills [1. Time management skills]	9	4.1	1.1
IV. Work skills [2. Judgment]	9	4.	1.1
IV. Work skills [3. Discipline]	9	4.3	1.2

Figure

Employer Survey



List of Subjects and Numbers

English-II (Composition Writing)	01
Pak Studies	02
Plant Systematic, Anatomy and Devolvement Embryology	03
Mathematics-II	04
Principles of Animal Life-II	05
Basic Organic Chemistry-I	06
Lab-II (Organic Chem)	07
Principles of Management	08
Applied Physics-II (Basic Thermodynamics and Quantum Mechanics)	09
Geo-tectonics/	10
Analytical Chemistry-I	11
Applied Chemistry-I	12
Biochemistry-I	13
Lab-IV (Analytical Chem)	14
Inorganic Chemistry-II	15
Organic Chemistry-II	16
Physical Chemistry-II	17
Analytical Chemistry-II	18
Biochemistry-II	19
Lab-V (Biochem-Lab)	20
English-II (Composition Writing)	21
Spectroscopy	22
Quantum & Thermo Chemistry	23

Nuclear Chemistry	24
Group Theory/ Magneto Chemistry	25
Organometallics	26
Nuclear Chemistry	27
Lab-II (Research Students)	28