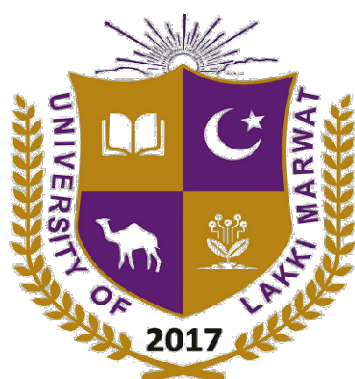


Course Structure

**Associate Degree/BS Chemistry
Department of Chemical Sciences,**



University of Lakki Marwat, Lakki Marwat, KP.

Two Year Associate Degree Program

University of Lakki Marwat

(Undergraduate Education Policy-2020 Higher Education Commission Pakistan)

		Name of Course	Credits	
A. General Education Courses	A1. Breadth courses			
	Arts and Humanities	Subject I of Arts and Humanities		03
		Subject II of Arts and Humanities		03
	Social Sciences	Subject I of Social Sciences		03
		Subject II of Social Sciences		03
	Natural Sciences	Subject I of Natural Sciences		03
		Subject II of Natural Sciences		03
	Total Sub-A1		Courses: 06	18
	A2. Functional Skills Courses			
	Expository Writing	English composition and comprehension (E-I)		03
		Communication and presentation skills (E-II)		03
		Technical report writing		03
	Quantitative Reasoning	Subject I		03
		Subject II		03
	Total Sub-A2		Courses 05	15
	A3. Civilization Courses			
	Islamic Studies/Ethics		03	
	Pakistan Studies		03	
Total Sub-A3		Courses: 02	06	
B. Disciplinary courses	Subject foundation and major subjects	Subject-I		03
		Subject-II		03
		Subject-III		03
		Subject-IV		03
		Subject-V		03
		Subject-VI		03
		Research Methods		03
	Total Sub-B		Courses: 07	21
Grand Total (A+B)			60	
C. Practical Learning (Non-credit courses)	C1. Internship: The student shall have to complete 9- weeks summer internship, or 360 hours work during their course			
	C2. Practical Learning Lab (PLL): AD students will be allowed to fulfill the PLL requirement by signing up for an extracurricular "lab" of 4 hours a week for 2 semesters , in one of the following three areas: entrepreneurship, youth clubs, or sports.			

	Name of Course		Credits
A. General Education Courses	A1. Breadth courses		
	Arts and Humanities	<ol style="list-style-type: none"> 1. Aesthetic Studies 2. Introduction to Philosophy 3. Language and Society 4. Urdu Language and Society 5. Islamic History 6. Islamic Morals 7. Creative Arts 8. History of Pakistan 9. Pashtun Language and Society 10. Chinese Language and society 11. Classical Poetry 12. Foundations of Literary Theory & Criticism 	Two subjects of 6 Credit Hours (3 C.Hs each) will be selected from the list
	Social Sciences	<ol style="list-style-type: none"> 1. CPEC Role in Planning & Development of Pakistan 2. Current Affairs 3. Principles of Psychology 4. Introduction to Political Science 5. International Trade 6. Principles of Management 7. Cultural History of Pakistan 8. Tourism Planning and Development 9. Western Political Philosophy 10. Introduction to Social Work 11. Pakistan Movement and Political History 12. Introduction to Economics 13. Introduction to International Relations 14. Environmental Psychology 15. Muslim Political Philosophy 16. Public International Law 17. Philosophical basis of Physical Education 18. Sports Biomechanics 19. Introduction to Sociology 20. Sociology of Health 21. Gender Studies 22. Introduction to Law and Human Rights 23. Constitutional Development in Pakistan 24. Introduction to Social Anthropology 25. Pakistan's Foreign Policy 26. General Methods of Teaching 27. Class Assessment and Management 	Two subjects of 6 Credit Hours (3 C.Hs each) will be selected from the list

	<ul style="list-style-type: none"> 28. Curriculum Development 29. Introduction to Mass Communication 30. Mass Media in Pakistan 31. Introduction to Social Media 32. International Communication and Reporting 33. Muslim Struggle for Pakistan (1857 – 1947) 34. Political History of Pakistan (1947-to date) 	
Natural Sciences	<ul style="list-style-type: none"> 1. Every day Science-I 2. Every day science-II 3. Introduction to Chemistry 4. Introduction to Geology 5. Geomorphology 6. Introduction to Biology 7. Introduction to Ecology 8. Introduction to Environmental Sciences 9. Introduction to Geography 10. Introduction to bio-chemistry 	Two subjects of 6 Credit Hours (3 C.Hs each) will be selected from the list
Total Sub-A1	Courses: 06	18
A2. Functional Skills Courses		
Expository Writing	<ul style="list-style-type: none"> 1. English composition and comprehension (Eng-I) 2. Communication and presentation skills (Eng-II) 3. Technical report writing (Eng-III) 	Three Courses of 9 C.Hs (3 Credit Hours each) will be included in Scheme of Studies by all Departments
Quantitative Reasoning	<ul style="list-style-type: none"> 1. Basic Mathematics 2. Introduction to Information & Communication Technology 3. Logic & Critical Reasoning 4. Statistics II 5. Introduction to Physics 6. Mathematics I 	Two subjects of 6 Credit Hours (3 C.Hs each) will be selected from the list
Total Sub-A2	Courses 05	15
A3. Civilizational Courses		
	<ul style="list-style-type: none"> Islamic Studies/Ethics Pakistan Studies 	Two subjects of 6 Credit Hours (3 C.Hs each) will be selected from the list
Total Sub-A3	Courses: 02	06

B. Disciplinary courses	Subject foundation and major subjects	Subject 1:	03
		Subject 2:	03
		Subject 3:	03
		Subject 4:	03
		Subject 5:	03
		Subject 6:	03
	Subject 7: Research Methods	03	
Total Sub-B	Courses: 07	21	
Grand Total (A+B)		60	

Semester I		
Course Code	Course Title	Cr. hr
EW-101	English-I	3
AH-101	Islamic Studies (CV-1)	3
NS-101	Everyday Science (NS-01)	3
NS-114	Fundamentals of Computer (NS-02)	3
QR-104	Introduction to statistics (QR-1)	3
SS-120	Introduction to Sociology	3
Total Credit Hrs		18
Semester II		
Course Code	Course Title	Cr. hr
AH-120	Constitutional Law	3
EW-102	English-II	3
SS-113	Introduction to Economics	3
QR-101	Basic Mathematics (QR-II)	3
CV-105	Islamic History & Culture	3
CHEM-161	Organic Chemistry (DS-I)	3+1
Total Credit Hrs		18+1

Semester III		
Course Code	Course Title	Cr. Hr
EW-103	English III	3
CHEM-131	Biochemistry-I (DS-II)	3+1
CV-102	Pakistan Studies (CV-II)	3
CHEM-171	Physical Chemistry (DS-III)	3+1
Total Credit Hrs		12+2

Semester IV		
Course Code	Course Title	Cr. Hr
CHEM-151	Inorganic Chemistry-I (DS-IV)	3+1
CHEM-111	Analytical Chemistry (DS-V)	3+1
CHEM-141:	Environmental Chemistry (DS-VI)	3+1

CHEM-107	Subject Specific: An advance Course or Research Methods (DS-VII)	3
Total Credit Hrs		12+3

ADA Program: Total Credit Hrs: 66

Department of Chemical Sciences: Approved Bridging Semester

Course Code	Course Name	Cr.hr	Total Marks
1	Biochemistry	3+1	
2	Organic Chemistry	3+1	
3	Physical Chemistry	3+1	
4	Analytical Chemistry	3+1	
5	Inorganic Chemistry	3+1	
6	Environmental Chemistry	3+1	
Total Credit hours		18+6	

ADA-BS Chemistry 1st Semester Breakup and Course Contents

First Year

Semester-I

S. N	Course Code	Course Title	Cr. Hrs
1	Ew-101	English – I	3(3 + 0)
2	AH-105	Islamic History	3(3 + 0)
3	NS-101	Everyday Science	3(3 + 0)
4	ICT-107	ICT	3(3 + 0)
5	SS-120	Sociology	3(3 + 0)
6	QR-104	Introduction to statistics	3(3 + 0)
Total			18(18 + 0)

Course Description:

The course is designed to help students take a deep approach in reading and writing academic texts which involve effective learning strategies and techniques aimed at improving the desired skills. The course consists of two major parts: the 'reading section' focuses on recognizing a topic sentence, skimming, scanning, use of cohesive devices, identifying facts and opinions, guess meanings of unfamiliar words. The 'writing section' deals with the knowledge and use of various grammatical components such as, parts of speech, tenses, voice, narration, modals etc. in practical contexts.

Course Contents**1. Reading Skills**

- Identifying Main Idea / Topic sentences
- Types of Reading Skills: skimming, scanning, extensive and intensive
- Active and Passive Reading
- Strategies for Improving Reading Skills
- Finding Specific and General Information Quickly
- Distinguishing Between Relevant and Irrelevant Information According to Purpose for Reading
- Recognizing and Interpreting Cohesive Devices
- Distinguishing Between Fact and Opinion
- Reading Comprehension

2. Writing Skills

- Sentence patterns and structures
- Phrase, clause
- Parts of Speech
- Tenses: meaning and use
- Modals
- Use of active and passive voice
- Reported Speech
- Writing good sentences
- Error Free writing
- Paragraph writing with topic sentence

Recommended Readings

- Howe, D. H, Kirkpatrick, T. A., & Kirkpatrick, D. L. (2004). *Oxford English for undergraduates*. Karachi: Oxford University Press.
- Eastwood, J. (2004). *English Practice Grammar* (New

edition with tests and answers). Karachi: Oxford University Press.

- Murphy, R. (2003). *Grammar in use*. Cambridge: Cambridge University Press.

AH-105: Islamic History (Compulsory) Credit Hours: 03

Objectives:

This course is aimed at:

- To provide basic information about Islamic History
- To provide basic information to the students about the life of the Holy Prophet Hazrat Muhammad (S.A.W).
- To inform the students about the administrative system of Caliphate Rashida period.
- To inform the students about the rule and administrative system of Umayyad period, Abbasids period and Muslims in Spain.
- To enhance understanding of the students regarding Islamic Culture and Civilization.
- To enhance skills of the students for understanding of issues related to faith and religious life.
- To communicate historical knowledge effectively and pursue higher studies in History and related fields.

Course Contents:

Part. 1 Life of the Holy Prophet Hazrat Muhammad (S.A.W)

1. Land and Geography of Arabia
2. Conditions of Arabia at the advent of Islam
3. Makki Life of the Holy Prophet (S.A.W)
Parentage, Birth and Early Childhood
Harb ul Fajjar, Half fu Fazool, Nikah and Re-Construction of Kaba
Baasat e Nabvi, Preeching of Islam and Hostility of Quraish
Emigration to Abyssinia 1st and 2nd, Aam ul Huzn, Pledge of Aqba 1st and 2nd
Hijrat e Madina
4. Madni Life of the Holy Prophet (S.A.W)
Causes, Events and Importance of Hijrat e Madina
Charter of Madina
Gazwat e Nabvi, Treaty of Hudaibiya and Conquest of Makkah
5. Last Sermon of the Holy Prophet (S.A.W)
6. Seerat tu Nabi (S.A.W)

Part. 2 Rashidun' Period

1. Hazrat Abu Bakr Sadiq (R. A)
2. Hazrat Umar Farooq (R. A)
3. Hazrat Usman (R. A)
4. Hazrat Ali (R. A)

5. Administration system and main Features of Rashidun Period

Part. 3 Umayyads' Period

1. Hazrat Amir Mu'awiya (R. A)
2. Yazed and Karbala incident
3. Hazrat Abdullah bin Zubair (R. A)
4. Marwan and Abdul Malik bin Marwan
5. Walid bin Abdul Malik and Sulaiman bin Abdul Malik
6. Hazrat Umar bin Abdul Aziz (R. A)
7. Later Rulers of Umayyad Dynasty
8. Administration under Umayyads and causes of their downfall

Part. 4 Abbasids' Period

1. As-Safah and Abu Jafr Al-Mansoor
2. Hadi, Mahdi, Haroon ur Rashid
3. Amin, Mamoon and Moatasim
4. Later Rulers of Abbasids' Dynasty
5. Administration under Abbasids and causes of their downfall
6. Crusades and Sultan Salah ud Din Ayubi
7. Muslims in Spain
8. Administration and Causes of the downfall of Muslims in Spain

Recommended Books:

- Islamic History (P-I and P-II). Published by KP Textbook Board Peshawar.
- Dr. Hameed du Din. "Tareekh e Islam".
- Mazar ul Haq. "History of the Arabs".
- Shah Moeen ud Din. "Tareekh e Islam".

- تاریخ الخلفاء (اردو ترجمہ) ----- عالمہ جلال الدین سیوطی
- خلفت اندلس ----- نواب ذوالؤدر جزیگ
- تاریخ اندلس ----- مولانا ریاست علی ندوی
- تاریخ اسلام ----- اکبر شاہ خان نجیب آبادی
- تاریخ الامم والملوک (اردو ترجمہ) ----- ابن جریر طبری

SS-120: Principles of Sociology

Credit Hours:

03

Course Contents

Fundamental of Sociology

Nature, Scope, and subject matter of Sociology
Brief historical development of Sociology
Society and community
Relationship with other social sciences like Economic, Political Science, History, Psychology, and Anthropology.
Social interaction processes (Cooperation, Competition, Conflict, Accommodation, Acculturation, and Assimilation).

Social Groups

Definition and Functions
Types of Social Groups (In and out group, Primary and Secondary groups, Reference groups. Formal and informal Groups and Pressure groups)

Social Institutions

Definition, Structure and Function of the following Institutions: Family, Religion, Education, Economics, Political Inter-relationship among various social institutions.

Cultural and Related Concepts

Definition and aspects of culture, Material and non-material culture, Ideal and real culture
Elements of culture, Beliefs, values, norms (folkways, mores, laws)
Organization of culture, Traits, complexes, and patterns
other related concepts, Cultural relativism, Sub-Culture and ethnocentrism

Socialization and Personality

Role and Status
Socialization
Culture and Personality

Deviance and Social Control

Definition and types of deviance
Formal and informal methods of social control

Social Stratification

Determinants of Social Stratification (Caste, Class, Ethnicity, Power, Prestige and Authority)
Social Mobility, Definition and types
Dynamics of social mobility

Social and Cultural Change

Definition of social change
Dynamics of social change (Education, Innovation, Industrialization, Urbanization and Diffusion)
Resistance to change

Suggested Readings:

- i. *Horton Paul B. and Hunt, Chester L (1990), Sociology Singapore: McGraw Hill Book Company.*
- ii. *Sociology I by Allama Iqbal Open University, Islamabad*

- iii. *Sociology 2 by Allama Iqbal Open University, Islamabad*
- iv. *Taga, Abdul Hameed (2000) An Introduction. New York: Harper and Rows*
- v. *Betrnad, Alvin L. (1969). Basic Sociology-An Introduction to Theory and Methods, New York; Appleton Century Crofts.*
- vi. *Curran, Jr.(1977).Introductory sociology: A basis Self Instructional Guide*
- vii. *Hafeez, Sabeeha (1990), The Changing Pakistan Society. Karachi: Royal Bookcompany, Zaibunisa Street, Sadar.*
- viii. *Horton Paul B. and Hunt, Chester I. (1990) Sociology singapore.Macgraw Hill BookCompany.*
- ix. *Merrii, F.E., (latest ed.), Sociology and Culture. N.J. Englewood Cliffs.*
- x. *Philips, Bernard (1990). Sociology-Form Concepts to Practice. New York: McGrawHill Book Company Inc.*
- xi. *Rao, C. Nshaukar (1990), Sociology, New Delhi: S.C Chand and Company Ltd.*

QR-104: Introduction to Statistics Credit Hours:3

Course Objectives

- The course will impart knowledge and understanding of Statistics. To provide knowledge about the importance and use of statistics in lifesciences.
- To familiar students with the methods of data analysis pertaining to their research work and to assess the significance of their experimental designs.

Course Outcomes:

Students who successfully complete this course will be able to:

- **DESCRIBE** the roles Statistics serves in their subject and research.
- **APPLY** numerical, tabular, and graphical descriptive techniques commonly used to characterize and summarize data.
- **EXPLAIN** general principles of study design and its implications for valid inference.
- **ASSESS** data sources and data quality for selecting appropriate data for specific research questions.
- **TRANSLATE** research objectives into clear, testable statistical hypotheses.
- **DESCRIBE** basic principles and the practical importance of key concepts.

Recommended Books

1. "Statistical Theory Part-I and Part-II By Sher Mohammad Chaudary, Carwan Publisher.
2. Statistics 4th Edition, "Schaum's Outline Series, McGRAW-HILL
3. Basic Concepts and Methodology for the Health Sciences By Wayne W. Daniel
4. Wayne W. D., (2005). Biostatistics: A foundation for Analysis in the health sciences. Wiley series in Probability and Statistics

5. Earl K. Bowem& Martin starr: Basic Statistics for Business and Economics.

WEEK WISE BREAKDOWN

Week	Description
1	A) Basic of Statistics: <ul style="list-style-type: none"> • Introduction to Statistics • Scope and importance of statistics • Meaning of Statistics according to the subject. • Branches of Statistics
2	<ul style="list-style-type: none"> • Population and sample, Parameter and Statistic • Variable and Constant • Discrete and continuous variable • Data and its types (Qualitative and Quantitative)
3	<ul style="list-style-type: none"> • Scales of measurements (Nominal, Ordinal, Interval and Ratio) • Diagrams and graphs • Simple and Multiple bar chart • Histogram, Pie chart
4	B) Frequency distribution (FD) <ul style="list-style-type: none"> • Definition of frequency distribution • Steps in construction of frequency distribution
5	C) Measures of Central Tendency <ul style="list-style-type: none"> • Arithmetic mean • Real life examples for group and ungroup data
6	<ul style="list-style-type: none"> • The Median • Uses of Median • Applications of Median for simple and frequency data
7	<ul style="list-style-type: none"> • The Mode • Uses of Mode • Applications of Mode for simple and frequency data
8	D) Measures of Dispersion <ul style="list-style-type: none"> • Definition and types of dispersion • Range, grouped and ungrouped data Coefficient of range • Standard deviation, variance and Co-efficient of variance
Two Assignments + Test	
Mid Term Exam	

9	E) Probability <ul style="list-style-type: none"> • Definition of probability • Objective and Subjective probability. • Experiment and random experiment, sample space and sample point,
10	<ul style="list-style-type: none"> • Event, simple and composite events. • Mutually exclusive and independent events Calculation of probability relative to dice, coins and balls.
11	F) Sampling <ul style="list-style-type: none"> • Sampling and sampling distribution • Probability and non-probability sampling
12	G) Estimation <ul style="list-style-type: none"> • Definition of Estimation • Estimator and Estimate • Definition of Point and Interval Estimation
13	H) Hypothesis Testing <ul style="list-style-type: none"> • Hypothesis , Statistical Hypothesis and Testing of Hypothesis • Simple and Composite hypothesis • Steps of hypothesis testing
14	<ul style="list-style-type: none"> • Definition of Student t-test • Properties of t-test • Real life examples of t-test for single population mean
15	I) Regression and Correlation <ul style="list-style-type: none"> • Definition of Regression • Estimated regression line • Solution of Real life Problems for simple regression
16	Correlation <ul style="list-style-type: none"> • Definition of Correlation • Pearson correlation co-efficient • Solution of Real life Problems
Two Assignments + Two Test+ Presentation	
Final Term	

NS- 101: EVERYDAY SCIENCE

Credit Hours: 03

Course outline:

Introduction, History of Science, Achievements of some giants of Science in

Chronological order, Islamic Science, Contribution of Muslim Scientists, Famous muslim scientist, Nature of science, Scientific method, impact of science on society. Introduction, The origin, The Big Bang, The structure, the galaxies, solar system, The sun, the moon, the earth, structure of the earth, earth atmospheres, the greenhouse effect, global warming, ozone depletion, acid rain, satellite, earthquake, eclipses, the mystery of Stonehenge, day-night and seasons, volcanoes, minerals, glossary of cosmology Introduction and sources of energy, Fossil Fuels, Major oil producing countries, Global search of Crude oil, Petroleum products, natural gas, hydel power or hydro-electric power, solar energy, nuclear energy, the nuclear reactor, heavy water, nuclear safety, nuclear fusion, energy conversion, radiation and living things, Ceramics, Semi-conductors, Communications systems, Laser, Telescope, Camera, Fertilizers, Nanotechnology, Plastics, Computer, Brain, Heart, Tissues, Epithelial Cell, Origin of Modern Humans, Pest Control, Protein, Vertebrate, Invertebrate, Liver, Enzymes, Organisms (Common to all living things), Blood Group system. Plants, Seed, Flower, Gene, Evolution Laws, Nucleic Acid (DNA and RNA), **Diseases and Threats to Living organism:**

Swine flow, Hepatitis, Dengue fever, Corona virus, SARS (Severe acute respiratory syndrome virus), Plants and Crop Diseases (Rust, Smut, Late Blight, Canker).

Recommended Books:

1. Exploring physical science 1977 by walter A. Thurber
2. Exploring Life science 1975 by walter A. Thurber
3. Encyclopedic Manual of everyday science, Author, Dr. Rabnawaz Samo Publisher; Maktab eFaridi.

ICT-107: Information and Communication Technologies Credit Hours:3

COURSE OBJECTIVES:

Students successfully completing this course should be able to:

- Develop a vocabulary of key terms related to the computer and to software programs.
- Identify the components of a personal computer system.
- Demonstrate mouse and keyboard functions.
- Demonstrate window and menu commands and how they are used.
- Demonstrate how to organize files and documents on a USB/hard drive.
- Send email messages and navigate and search through the internet.

Week	Topics
1.	Data and Information, Information Processing Cycle
2.	Introduction to Computer, Components of a Computer, Advantages and Disadvantages of Using Computers.
3.	Categories of Computers, Computer Applications in Society.

4.	Input Devices: Types of Input, Input for Smart Phones, Game Controllers, Digital Cameras, Voice Input, Video Input, Scanners and Reading Devices, Biometric Input,
5.	Output Devices: Terminals. Display Devices, LCD Monitors and LCD Screens, Plasma Monitors, CRT Monitors,
6.	Printers, Nonimpact Printers, Impact Printers, Speakers, Headphones, Data Projectors. Interactive Whiteboards
7.	Storage Devices: Hard disks, Flash Memory Storage, Solid State Drives, Memory Cards, USB Flash Drives, Cloud Storage, Optical Discs, Blue-Ray Discs, Magnetic Tapes, Magnetic Stripe Cards and Smart Cards, Microfilm and Microfiche, Enterprise Storage.
8.	Programming Languages
9.	Mid Term Exam
10.	CPU: Processor, Control Unit, Arithmetic Logic Unit, Machine Cycle.
11.	Memory: Data Representation, Memory Sizes, Types of Memory, RAM, Cache, ROM, Flash Memory, Primary and Secondary Memory
12.	Software: System Software, Operating Systems, Utility Programs. Application Software, Business Software, Graphics and Multimedia Software, Software for Home, Personal, and Educational Use, Web Applications
13.	Data Communication
14.	Internet, World Wide Web,
15.	Networks, Internet and Searching Techniques, E-Learning, Freelancing
16.	Enterprise Computing, Computer Security Risks, Viruses
17.	Introduction to MS Word, MS Excel, MS PowerPoint
18.	Terminal Examination

Semester-II			
S. N	Course Code	Course Title	Cr. Hrs
1	QR-101	Basic Mathematics	3(3 + 0)
2	SS-113	Introduction Economics	3(3 + 0)
3	Chem-161	Organic Chemistry	3(3 + 1)
4	CIV-110	Islamiyat history	3(3 + 0)
5	AH-120	Constitutional Law	3(3 + 0)
6	ENG-121	English-II (Communication Skills)	3(3 + 0)
		Total	18(18 + 1)

Course Title: ORGANIC CHEMISTRY

Code: CHEM-161

Credit Hours: 3+1

Course Objectives:

Students will acquire knowledge about basic concepts of organic chemistry, chemistry of hydrocarbons and functional groups and the mechanism of organic reactions. Such information will be useful for qualitative analysis and synthesis of organic compounds.

Course Content:

Basic Concepts of Organic Chemistry:

Bonding and hybridization, localized and delocalized bonding, structurearomaticity, inductive effect, dipole moment, resonance and its rules, hyperconjugation, classification and nomenclature of organic compounds including IUPAC system, types of organic reactions (an overview).

Chemistry of Hydrocarbons:

Saturated, unsaturated and aromatic hydrocarbons with emphasis on synthesis and free radical, electrophilic addition and electrophilic substitution reactions.

Chemistry of Functional Groups:

Hydroxyl, ether and amino groups, preparation and properties of alcohols, phenols, ethers, and amines with focus on reaction mechanism and applications, carbonyl compounds, preparations and reaction mechanism of aldehydes and ketones and their applications, carboxylic acids and their derivatives, acidity of carboxylic acids and effect of substituents on their acidity, preparation and reactions of carboxylic acids and their derivatives including esters, amides, acid halides and acid anhydrides.

CHEM-161 Lab.

Qualitative analysis of compounds with different functional groups, synthesis of organic compounds using as a tool for understanding techniques like reflux, distillation, filtration, recrystallization and yield calculation, organic syntheses may include preparation of benzanilide from benzoyl chloride, succinic anhydride from succinic acid, phthalimide from phthalic anhydride, oximes and hydrazones from carbonyl compounds, and an ester from a carboxylic acid and alcohol etc.

Recommended Books:

1. Brown, W. and Poon, T., *Introduction to Organic Chemistry*, 3rd ed., John-Wiley & Sons, Inc., (2005).
2. John, E. M. *Organic Chemistry*, 8th ed., Brooks/Cole Publishing Co, USA, (2012).
3. Robert, T. M. and Robert, N. B., *Organic Chemistry*, 6th ed., Prentice Hall, New Jersey, (1992).
4. Younus, M., *A Textbook of Organic Chemistry*, Ilmi Kitab Khana, Urdu Bazar, Lahore, Pakistan, (2006).
5. Sykes, P., *A Guide Book to Mechanism in Organic Chemistry*, 6th ed., Pearson Education Limited, England, (1986).
6. Solomons, T. W. G. and Fryhle, C. B., *Organic Chemistry*, 10th ed., John-Wiley & Sons, Inc., (2011).
7. Furniss, B. S., Hannaford, A. J., Smith, P. W. G., Tatchell, A. R., *Vogel's Textbook of Practical Organic Chemistry*, 5th ed., Longman, UK, (1989).
8. Pavia, D. L., Kriz, G. S., Lampman, G. M. and Engel, R. G., *A Microscale Approach to Organic Laboratory Techniques*, 5th ed., Brooks/ Cole Cengage Learning, (2013).
9. Mayo, D. W., Pike, R. M. and Forbes, D. C., *Microscale Organic to*

Laboratory with Multistep and Multisacle Syntheses, 5th ed., John-Wiley & Sons, Inc., (2011).

10. Gilbert, J. C. and Martin, S. F., *Experimental Organic Chemistry: A Miniscale and Microscale Approach*, 5th ed., Brooks/ Cole Cengage Learning, (2010).

11. Brown, W. H., Fotte, C. S., Iverson, B. L. and Anslyn, E. V., *Organic Chemistry*, 6th ed., Brooks/ Cole Cengage Learning, (2012).

QR-101: Basic Mathematics

Credit

Hours: 3

1. Numbers systems

1.1.Real

Numbers

1.2.Compl

ex

numbers

- The integers
- Rules for addition
- Rules for multiplication
- Even and odd integers; divisibility.
- Rational numbers
- Multiplicative inverses
- Addition and multiplication.
- Real numbers: positivity.
- Powers and roots
- Inequalities
- The complex plane
- Polar form

Linear and Quadratic Equations

- Equations in two unknowns
 - Equations in three unknowns
 - Quadratic Equations

Functions

- Definition of a function
- Polynomial functions.
- Graphs of functions
- Exponential function.

Determinants Matrices

- Determinants of order
- Properties of 2 X 2 determinants

- Determinants of order 3
- Properties of 3 X 3 determinants

Differentiation—Fundamentals

- Derivatives by Definitions
- Power Rule
- Properties of Derivatives
- Product and Division Rules

Integration—Fundamentals

- Basic Integrations
- Product Rule

GEOMETRY

- Distance and Angles
- The Pythagoras theorem.

Area and Applications

- Area of a disc of radius r
- Circumference of a circle of radius r

Coordinates and Geometry

- Coordinate systems
- Distance between points.
- Equation of a circle

Segments, Rays, and Lines

Segments

Rays

Lines

Ordinary equation for a line

Trigonometry

Radian measure

Sine and cosine.

The graphs.

The tangent

Reference Book

SERGE LANG, ADDISON -WESLEY PUBLISHING COMPANY Reading, Massachusetts, Menlo Park, California • London Don Mills, Ontario

SS-113: Introduction Economics

Credit Hours:3

Course Objectives

- This course discusses the basic principles of micro and macroeconomics. This

course provides the student with a solid grounding in economic principles and familiarize him or her with the institutions and policies that influence economic activity. For those who elect to major in economics, these courses provide the base upon which subsequent courses will build.

- First Introduction to microeconomics studies the economy from the perspective of individual consumers and producers who interact in a market setting. It shows how their choices influence the production and distribution of goods and services and considers the criteria that can be used to assess these outcomes. The course also studies how government intervention can affect the behavior of consumers, producers, and workers and alter market out-comes.
- Second Macroeconomics describes the overall behavior of the economy. In macroeconomics the basic principles of macroeconomics and basic concepts of national income accounting i-e GDP, GNP, NNP, PI, DPI, GDP Deflator etc.
- This also highlights the concepts of money, functions of money, inflation, CPI, impact ofinflation on economy and the role of government in an economy

Grading Criteria

Distribution	Weight
Quizzes, Assignments, and class participation	10
Mid Term	20
Final Term	70
Total	100

Recommended Books

- Fundamentals of Economics Part 1 for Intermediate Classes By Habib Ullah Vaseer, edition2015-2016, Farhan Publishers
- Samuelson and Nordhaus: Economics 19th edition
- Welcome to Economics (McConnell) AP Edition, 19th Edition
- Economic Theory. Vol 2,(2000) by Hussain Ch. M. The carvan press; (Lahore)
- Walter Nicholson: Micro Economics Theories: Basic Principles and Extensions, 10th Edition.
- Mankiw, G–Principles of Economics- latest edition.
- Samulson and Nordrons - Economics –latest edition

CIV-110: Constitutional Law

Credit Hours:3

Course Contents:

The following concepts shall be covered with special reference to the constitutions of United Kingdom and United States of America:

This course shall cover the nature, sources and fundamental principles of the United

Kingdom and the United States Constitutions. The course will examine the remarkable unwritten constitution of the UK, the Separation of Powers, Rule of Law, Parliamentary Supremacy and the Independence of Judiciary under the British constitutional conventions. The course apart from other aspects will cover the concepts of federalism, separation of powers, the functions of the Congress and the legislative procedure, the election of the President and the judicial review under the US Constitution. To understand these concepts with reference to the UK and US constitutions, the following contents order shall be followed:

1. British Political System

- a. Nature of the Constitution
- b. Nature of the Conventions in British Constitution
- c. The Institution of Monarchy: Role, Power & Functions and Importance.
- d. The British Legislature: The Structure and Powers & Functions of the British Parliament, the Concept of Parliament Supremacy & Ministerial Responsibility.
- e. The British Executive; Cabinet and the Prime Minister.
- f. The Law-Making Process and Rule of Law
- g. Committee System in UK
- h. British Judicial System

2. US Political System

- a. Nature of the Constitution
- b. Nature of the US Federation
- c. The Theory of Separation of Powers and Check and Balance
- d. The American Legislature: Structure and Powers & Functions of US Congress.
- e. The US Executive: Election, Role and Powers & Functions of the US President
- f. Committee System in US
- g. The US Supreme Court: Structure and Powers & Functions
- h. Judicial Review

Suggested Readings

1. Modern Constitutions by Mazhar Ul Haq, 2017
2. America's Constitution by Akhil Reed Amar, 2005
3. World Constitutions by S.L Kelly
4. British Politics by F. N Forman and N. D.J Baldwin, 1991.
5. American Government: Institutions and Politics, 3rd edition by G.Q. Wilson,
6. Parliamentary Government in England by Harold J. Laski, 1960.
7. Political Institutions in Europe by J. M. Colomer, 1996.
8. Major Foreign Powers, New York: Harcourt, Brace & World, INC, 1967.
9. Comparative Constitutional Law by Hamid Khan & M.W. Rana
10. Introduction to the Study of the Law of the Constitution by Dicey
11. Elgar Encyclopedia of Comparative Law by J.M. Smits.

The course focuses on the basic strategies of composition and writing skills. Good writing skills not only help students obtain good grades but also optimize their chances to excel in professional life. The course includes modes of collecting information and arranging it in appropriate manner such as chronological order, cause and effect, compare and contrast, general to specific etc. It enables the students to write, edit, rewrite, redraft and proofread their own document for writing effective compositions. Because of the use of a significant amount of written communication on daily basis, sharp writing skills have always been valued highly in academic as well as professional spheres.

Course Contents:

Writing Process

- Invention
 - ❖ Generating Ideas (collecting information in various forms such as mind maps, tables, lists, charts etc)
 - ❖ Identifying Audience, Purpose, and Message

Ordering Information

- ❖ Chronology for a narrative
 - ❖ Stages of a process
 - ❖ From general to specific and vice versa
 - ❖ From most important to least important
 - ❖ Advantages and disadvantages
 - ❖ Comparison and contrast
 - ❖ Problem solution pattern
-
- Drafting
 - ❖ Free Writing
 - ❖ Revising
 - ❖ Editing
1. Paraphrasing
 2. Cohesion and Coherence
 - Cohesive Devices
 - Paragraph unity
 3. Summary and Precis Writing
 4. Creative Writing
 5. Essay Writing
 - ❖ developing a thesis
 - ❖ organizing an essay
 - ❖ writing effective introduction and conclusion
 - ❖ different types of essays
 - ❖ use of various rhetorical modes including exposition, argumentation and analysis

Recommended Books:

- Goatly, A. (2000). *Critical Reading and Writing: An Introductory Course*. London: Taylor & Francis
- Hacker, D. (1992). *A Writer's Reference*. 2nd ed. Boston: St. Martin's
- Hamp-Lyons, L. & Heasley, B. (1987). *Study writing: A course in written English for academic and professional purposes*. Cambridge: Cambridge University Press.
- Howe, D. H, Kirkpatrick, T. A., & Kirkpatrick, D. L. (2004). *Oxford English for Undergraduates*. Karachi: Oxford University Press.

Objectives

This course is aimed:

- ❖ To provide basic information about fundamental beliefs and Pillars of Islam
- ❖ To enhance understanding of the students regarding Quran and Sunnah
- ❖ To inform the students about the practical life of Prophet Muhammad (SAW)
- ❖ To provide the students with the sufficient knowledge about economic, social and cultural systems of Islam
- ❖ To boost up the balanced, enlightened and broad minded information of Islam in students
- ❖ To enable the students for adopting Islamic ethics and moral values
- ❖ To enable the students to live peacefully in a pluralistic and diversified society
- ❖ To promote the feelings of human sympathy in students without the condition of race or religion

Course Contents**1. Study of Fundamental Religious Beliefs & Practices****Islamic Beliefs:**

- i. Importance of Beliefs in personality building (general discussion)
- ii. Study of the Islamic Beliefs: (Beliefs in Almighty Allah, Angels, Revealed Books, Prophet hood as well as Finality of Prophet hood, Destiny, Day of Judgment (Resurrection), desired effects of Islamic beliefs on Individual and Society)

Practices (Ibadaat) of Islam

Philosophical Study of *Ibadaat*:

- i. Definition and Scope of *Ibadah*
- ii. Physical Submissions i.e. prayer and fasting : its rationale and its desired effects on Individual and society
- iii. Financial Submissions i.e. Zakat and alms giving: its rationale and its desired effects on Individual and society

- iv. Collective Submissions [Physical cum Financial] i.e. performing Hajj and Umarh: its rationale and its desired effects on Individual and society
- v. Scope of chain of various *Ibadah*

2. Study of Basic Sources of Religion

Study of Quran:

- i. Sources of Knowledge
- ii. Need for Revelation
- iii. Division of Surahs in Makki and Madani Titles
- iv. Brief introduction of various kinds of Ayaat (verses) i.e. Ayaat ul Ahkaam, Ayaat Anfusi, Ayaat Kawnia.
- v. Special focus on the behavior of Qura'n with other divine books and prophets in the lights of Qura'nic texts
- vi. Textual & Thematic Study of Holy Quran:
 - a. Surah Hujarat (Complete) with special focus on ethics and morality
 - b. Surah Israa verses 23-40 with special focus on ethics and morality

Study of Sunnah:

- i. Meaning of Hadith & Sunnah and its kinds (Qawli, Feli, Taqreeri)
- ii. Need, Importance of Hadith and its authority
- iii. Important Books of Hadith (*Sihah Sitta* and *Kutub-e-Arbah*)
- iv. Textual & Thematic Study of Hadith: Study of 20 Selected Hadiths (attached as Annex-1)

Brief Study of Biography of Prophet Muhammad (SAW)

Year wise Summary of Prophet's Life

Lessons learnt from life at Makkah

Lessons learnt from His life at Madinah with special reference to pact of Madina and Hudaibiyyah

Hijrat (Migration): its philosophy in general, causes and results

Jihad: Definition, Philosophy, justification (with special reference to *Badr, Uhad*

and *Khandaq*)

Study of Islam in Multi-dimensional Aspects

Cultural and Social System of Islam: Introduction of Society and Culture, Salient features of Islamic culture and Society

Economic System of Islam: Basic concepts of Islamic economic system, Means of distribution of wealth in Islam

Political System of Islam: Basic concepts of Islamic political system, Qualities of Islamic political System

Pluralism, Diversity and Islam

Introduction of Pluralism and diversity, with special reference to diversity in Universe

Diversity in humans (personalities, gender, interests, hobbies, languages etc.)

Religious diversity, with special focus on various religions and sects

Human Rights and Islam

Concept and significance

Human Rights in Islam
 Human Rights in the constitution of Pakistan
 Human Rights in UNO Charter

Peace Education and Conflict Resolution

Peace: Concept, its significance in personal, domestic, social, national and International level
 Religious instructions regarding peace in various dimensions of life
 Conflict: Reasons and Stages of conflict, Reconciliation
 Role of Communication in Peace building: Concept of Communication, Effective Communication, Rehabilitation of peace through communication
 The role of inter and intra faith dialogue in maintaining peace as well as religious Harmony on national and international level

Recommended Books

1. Hamidullah, Dr. (2000), *Introduction to Islam*, Dawah Academy, Islamabad
2. Khan, Rafique Ali(2001), *Freedom of Thought in Islam*, Royal Book Company, Karachi
3. Ali, Syed Amir (2009), *The Spirit of Islam*, Islamic Book Service, Lahore
4. Hamidullah, Dr. (2005), *Muhammad Rasulullah: A concise survey of the life and work of the founder of Islam*, Dawah Academy, Islamabad
5. Hamidullah, Dr. (2000), *Islamic Notion of conflict of Laws*, Dawah Academy, Islamabad
6. UNO Charter of International Human Rights of 1948

Semester III		Cr. hr
	English III	3
	Pakistan Studies (CV-II)	3
	Physical Chemistry (DS-III)	3+1
	Biochemistry-I (DS-II)	3+1
Total Credit Hrs		12+2

ENG-231: English III: Communication and Presentation Skills

Credit Hours: 3

Description:

For professional growth and future development, effective presentation skills and interactive and interpersonal communicative

skills are very important. This course offers methods, techniques, and drills significant and useful in optimising communication and presentation skills of the learners, enabling them to face divergent groups of audience with poise and confidence. The course has been divided into modules relating to the essentials, contents, gestures, technology, and variety associated with communication and presentations skills. The presentation skills part focuses on preparing students for long-life skill of preparing and giving presentations. Communication is a vital part of our daily routine. The communication skills part focuses on developing good communication skills among students.

Course Contents

1. Introduction
 - Components of Communication
 - Types of Communication
 - Understanding the purpose of Communication
 - Analyze the Audience
 - Communicating with words as well as with body language
 - Writing with a Purpose
 - Barriers to Communication
2. Presentation skills
3. Delivering your presentation
4. Speaking with Confidence
5. Communicating Effectively
6. Job Interviews and Communicating Skills
7. Communicating with Customers
8. Communication in a Team

Recommended Readings:

1. Carnegie, Dale. (). *How to Win Friends & Influence People*.
2. Giblin, Les. *Skill with People*.
3. Newton, Paul. *How to communicate effectively*.

Pakistan Studies

Credit Hours:3

Course Contents:

Introduction/Objectives:

To develop vision of historical perspective, government, politics,

Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

Course Outline

a. Historical Perspective

Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah.

b. Factors leading to Muslim separatism

c. People and Land

i. Indus Civilization

ii. Muslim advent

iii. Location and geo-physical features.

1. Government and Politics in Pakistan

Political and constitutional phases:

a. 1947-58

b. 1958-71

c. 1971-77

d. 1977-88

e. 1988-99

f. 1999 onward

3. Contemporary Pakistan

a. Economic institutions and issues

b. Society and social structure

c. Ethnicity

d. Foreign policy of Pakistan and challenges

e. Futuristic outlook of Pakistan

Recommended Books:

1. Afzal, M. Rafique. Political Parties in Pakistan, Vol. I, II & III. Islamabad: National Institute of Historical and Cultural Research, 1998
2. Akbar, S. Zaidi. Issue in Pakistan's Economy. Karachi: Oxford University Press, 2000.
3. Amin, Tahir. Ethno - National Movement in Pakistan, Islamabad: Institute of Policy Studies, Islamabad.
4. Aziz, K.K. Party, Politics in Pakistan, Islamabad: National Commission on Historical and Cultural Research, 1976.
5. Burki, Shahid Javed. State & Society in Pakistan, the Macmillan Press Ltd 1980.
6. Haq, Noor ul. Making of Pakistan: The Military Perspective. Islamabad: National Commission on Historical and Cultural Research, 1993.
7. Mehmood, Safdar. Pakistan Kayyun Toota, Lahore: Idara-e- Saqafat-e-Islamia, Club Road, nd.
8. Mehmood, Safdar. Pakistan Political Roots & Development. Lahore, 1994.
9. Muhammad Waseem, Pakistan Under Martial Law, Lahore: Vanguard, 1987.

10. S.M. Burke and Lawrence Ziring. Pakistan's Foreign policy: An Historical analysis. Karachi: Oxford University Press, 1993.
11. Sayeed, Khalid Bin. The Political System of Pakistan. Boston: Houghton Mifflin, 1967.
12. Wilcox, Wayne. The Emergence of Bangladesh., Washington: American Enterprise, Institute of Public Policy Research, 1972.
13. Zahid, Ansar. History & Culture of Sindh. Karachi: Royal Book Company, 1980.
14. Ziring, Lawrence. Enigma of Political Development. Kent England: Wm Dawson & sons Ltd, 1980.

Course Title: BIOCHEMISTRY

Code: CHEM-131

Credit Hours: 2+1

Course Objectives:

Students will gain knowledge about fundamental concepts of biochemistry as well as be able to learn about the structures, properties and functions of amino acids, proteins, carbohydrates, lipids and nucleic acids.

Introduction to Biochemistry:

Brief introduction to the scope and history of Biochemistry, molecular logic of the living organism, cell structures and their functions, origin and nature of biomolecules.

Acid–Base and Electrolyte Chemistry:

Intracellular and extracellular electrolytes, body fluids as electrolyte solutions, pH, Henderson-Hasselbalch equation and buffers, amino acids, peptides and proteins, buffer capacity, buffers of body fluids, haemoglobin as an acid-base system, renal control of acid-base, balance, acid-base disorders: acidosis, alkalosis. haemoglobin and omeostasis, variation of Na⁺, K⁺, Cl⁻ in acid-base disturbances.

Carbohydrates, Lipids and Proteins:

Definition and classification, chemistry, physical and chemical properties of various classes of carbohydrates, biological functions of starch, glycogen, cellulose, and cell wall polysaccharides, acid mucopolysaccharides and proteoglycans.

Definition and classification of lipids, chemistry and biological importance of fatty acids, waxes, glycerides, phospholipids, sphingolipids, glycolipids, sterols and prostaglandins.

Significance of lipids in biological membranes and transport mechanism.

Chemistry and classification of amino acids, physical and chemical properties of amino acids, biological significance of amino acids, peptides, proteins, their classification, properties and biological significance, primary, secondary tertiary and quaternary structure of proteins, denaturation of proteins.

Nucleic Acids:

Chemical composition of nucleic acids, structure and biological significance of nucleic acids, chemical synthesis of oligonucleotides, nucleic acids hydrolysis, isolation and separation of nucleic acids, introduction to recombinant DNA

technology.

Biochemistry -Lab.

Qualitative and quantitative analysis of carbohydrates, lipids and proteins.

Laboratory work illustrating topics covered in the lecture of Chem.131,

Determination of pH, Preparation of buffers.

Enzyme catalysis, Progress curve for enzyme catalyzed reactions,

Determination of values. To study the effect of different factors on the rate of enzyme catalyzed reactions.

Recommended Books:

1. R. C. Alkire, D. M. Kolb, J. Lipkowski, *Biselectro chemistry, volume 13*, 13th ed., Publisher: Wiley-VCH Verlag GmbH & Co. ISSN: 0938-5193.

2. Nelson, D.L., *Lehninger's Principles of Biochemistry*, 6th ed., Publisher: Macmillan Higher Education, (2008). ISBN: 149222638, 978142922631.

3. Voet, D. and Voet, J.D., *Biochemistry*, 4th ed., illustrated. Publisher: John-Wiley & Sons Canada, Limited, (2011). ISBN: 0470917458, 9780470917459.

4. Murray, R.M. and Harper, H.A., *Harper's Biochemistry*, 25th ed., Publisher: Appleton & Lange, (2000). ISBN: 0838536840, 9780838536841.

5. Zubay, G. L., *Biochemistry*, 4th ed., illustrated, Publisher W. M. C. Brown Publishers, (1998), Digitized (2008). ISBN: 0697219003, 9780697219008.

6. Guyton, A. C. & Hall, J. E., *Guyton & Hall Textbook of Medical Physiology*, 12th ed., Publishers: Saunders Elsevier, (2011). ISBN: 978-1-4160-4574-8.

7. Harvey, R. A., Ferrier, DR, Karandish S., *Lippincott's illustrated Reviews: Biochemistry*, 5th ed., and *Biochemistry Map (Med maps) Bundle*.

Publisher: Lippincott Williams & Wilkins, (2010). ISBN: 1451116314, 9781451116311.

Course Title: PHYSICAL CHEMISTRY

Code: CHEM-171

Credit Hours: 3+1

Course Objectives:

Students will acquire knowledge to enable themselves to understand the fundamental principles and laws of thermodynamics and chemical equilibria and to investigate the physical properties of ideal/non-ideal binary solutions. Students will also be able to study the rates of reactions and perform related calculations.

Chemical Thermodynamics:

Equation of states, ideal and real gases, the virial equation and the van der Waals equation for real gases, critical phenomena and critical constants, four laws of thermodynamics and their applications, thermochemistry, calorimetry, heat capacities and their dependence on temperature, pressure and volume, reversible and non-reversible processes, spontaneous and non-spontaneous processes, relations of entropy and Gibbs free energy with equilibrium constant, Gibbs Helmholtz equation, fugacity and activity.

Chemical Equilibrium:

General equilibrium expressions, reaction quotients, examples of equilibrium reactions in solid, liquid and gas phases, extent of reactions and equilibrium constants, Gibbs energies of formation and calculations of equilibrium constants, effect of temperature and pressure on the equilibrium constants/compositions, van't Hoff equation, Le-Chatelier's principle.

Solution Chemistry:

Physical properties of liquids, surface tension, viscosity, refractive index, dipole moment etc. and their applications, brief account of interactions among the molecules in liquids, ideal and non-ideal solutions, Raoult's law and its applications, lowering of vapor pressure, elevation of boiling point, depression of freezing point, osmotic pressure, vapor pressure of non-ideal solutions and Henry's law, abnormal colligative properties, degrees of association and dissociation of solutes, osmotic pressure and its measurement, fractional distillation and concept of azeotropic mixtures.

Chemical Kinetics:

The rates of reactions, zero, first, second and third order reactions with same and different initial concentrations, half-lives of reactions, experimental

19 techniques for rate determination and methods for determination of order of reaction (integration, half-life, initial rate, and graphical methods), Arrhenius equation.

Physical Chemistry-171 Lab

(Credit Hours 01).

Determination of viscosity and refractive index of liquids.

Determination of percent composition of liquid solutions viscometrically.

Determination of refractive index and molar refractivity.

Determination of percent composition of liquid solutions by refractive index measurements.

Determination of molecular weight of a compound by elevation of boiling point (ebullioscopic method).

Determination of molecular weight of a compound by lowering of freezing point (cryoscopic method).

Determination of heat of solution by solubility method.

Determination of heat of neutralization of an acid with a base.

Kinetic study of acid catalyzed hydrolysis of ethyl acetate.

Determination of partition coefficient of a substance between two immiscible liquids.

4th Semester Scheme of Studies

Semester IV		Cr. hr
	Inorganic Chemistry-I (DS-IV)	3+1
	Analytical Chemistry (DS-V)	3+1

	Environmental Chemistry (DS-VI)	3+1
	Subject Specific: An advance Course or Research Methods (DS-VII)	3
Total Credit Hrs		12+3

Course Title: INORGANIC CHEMISTRY

Credit Hours: 3+1

Course Objectives:

Students will acquire knowledge about the key introductory concepts of chemical bonding, acid-base chemistry, and properties of p-block elements as well as using this knowledge for qualitative and quantitative analysis of inorganic compounds during laboratory work.

Course Content:

Chemical Bonding:

Types of chemical bonding, ionic and covalent bonding, localized bond approach, theories of chemical bonding, valence bond theory (VBT), hybridization and resonance, prediction of molecular shapes using Valence Shell Electron Pair Repulsion (VSEPR) model, molecular orbital theory (MOT) applied to diatomic molecules, delocalized approach to bonding, bonding in electron deficient compounds, hydrogen bonding.

Acids and Bases:

Brief concepts of chemical equilibrium, acids and bases including soft and hard acids and bases (SHAB), concept of relative strength of acids and bases, significance of pH, pKa, pKb and buffer solutions, theory of indicators, solubility, solubility product, common ion effect and their industrial applications.

p-Block Elements:

Physical and chemical properties of p-block elements with emphasis on some representative compounds, inter-halogens, pseudo-halogens and polyhalides.

Inorganic Chemistry Lab.

(Credit Hours 01)

Lab safety and good laboratory practices, knowledge about material safety data sheets (MSD), disposal of chemical waste and first-aid practices, qualitative analysis of salt mixtures, quantitative analysis, acid- base titrations, preparation and standardization of acid and alkali solutions, redox titrations, preparation and standardization of potassium permanganate solution and its use for the determination of purity of commercial potassium oxalate or oxalic acid, preparation and standardization of sodium thiosulfate solution and its use in determination of copper in a given sample, gravimetric analysis, determination of barium in a given sample, determination of chloride in a given solution.

Recommended Books:

1. Shriver, D. F., Atkins, P. W., Langford, C. H., Inorganic Chemistry, 2nd ed., Oxford University Press, (1994).
2. Cotton, F. A. and Wilkinson, G., Advanced Inorganic Chemistry, 6th ed., John-Wiley & Sons, New York, (2007).

3. Huheey, J. E., Inorganic Chemistry: Principles of Structure and Reactivity, 3rd ed., Harper International SI Edition, (2006).
4. House, J. E., Inorganic Chemistry, Academic Press. USA, (2008).
5. Lee, J. D., Concise Inorganic Chemistry, 5th ed., Chapman and Hall, (1996).
6. Miessler, G. L., Tarr, D. A., Inorganic Chemistry, 3rd ed., Pearson Education, India, (2008).
7. Huheey, J. E., Keiter E. A., Keiter L. R., Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Benjamin-Cummings Pub Co., (1993).
8. Sharpe, A. G., Inorganic chemistry, 3rd ed., Pearson Education India, (1981).
9. Chaudhary S. U., Ilmi Textbook of Inorganic Chemistry, Ilmi Kitab Khana, Lahore, (2013).
10. Catherine E. House crdft, Alan G. Sharpe, Inorganic Chemistry Prentice Hall, (2008).
11. Kathleen A. H., James E. H., Descriptive Inorganic Chemistry, 2nd ed., Brooks Cole, (2010).
12. Wulfsberg G., Principles of Descriptive Inorganic Chemistry, 1st ed., University Science Books, (1991).
13. Hill, R. H. JR and Fister, D. C., Laboratory Safety for Chemistry Students, John-Wiley & Sons, Inc., (2010).
14. Mendham, J., Denny, R. C., Barnes, J. D., Thomas, M. and Sivasankar, B., Vogel's Textbook of Quantitative Chemical Analysis, 6th ed., Pearson Education, Ltd., (2000).
15. Svehla, G., Vogel's Qualitative Inorganic Analysis, 7th ed., (7th imp.), Pearson Education, Ltd., (2009).

CHEM-105	Analytical Chemistry (DS-V)	Credit Hours 3+1
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Course Title: ANALYTICAL CHEMISTRY

Course Objectives:

Students will acquire knowledge about sampling and their handling and preparation and results calculation and data reporting. In addition they will learn and develop understanding about the classical techniques of analytical chemistry and quality control and quality assurance

Course Contents:

Chemometrics:

Sampling, significant figures, stoichiometric calculations, measurement errors, analysis of variance (ANOVA), arithmetic mean, median, mode, standard deviation/relative standard deviation, confidence limits, Gaussian distribution, least square method, tests for significance, outliers

Quality Control and Quality Assurance:

Definitions, seven tools for quality control, the concept of quality assurance, quality assurance techniques, validations based on design qualification (DQ), installation qualification (IQ),

operational qualification (OQ) and performance qualification (PQ), calibrations, monitoring and quality reviews, periodical trainings, six sigma concept, ISO standards.

Classical Analytical Methods:

Acid-base, complexometric and redox titrations, gravimetric analysis.

Analytical Chemistry Lab.

Calibration of volumetric glassware, electronic and analytical equipment, statistical evaluation of analytical data including linear regression analysis, constructing a calibration curve from a given analytical data using spread sheet software, determination of hardness of water using EDTA, determination of chloride in tap water sample, estimation of copper, arsenic, hydrogen peroxide and vitamin C using iodometry, gravimetric analysis, determination of barium in barium nitrate, determination of nickel in a given steel sample, determination of bicarbonates in a clinical sample using back-titration, determination of cation in a mixture by complexometric titration, studying the effect of common ions on solubility of sparingly soluble salts (e. g. AgCl / PbSO_4).

Recommended Books:

1. Skoog, D. A., West, P. M., Holler, F. J., Crouch, S. R., *Fundamentals of Analytical Chemistry*, 9th ed., Brooks Cole Publishing Company, (2013).
2. Christian, G. D., *Analytical Chemistry*. 6th ed., John-Wiley & Sons, NewYork, (2006).
3. Harris, D. C., *Quantitative Chemical Analysis*, 8th ed., W. H. Freeman and Company, New York,USA, (2011).
4. Kealey, D. and Haines, P. J,Instant Notes., *Analytical Chemistry*, Bios Scientific Publishers Limited, Oxford, UK, (2002).
5. Matthios, Otto, *CHEMOMETRICS-Statistics and Computed applications in Analytical Chemistry*, 2nd ed., Wiley-VCH, Germany, (2007).
6. Mitra A., *Fundamentals of Quality Control and Improvement*, 3rd ed., John- Wiley & Sons, (2008).
7. Miller, J. and Miller, J., *Statistics and Chemometrics for Analytical Chemistry*, 5th ed., Prentice Hall, (2005).

CHEM-106

Environmental Chemistry (DS-VI)

3+1

Course Title: ENVIRONMENTAL CHEMISTRY

Credit Hours: 3

Course Objectives:

Students will be able to acquire knowledge and develop understanding about the fundamental principles of environmental chemistry and different types of pollutions. Such information will be useful in studying and solving pollution related issues and experiments in the laboratory.

Course Contents:

Atmospheric Pollution:

The atmosphere, composition, temperature and pressure profile, role of free radicals in the atmosphere, temperature inversion and photochemical smog, particulate matter in the atmosphere, Industrial pollutants, atmospheric aerosols, acid-rain major sources, mechanism, control measures and effects on buildings and vegetation, global warming, major greenhouse gases, mechanism, control measures and global impact, the stratospheric ozone—the ozone hole, CFCs, ozone protection, biological consequences of ozone depletion.

Water Pollution:

Water pollution and waste water treatment, municipal, industrial and agricultural sources of pollution, heavy metals contamination of water, eutrophication, detergents and phosphates in water, water quality criteria, water purification: primary, secondary and advanced treatment, removal of nitrogen and phosphorous compounds from polluted water, organic matter in water and its decomposition.

Land pollution:

Soil and mineral resources, general principles of metal extraction, heavy metals contamination of soil, toxicity of heavy metals, bio-accumulation of heavy metals, organic matter in soil, macro and micro-nutrients in soil, ionexchange in soil, soil pH and nutrients availability.

Green Chemistry:

Atom economy, integrated pests management control (IPMC), ionic liquids, super critical extraction technology, green synthesis, recycling, carbon dioxide sequestering, water based paints.

Recommended Books:

1. Baird, C. and Cann, M., *Environmental Chemistry*, 5th ed., W. H. Freeman & Company, (2012).
2. Dara, S. S. and Mihsra, D. D., *A Text Book of Environmental Chemistry and Pollution Control*, 9th ed., S. Chand & Co. Ltd., (2004).
3. **Singhi**, R. and Singh, V., *Green Chemistry for Environmental Remediation*, John-Wiley & Sons, Inc., (2011).
4. Holloway, A. M. and Wayne, R. P., *Atmospheric Chemistry*, 1st ed., Royal Society of Chemistry, (2010).
5. Vaclavikova, M., Vitale, K., Gallios, G. P. and Ivanicova, L. *Water Treatment Technologies for Removal of High Toxicity Pollutants*, Springerlink, UK, (2010).
6. Manahan, S. E., *Environmental Chemistry*, 9th ed., CRC press, Taylor & Francis group, USA, (2009).
7. Girard, J. E., *Principles of Environmental Chemistry*, 2nd ed., Jones and Bartlett publishers, (2010).
8. Harrison, R. M., Monks, P., Farmer, J. G., Graham, M. C., Mora, S. J., Pulford, I. and Hulsal, C., *Principles of Environmental Chemistry*, 1st ed., Royal Society of Chemistry, (2007).
9. Matalack, A., *Introduction to Green Chemistry*, 2nd ed., CRC press, Taylor Francis group, USA, (2010).
10. Wright, J., *Environmental Chemistry*, Routledge, (2003). O'Neill, P., *Environmental Chemistry*, 3rd ed., Blackie Academic & Professional, (1998).

11. Elsom, D. M., *Atmospheric Pollution: A Global Problem*, 2nd ed., Wiley- Blackwell, (1992).

**Subject Specific: An advance Course or Research Methods
(DS-VII)
Credit Hours 03**

Research Methodology in Chemistry

1. Foundation of Research:

Objectives, Scientific Research, Theory-conceptual and theoretical model-importance of research methodology in scientific research, research design, basic principles-need of research design, features of good design, important concepts relating to research design. Types and methods of research, classification of research, pure and applied research, exploring or formulative research, descriptive research, diagnostic research/study, Evaluation of research/study, action research, experimental research-problem selection.

2. Literature survey:

Sources of information, need for reviewing literature, primary-secondary- tertiary sources, journals, journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text books, current contents, Introduction to chemical abstracts and Beilstein, subject index, substance index, author index, formula index and other indices with examples.

3. Research problem:

Identification, statement of research problem, objectives, design and execution of experiments, collection and interpretation of experimental data, arriving at conclusions, reporting the results of research-style and format, title, abstract and the text, references, tables, figures, elucidations, quotations and footnote. Writing of monographs, review articles and dissertations.

4. Concepts of chemical safety:

Chemical safety and ethical handling of chemicals, safe working procedure and protective environment, emergency procedure and first aid, laboratory ventilation, safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmosphere, safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals.

5. Advanced techniques of analysis and ethics of research:

Applications of UV-Visible, IR, NMR, Mass, ESR, XRD for the structural elucidation of compounds, Thermal analysis and electro-chemical principles (polarography, cyclic voltametry).

Ethical issues, copy right, royalty, intellectual property rights, citation and acknowledgement. Reproducibility. Safety rules of laboratory acquaintance of experimental set up, importance of safety and security of data.

Reference Books and literature:

1. Creswell, J. W. (2009). Research Design: Qualitative, Quantitative, and Mixed Method Approaches.
2. SAGE.Dodig-Crnkovic, G. (2002). COMPUTER SCIENCE IN A THEORY OF SCIENCE DISCOURSE. MasterThesis in Computer Science.
3. Hong, L. Y. (2006). RESEARCH METHODS IN ENGINEERING AND SCIENCE. http://www.wabri.org.au/postgrads/documents/RM%20sci_eng_notes/Eng_Leung.pdf
4. Kumar, R. (2005). Research methodology – A step-by-step guide for beginners.
4. SAGE.Liles, D.; Johnson, M.; Meade, L.; Underdown, D. (1995). Enterprise Engineering: A discipline?, Society for Enterprise Engineering (SEE) Conference, Orlando, FL, <http://www.webs.twsu.edu/enteng/ENTENG1.html>