

Scheme of Studies 4-YEAR BS Program in Chemistry

Courses Code Key:

i) The code will start with the alphabets as follows.


CHEM:	Chemistry Courses
CS:	Computer Courses
ELL:	English Language & Literature
IS:	Islamic Studies
MATH:	Mathematics Course
PHIL:	Philosophy
PS:	Pakistan Studies
SOC:	Sociology Courses

ii) The letter code will be followed by three digits; the first digit will denote University year of study.

iii) Second digit specifying the Semester in academic year

iv) In case of Chemistry courses the third digit will be used to indicate the specialty within Chemistry as under:

Analytical Chemistry	1
Applied / Industrial Chemistry	2
Biochemistry	3
Environmental Chemistry	4
Inorganic Chemistry	5
Organic Chemistry	6
Physical Chemistry	7
Research Thesis/Special Practical	8
General Chemistry Course	0



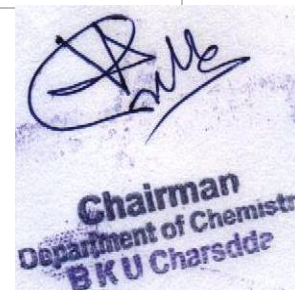
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FIRST YEAR: FIRST SEMESTER

COURSE CODE	COURSE TITLE	Course Type	CREDIT HOURS
ELL-311	English I: Functional English	Gen Ed	03
PS-321	Pakistan Studies	Gen Ed	03
CS-311	QR-1 (Introduction to Computer)	Gen Ed	2+1
	NS-I*	Gen Ed	03
CHEM-315	Inorganic Chemistry – I	Subject-Specific	(2+1)
CHEM-316	Organic Chemistry – I	Subject-Specific	(2+1)
Total Credit Hours			18

FIRST YEAR: SECOND SEMESTER

COURSE CODE	COURSE TITLE	Course Type	CREDIT HOURS
ELL-321	English II: Composition Writing	Gen Ed	03
IS-312	Islamic Studies	Gen Ed	03
	Arts and Humanities-I (Languages)**	Gen Ed	03
SOC -313	SS-1 (Citizenship Education and community Engagement)	Gen Ed	03
CHEM-327	Physical Chemistry –I	Subject-Specific	(2+1)
CHEM-321/2/3	Analytical Chemistry - I/ Applied Chemistry - I/Biochemistry – I	Subject-Specific	02
Total Credit Hours			17



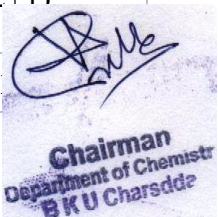
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SECOND YEAR: THIRD SEMESTER

COURSE CODE	COURSE TITLE	Course Type	CREDIT HOURS
ELL-411	English III: Academic Reading and Writing	Gen Ed	03
	NS-II *	Gen Ed	03
PHIL-412	QR-II (Logic and Quantitative Reasoning)	Gen Ed	03
CHEM-415	Inorganic Chemistry –II	Subject-Specific	(2+1)
CHEM-416	Organic Chemistry – II	Subject-Specific	(2+1)
CHEM-411/2/3	Analytical Chemistry - II/ Applied Chemistry -I I/Biochemistry –II	Subject-Specific	02
Total Credit Hours			17

SECOND YEAR: FOURTH SEMESTER

COURSE CODE	COURSE TITLE	Course Type	CREDIT HOURS
	Arts and Humanities-II**	Gen Ed	03
	Social Sciences - II***	Gen Ed	03
CHEM-427	Physical Chemistry –II	Subject-Specific	(2+1)
CHEM-424	Environmental Chemistry	Subject-Specific	03
CHEM-421/2/3	Analytical Chemistry - III/ Applied Chemistry - III/Biochemistry –III	Subject-Specific	(2+1)
Total Credit Hours			



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Semester-V		Credit Hours		
Course Code	Course Title	Theory	Laboratory	Marks
CHEM-555	Inorganic Chemistry-II	3	1	100+25
CHEM-556	Organic Chemistry-II	3	1	100+25
CHEM-557	Physical Chemistry-II	3	1	100+25
CHEM-551	Analytical Chemistry-II	3	1	100+25
CHEM-552	Applied Chemistry-II	each	Each	each
CHEM-553	Biochemistry-II			
CHEM-558	Fuel Chemistry-II			
Total		12	4	500
Semester-VI		Credit Hours		
Course Code	Course Title	Theory	Laboratory	
CHEM-565	Inorganic Chemistry-III	3	1	100+25
CHEM-566	Organic Chemistry-III	3	1	100+25
CHEM-567	Physical Chemistry-III	3	1	100+25
CHEM-561	Analytical chemistry-III	3	1	100+25
CHEM-562	Applied Chemistry-III	Each	Each	each
CHEM-563	Biochemistry-III			
CHEM-568	Fuel Chemistry-III			
Total		12	4	500
Semester-VII				
Course Code	Papers in specialization	Theory	Laboratory	Marks
CHEM -671-I CHEM-672-I CHEM-673-I CHEM-675-I CHEM-676-I CHEM-677 -I CHEM-678-I	Paper-I each in Analytical Applied Biochemistry Inorganic Chemistry Organic Chemistry Physical Chemistry Fuel Chemistry	3	0	100
CHEM- 671-II CHEM-672-II CHEM-673-II CHEM-675-II CHEM-676-II CHEM-677-II CHEM-678-II	Paper-II, each in Analytical Applied Biochemistry Inorganic Chemistry Organic Chemistry Physical Chemistry Fuel Chemistry	3	0	100
CHEM-671-III CHEM-672 -III CHEM-673-III	Paper-III, each in Analytical Applied Biochemistry	3	0	100


CHEM-675-III CHEM-676-III CHEM-677 -III CHEM-678-III	Inorganic Chemistry Organic Chemistry Physical Chemistry Fuel Chemistry			
CHEM -674-IV	Elective Courses-I (Other than the field of specialization) (Environmental)	3	0	100
Practical-I CHEM -671-V CHEM -672-V CHEM -673-V CHEM -675-V CHEM -676-V CHEM -677-V CHEM -678-V	Practical-I, each in Analytical Applied Biochemistry Inorganic Chemistry Organic Chemistry Physical Chemistry Fuel Chemistry	0	1	100
THES/CHEM-671- VI THES/CHEM-672- VI THES/CHEM-673- VI THES/CHEM-675- VI THES/CHEM-676- VI THES/CHEM-677- VI THES/CHEM-678- VI	Analytical Applied Biochemistry Inorganic Chemistry Organic Chemistry Physical Chemistry Fuel Chemistry (Thesis /Advanced Special Practical/Review article Literature Survey)	0	3	25
	Total	12	4	525
Semester-VIII				
Course Code	Papers in specialization	Theory	Laboratory	Marks
CHEM-681-I CHEM-682 -I CHEM-683-I CHEM-685-I CHEM-686-I CHEM-687 -I CHEM-688-I	Paper-I each in Analytical Applied Biochemistry Inorganic Chemistry Organic Chemistry Physical Chemistry Fuel Chemistry	3	0	100
CHEM-681-II CHEM-682 CHEM-683 CHEM-685 CHEM-686	Paper-II, each in Analytical Applied Biochemistry Inorganic Chemistry Organic Chemistry	3	0	100

CHEM-687 CHEM-688	Physical Chemistry Fuel Chemistry			
CHEM-681-III CHEM-682 -III CHEM-683-III CHEM-685-III CHEM-686-III CHEM-687 -III CHEM-688-III	Paper-III, each in Analytical Applied Biochemistry Inorganic Chemistry Organic Chemistry Physical Chemistry Fuel Chemistry	3	0	100
CHEM-684-IV	Elective Courses-II (Other than the field of specialization) (Environmental)	3	0	100
CHEM-681-V CHEM- 682-V CHEM- 683-V CHEM- 685-V CHEM- 686-V CHEM- 687-V CHEM- 688-V	Practical-II, each in Analytical Applied Biochemistry Inorganic Chemistry Organic Chemistry Physical Chemistry Fuel Chemistry	0	1	100
THES/CHEM-681- VI THES/CHEM-682- VI THES/CHEM-683- VI THES/CHEM-685- VI THES/CHEM-686- VI THES/CHEM-687- VI THES/CHEM-688- VI	Analytical Applied Biochemistry Inorganic Chemistry Organic Chemistry Physical Chemistry Fuel Chemistry (Thesis /Advanced Special Practical/Review article Literature Survey)	0	3	25
	Total	12	4	525

* Annex-I

** Annex-II

*** Annex-III



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ADS 1st Year

Semester-I

COURSE TITLE:	English I: Functional English
LEVEL:	BS 1st
COURSE CODE:	ELL-311
CREDITS HOURS:	03
COURSE TYPE:	Foundational Course

Course Description

The subject aims at enhancing the students' ability in the meaningful use of grammatical structures. Students will be able to use the targeted grammatical structures meaningfully and appropriately both in oral and written production.

Course Objectives

1. To enable students to identify the main/topic sentences.
2. To teach them to use effective strategies while reading the text.
3. To acquaint them about the cohesive devices and their function in the text.

Course Contents

- Vocabulary (Frequently confused / misused words, Phrases, synonyms, antonyms, idioms.
- Practical Use of Grammar (Nouns, Pronouns, Verbs, Adjectives, Adverbs, Prepositions, Conjunctions, Articles, Interjections, Tenses and narration.
- Transitive and Intransitive verbs
- Punctuations, 14 American English Punctuations.
- Sentences (Types of sentences, Parts of sentences, Direct and Indirect Speech, Active & Passive Voice & Conditional Sentences)
- Composition + Summarization (Describing, Narrating, Argumentation, Short / long Composition)
- Comprehension + Précis writing.
- Phrase, Types of Phrase
- Clause, Types of Clause

Recommended Books

- High School English Grammar & Composition by Wren and Martin.
- Practical English Grammar by A.J. Thomson & A.V. Martinet. Exercises 1 & 2. 3rd edition. Oxford University Press.
- Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand & Françoise Grellet. Oxford Supplementary Skills. 4th Impression 1993.
- Reading. Upper Intermediate. Brian Tomilson & Rod Ellis. Oxford Supplementary Skills. 3rd Impression 1992.

5/2/2021
Department of English
Bachchanand University
Lalitpasta

COURSE TITLE: PAKISTAN STUDIES (COMPULSORY)

COURSE CODE: PS-321

CREDIT HOURS: 02

COURSE OBJECTIVES:

Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan and to Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

Course learning outcomes:

The outcome of this subject is purely the understanding of emergence of Muslims in Sub-Continents, Pakistan History, Culture, Society politics and its ideological basis. A part from these considering the national and international politics, this course also thoroughly explains the status and position of Pakistan and its importance in the global village.

The highlighted points are as given below:

- Advent of Islam in sub-continent
- The rise and fall of Muslims in India
- The emergence of imperial power Britain
- Political emergence of Muslim as nation
- Role of religion in the freedom movement of Pakistan
- Geo strategic importance of Pakistan

COURSE CONTENTS:

Historical Perspective

- Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah.
- Factors leading to Muslim separatism
- People and Land
 - i. Indus Civilization
 - ii. Muslim advent
 - iii. Location and geo-physical features.

Government and Politics in Pakistan

- Political and constitutional phases:
 - 1947-58
 - 1958-71
 - 1971-77
 - 1977-88
 - 1988-99
 - 1999 onward

Contemporary Pakistan

- Economic institutions and issues
- Society and social structure



- Ethnicity
- Foreign policy of Pakistan and challenges
- Futuristic outlook of Pakistan

COURSE RECOMMENDED BOOKS:

1. Amin, Tahir. (1999). Ethno-National Movement in Pakistan. Islamabad: Institute of Policy Studies, Islamabad.
2. Burke, S.M and Ziring, Lawrence. (1993). Pakistan's Foreign policy: An Historical analysis. Karachi: Oxford University Press,
3. Mehmood, Safdar. (2001). Pakistan Kayyun Toota. Lahore: Idara-e-Saqafat-e-Islamia. Club Road Press.
4. Mehmood, Safdar. (1994). Pakistan Political Roots & Development. Lahore.
5. Waseem, Muhammad. (1987). Pakistan Under Martial Law. Lahore: Vanguard.
6. Zaidi, Akbar. S. (2000). Issue in Pakistan's Economy. Karachi: Oxford University Press.



CS-311 Introduction to Information and Communication Technologies		
Credit Hours:	3 (2,1)	Prerequisites: None
Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:		
Understand basics of computing technology (Knowledge)	C	1
Have knowledge of types of software (Understand)	C	2
Have knowledge of computing related technologies	C	2
Have practical knowledge of use of computer and MS office.	C	3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

Course Content:	
Introduction:	Introduction to ICT, Brief history of Computer, Basic Computer Elements and computer types (Super, Mainframe, Mini and Micro), Digital and Analogue Computer
Computer Hardware:	(Input Devices, processor, Output Devices)
Storage Devices:	(Register, Cache, RAM, ROM, HDD, optical Storage devices (CD, DVD, Blue rays), Cloud Storage)
Computer Software:	System Software (Operating System, Device Drivers and Language processor) Application software
Computer Network:	Types of Computer Network (LAN, MAN, WAN, PAN, CAN), Topologies (Bus, Star, Ring Mesh), Client, Server, Hub, Switch, Router
Internet and WWW:	Basic Structure of Internet, Web page, Website, Web application, Web Browser, Search engine, email, cyber security
<u>MS Word</u> <u>MS Power Point</u> <u>MS Excel</u> <u>Basics of program relevant tools</u>	
Teaching Methodology:	Lectures, Written Assignments, Practical labs, Semester Project, Presentations
Course Assessment:	Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam
Reference Materials:	<ol style="list-style-type: none"> 1. Charles S. Parker, Understanding Computers: Today and Tomorrow, Course Technology, 25 Thomson Place, Boston, Massachusetts 02210, USA 2. Livesley, Robert Kenneth. An introduction to automatic digital computers. Cambridge University Press, 2017. 3. Zawacki-Richter, Olaf, and Colin Latchem. "Exploring four decades of research in Computers & Education." Computers & Education 122 (2018): 136-152. 4. Sinha, Pradeep K., and Priti Sinha. Computer fundamentals. BPB publications, 2010. 5. Goel, Anita. Computer fundamentals. Pearson Education India, 2010. 6. Introduction-To-Computers-By-Peter-Norton-6E-C.B

ADS 1st Year

Semester-I

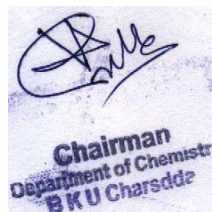
General Education

Course Title: NS-I*

Course Code:

Credit Hours: 03

Course will be selected from Annex-I



SUBJECT SPECIFIC**Course Title: INORGANIC CHEMISTRY-I****Course Code: CHEM-315****Credit Hours: (2+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:

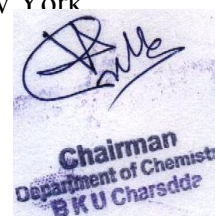
Physical and chemical properties of p-block elements with emphasis on some representative compounds, inter-halogens, pseudo-halogens and polyhalides.

Recommended Books

- 1 Miessler, G. L.; Tarr, D.A., *Inorganic Chemistry*, Prentice-Hall International, New Jersey, USA, **1991**.
- 2 Day, M.C.; Selbin, J., *Theoretical Inorganic Chemistry*, 2nd ed., Van Nostrand Reinhold Company, New York, USA, **1969**.
- 3 Shriver, D. F.; Atkins, P. W.; Langford, C. H., *Inorganic Chemistry*, 2nd ed., Oxford University Press, **1994**.

Supplementary Reading Material

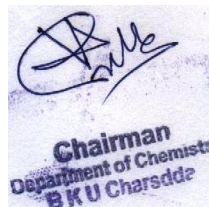
- 1 Huheey, J. E.; Keiter, E. A.; Keiter, R. L., *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed., Harper and Row, New York, **2001**.
- 2 Cotton, F. A.; Wilkinson, G. *Basic Inorganic Chemistry*, 3rd ed., Wiley, New York **1995**.
- 3 Lee, J.D., *Concise Inorganic Chemistry*, Chapman and Hall, 5th ed., **1996**.



PRACTICAL

Inorganic Chemistry Practical

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-315



Credit Hours: (2+1)

Course Objectives

The objectives of Organic Chemistry offered in this semester are to provide the beginning student with the necessary knowledge and experience to be able to:

1. Realize the importance of organic chemistry in our daily life and learn the evolutionary historical developments of organic chemistry.
2. Draw proper chemical structures and ways in which organic structures may be drawn.
3. Get familiarized with the systematic nomenclature of hydrocarbons beside compounds having heteroatomic functional groups.
4. Understand the basic concepts of chemical bonding, molecular structure, inductive and field effects, resonance theory, aromaticity and tautomerism besides the Lewis and Bronsted–Lowry theories of acids and bases.
5. Identify centers of reactivity in organic structures, including the names, structures and basic chemical properties of the most important functional groups.
6. Learn characteristic reactions of basic organic functional groups and use this knowledge to predict products of reactions and distinguish related compounds.

Course Contents

Introduction to Organic Chemistry:

Organic Chemistry- the chemistry of Carbon compounds; Nature of organic chemistry-a historical perspective.

Basic Concepts in Organic Chemistry:

Localized and delocalized chemical bonding; concept of hybridization leading to bond angles, bond lengths, bond energies and shapes of organic molecules; dipole moment; inductive and field effects, resonance; aromaticity; tautomerism; hyperconjugation; hydrogen bonding, acids and bases; factors affecting the strengths of acids and bases.

Nomenclature of Organic Compounds:

Classification of organic compounds; development of systematic nomenclature of organic compounds; IUPAC nomenclature of hydrocarbons and heteroatom functional groups.

Functional Group Chemistry:

A brief introduction to the chemistry of hydrocarbons, alkyl halides, alcohols, phenols, ethers, aldehydes, ketones, amines, carboxylic acids and their derivatives.

Recommended Books

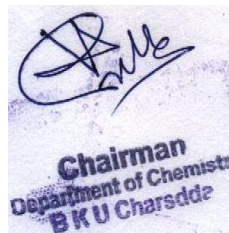
(Latest available editions of the following books)

1. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P., *Organic Chemistry*, Oxford University Press, New York.
2. Wade Jr., L. J., *Organic Chemistry*, Pearson Education, Delhi.
3. Younas, M., *A Text Book of Organic Chemistry*, IlmiKitabKhana, Lahore.
4. Morrison, R. T.; Boyd, R. N., *Organic Chemistry*, Prentice-Hall of India, New Delhi.
5. Panico, R.; Powell, W. H.; Richer, J. C., *A Guide to IUPAC Nomenclature of Organic Compounds*, Jain-Interscience Press, Delhi.

Practical

Organic Chemistry-I

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-316



COURSE TITLE:	English II: Composition Writing
LEVEL:	BS 2nd
COURSE CODE:	ELL-321
CREDIT HOURS:	03
COURSE TYPE:	Foundational

Course Description:

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, compares 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 are always being valued highly in academic as well as professional spheres.

Course Objectives:

This course aims to:

1. Assist students identify the audience, message, and the purpose of writing
2. Develop rhetorical knowledge and critical thinking
3. Enable them express themselves in a variety of writing styles
4. Help students write well organized academic texts including examination answers with topic/thesis statement and supporting details.
5. Make students write argumentative essays and course assignments
6. Use different mechanics of writing to produce various types of compositions effectively keeping in view the purpose and the audience
7. Demonstrate rhetorical knowledge
8. Demonstrate critical thinking in well-organized forms of academic texts

Course Contents:

- Writing Process,
- Invention in writing Process or brainstorming
- 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,
- Deductive vs Inductive approach in writing
- Comparison and contrast,
- Problem solution pattern,
- Drafting,
- Free Writing,
- Revising, Editing, Paraphrasing,
- Cohesion and Coherence, Cohesive Devices,
- Paragraph unity, Summary and Précis Writing,

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- Creative Writing, Essay Writing
- Developing a thesis, writing effective introduction and conclusion
- Organizing an essay, different types of essays, use of various rhetorical modes including exposition, argumentation and analysis

Recommended Books

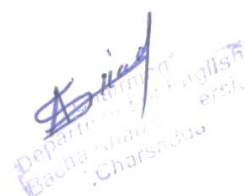
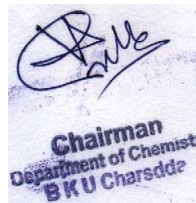
Critical Reading and Writing: An Introductory Course by Goatly, A. 2000. London: Taylor & Francis

A Writer's Reference by Hacker, D. 1992. 2nd ed. Boston: St. Martin's

Study writing: A course in written English for academic and professional purposes. by Hamp-Lyons, L. & Heasley, B. 1987. Cambridge: Cambridge University Press.

Oxford English for Undergraduates by Howe, D. H, Kirkpatrick, T. A. & Kirkpatrick, D. L. 2004. Karachi: Oxford University Press.

- Patterns for College Writing: Fourth Edition. Kirsznner, L.G & Mandell, S.R. 1989 USA: St. Martin's Press, Inc.
- Write to be Read: Reading, Reflection and Writing by Smazler, W. R. 1996. Cambridge: Cambridge University Press.



Credit Hours: 03**Course Objectives**

This course is aimed at:

1. To provide Basic information about Islamic Studies
2. To enhance understanding of the students regarding Islamic Civilization
3. To improve Students skill to perform prayers and other worships
4. To enhance the skill of the students for understanding of issues related to faith and religious life.

Course Contents**Introduction to Quranic Studies**

- 1) Basic Concepts of Quran
- 2) History of Quran
- 3) Uloom-ul -Quran

Study of Selected Text of Holly Quran

- 1) Verses of Surah Al-Baqra Related to Faith (Verse No-284-286)
- 2) Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18)
- 3) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
- 4) Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
- 5) Verses of Surah Al-Inam Related to Ihkam (Verse No-152-154)

Study of Selected Text of Holly Quran

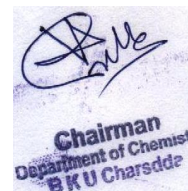
- 1) Verses of Surah Al-Ihزاب Related to Adab al-Nabi (Verse No.6,21,40,56,57,58.)
- 2) Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
- 3) Verses of Surah Al-Saf Related to Tafakar, Tadabar (Verse No-1,14)

Seerat of Holy Prophet (S.A.W) I

- 1) Life of Muhammad Bin Abdullah (Before Prophet Hood)
- 2) Life of Holy Prophet (S.A.W) in Makkah
- 3) Important Lessons Derived from the life of Holy Prophet in Makkah

Seerat of Holy Prophet (S.A.W) II

- 1) Life of Holy Prophet (S.A.W) in Madina
- 2) Important Events of Life Holy Prophet in Madina



- 3) Important Lessons Derived from the life of Holy Prophet in Madina

Introduction To Sunnah

- 1) Basic Concepts of Hadith
- 2) History of Hadith
- 3) Kinds of Hadith
- 4) Uloom –ul-Hadith
- 5) Sunnah & Hadith
- 6) Legal Position of Sunnah

Selected Study from Text of Hadith

Introduction To Islamic Law & Jurisprudence

- 1) Basic Concepts of Islamic Law & Jurisprudence
- 2) History & Importance of Islamic Law & Jurisprudence
- 3) Sources of Islamic Law & Jurisprudence
- 4) Nature of Differences in Islamic Law
- 5) Islam and Sectarianism

Islamic Culture & Civilization

- 1) Basic Concepts of Islamic Culture & Civilization
- 2) Historical Development of Islamic Culture & Civilization
- 3) Characteristics of Islamic Culture & Civilization
- 4) Islamic Culture & Civilization and Contemporary Issues

Islam & Science

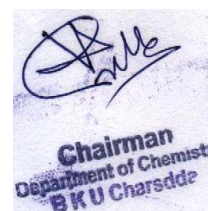
- 1) Basic Concepts of Islam & Science
- 2) Contributions of Muslims in the Development of Science
- 3) Quranic & Science

Islamic Economic System

- 1) Basic Concepts of Islamic Economic System
- 2) Means of Distribution of wealth in Islamic Economics
- 3) Islamic Concept of Riba
- 4) Islamic Ways of Trade & Commerce

Political System of Islam

- 1) Basic Concepts of Islamic Political System
- 2) Islamic Concept of Sovereignty
- 3) Basic Institutions of Govt. in Islam



Islamic History

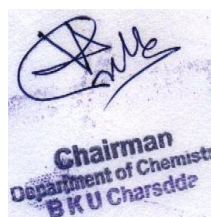
- 1) Period of Khlaft-E-Rashida
- 2) Period of Ummayyads
- 3) Period of Abbasids

Social System of Islam

- 1) Basic Concepts Of Social System Of Islam
- 2) Elements Of Family
- 3) Ethical Values Of Islam

Reference Books:

1. Hameed ullah Muhammad, "Emergence of Islam" , IRI, Islamabad
2. Hameed ullah Muhammad, "Muslim Conduct of State".
3. Hameed ullah Muhammad, 'Introduction to Islam
4. Mulana Muhammad YousafIslahi,"
5. Hussain Hamid Hassan, "An Introduction to the Study of Islamic Law" leaf Publication Islamabad, Pakistan.
6. Ahmad Hasan, "Principles of Islamic Jurisprudence" Islamic Research Institute, International Islamic University, Islamabad (1993)
7. Mir Waliullah, "Muslim Jrisprudence and the Quranic Law of Crimes" Islamic Book Service (1982)
8. H.S. Bhatia, "Studies in Islamic Law, Religion and Society" Deep & Deep Publications New Delhi, 1989.
9. Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad 2001



ADS 1st Year
General Education

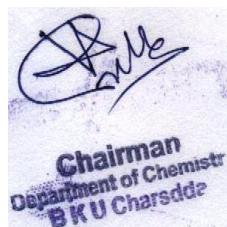
Semester-II

Course Title: Arts and Humanities-I (Languages)

Course Code:

Credit Hours: 03

Course will be selected from Annex II



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Pool Course:	Social Science-I	
Course Title:	Citizenship Education and Community Engagement	
Course Code:	SOC-313	
Contact Hours:		Credit Hours:
Theory = 16		Theory = 1.0
Practical = 64		Practical = 2.0
Total = 80		Total = 3.0

Course Objectives:

The overall objectives of this course are to:

- Teach students the importance and role of active citizenship in promoting a productive, harmonious and developed society/world
- Educate students about the importance of concepts, skills and philosophy of community linkages in developing a sustainable society
- Inculcate the importance of community involvement for ensuring an improved, tolerant and generative society/world
- Provide an opportunity to the students to develop their relationship with the community

Learning Outcomes:

The primary outcome is inclusive development through active citizenship locally and globally,. Moreover, the following are the detailed outcomes of the course based on the three domains of Bloom’s Taxonomy i.e Affective, Psychomotor and Cognitive. The students will be able to:

- Understand the overall organization of the society
- Recognize and exercise their rights, responsibilities and the significance of active citizenship in positive societal development
- Identify and critically evaluate social issues and implement practicable community based solutions
- Understand the concept of human rights and its significance
- Appreciate diverse viewpoints and inter-cultural harmony

Course Outline:

Introduction to Citizenship Education and Community Engagement

- Meaning & History
- Attributes of Active Citizenship
- Different Approach
 - i. Republican Approach
 - ii. Liberal Approach

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- iii. Cosmopolitan Approach
- Dimensions of Active Citizenship
 - i. Rights
 - ii. Membership
 - iii. Participation
 - iv. Identity

Identity, Culture, and Social Harmony

- Sociological Theories of Self Formation
 - i. Sigmund Freud Theory
 - ii. George Herbert Mead Theory
 - iii. Charles Horton Cooley Theory
- Cultural & Religious Harmony
- Pluralism & Diversity
- Democracy & Democratic Norms
- Concept and Development of Identity
- Components of Cultural and Social Harmony

Inter-Cultural Dialogue (me versus you)

- Principles & Purpose
- Ability to Support, learn and share through dialogue
- Policy Dialogue (encourage young people to share their opinion and perspective with policy makers and opinion makers).

Local & Global Communities

- Concept of Community
- Needs, Issues & Conflicts
- Conflict Resolution
- Communication & Networking
- Social Cohesion
- Social Capital
- Social Networking
- Advocacy
- Social Entrepreneurship & Partnership

Social Action Planning

- Skills in Project Planning & Management
- Project Cycle
- Stakeholder Analysis
- Problem Identification
- Writing Project Plan



- Monitoring & Evaluation
- Risk Analysis

Population Dynamics in Pakistan

- Population Growth Pakistan
- Factors Behind High Fertility Rate
 - i. Legislative Actions
 - ii. Dearth of Medical Facilities
 - iii. Delayed VS Early Age Marriages
 - iv. Poverty
 - v. Women Empowerment
 - vi. Spreading Awareness
 - vii. Providing Incentives
- Population Theory
- How to Control Population Growth

Text and Reference Books:

Core Readings:

- Larsen, A. K., Sewpaul, V., & Hole, G. O. (Eds.). (2013). *Participation in community work: International perspectives*. Routledge.
- Alan, T. (2008). *Community work*, London: Palgrave Macmillan.
- British Council, (2017) *Active Citizen's Social Action Projects Guide* (Scotland: British Council.
- Kaye, C. B. (2004). *The complete guide to service learning: Proven, practical ways to engage students in civic responsibility, academic curriculum, & social action*. Free Spirit Publishing.
- Hans, R. (1993). *Population Studies*, Indian Council of Social Science Research, New Delhi.
- Demeny, P., McNicoll, G., & Hodgson, D. (2003). *Encyclopedia of population*. Hodgson, Dennis (2003). *Contemporary Population Thought*.
- Peterson, W. (1975). *Population*, New York, Macmillan.
- Srinivasan, K. (1998). *Basic demographic techniques and applications*. SAGE Publications Pvt. Limited.
- Todaro, M. P. (1977). *Economic Development in the Third World: An introduction to problems and policies in a global perspective*. Pearson Education.
- United Nations Economic Commission for Europe – Official Web site

- UNO (2000). Population Trends, World Population Monitoring, Population growth Structure and Distribution 1999. Department of Economics and Social Affairs, Population Division, UNO.
- Weeks, J. R. (1992). Population: An Introduction to Concepts and Issues, Belmont California, Wadsworth Publishing Company.



Credit Hours: (2+1)

Course Objectives: Students will acquire knowledge to enable themselves to understand the fundamental principles and laws of thermodynamics and chemical equilibria.

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.

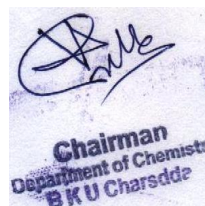
Chemical Equilibrium: General equilibrium expressions, reaction quotients, examples of equilibrium reactions in solid, liquid and gas phases, extent of reactions and equilibrium constants, Gibbs energies of formation and calculations of equilibrium constants, effect of temperature and pressure on the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

Books Recommended

1. McQuarrie, D. A. and Simon, J. D., Physical Chemistry – A Molecular Approach, 1st ed., University Science Books, (1997).
2. Atkins, P. and Paula, J. D., Atkin's Physical Chemistry, 9th ed., Oxford University Press, (2010).
3. Shoemaker, D., Experiments in Physical Chemistry, 8th ed., McGraw Hill Publishing Company Limited, (2003).
4. Silbey, R., Alberty, R. and Bawendi, M., Physical Chemistry, 4th ed., (2005).
5. Glasstone, S., Textbook of Physical Chemistry, Macmillan London (1960).
6. James, A. M., Prichard, F. E., Practical Physical Chemistry, 3rd ed., Longman Group Limited, New York, (1974).
7. Chaudhary, S. U., Ilmi Textbook of Physical Chemistry, 2nd ed., Ilmi Kitab Khana, Lahore, (2013).
8. Atkins, P., Jones, L., Chemical Principles: The Quest for Insight, 5th ed., W. H. Freeman, New York, (2010).
9. Linder, B., Elementary Physical Chemistry, World Scientific Publishing Co. Pvt. Ltd., (2011).
10. Davis, W. M., Dykstra, C. E., Physical Chemistry: A Modern Introduction, 2nd ed., CBS Press, (2011).

**Practical
Physical Chemistry**

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-327



Credit Hours: 02**Course Objectives**

The objectives of Analytical Chemistry offered in this semester are to provide the beginning student with the necessary knowledge and experience to be able to:

7. Realize the importance of analytical chemistry in our daily life and learn the evolutionary historical developments of analytical chemistry.
8. Get familiarized with the units of measurement.
9. To know about the various classical methods of analysis.
10. To know the different instruments used for measuring mass, volume and sample drying.

Course Contents**Introduction to Analytical Chemistry**

Introduction to Analytical Chemistry, Qualitative and quantitative Analysis, Concentrations of solutions, Molarity, Molality, Normality, Formality, Converting between concentration units, weight, volume, and weight-to-volume ratios, Percent composition, the role of analytical chemistry.

Classical Methods of Analysis

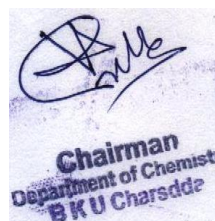
Introduction to gravimetric, volumetric and complexometric method of analysis.

Basic Equipment and Instrumentation

Instrumentation for measuring mass, equipment for measuring volume, equipment for drying samples, preparing stock solutions, preparing solutions by dilution

Books Recommended

1. Gary D. Christian, Analytical Chemistry, John Wiley and Sons.
2. Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, Fundamentals of Analytical Chemistry, Reinhote, New York.
3. Robert D. Braun, Introduction to Chemical Analysis,
4. I.M. Kolthoff, Sandell, Text Book of Quantitative Inorganic Analysis, Macmillan and Co. New York.
5. David Harvey, Modern Analytical Chemistry



SUBJECT SPECIFIC**Title of the Course: Applied Chemistry-I****Course Code: CHEM-322****Credit Hours: 02****Course Objectives**

After successful completion of the course the students will acquire the knowledge about basic unit operation such as filtration, size reduction, filtration, distillation, crystallization and drying etc. The students will understand the basic and heavy chemical industries such as production of sulphuric acid, nitric acid and hydrochloric acid etc. They will also acquire the knowledge about silicate industries.

Course Contents**Fundamentals of Chemical Industry**

Basic principles and parameters for industrial plant location; Elementary treatment of general unit operations commonly used in industries such as size reduction; evaporation, filtration, distillation, crystallization and drying; Chemical unit processes like carbonation, sulfitation, defecation, nitration, etc. in chemical process industries.

Basic and Heavy Chemical Industries

Raw materials and chemicals; Flow sheet diagrams and commercial production of sulphuric acid, nitric acid, hydrochloric acid, oxalic acid, formic acid, caustic soda, washing soda; Petroleum, textile Industry, Applications of these chemicals in chemical industries.

Ceramics Industry

Raw material used for ceramics; Chemistry involved in the production of ceramics articles and wares; Types and classification of ceramic products; Manufacture of ceramics products.

Cement Industry

Raw materials used for cement production; Chemistry involved in the production of cement; Manufacture of cement by wet and dry processes; Types of cement and composition of clinker. Chemical phenomena and chemistry involved in the hardening and setting of cement.

Recommended Books

Coulson & Richardson., Chemical Engineering, 1st Ed., (1985).

Walter. L. Badger & Julius T. Banchero, Introduction to Chemical Engineering, (1955).

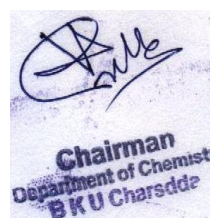
George T. Austin., Shreve's Chemical Process Industries, 5th Edition., McGraw Hill Book Company Inc. New York, (1984).

Riegel, E. R., Industrial Chemistry, 5th Ed., Reinhold Publishing Corporation New York, (1997).

Wyatt, Metal Ceramics & Polymers, (1974).

Supplementary Reading Materials

Google/topic/book/publication /search., <http://en.wikipedia.org>,
<http://www.sciencedirect.com>.



SUBJECT SPECIFIC**Course Title: Biochemistry-I****Course Code: CHEM-323****Credit Hours: 02****Course Objectives**

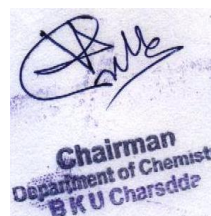
Student will acquire knowledge about the fundamental concept of biochemistry, origin of life, types of cells and significance of biochemistry.

Course Contents

A general introduction to the science of Biochemistry. Importance and the scope of Biochemistry. Forms, functions, and brief classification of prokaryotes. Cellular architecture and diversity of eukaryotes. Prebiotic molecular evolution and rise of living systems. Review of the variety and ecology of the living world. Evolution of life. Use and significance of Radioisotopes in Biochemistry.

BOOKS RECOMMENDED:

1. Fundamentals of Biochemistry. (2008) 3rd Ed. by D. J. Voet, G.J. Voet and C. W. Pratt. J. Wiley & Sons Inc.
2. Text Book of Biochemistry (1970) by E. West & W. Todd Macmillan
3. Biochemistry. (1999) 3rd Ed. by C. K. Mathews, K. E. Van Holde, & K.G. Ahern. Prentice Hall.
4. Harper's Illustrated Biochemistry, 27th Ed. by R.K. Murray, D.K. Grannar, V.W. Rodwell. McGraw Hill.
5. Lehninger Principles of Biochemistry (2008) 5th Ed. by D. L. Nelson, M. M. Cox. W. H. Freeman Publishers



COURSE TITLE:	English III: Academic Reading & Writing
LEVEL:	BS 3rd
COURSE CODE:	ELL-411
CREDIT HOURSS:	03
COURSE TYPE:	Foundational

Course Description

This course aims at inculcating proficiency in academic writing through research. It guides students to develop a well-argued and well documented academic paper with a clear thesis statement, critical thinking, argumentation and synthesis of information. This course also teaches students how to use different systems of citations and bibliography. It allows students to become independent and efficient readers armed with appropriate skills and strategies for reading and comprehending texts at undergraduate level.

Course Objectives

To enable the students to:

1. Improve literal understanding, interpretation & general assimilation, and integration of knowledge
2. Write well organized academic texts including examination answers with topic/thesis statement and supporting details.
3. Write argumentative essays and course assignments

Course Contents:

- Read academic texts effectively by:
- Using appropriate strategies for extracting information and salient points according to a given purpose
- Identifying the main points supporting details, conclusions in a text of intermediate level
- Identifying the writer's intent such as cause and effect, reasons, comparison and contrast, and exemplification
- Interpreting charts and diagrams
- Making appropriate notes using strategies such as mind maps, tables, lists, graphs.
- Reading and carrying out instructions for tasks, assignments and examination questions
- Enhance academic vocabulary using skills learnt in Compulsory English I course
- Acquire efficient dictionary skills such as locating guide words, entry words, choosing appropriate definition, and identifying pronunciation through pronunciation key, identifying part of speech, identifying syllable division and stress patterns
- Writing Academic Texts

Organization and development of effective compositions

- employ appropriate strategies for prewriting, drafting, revising, and editing as part of the writing process
- compose coherent paragraphs, supporting central ideas with specific details

- Compose organized essays with genre-specific structure including thesis, introduction, body, and conclusion.
- demonstrate control of key conventions of standard written English
- summarize a text objectively
- respond to a text subjectively
- analyze, synthesize, interpret, and evaluate information from multiple texts
- apply active reading strategies such as skimming, scanning, questioning, and annotating
- develop vocabulary; choose correctly among different forms of related words; evaluate differences in diction, guess the meaning of unfamiliar words using context clues.
- Skimming and scanning practice exercise with every above mentioned aspect of reading.
- Combining sentences, Modals
- **Note:** Teachers need to include practice activities, exercises and worksheets on the provided topics

Recommended Books:

- English Practice Grammar (New edition with tests and answers) by Eastwood, J. 2004. Karachi: Oxford University Press.
- Fisher, A. 2001. Critical Thinking. C UP
- Critical Reading and Writing: An Introductory Course. By Goatly, A. 2000. London: Taylor & Francis
- A Writer's Reference. 2nd Ed. By Hacker, D. 1992. Boston: St. Martin's
- Study writing: A course in written English for academic and professional purposes. By Hamp-Lyons, L. & Heasley, B. 1987. Cambridge: Cambridge University Press.
- Oxford English for Undergraduates. By Howe, D. H, Kirkpatrick, T. A., & Kirkpatrick, D. L. 2004. Karachi: Oxford University Press.
- Grammar in Use. By Murphy, R. 2003. Cambridge: Cambridge University Press.
- Write to be Read: Reading, Reflection and Writing. By Smazler, W. R. 1996. Cambridge: Cambridge University Press.
- Study Skills. By Wallace, M. 1992. Cambridge: Cambridge University Press.
- Primary Texts: The Norton Field Guide to Writing, by Richard Bullock; or The St. Martin's Guide to Writing, by Rise Axelrod and Charles Cooper; or The Allyn and Bacon Guide to Writing, by John Ramage and John Bean; or The Call to Write, by John Trimbu



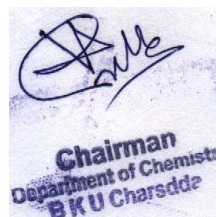
ADS 2nd Year
General Education
Course Title: NS-II*

Semester-III

Course Code:

Credit Hours: 03

Course will be selected from Annex II



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Pool Course: Quantitative Reasoning (QR-II)
Course Title: Logic & Quantitative Reasoning
Course Code: PHIL-412
Credit Hours: 03
Course Type: Compulsory

Course Contents

Basic Concept of Logic and Quantitative Reasoning:

- Definition of Logic
- The logic and Quantitative Reasoning.
- The importance of Logic and Quantitative Reasoning
- Propositions, Argument

Two main types of Reasoning

- Inductive Reasoning
- Deductive Reasoning

Formal and Informal Fallacies

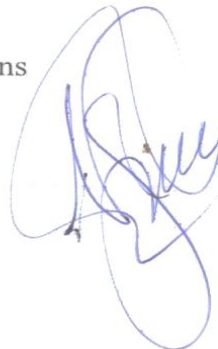
- Definition of fallacies
- Kinds of fallacies
- Some famous fallacies
- The fallacy of Argument against person
- The fallacy of Appeal to people
- The fallacy of Appeal to pity
- The fallacy of appeal to irrelevant authority
- The fallacy of Red herring
- The fallacy of false conclusion

Language, Argument and Critical Thinking

- The basic uses of language and Critical thinking
- Discourse serving multiple functions
- Logical Reasoning in selected paragraphs.
- Reading comprehension and answer the questions at the end

Symbolic Logic, Quantitative Reasoning and Analytical Questions

- The nature of analytical questions
- Objects, names and quantity
- Rules and conditions
- Solving some selected analytical questions



Categorical Propositions, Categorical syllogism and Research Methodology

- Introduction and Definitions of Variables in research.
- Qualitative and Quantitative Research methods
- Concept, Indicators, and Variables
- Types of Variables.
- Measurement scale.
- Qualitative and Quantitative research.
- Scale and Types of Measurement Scale.

Recommended Books:

1. Stewart, David and Blocker, Gene. H. (2006). Fundamentals of Philosophy. New Delhi: Pearson Education.
2. Jackson, Sherri.L. (2008). Research Methods: A Modular Approach. USA: Thomson Higher Education.
3. Copi, Irving. M. And Cohen, Carl. (2009). Introduction to Logic. New Delhi: Pearson Education.
4. Copi, Irving. M., Cohen, Carl. Jetli, Priyadarshi. and Prabhakar, Monica. (2009). Introduction to Logic. New Delhi: Dorling Kindersley Pvt, Ltd



SUBJECT SPECIFIC**Course Title: INORGANIC CHEMISTRY-II****Course Code: CHEM-415****Credit Hours: (2+1)****Course Objectives:**

Students will acquire knowledge about the key introductory concepts of Stoichiometry, Inorganic Reactions and Synthesis and Methods of Characterization following these reactions. Students will learn about basic spectroscopic techniques.

Course Content:**Stoichiometry:**

Introduction. Atomic Mass, Average Atomic Mass, Avogadro's Number and the Molar Mass of an Element, Molecular Mass, The Mass Spectrometer, Percent Composition of Compounds, Experimental Determination of Empirical Formulas, Determination of Molecular Formulas, Chemical Reactions and Chemical Equations, Writing Chemical Equations, Balancing Chemical Equations, Amounts of Reactants and Products, Limiting Reagents, Reaction Yield.

Inorganic Reactions and Synthesis:

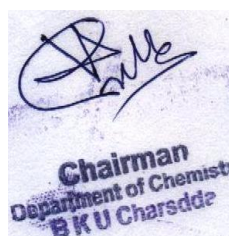
Introduction. Direct combination and decomposition reactions, Exchange and metathesis reactions, The Role of solvents, Solid-state reactions.

Methods of Characterization:

Introduction. Elemental analysis, Mass spectrometry, Spectroscopic methods, Infrared and nuclear magnetic resonance, UV-Visible absorption spectroscopy. Diffraction methods.

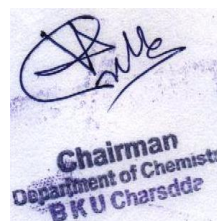
Recommended Books

- 1 Miessler, G. L.; Tarr, D.A., *Inorganic Chemistry*, Prentice-Hall International, New Jersey, USA, **1991**.
- 2 Huheey, J. E.; Keiter, E. A.; Keiter, R. L., *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed., Harper and Row, New York, **2001**.
- 3 Cotton, F. A.; Wilkinson, G. *Basic Inorganic Chemistry*, 3rd ed., Wiley, New York, **1995**.
- 4 Lee, J.D., *Concise Inorganic Chemistry*, Chapman and Hall, 5th ed., **1996**.



**Practical
Inorganic Chemistry-II**

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-415



Credit Hours: (2+1)

Course Objectives

As a result of successful completion of this course, a student will be able to:

1. Give IUPAC and common names to the classes of compounds as well as be able to determine the optical configurations of stereo-chemical compounds using the R,S convention, and give proper names to the geometric isomers using the E,Z convention;
2. Apply the concepts and principles in structure elucidation of simple organic compounds.
3. Compare and contrast the mechanisms for nucleophilic substitution reactions in terms of nucleophile, substrate and reaction solvent.
4. Compare and contrast the mechanism for β -elimination reaction in terms of substrate, base, reactant, solvent and the stereochemistry of the reaction.

Course Contents

Isomerism:

Introduction; classification of isomerism; optical isomerism: optical activity, chirality and optical activity, symmetry elements and optical inactivity, relative and absolute configuration, R,S notation, method of determining configuration, racemic mixtures and their resolution, asymmetric synthesis, optical activity in biphenyls, allenes and Spiro-compounds, stereo-specific and stereo-selective reactions; geometrical isomerism: determination of configuration of geometrical isomers, Z,E convention and *cis-trans* isomerism in cyclic systems; conformational isomerism: conformational analysis of mono-substituted cyclohexanes, di-substituted cyclohexanes and decalin systems.

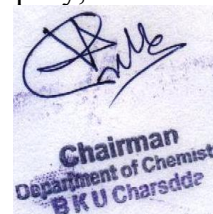
Introductory Organic Spectroscopy:

Introduction to IR, UV, $^1\text{H-NMR}$ and Mass spectrometric methods, and their usage for structure elucidation of some simple organic compounds.

Recommended Books

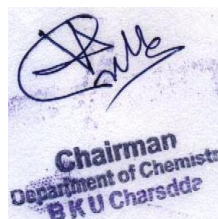
(Latest available editions of the following books)

1. Wade Jr., L. J., *Organic Chemistry*, Pearson Education, Delhi.
2. Sykes, P., *A Guide Book to Mechanism in Organic Chemistry*, Longman, London.
3. Pavia, D. L., Lampman, G. M.; Kriz, G. S.; *Introduction to Spectroscopy: A Guide for Students of Organic Chemistry*, Saunders Golden Sunburst Series, London.
4. Morrison, R. T.; Boyd, R. N., *Organic Chemistry*, Prentice-Hall of India, New Delhi.
5. McMurry, J., *Organic Chemistry*, Brooks/Cole Publishing Company, California.



**Practical
Organic Chemistry**

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-416



Credit Hours: 02

Course Objectives

The objectives of Analytical Chemistry offered in this semester are to provide the students with the necessary knowledge and experience to be able to:

11. Get familiarized with the various concepts of acids and bases.
12. To know about the pH, pOH and pK_w, buffer solution and application of buffers.
13. To know the various titration curves of acid and bases.

Course Contents

Acids and Bases

Introduction to acids, bases and amphoteric substances. Various concepts of acids and bases, the Arrhenius concept, the Bronsted Lowery concept, the Lewis concept, conjugate acids-base pairs, relative strengths of acids and bases, ionization of water, pH, pOH and pK_w, acid ionization constant K_a, base ionization constant K_b, buffer solutions, buffer action, calculating the pH of buffer solutions, application of buffer solutions.

Acids base titrations

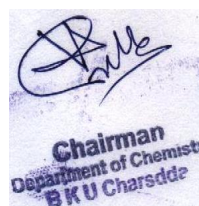
Acid base titration curve; strong acid versus strong base, weak acids versus strong base, weak base versus strong acid.

Spectroscopy

Introduction to spectroscopic techniques, Basic concept of UV-Visible, IR and mass spectrometry.

Books Recommended

1. Gary D. Christian, Analytical Chemistry, John Wiley and Sons.
2. Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, Fundamentals of Analytical Chemistry, Reinhote, New York.
3. Robert D. Braun, Introduction to Chemical Analysis,
4. I.M. Kolthoff, Sandell, Text Book of Quantitative Inorganic Analysis, Macmillan and Co. New York.
5. David Harvey, Modern Analytical Chemistry



SUBJECT SPECIFIC**Course Title: Applied Chemistry-II****Course Code: CHEM-412****Credit Hours: 02****Course Objectives**

After completing the course, the students will acquire knowledge about coal beneficiation, storage, and briquetting, and crude oil, fractional distillation of crude oil, Reforming and cracking. They will learn about economical and environmentally friendly utilization of coal and petroleum.

Course Contents**Coke oven gas conditioning (Chemicals from Coal):**

Classification of coal: Origin and theories of coal, Ranks of coal, Parr's, Ralston's, Seyler's, ASTM, NCB and International (E.C.E) classifications.

Coal beneficiation: Gravity separation; Wet Launder washers, Wet Jig washers, Wet classifiers, Wet tables, Air cleaning tables, Air Launder, Air cleaning jig. Float and sink process; Chance sand flotation process, Air sand process, Froth flotation.

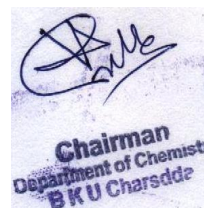
Storage of Coal: Spontaneous heating factors, Precautions in coal storage.

Coal briquetting: Objectives of briquetting, Binder less briquetting, Briquetting with binder.

Cracking and Reforming of Petroleum Fractions: Origin of crude oil, Theories, Fractional Distillation of crude oil, Reforming Process, cracking Process, Hydroforming and desulphurisation of petroleum products.

Recommended Books:

1. Berkowitz. N. "An Introduction to Coal Technology" Academic Press, London, New York (1981).
2. Wilson, P.J. and Wells, J.H. "Coal Coke and Coal Chemicals" McGraw-Hill Book Company, London, (1980).
3. Hobson, G.D. "Modern Petroleum Technology" Part 2, John Wiley and Sons, New York. (1984).
4. Gates, B.C, Katzer, J.R and Schuit, G.C.A. "Chemistry of Catalytic Processes". McGraw Hill Book company, London (1979).



Credit Hours: 02

Course Objectives

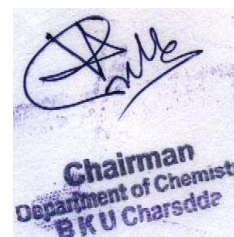
This course provides fundamental concepts in biochemistry, which focuses upon the major macromolecules and chemical properties of living systems. Primary topics include the structure, properties and functions of amino acids, proteins, carbohydrates, lipids and nucleic acids.

Course Contents

Structure, physical properties & importance of water. Unique properties of carbon. Nature of organic matter. Isomerism. General reactions of different functional groups. Biologically important organic compounds / Solvents. Overview of biological molecules (Biomolecules) and their structures including proteins, carbohydrates, lipids and nucleic acids.

BOOKS RECOMMENDED:

1. Fundamentals of Biochemistry. (2008) 3rd Ed. by D. J. Voet, G.J. Voet and C. W. Pratt. J. Wiley & Sons Inc.
2. Text Book of Biochemistry (1970) by E. West & W. Todd Macmillan
3. Biochemistry. (1999) 3rd Ed. by C. K. Mathews, K. E. Van Holde, & K.G. Ahern. Prentice Hall.
4. Harper's Illustrated Biochemistry, 27th Ed. by R.K. Murray, D.K. Grannar, V.W. Rodwell. McGraw Hill.
5. Lehninger Principles of Biochemistry (2008) 5th Ed. by D. L. Nelson, M. M. Cox. W. H. Freeman Publishers



ADS 2nd Year

Semester-IV

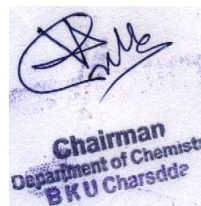
General Education

Course Title: Arts & Humanities-II

Course Code: _____

CREDIT HOURS: 03

Course will be selected from Annex-II



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ADS 2nd Year

Semester-IV

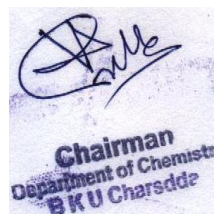
General Education

Course Title: Social Sciences-II

Course Code:

CREDIT HOURS: 03

Course will be selected from Annex-III



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Department of Chemistry
B K U Charsadda

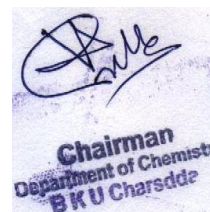
Credit Hours: 2+1

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.

Books Recommended:

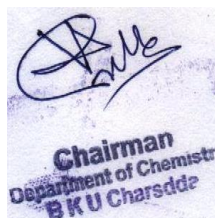
1. McQuarrie, D. A. and Simon, J. D., Physical Chemistry – A Molecular Approach, 1st ed., University Science Books, (1997).
2. Atkins, P. and Paula, J. D., Atkins's Physical Chemistry, 9th ed., Oxford University Press, (2010).
3. Shoemaker, D., Experiments in Physical Chemistry, 8th ed., McGraw Hill Publishing Company Limited, (2003).
4. Silbey, R., Alberty, R. and Bawendi, M., Physical Chemistry, 4th ed., (2005).
5. Glasstone, S., Textbook of Physical Chemistry, Macmillan London (1960).
6. James, A. M., Prichard, F. E., Practical Physical Chemistry, 3rd ed., Longman Group Limited, New York, (1974).
7. Chaudhary, S. U., Ilmi Textbook of Physical Chemistry, 2nd ed., Ilmi Kitab Khana, Lahore, (2013).
8. Atkins, P., Jones, L., Chemical Principles: The Quest for Insight, 5th ed., W. H. Freeman, New York, (2010).
9. Linder, B., Elementary Physical Chemistry, World Scientific Publishing Co. Pvt. Ltd., (2011).
10. Davis, W. M., Dykstra, C. E., Physical Chemistry: A Modern Introduction, 2nd ed., CRC Press, (2011).



Practical

Physical Chemistry-II

Laboratory Work illustrating Topics Covered in CHEM-427



SUBJECT SPECIFIC**Course Title: Environmental Chemistry****Course Code: CHEM-424****CREDIT HOURS: 03****Fossil fuels and energy sources**

Origin and development of coal: Origin and reserves of petroleum and natural gas, composition and classification of petroleum, refining, and environmental problems associated with petroleum, nuclear fission reactors, solar energy, power synthesis, tidal and geothermal energy, synthetic chemical fuels, the H economy, electrochemical energy conversion, conservation of free energy, the energy balance of the earth.


Soils and mineral resources

Estimating reserves of mineral resources of earth, extraction of metal-general principles, iron, steel, aluminium, copper and other metals, sulphur and nitrogen. Organic matter in soil, soil nutrients, ion exchange in soils, solid pH and nutrients availability.

Books Recommended

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.

Staneley E. Manahan, Environmental chemistry, Brooks, California



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Credit Hours: 02+1**Course Objectives**

To familiarize students with the concept of accuracy, manipulation and use of statistical analysis in data handling for quantitative determination.

Course Contents**Introduction to Analytical Chemistry:**

Scope and applications of analytical chemistry, quantitative reactions, stoichiometric relationships, solution chemistry, expression of quantities and concentrations. Basic approach to equilibrium.

Sampling:

Types of sampling techniques, sampling of gas, liquid and solid, treatment of samples to obtain homogenous solutions.

Errors in chemical analysis and minimization:

Steps in analytical procedures, errors, precision, accuracy, types of errors, steps involved in minimization of errors.

Statistical evolution of data:

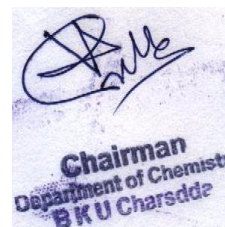
Ways of expressing accuracy, mean, median, mode, deviation, standard deviation, mean deviation, relative standard deviation. The confidence limit, confidence intervals, rejection of the results, limit of detection and quantification.

Recommended Books

1. Skoog, D.A.; West, P.M.; Holler, F.J.; Crouch, S. R., *Fundamentals of Analytical Chemistry*, 8th Edition, Holt, Rinehart and Winston, NY, USA, 2004.
2. Christian, G.D., *Analytical Chemistry*, 6th ed., John Wiley and Sons, Inc., NY, USA, 1999.

Supplementary Reading Material

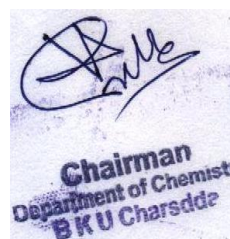
1. Harris, D. C., *Quantitative Chemical Analysis*, 5th ed. W. H. Freeman and Company, NY, USA, 1999.
2. Braun, R.D., *Introduction to Chemical Analysis*, International Student Edition, 1985.
3. Vogel, A.I., *A Text Book of Quantitative Inorganic Analysis*, 3rd ed. The English Language Book Society, 1961.
4. Kolthoff, I.M.; Sandal, E.B., *Text Book of Quantitative Inorganic Analysis*, The
5. Miller, J.C.; Miller, J.N., *Statistics for Analytical Chemistry*, Ellis Horwood Limited, Chichester, England, 1984.
6. Woodget, B.W.; Cooper, D., *Samples and Standards*; Editor: Chapman, N.B., Analytical Chemistry by Open Book Learning, John Wiley and Sons, Inc., NY, USA, 1987.



PRACTICAL

Analytical Chemistry Practical

Laboratory work illustrating topics covered in the Lectures of CHEM-421



SUBJECT SPECIFIC**Course Title: Applied Chemistry-III****Course Code: CHEM-422****CREDIT HOURS: 02+1****Course Objectives**

The course is designed to give sufficient knowledge about iron, steel and its alloys, petrochemicals and polymers. The course also provide the knowledge about corrosion and its preventions.

Course Contents**Iron, Steel and Alloys Industries**

Iron ores, constituents and their classification; Manufacture of iron and steel; Types of iron and steel; Metal Extractions and production of Alloys.

Corrosion and its Prevention

Chemistry and causes of corrosion phenomena; Types and theories of corrosion; Corrosion prevention and inhibitors; Surfaces coating and Electroplating.

Petrochemicals

Introduction of petrochemical, Petrochemical Processes, Manufacture of monomers such as acetylene, ethylene, propylene; benzene, toluene and xylene.

Polymers

Introduction to Polymers, Types of polymers i.e. Natural and synthetic Polymers, Inorganic polymers, Types of polymerizations such as *In-situ* bulk polymerization, Addition polymerization, step-growth polymerization, Ionic polymerization, Copolymerization, Emulsion Polymerization, Applications of polymers

Recommended Books

Christie, R. M., Colour Chemistry, The Royal Society of Chemistry, 2001.

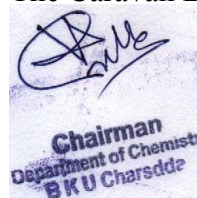
Gyngell, E. S., Applied Chemistry for Engineers, 3rd Ed. Edward Arnold, Ltd London, 1972 Reprinted 1989.

Kuriacose J. C.; J. Rajaran., Chemistry in Engineering and Technology, Vol. II 1988.

Evans, U. R., An Introduction to Metallic Corrosion, 3rd Ed., Edward Arnold 1981.

Haq Nawaz Bahtti, Muhammad Salman Applied Chemistry, Publisher The Caravan Book House, Lahor, Pakistan

Malcolm P.S. "Polymer Chemistry" Oxford University Press (2005).



SUBJECT SPECIFIC**Course Title: Biochemistry-III****Course Code: CHEM-423****Course Objectives**

This course provides fundamental concepts in biochemistry, which focuses upon the major macromolecules and chemical properties of living systems. Primary topics include the structures, properties and functions of amino acids, proteins, carbohydrates, lipids and nucleic acids.

Course Contents**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.

Carbohydrates

Definition, 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.

Lipids

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.

Proteins

Chemistry and classification of Amino acids, physical and chemical properties of amino acids. Biological significance of amino acids and peptides. Proteins; their classification, properties and biological significance. Primary, secondary, tertiary and quaternary structure of proteins. Denaturation of proteins. Protein sequencing.

Nucleic Acids

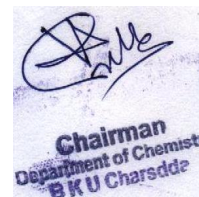
Chemical composition, structure and biological significance of nucleic acids. Chemical synthesis of oligonucleotides. Nucleic acids hydrolysis. Isolation and separation of Nucleic acids. Introduction to recombinant DNA technology.

Recommended Books

1. Nelson, D. L.; Cox, M. N., *Lehninger principles of biochemistry*, 4th ed. Worth Publisher, New York, 2004.
2. Murray, R. K.; Mayes P. A.; Granner, D. K.; and Rodwell, V. W., *Harper's Biochemistry*, Appleton & Lange, 2000.
3. West, W. R.; Todd, H. S., *Text Book of Biochemistry*, 4th ed. Macmillan, London, 1968.

Supplementary Reading Material

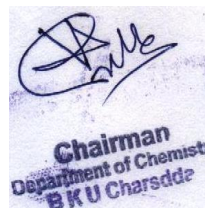
1. Voet, D.; Voet J. G., *Biochemistry*, 3rd ed. John Wiley & Sons, New York, 2004.
2. Zubay, G., *Biochemistry*, 4th ed. Macmillan Publishing Co, 1999.
3. www.bio.mtu.edu/campbell/401sch1.html



PRACTICAL

Biochemistry Practical

Laboratory Work Illustrated Topics Covered in the Lectures of CHEM-423



COURSE WISE BREAKUP

Third Year

Fifth Semester


THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-555	INORGANIC CHEMISTRY	03	100
CHEM-556	ORGANIC CHEMISTRY	03	100
CHEM-557	PHYSICAL CHEMISTRY	03	100
CHEM-551/552/553/558	ANALYTICAL/APPLIED/BIO /FUEL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-555	INORGANIC CHEMISTRY	01	25
CHEM-556	ORGANIC CHEMISTRY	01	25
CHEM-557	PHYSICAL CHEMISTRY	01	25
CHEM-551/552/553/558	ANALYTICAL APPLIED /BIO/ /FUEL CHEMISTRY	01	25

- **Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)**
- **Maximum Marks = 500 (theory 400 & practicals 100 marks)**



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CHEMISTRY COURSE**Course Title: Inorganic Chemistry****Course Code: CHEM-555****Credit Hours: 03****Marks: 100****Course Objectives:**

Students will acquire knowledge about the physical and chemical properties of d- & f- block elements on the basis of their electronic configurations and will be able to work out structures of coordination compounds through development of understanding of VBT, CFT and MOT.

Course Contents:

Chemistry of d-block elements and coordination complexes: Back ground of coordination chemistry, nomenclature and structure of coordination complexes with coordination number 2-6, chelates and chelate effect, theories of coordination complexes, Werner's theory, valence bond theory (VBT), crystal field theory (CFT) and molecular orbital theory (MOT), Jahn-Teller theorem, magnetic properties, spectral properties, isomerism, stereochemistry, and stability constants of coordination complexes.

Chemistry of f-block elements:

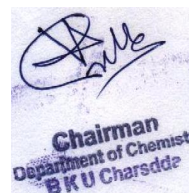
- i. Lanthanides: General characteristics, occurrence, extraction and general principles of separation, electronic structure and position in the periodic table, lanthanides contraction, oxidation states, spectral and magnetic properties and uses.
- ii. Actinides: General characteristics, electronic structure, oxidation state and position in the periodic table, half-life and decay law

Recommended Books

- 1 Miessler, G. L.; Tarr, D.A., *Inorganic Chemistry*, Prentice-Hall International, New Jersey, USA, **1991**.
- 2 Day, M.C.; Selbin, J., *Theoretical Inorganic Chemistry*, 2nd ed., Van Nostrand Reinhold Company, New York, USA, **1969**.
- 3 Shriver, D. F.; Atkins, P. W.; Langford, C. H., *Inorganic Chemistry*, 2nd ed., Oxford University Press, **1994**.

Supplementary Reading Material

- 1 Huheey, J. E.; Keiter, E. A.; Keiter, R. L., *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed., Harper and Row, New York, **2001**.
- 2 Cotton, F. A.; Wilkinson, G. *Basic Inorganic Chemistry*, 3rd ed., Wiley, New York, **1995**.
- 3 Lee, J.D., Chapman and Hall, *Concise Inorganic Chemistry*, 5th ed., Chapman and Hall, **1996**.



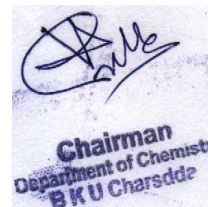
Course Title: Inorganic Chemistry (Practical)

Course Code: CHEM-555

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-555



CHEMISTRY COURSE**Course Title: Organic Chemistry-II****Course Code: CHEM-556****Credit Hours: 03****Marks: 100****Course Objectives**

As a result of successful completion of this course, a student will be able to:

5. Give IUPAC and common names to the classes of compounds as well as be able to determine the optical configurations of stereo-chemical compounds using the R,S convention, and give proper names to the geometric isomers using the E,Z convention;
6. Apply the concepts and principles in structure elucidation of simple organic compounds.
7. Compare and contrast the mechanisms for nucleophilic substitution reactions in terms of nucleophile, substrate and reaction solvent.
8. Compare and contrast the mechanism for β -elimination reaction in terms of substrate, base, reactant, solvent and the stereochemistry of the reaction.

Course Contents**Isomerism:**

Introduction; classification of isomerism; optical isomerism: optical activity, chirality and optical activity, symmetry elements and optical inactivity, relative and absolute configuration, R,S notation, method of determining configuration, racemic mixtures and their resolution, asymmetric synthesis, optical activity in biphenyls, allenes and Spiro-compounds, stereo-specific and stereo-selective reactions; geometrical isomerism: determination of configuration of geometrical isomers, Z,E convention and *cis-trans* isomerism in cyclic systems; conformational isomerism: conformational analysis of mono-substituted cyclohexanes, di-substituted cyclohexanes and decalin systems.

Introductory Organic Spectroscopy:

Introduction to IR, UV, $^1\text{H-NMR}$ and Mass spectrometric methods, and their usage for structure elucidation of some simple organic compounds.

Aliphatic Substitution Reactions**Aliphatic Nucleophilic Substitution Reactions:**

Mechanisms — study of SN_2 , SN_1 , SN_i , SN_2' , SN_1' , SN_i' mechanisms; neighbouring group participation—intramolecular displacement by neighbouring oxygen, nitrogen, sulphur and halogen; structure and reactivity—effects of the substrate structure, entering group, leaving group and reaction medium on the mechanisms and rates of substitution reactions.

Aliphatic Electrophilic Substitution Reactions:

Mechanisms—study of SE_1 , SE_2 (front), SE_2 (back) and SE_i mechanisms; structure and reactivity effects of substrate, leaving group and medium on the rates of these reactions.

Elimination Reactions:

Eliminations Proceeding by Polar Mechanisms:

Study of E₁, E_{1c}B and E₂ mechanisms; orientation- Saytzeff and Hofmann rules; structure and reactivity, the effects of substrate structure, attacking base, leaving group and the reaction medium on the rates and mechanisms of elimination reactions; competition between elimination and substitution reactions.

Eliminations by Non-polar Mechanisms:

Pyrolytic eliminations—study of E_i and free-radical mechanisms; orientation in pyrolytic eliminations.

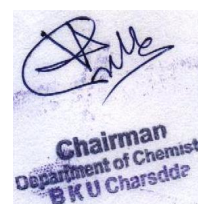
Recommended Books

(Latest available editions of the following books)

6. Wade Jr., L. J., *Organic Chemistry*, Pearson Education, Delhi.
7. Sykes, P., *A Guide Book to Mechanism in Organic Chemistry*, Longman, London.
8. Pavia, D. L., Lampman, G. M.; Kriz, G. S.; *Introduction to Spectroscopy: A Guide for Students of Organic Chemistry*, Saunders Golden Sunburst Series, London.
9. Morrison, R. T.; Boyd, R. N., *Organic Chemistry*, Prentice-Hall of India, New Delhi.
10. McMurry, J., *Organic Chemistry*, Brooks/Cole Publishing Company, California.

Supplementary Reading Material

1. Eliel, E. L.; Wilen, S. H.; Doyle, M. P., *Basic Organic Stereochemistry*, Wiley Interscience, New York.
2. Loudon, G. M., *Organic Chemistry*, Oxford University Press, New York.
3. March, J., *Advanced Organic Chemistry*, John Wiley & Sons, New York.
4. Sykes, P., *A Guide Book to Mechanism in Organic Chemistry*, Longman, London.
5. Norman, R. O.C.; Coxon, J. M., *Principles of Organic Synthesis*, Nelson Thornes, Cheltenham.
6. Kalsi, P.S., *Spectroscopy of Organic Compounds*, Wiley Eastern Ltd., New Delhi.
7. Pavia, D. L.; Lampman, G. M.; Kriz, G. S., *Introduction to Spectroscopy: A Guide for Students of Organic Chemistry*, Saunders Golden Sunburst Series, London.
8. Carey, F. A., *Organic Chemistry*, McGraw-Hill, New York.
9. Solomons, T. W. G.; Fryhle, C. B., *Organic Chemistry*, John Wiley & Sons, New York.



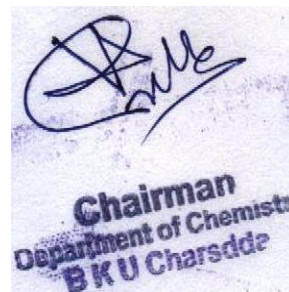
Course Title: Organic Chemistry (Practical)

Course Code: CHEM-556

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-556



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Course Objectives

To acquire more knowledge of the kinetic theory of gases, chemical thermodynamics, and chemical kinetics and the basic knowledge of quantum chemistry.

Course Contents**KINETIC MOLECULAR THEORY OF GASES**

Molecules in motion, Collision diameter, Collision frequency and mean free path. Maxwell's law for distribution of molecular velocities, calculation of molecular velocities. Maxwell-Boltzmann's law of energy distribution.

CHEMICAL EQUILIBRIUM

Concept of chemical equilibrium, Law of mass action, Relation of K_c with K_p , K_x and K_n , Applications of equilibrium constant, Le-Chatelier's principle and its applications, Common ion effect, Solubility product constant. Acid-Base equilibria and buffer solution

INTRODUCTION TO QUANTUM CHEMISTRY

Nature of light, Plank quantization theory, Wave and particle nature of matter, De Broglie's equation, Heisenberg's uncertainty principle, Bohr's Model and its defects, Four quantum numbers, Setting up of Schrodinger wave equation.

ELECTROCHEMISTRY-I

An introduction to electrochemistry, Ohm's law, conductance, molar conductance and equivalent conductance, Kohlraush's law of independent migration of ion, Activity and activity coefficient, Debye-Huckel Theory, Electrochemical cells, Voltaic cell, Electrolytic cell, Cell notation, Types of electrochemical cell (Concentration cell & Redox cell).

Recommended Books:

1. Smith, E. Brain, "Basic Chemical Thermodynamics" 5th ed., Imperial College Press (2004).
2. Smith E.B. "Basic Chemical Thermodynamics" 4th ed. Oxford University Press(1990).
3. Micheal D.F. "Elements of Quantum Mechanics" Oxford University Press (2005).
4. Griffiths, David J., "Introduction to Quantum Mechanics" 2nd ed., Prentice Hall (2004)



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Department of Chemistry
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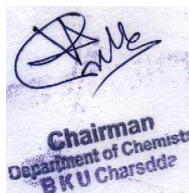
Course Title: Physical Chemistry (Practical)

Course Code: CHEM-557

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-557



BS 3rd Year

Semester-V

CHEMISTRY COURSE

Course Title: ANALYTICAL CHEMISTRY

Course Code: CHEM-551

Credit Hours: 03

Marks: 100

Course Objectives

By taking this course, students will learn how to prepare buffer solutions and how to use gravimetric and different titrimetric methods of analysis for quantitative determination.

Course Contents

Gravimetric methods of analysis:

Solubility and solubility product of sparingly soluble salts, separation by precipitation, formation and size of precipitates, types of precipitates, impurities in precipitates, quantitative calculations, stoichiometric reactions.

Neutralization titration:

Theory of neutralization titration, titration curve, theories of indicator, choice of indicator, buffer, preparation of buffer, buffer capacity and buffer mechanism. Application of neutralization titration. Hydrolysis of salt and pH calculation.

Complexometric and precipitation titration:

Complex formation reaction, titration with chelating agents, indicators used in complexometric titration. Precipitation titration, endpoint location in precipitation titration, Applications of complexometric and precipitation titration.

Oxidation Reduction titrations:

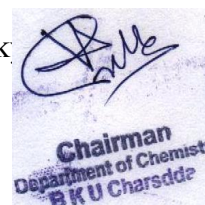
Oxidizing and reducing agents, titration curve, choice of indicator and colour change mechanism, applications of redox titrations.

Recommended Books

1. Skoog, D.A.; West, P.M.; Holler, F.J.; Crouch, S. R., *Fundamentals of Analytical Chemistry*, 8th ed. Holt, Rinehart and Winston, NY, USA, 2004.
2. Vogel, A.I., *A Text Book of Quantitative Inorganic Analysis*, 3rd ed. The English Language Book Society, 1961.
3. Harris, D. C., *Quantitative Chemical Analysis*, 5th ed. W. H. Freeman and Company, NY, USA, 1999.

Supplementary Reading Material

1. Barun, R.D., *Introduction to Chemical Analysis*, International Student Edition, 1985.
2. Kolthoff, I.M.; Sandell, E.B., *Text Book of Quantitative Inorganic Analysis*, The MacMillan Company, NY, USA, 1943.
3. Chistian, G.D., *Analytical Chemistry*, 6th ed. John Wiley and Sons, Inc., NY, USA, 1999.
4. Fifield, F. W.; Kealey, D., *Principle and Practice of Analytical Chemistry*, 2nd ed. International Text Book Company Limited, London, 1983.
5. Dick, J.G., *Analytical Chemistry*, McGraw-Hill Kogakusha, Limited, Tok 1973.



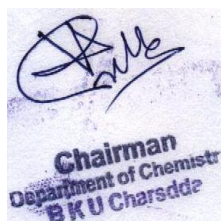
Course Title: Analytical Chemistry (Practical)

Course Code: CHEM-551

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-551



BS 3rd Year

Semester-V

CHEMISTRY COURSE

Title of the Course: Applied Chemistry

Course Code: CHEM-552

Credit Hours: 03

Marks: 100

Course Objectives

The objectives of the course are

To cater the students about the raw material, manufacturing and chemistry involved in the cement industry. To understand the various water softening processes ,chemistry involed in scale formation and its prevention.To understand the i.e;that is its raw material chemistry involved in processing of pulp and in manufacturing of paper.The students will also acquire the knowledge about the size separation paper and pulp technology, principles of evaporation, types construction of evaporators and heat and material balances equation.

Course Contents

Glass Industry

Raw materials and manufacture of glass; Chemistry involved in the production of glass; Types of glass; Glassy state phenomena and annealing of glass; Photochromic and photographic lasses; Production of safety glasses.

Water Treatment, Steam Production and Scale Removal

Sources of water; hardness of water; water treatment and conditioning for municipal and industrial purposes. Steam production and its utilization for power and energy generation; boiler water treatment; chemistry involved in the formation of scale; prevention of scale formation.

Metallurgy

Ores, General steps in Metallurgical Process, Extraction of Iron, copper, Aluminium, Nickel

Grinding and Separation

Principal of communiton, Communiting equipments. Energy Requirements for Size reduction.

Evaporation

Principles of evaporation. Types of evaporation. Construction and wsorking principal of evaporators. Heat and mass transfer in evaporation. Methods of feeding multiple effect evaporators. Improved efficiency in evaporators

Recommended Books

- 1 George T. Austin., Shreve's Chemical Process Industries, 5th Edition., McGraw Hill Book Company , New York, (1984).
- 2 Riegel, E. R., Industrial Chemistry, 5th Ed., Reinhold Publishing Corporation New York, (1997).
- 3 Jain .P. C., A Textbook of Applied Chemistry, (1993).
- 4 Bye .G. C., Portland Cement, (1983).
- 5 Walter. L. Badger & Julius T. Banchemo, Introduction to Chemical Engineeing, (1955).
- 6 Wiseman, P., Industrial Organic Chemistry, 2nd Ed., Applied Science Publisher Ltd., London, (1979).
- 7 Coulson & Richardson., Chemical Engineering, Vol I and II., (1985).
- 8 James P. Casey, Pulp & Paper Chemistry and Chemical Technology, 3rd Ed., Vol.II, (1980).

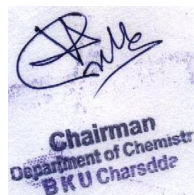
Course Title: Applied Chemistry (Practical)

Course Code: CHEM-552

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-552



BS 3rd Year

Semester-V

Course Title: Biochemistry

Course Code: CHEM-553

Credit Hours :03

Marks: 100

Course Objectives

This course provides fundamental concepts about the energy production and the mechanisms of the major macromolecules metabolism. Regulation and inhibition of the metabolic pathways are also addressed. This course will also integrate knowledge of bioenergetics and the metabolic pathways of amino acids, proteins, carbohydrates, nucleic acids and lipids to solve biological problems.

Course Contents

Intermediary Metabolism and Bioenergetics

Biological oxidation—Reduction including respiratory carriers. Cell bioenergetics. Oxidative Phosphorylation.

Metabolism of Carbohydrates

Digestion, absorption and transport of sugars into cell. Glycolysis, Citric Acid Cycle, HMP pathway and its significance. Uronic acid pathway. Gluconeogenesis, Glycogenesis, Glycogenolysis.

Metabolism of Lipids

Digestion of Lipids, absorption and transport of lipids and fatty Acids. Oxidation of saturated, unsaturated, odd chain and branched chain fatty acids. Biosynthesis of Fatty Acids and eicosanoids. Biosynthesis of triglycerides, phospholipids, steroids and bile Acids. Biosynthesis and utilization of Ketone bodies.

Metabolism of Proteins

Digestion of proteins, absorption and transport of amino acids to the cell. Biochemical reaction of amino acids: Decarboxylation, deamination, transamination and transmethylation etc. Metabolism of essential amino acids, Metabolic disorders, Urea cycle. Creatine and uric Acid synthesis. Inter-relationship between carbohydrate, lipid and protein metabolism.

Metabolism of Nucleic Acids

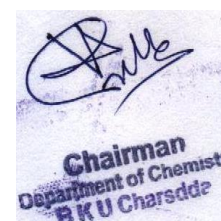
Biosynthesis and catabolism of purines and pyrimidines and their regulation. Synthesis and catabolism of nucleic acids and nucleotide. DNA Polymerases and other enzymes involved in metabolism.

Recommended Books

1. Berg, J. M.; Tymoczko, J. L.; Stryer, L., *Biochemistry*, 6th ed. W. H. Freeman, 2006.
2. Murray, R. K.; Mayes P. A.; Granner, D. K.; and Rodwell, V. W., *Harper's Biochemistry*, Appleton & Lange, 2000.
3. West, W. R.; Todd, H. S., *Text Book of Biochemistry*, 4th ed. Macmillan, London, 1968.

Supplementary Reading Material

1. Pankajanaik., *Biochemistry*, 2nd ed. Jaypee brothers medical publishers Ltd., New Delhi, 2007.
2. <http://www.wiley.com/college/voetfundamentals>
3. www.worthington-biochem.com/best



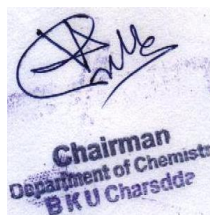
Course Title: Biochemistry (Practical)

Course Code: CHEM-553

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-553



BS 3rd Year

Semester-V

CHEMISTRY COURSE

Course Title: Fuel Chemistry

Course Code: CHEM-558

Credit Hours: 03

Marks: 100

Course Objectives

After completing the course, the students will acquire knowledge about coal beneficiation, storage, briquetting, and coke oven gas conditioning. They will learn about economical and environmentally friendly utilization of coal and coke.

Course Contents

Coke oven gas conditioning (Chemicals from Coal):

Separation of tar from coke oven gas, Hydrogen sulphide removal from coke oven gas: Oxide boxe process, Seaboard process, Hot-actification process, and Thylox sulphur recovery process. Recovery of ammonia from coke oven gas: Semi direct sulphate process, Indirect process. Separation of light oil from coke oven gas.

Coal beneficiation: Gravity separation; Wet Launder washers, Wet Jig washers, Wet classifiers, Wet tables, Air cleaning tables, Air Launder, Air cleaning jig. Float and sink process; Chance sand flotation process, Air sand process, Froth flotation.

Storage of Coal: Spontaneous heating factors, Precautions in coal storage.

Coal briquetting: Objectives of briquetting, Binder less briquetting, Briquetting with binder.

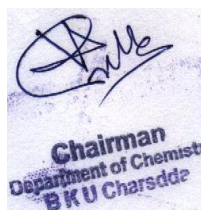
Classification of coal: Ranks of coal, Parr's, Ralston's, Seyler's,, ASTM, NCB and International (E.C.E) classifications.

Petrology of coal: Thiessen U.S Bureau of mines nomenclature, Stopes nomenclature, International committee for coal petrography (ICCP) nomenclature, Bright coal, Splint coal, and Semi-splint coal.

Carbonization of coal: Low temperature and high temperature carbonization, Coking and non coking coals, Giesceler plastometer, Audibert-Arnu dilatometer, Free swelling index, Gray King assays

Recommended Books:

5. Berkowitz. N. "An Introduction to Coal Technology" Academic Press, London, New York (1981).
6. Wilson, P.J. and Wells, J.H. "Coal Coke and Coal Chemicals" McGraw-Hill Book Company, London, (1980).



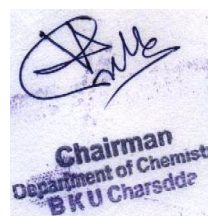
Course Title: Fuel Chemistry (Practical)

Course Code: CHEM-558

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-558



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BKU Charsada

COURSE WISE BREAKUP

Third Year

Sixth Semester


THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-565	INORGANIC CHEMISTRY	03	100
CHEM-566	ORGANIC CHEMISTRY	03	100
CHEM-567	PHYSICAL CHEMISTRY	03	100
CHEM-561/ CHEM-563 /CHEM-562/ CHEM-568	ANALYTICAL/BIO/APPLIED /FUEL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-565	INORGANIC CHEMISTRY	01	25
CHEM-566	ORGANIC CHEMISTRY	01	25
CHEM-567	PHYSICAL CHEMISTRY	01	25
CHEM-561/ CHEM-563 /CHEM-562/ CHEM-568	ANALYTICAL/BIO/APPLIED /FUEL CHEMISTRY	01	25

- Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)
- Maximum Marks = 500 (theory 400 & practicals 100 marks)



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CHEMISTRY COURSE**INORGANIC CHEMISTRY****Course Title: Inorganic Chemistry****Course Code: CHEM-565****Credit Hours: 03****Marks: 100****Course Objectives:**

Students will acquire knowledge about various types of inorganic materials, their structure, synthesis, characterization and applications in various fields

Course Contents:

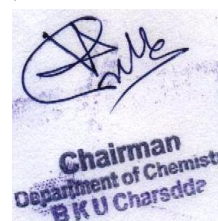
Introduction to inorganic materials, crystalline and amorphous states, bonding in solids, non-stoichiometric compounds, binary solid solutions, mechanical, electrical, magnetic, dielectric, optical, and chemical (corrosion) properties of advanced materials, synthesis (e.g., sol-gel, hydrothermal techniques, etc.) and design of inorganic materials and characterization, doping and purification of silicone, chemical vapour deposition and sputtering, introduction to nano-materials

Recommended Books

- 1 Miessler, G. L.; Tarr, D.A., *Inorganic Chemistry*, Prentice-Hall International, New Jersey, USA, **1991**.
- 2 Day, M.C.; Selbin, J., *Theoretical Inorganic Chemistry*, 2nd ed., Van Nostrand Reinhold Company, New York, USA, **1969**.
- 3 Shriver, D. F.; Atkins, P. W.; Langford, C. H., *Inorganic Chemistry*, 2nd ed., Oxford University Press, **1994**.

Supplementary Reading Material

- 1 Huheey, J. E.; Keiter, E. A.; Keiter, R. L., *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed., Harper and Row, New York, **2001**.
- 2 Cotton, F. A.; Wilkinson, G. *Basic Inorganic Chemistry*, 3rd ed., Wiley, New York, **1995**.
- 3 Lee, J.D., *Concise Inorganic Chemistry*, 5th ed., Chapman and Hall, **1996**.



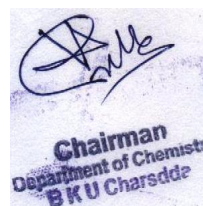
Course Title: Inorganic Chemistry (Practical)

Course Code: CHEM-565

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-565



CHEMISTRY COURSE**Course Title: Organic Chemistry-III****Course Code: CHEM-566****Credit Hours: 03****Marks: 100****Course Objectives**

At the conclusion of this course, the student should be able to:

1. Apply fundamental chemical principles of addition of various types of nucleophiles and electrophiles to electron rich centers such as carbon-carbon and carbon-heteroatom multiple bonds.
2. Describe, in general, the structure and bonding in organometallics.
3. Describe the reactivity order of the Grignard reagent, organo-lithium, organo-cadmium, organo-zinc and organo-copper with carbon-heteroatom multiple bonds.
4. Acquire the knowledge of generating stabilized carbanions and their reactions with soft electrophiles selectively and specifically. Predict the effect of a substituent on pK_a.
5. Outline the completed electrophilic aromatic substitution reactions.
6. Predict the effect; a substituent will have on the regioselectivity of an electrophilic and nucleophilic substitution reaction. Recognize and be able to write the mechanism of nucleophilic/electrophilic aromatic substitution.

Course Contents**Addition Reactions:**

Electrophilic and Nucleophilic Addition to C=C: Their mechanisms, orientation and stereochemistry; electrophilic addition of halogens and hydrogen halides to C=C; electrophilic addition to conjugated dienes; nucleophilic addition to C=C and C=C-C=O linkage.

Nucleophilic Addition to C=O:

Structure and reactivity of carbonyl group; simple addition reactions i.e. addition of water, alcohol, hydrogen cyanide and bisulphite; addition/elimination reactions: addition of derivatives of ammonia; stereoselectivity in carbonyl addition reactions.

Organometallic Compounds:

Principles; organo-magnesium, organo-sodium, organo-lithium, organo-copper, organo-cadmium, organo-mercury and organo-zinc compounds: their structure and reactivity, methods of preparation and synthetic applications.

Chemistry of Enols and Enolate Ions:

Acidity of carbonyl compounds; enolization of carbonyl compounds; α -halogenation of carbonyl compounds; aldol-addition and aldol-condensation; condensation reactions involving ester enolate ions; alkylation of ester enolate ions.

Aromatic Substitution Reactions:

Electrophilic Substitution Reactions: Mechanisms of substitution; orientation and reactivity; electrophilic substitution reactions i.e. nitration, halogenation, sulphonation; Friedel-Craft's reaction, diazocoupling, formylation and carboxylation.

Nucleophilic Substitution Reactions:

Mechanisms - study of S_NAr, S_N1 and benzyne mechanisms; structure and reactivity - the effects of substrate structure, leaving group and the attacking nucleophile on the rates of substitution reactions.

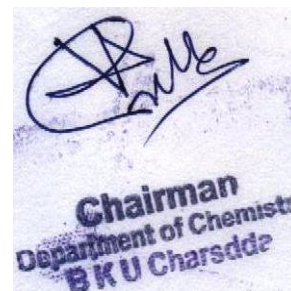
Recommended Books

(Latest available editions of the following books)

1. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P., *Organic Chemistry*, Oxford University Press, New York.
2. Sykes, P., *A Guide Book to Mechanism in Organic Chemistry*, Longman, London.
3. March, J., *Advanced Organic Chemistry*, John Wiley & Sons, New York.
4. Bruckner, R., *Advanced Organic Chemistry-Reaction Mechanisms*, Harcourt Science & Technology Company, New York.

Supplementary Reading Material

1. Carroll, F. A., *Perspectives on Structure and Mechanism in Organic Chemistry*, Brooks/Cole Publishing Company, New York.
2. Loudon, G. M., *Organic Chemistry*, Oxford University Press, New York.
3. Carey, F. A., *Organic Chemistry*, McGraw-Hill, New York.
4. Morrison, R. T.; Boyd, R. N., *Organic Chemistry*, Prentice-Hall of India, New Delhi.
5. Solomons, T. W. G.; Fryhle, C. B., *Organic Chemistry*, John Wiley & Sons, New York.
6. Pine, S. H., *Organic Chemistry*, National Book Foundation, Islamabad.
7. Ege, S., *Organic Chemistry*, A.I.T.B.S. Publishers & Distributors, Delhi.
8. Parkins, A. W.; Poller, R. C., *An Introduction to Organometallic Chemistry*, Macmillan, London.
9. Norman, R. O.C.; Coxon, J. M., *Principles of Organic Synthesis*, Nelson Thornes, Cheltenham.



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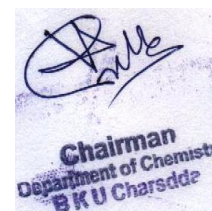
Course Title: Organic Chemistry (Practical)

Course Code: CHEM-566

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-566



Handwritten signature: *Chauhan*
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BS 3rd Year

Semester-VI

CHEMISTRY COURSE

Course Title: Physical Chemistry

Course Code: CHEM-567

Credit Hours: 03

Marks: 100

Course Objectives

To acquire basic knowledge of electrochemistry, nuclear chemistry, group theory and photochemistry.

Course Contents

SOLUTION CHEMISTRY

Solution and its types, Ideal and non-ideal solutions, Raoult's and Henry's laws and their applications, Solubility of solids. Factors affecting solubility of solids.

Fugacity, Raoult's law in terms of fugacity, Heat of mixing, Statistical mechanics of ideal solutions.

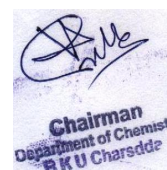
Colligative properties of solutions i.e. Lowering of vapor pressure, Depression of freezing point, Elevation of boiling point, Osmotic pressure and their applications in determination of molecular masses. Salt hydrolysis and determination of hydrolysis constant (K_h), Activity & activity coefficient.

CHEMICAL THERMODYNAMICS -II

Concept of entropy and its calculations, 2nd Law of thermodynamics, Free energy and its calculations, Relation of free energy with equilibrium constant, dependence of entropy and free energy on temperature, Clausius-Clapeyron's equation, Partial molar quantities and chemical potential.

Books Recommended

1. Segal H. "Enzyme Kinetics" John Wiley New York (1975).
2. Schlutz A.R. "Enzyme Kinetics" (1964) Cambridge University Press England
3. Bockris J.O.M. and Reddy A.K.N. "Modern Electrochemistry" Vol-I and II, 4th ed. Plenum Press, London (2003).
4. Muhammad M. and Amjad M. "Principles of Electrode Kinetics" Rooha Printers, Lahore (2001).
5. Calvert J.G. and Pitts J.N. "Photochemistry" John Wiley, New York (1966).
6. Suppan P. "Principles of Photochemistry", the Chemical Soc., UK (1973).



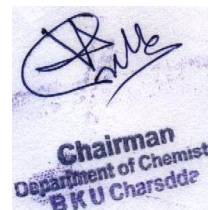
Course Title: Physical Chemistry (Practical)

Course Code: CHEM-567

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-567



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BS 3rd year

Semester-VI

CHEMISTRY COURSE (ANALYTICAL CHEMISTRY)

Course Title: ANALYTICAL CHEMISTRY

Course Code: CHEM-561

Credit Hours: 03

Marks: 100

Course Objectives

To apply the knowledge of separation techniques in chemistry and to realize its significance in instrumental methods.

Course Contents

Separation Techniques

Introduction and classification of separation techniques:

Precipitation, volatilization, distillation, masking, solvent extraction, chromatography and electrophoresis.

Solvent Extraction:

Principle of solvent extraction, the distribution coefficient, the distribution ratio, solvent extraction of metals. Analytical separation, multiple batch extraction, solid phase extraction. Applications of solvent extraction.

Classical Chromatographic Techniques:

Principles of chromatography, classification of chromatographic techniques; adsorption, partition, ion exchange, affinity and size exclusion chromatography. Separation techniques of column chromatography, column efficiency in chromatography. Ion exchange chromatography, size exclusion chromatography, paper chromatography and thin layer chromatography

Electrophoresis:

Capillary zone electrophoresis. Low voltage electrophoresis. High voltage electrophoresis. Analytical applications of electrophoresis.

Thermal Analysis:

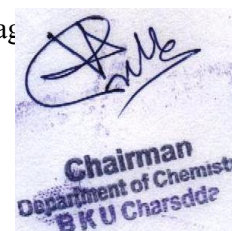
Thermogravimetric and differential thermal analysis. Basic principle, instrumentation and applications.

Recommended Books

1. Barun, R.D., *Introduction to Chemical Analysis*, International Student Edition, 1985.
2. Stock, R.; Rice, C.B.F., *Chromatographic methods*, 2nd ed. Chapman and Hall Limited, 1967.
3. Chistian, G.D., *Analytical Chemistry*, 6th ed. John Wiley and Sons, Inc., NY, USA, 1999.
4. Miller, J.M., *Chromatography Concepts and Contrasts*, John Wiley and Sons, NY, USA, 1988.

Supplementary Reading Material

1. Kolthoff, I.M.; Sandell, E.B., *Text Book of Quantitative Inorganic Analysis*, The MacMillan Company, NY, USA, 1943.
2. Skoog, D.A.; West, P.M.; Holler, F.J., Crouch, S. R., *Fundamentals of Analytical Chemistry*, 8th ed. Holt, Rinehart and Winston, NY, USA, 2004.
3. Dodd, J. W.; Tonge, K.H., *Thermal Methods*, Analytical Chemistry by Open Book Learning, John Wiley and Sons, NY, USA, 1987.
4. Daniels, T., *Thermal Analysis*, John Wiley and Sons, Inc., 1973.
5. Vogel, A.I., *A Text Book of Quantitative Inorganic Analysis*, 3rd ed. The English Language Society, 1961.



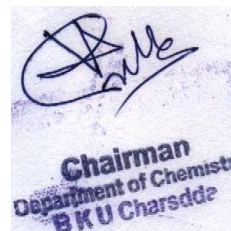
Course Title: Analytical Chemistry (Practical)

Course Code: CHEM-561

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-561



CHEMISTRY COURSE (APPLIED CHEMISTRY)**Title of the Course: Applied Chemistry****Course Code: CHEM-562****Credit Hours: 03****Marks: 100****Course Objectives**

The course introduces fermentation and biotechnology, photography, coal cleaning and its utilization. The course will also provide the knowledge about the filtration and distillation used in industrial processes.

Course Contents**Distillation**

Vapor Liquid equilibrium, methods of getting equilibrium data for binary systems, construction of equilibrium diagram, designing of distillation column, reflux ratio and its importance.

Coal cleaning and utilizations

Origin and types of coal; Coal cleaning and its utilization; Coal combustion, carbonization and gasification; Production of various fuel gases from coal such as water gas, producer gas etc.

Polymer Composites

Introduction to composite material, classification of composite on the basis of reinforcement (particle-reinforced composites, fiber reinforced composites, structural composites) and classification of composites on the basis of matrix phase (polymer matrix composite, metal matrix composite, ceramic matrix composite, carbon-carbon composite, hybrid composite, laminar composite, sandwich panels) synthesis, properties and applications of composite materials.

Recommended Books

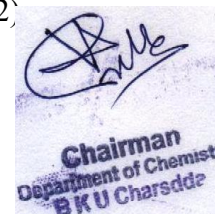
1. George T. Austin., Shreve's Chemical Process Industries, 5th Edition., McGraw Hill Book Company Inc. New York, (1984).
2. Riegel, E. R., Industrial Chemistry, 5th Ed., Reinhold Publishing Corporation New York, (1997).
3. Kister, H., Distillation operation 1st ed., McGraw-Hill professional, (1990)
4. Wiseman, P., Industrial Organic Chemistry, 2nd Ed., Applied Science Publisher Ltd., London, (1979).
5. Coulson & Richardson., Chemical Engineering, Vol I and II.,(1985).
6. Jain., P. C., A Textbook of Applied Chemistry, (1993).
7. Berkowitz, N. "The Chemistry of Coal" Elsevier Amsterdam.(1985).
8. Gyngell, E. S., Applied Chemistry for Engineers, 3rd Ed. Edward Arnold, Ltd London,
9. Chawla, K.K., Composite materials: science and engineering, 3rd ed., Springer (2012).
10. Kister, H., Distillation operation 1st ed., McGraw-Hill professional, (1992)

Supplementary Reading Materials

Google/topic/book/publication /search.

<http://en.wikipedia.org>.

<http://www.sciencedirect.com>.



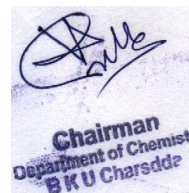
Course Title: Applied Chemistry (Practical)

Course Code: CHEM-562

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-562



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CHEMISTRY COURSE (BIOCHEMISTRY)**Course Title: Biochemistry****Course Code: CHEM-563****Credit Hours: 03****Marks: 100****Course Objective**

Course will emphasize on all the aspects of the chemistry of enzymes. Importance of coenzyme and cofactors will also be covered. This course will also emphasize on the acid-base regulation in human body.

Course Contents**Enzymes**

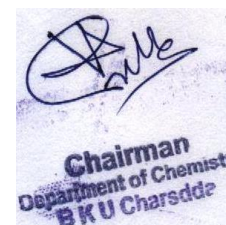
Chemical nature, nomenclature and classification of Enzymes and Cofactors. Substrate specificity, enzyme-substrate interactions and nature of active site. Mechanism of enzyme action with specific reference to chymotrypsin and ribonuclease. Kinetics of single substrate reactions. Effect of different factors on enzyme activity. Bisubstrate reactions. Quantitative assays of enzyme activity. Enzyme Inhibition. Regulatory enzymes; Allosteric enzymes, Multienzyme system, Zymogens, and Isozymes. Enzymatic control of metabolic pathways, Immobilized enzymes; synthesis, properties and uses.

Acid – Base and Electrolyte Chemistry

Intracellular and Extracellular Electrolytes. Body fluids as electrolyte solutions, pH, Henderson-Hasselbalch Equation and Buffers. Acids and bases, Actual and titratable acidities, Equilibrium reactions of acids, bases and protons. Buffer action. Effect of other ions on acid-base equilibria. Amino acids, peptides and proteins as acids and bases. Acid and base production in human metabolism. Regulation of Acid-Base Balance; Control of acidity and physiologic buffer action. Buffer capacity. Buffers of body fluids. Respiratory regulation of acid-base balance. Haemoglobin as an acid-base system. Renal control of Acid-base balance. Acid- Base disorders; Acidosis, Alkalosis. Effect of acid-base disturbances on electrolytes. Homeostasis, Variation of Na⁺, K⁺ and Cl⁻ in acid-base disturbances.

Recommended Books

1. Berg, J. M.; Tymoczko, J. L.; Stryer, L., *Biochemistry*, 6th ed. W. H. Freeman, 2006.
2. Guyton, A.C.; and Hall, J. E., *Text Book of Medical Physiology*, 9th ed. W. B. Saunders Company, Tokyo, 1996.
3. Jain. J. L., *Fundamentals of Biochemistry*, 5th ed. S. Chand and Company Ltd., New Delhi, 2003.
4. West, W. R.; Todd, H. S., *Text Book of Biochemistry*, 4th ed. Macmillan, London, 1968.

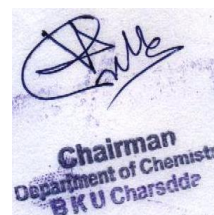


Course Title: Biochemistry (Practical) Course Code: CHEM-563

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-563



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CHEMISTRY COURSE (FUEL CHEMISTRY)**Course Title: Fuel Chemistry****Course Code: CHEM-568****Credit Hours: 03****Marks: 100****Course Objectives**

After successful completion of the course, the students will be able to achieve real depth of understanding in fuel chemistry particularly petroleum based oils ranging from gaseous fuels to the heavy residual fuel oils. The student will also get knowledge about alternative fuels to be used in case of non availability of petroleum based oils

Course Contents

Chemistry of hydrocarbon fuels: Occurrence and exploration of crude petroleum. Preliminary treatment of crude petroleum .Classification of crude petroleum Fractionation column, fractionation of crude petroleum and its theory. Thermal cracking, catalytic cracking .Catalytic reforming, steam reforming . Basic properties of petroleum products i.e. CNG, LPG, gasoline, kerosene, diesel fuels, lubricating oils and heavy residue. Lubricating grasses and petroleum waxes

Alternate Sources of energy: Biomass Resources: Biomass conversion processes, Bio gas technology. Alcohols: Alcohols and its uses as alternative fuel. Hydrogen: Hydrogen production, storage, handling and its uses as alternative fuel. Fuel cells: Fuel Cells and its application, Phosphoric acid, molten carbonate and solid oxide fuel cells. Solar Energy: Photovoltaic power conversion & solar energy collectors. Nuclear fuels: Nuclear fuels processing, fission and fusion, nuclear reactors.

Recommended Books:

1. Wiseman, P. "An Introduction to Industrial Organic Chemistry" Applied Science Publishers Ltd., London, (1979).
2. Goodger E.M. "Alternative fuels (chemical energy resources)" The Macmillan press Ltd, London, (1980).
3. Twidell, J. and Weir, T. "Renewable Energy Resources" Spon London, New York, (1986).

Supplementary Reading Materials:

1. Penner, S.S, and Icreman, L. "Non nuclear energy technology" Vol-II pergaman press, New York, (1984).
2. Probststein R.F. and Hicks, R.E. "Synthetic fuels" Mc Graw Hill, New York, (1982).
3. Hobson, G.D. "Modren petroleum technology" part-I. John W Toronto, (1984).

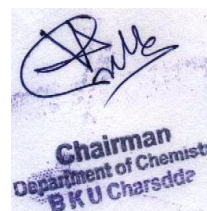
Course Title: Fuel Chemistry (Practical)

Course Code: CHEM-568

Credit Hour: 01

Marks: 25

Laboratory Work Illustrating Topics Covered in the Lectures of CHEM-568



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BKU Charsadda

BS 4th YEAR
SEMESTER-V11

INORGANIC CHEMISTRY

COURSE WISE BREAKUP

Fourth Year

Seventh Semester

SPECIALIZATION

INORGANIC CHEMISTRY


THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM -675-I	PAPER-I: INORGANIC CHEMISTRY	03	100
CHEM -675-II	PAPER-II: INORGANIC CHEMISTRY	03	100
CHEM -675-III	PAPER-III: INORGANIC CHEMISTRY	03	100
CHEM -674-IV	PAPER-IV-ENVIRONMENTAL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM -675-V	Inorganic Chemistry Lab. I	01	25
THES/CHEM- 675-VI	Research Thesis/Research Project/Advanced Lab./Position paper (Literature survey)	03	100

- Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)
- Maximum Marks = 525 (theory 400 & practicals 125 marks)



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B K U Charsadda

(INORGANIC CHEMISTRY)**Course Title: Inorganic Reaction Mechanism****Course Code: CHEM-675-I****Credit Hours: 03****Marks:100****Course Objective:**

Students will acquire know-how and understanding about different mechanisms of inorganic reactions and their applications towards understanding different types of complexes.

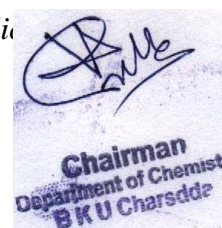
Course Contents:

Classification of reaction mechanisms; rate laws; steady state approximation; inert and labile complexes; substitution reactions in octahedral complexes and square planar complexes, acid hydrolysis, base hydrolysis, steric effects of inert ligands, nucleophilic reactivity, trans-effect, cis-effect, racemization reactions. Mechanism of electron transfer reactions, oxidation reduction

reactions of metal ions, outer and inner sphere mechanisms, factors affecting rate of electron transfer reactions, two electrons transfer reactions, complementary or non-complementary electron transfer reactions, oxidative addition, addition of oxygen, hydrogen, HX, organic halides and bimetallic species, Reductive Elimination Reactions.

Recommended Books

- 1 Basolo, F.; Pearson, R. G., *Mechanism of Inorganic Reactions*, Wiley, New York, **1982**.
- 2 Huheey, J. E.; Keiter, E. A., Keiter, R. L., *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed., Harper & Row, New York, **2001**.
- 3 Benson, D., *Mechanisms of Inorganic Reactions in solution*, McGraw Hill, **1968**.
- 4 Purcell, K.F., Kotz, J.C., *Inorganic Chemistry*, W.B.Saunders Company Holt-Saunders Internal editions, **1977**.
- 5 Shirve D.F., Atkins P.W., Langford C.H., *Inorganic Chemistry*, Oxford University Press, **1990**.
- 6 Wilkins R.G., *Kinetics and Mechanism of Reactions of Transition Metal Complex*, VCH Publishers, Inc, **1991**.
- 7 William. J., *Modern Inorganic Chemistry*, 2nd ed., McGraw Hill Company, **1991**.
- 8 Porterfield, W.W., *Inorganic chemistry, Unified approach*, Elsevier Company, Delhi, **2005**.
- 9 Jordan, R.B., *Reaction Mechanisms of Inorganic and Organometalli*



(INORGANIC CHEMISTRY)**Course Title: π - ACCEPTOR LIGANDS AND INORGANIC POLYMERS****Course Code: CHEM-675-II****Credit Hours: 03****Marks: 100****Course Objectives**

After completing this course, students will know about; the chemistry of organometallics especially with reference to their types and bonding, and reactivity of organometallic compounds in homogenous catalysis.

Course Objective:

Student will acquire sound knowledge about π -acceptor ligands and different types of inorganic polymers.

Course Contents: **π -Acceptor Ligands:**

Introduction to π -acceptor ligands, effective atomic number (EAN) rule and chemistry of metal carbonyls, nitrosyls, and isocyanides, structure elucidation based on spectroscopic evidences, applications and uses of metal carbonyls and their derivatives for catalysis and organic synthesis.

Inorganic Polymers:

Introduction to homoatomic and heteroatomic inorganic polymers, chains and cages of boron, silicon, nitrogen, phosphorous and sulphur, synthesis and applications, Polyionic species, Isopoly and heteropoly, anions of transition metals, silicates, borates, condensed phosphates, zeolites.

Recommended Books:

1. Brady, J. E., and Sense, F., Chemistry-The Study of Matter and Its Changes, 5th ed., Wiley Plus, (2009).
2. Miessler, G. L., Tarr, D. A., Inorganic Chemistry, 4th ed., Prentice-Hall International, New Jersey, USA, (2010).
3. Douglas, B., McDaniel, D., Alexander, J., Concepts and Models of Inorganic Chemistry, 3rd ed., John-Wiley & Sons, New York, (1994).
4. Huheey, J. E., Keiter, E. A., Keiter, R. L., Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Prentice Hall, (1997).
5. Shriver, D. F., Atkins, P. W., Langford, C. H., Inorganic Chemistry, 2nd ed., Oxford University Press, (1994).
6. Cotton, F. A., Wilkinson, G., Murillo, C. A. and Bochmann, M., Advanced Inorganic Chemistry, 6th ed., Wiley-Interscience, (1999).
7. Atkins, P. and Jones, L., Chemicals Principles: The Quest for Insight, 5th ed., W. H. Freeman, (2010).
8. Mandelkern, L., An Introduction to Macromolecules, 2nd ed., Springer Verlag, New York, (1983).
9. Ravve, A., Principles of Polymer Chemistry, 2nd ed., Plenum Publishers, (2000).
10. Crabtree, R. H., The Organometallic Chemistry of the Transition Metals, 5th ed., John-Wiley and Sons, New Jersey, (2011).
11. Yamamoto, A., Organotransition Metal Chemistry, Prentice Hall, (1992).
12. Billmeyer, F. W., A Text Book of Polymer Science, 3rd, John-Wiley and Sons, (2005).
13. Malmcoim, P.S., Polymer Chemistry: An Introduction, 3rd ed., Oxford University Press, (2005).

BS 4th Year

Semester-VII

INORGANIC CHEMISTRY

Course Title: INORGANIC SPECTROSCOPY

Course Code: CHEM-675-III

Credit Hours: 03

Marks: 100

Course Objectives:

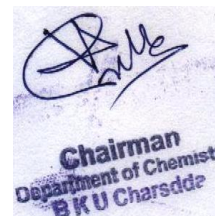
Students will acquire understanding about various types of transitions (e. g. dd transition, charge transfer) occurring in transition metal compounds and to characterize new compounds by application of electronic spectroscopy.41

Course Contents:

Electronic States of transition metal complexes, Russel-Sander's coupling scheme, derivation of term symbols for d1-d10 systems, d-d transitions, connecting atomic states and molecular states, correlation diagrams, Tanabe-Sugano diagrams, calculation of 10Dq values, High-spin and low-spin molecules, Jahn-Teller effect, applications of subgroups, selection rules for electronic transitions in molecules, LMCT and MLCT transitions, some examples involving different geometries.

Recommended Books:

1. Yarwood, J., Bazin, P., and Douthwaite, R., Spectroscopic Properties of Inorganic and Organometallic Compounds, Volume 42, The Royal Society of Chemistry, UK, (2011).
2. Lever, A. B. P., Inorganic Electronic Spectroscopy, 2nd ed., Elsevier, UK, (1984).
3. Brisdon, A. K., Inorganic Spectroscopic Methods, Oxford University Press, UK, (1998).
4. Solomon, E.I., Inorganic Electronic Structure and Spectroscopy: Methodology, Volume 2, Wiley, New York, (1999).



BS 4th Year

Semester-VII

INORGANIC CHEMISTRY

Practical-I

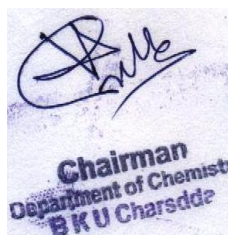
Course Title: Inorganic Chemistry

Course Code: CHEM-675-V

Credit Hours: 01

Marks: 25

Laboratory work illustrating topics covered in the lectures of Paper I, II, and III



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Elective Course-I**ENVIRONMENTAL CHEMISTRY****Course Code: CHEM-474-IV****Credit Hours: 03****Marks: 100****The atmosphere and air pollution:**

Structure and properties of the atmosphere, temperature inversion and air pollution, atmosphere photochemistry, possible depletion of stratospheric ozone, natural vs polluted air, particulate matter, analysis and control of particulations, sulphur oxides, effects of sulphur dioxides and particulates, other industrial air pollutants, carbon monoxide, oxides of nitrogen photochemicals smog, airborne load, control of automobile emissions.

Water and water treatment:

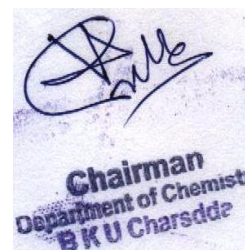
Unique physical and chemical properties of water, criteria of water quality, natural water-eutrophication, detergents and phosphates, importance of micro organisms in water purification, primary and secondary treatment of water, advanced waste water treatment, removal of nitrogen and phosphorus, sources of industrial water pollution, heavy metals and mercury.

The green revolution:

Pest control, pesticides, toxicity of pesticides, pest management.

Books Recommended:

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi. J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
4. Staneley E. Manahan, Environmental chemistry, Brooks, California



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BS 4th Year

Semester-VII

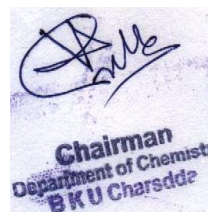
INORGANIC CHEMISTRY

Course Title: Inorganic Chemistry Practical Course Code: THES/CHEM-675-VI

Credit Hours: 03

Marks: 100

Title of Course: Special Practicals/Research Project/Position Paper (Literature Survey)



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ORGANIC CHEMISTRY

Fourth Year

Seventh Semester

SPECIALIZATION

ORGANIC CHEMISTRY

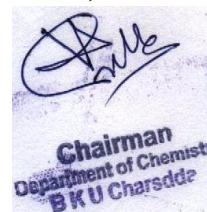
THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-676-1	PAPER-I: ORGANIC CHEMISTRY	03	100
CHEM-676-II	PAPER-II: ORGANIC CHEMISTRY	03	100
CHEM-676-III	PAPER-III: ORGANIC CHEMISTRY	03	100
CHEM-674-IV	PAPER IV: ENVIRONMENTAL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
THES/CHEM-476-VI	Research Thesis/Research Project/Advanced	03	100
CHEM-676-V	Organic Lab. I	01	25

- **Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)**
- **Maximum Marks = 525 (theory 400 & practicals 125 marks)**



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ORGANIC CHEMISTRY**Course Title: Synthesis and mechanism-I****Course Code: CHEM-676-I****Credit Hours: 03****Marks: 100****Course Objectives**

The objectives of the course are:

- To acquire basic Knowledge of all aspects of oxidations and reductions in organic chemistry.
- To become acquainted with approaches to the synthesis of organic molecules.
- To develop an understanding of the processes of synthesis and mechanism of the reactions and to apply them in a practical context by designing syntheses.

Course Contents**Oxidation:**

Introduction; reactions involving elimination of hydrogen, cleavage of C-C bond, replacement of hydrogen by oxygen and addition of oxygen to the substrate; oxidative coupling.

Reduction:

Introduction; reactions involving replacement of oxygen by hydrogen, removal of oxygen from the substrate and reduction with cleavage; reductive coupling.

Protective Groups:

Use of hydroxyl-, amino-, carboxyl- and carbonyl- protecting groups in organic synthesis.

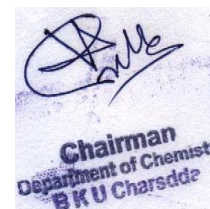
Pericyclic Reactions:

Principles; cycloadditions; electrocyclic reactions; cheletropic reactions; sigmatropic rearrangements; the ene-reaction and related reactions.

Recommended Books

(Latest available editions of the following books)

1. Norman, R. O.C.; Coxon, J. M., *Principles of Organic Synthesis*, Nelson Thornes, Cheltenham.
2. Rinehart Jr., K. L., *Oxidation and Reduction of Organic Compounds*, Prentice-Hall, London.
3. March, J., *Advanced Organic Chemistry*, John Wiley & Sons, New York.
4. Clayden, J., Greeves, N.; Warren, S.; Wothers, P., *Organic Chemistry*, Oxford University Press, New York.
5. Bruckner, R., *Advanced Organic Chemistry-Reaction Mechanisms*, Harcourt Science & Technology Company, New York.
6. House, H.O., *Modern Synthetic Reactions*, The Benjamin/Cummings Publishing Company, California.
7. Greene, T. W., *Protective Groups in Organic Synthesis*, John Wiley & Sons, New York.



ORGANIC CHEMISTRY**Course Title: Synthesis and Mechanism-II****Course Code: CHEM-676-II****Credit Hours: 03****Marks: 100****Course Objectives**

The objectives of the course are:

1. To provide an introduction to selected topics in modern synthetic organic chemistry.
2. To bring the students to a good knowledge on structure and reactivity of the most important reactive intermediates as well as on remarkable reactions and their mechanism, and make them able to design synthetic procedures for simple organic compounds.
3. To develop an understanding of the role of a chemist in the synthesis of new compounds and study of their reactions.
4. To develop an understanding of the role of a chemist in the synthesis of new compounds and study of their reactions on the basis of molecular rearrangements and free radicals.

Course Contents**Molecular Rearrangements:**

Types of rearrangements; general mechanisms of nucleophilic, free radical and electrophilic rearrangement reactions; hydrogen and/or carbon migration to electron-deficient carbon, nitrogen and oxygen; carbon migration to electron-rich carbon; aromatic rearrangements: inter- and intra-molecular carbon migration from oxygen to carbon.

Free Radicals:

Introduction; radical generation; radical detection; radical shape and stabilization; radical reactions: addition reactions – addition of halogens, hydrogen halides, halomethanes, other carbon radicals and S-H compounds; substitution reactions-halogenations, oxidations and substitution involving aryl radicals.

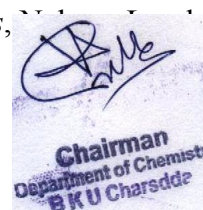
Reactive Intermediates:

Carbenes, nitrenes, and arynes: Their generation, stability, reactions and synthetic applications.

Recommended Books

(Latest available editions of the following books)

1. March, J., *Advanced Organic Chemistry*, John Wiley & Sons, New York.
2. Norman, R. O.C.; Coxon, J. M., *Principles of Organic Synthesis*, Nelson Thornes, Cheltenham.
3. Bruckner, R., *Advanced Organic Chemistry-Reaction Mechanisms*, Harcourt Science & Technology Company, New York.
4. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P., *Organic Chemistry*, Oxford University Press, New York.
5. Gilchrist, T. L.; Rees, C. W., *Carbenes, Nitrenes and Arynes*, Wiley, New York.
6. Smith, M. B., *Organic Synthesis*, McGraw-Hill, New York.
7. Lwowski, W., *Nitrenes*, Interscience Publishers, New York.



ORGANIC CHEMISTRY**Course Title: Interpretative Organic Spectroscopy** **Course Code: CHEM-676-III****Credit Hours: 03****Marks: 100****Course Objectives:**

On completing this course the student should be able to:

1. Determine the structures of simple and medium size organic compound by spectroscopic methods.
2. Have reasonable understanding of the chemistry of heterocyclic aromatic compound, and correlates these with their aromatic hydrocarbons compounds.

Course Contents**¹H-NMR and ¹³C-NMR Spectroscopy:**

Brief description of the instrumentation, Chemical shift; factors affecting the chemical shift; coupling constants; factors affecting coupling constants; simple and complex splitting patterns, 2-D NMR. C-13 NMR, brief treatment of the theoretical aspects, use of correlation tables.

Mass Spectrometry:

Introduction; brief instrumentation. Main Objective: Structure elucidation of simple organic compounds by the combined use of the spectroscopic methods.

Recommended Books

(Latest available editions of the following books)

1. Kemp, W., *Organic Spectroscopy*, Palgrave, New York.
2. Silverstein, R. N.; Barrler, G. C.; Morrill, T. C., *Spectrometric Identification of Organic Compounds*, John Wiley & Sons, New York.
3. Williams D. H.; Fleming, I., *Spectroscopic Methods in Organic Chemistry*, Athlone Press, London.
4. Bansal, R. K., *Heterocyclic Chemistry*, Wiley Eastern Ltd., New Delhi.
5. Gilchrist, T. L., *Heterocyclic Chemistry*, Longman, Singapore.
6. Joule, J. A.; Mills, K., *Heterocyclic Chemistry*, Blackwell Science, Tokyo.

Supplementary Reading Material

1. Atta-ur-Rehman., *Nuclear Magneti Resonance Spectroscopy*, UGC, Islamabad.
2. Davis, R.; Freason, M., *Mass Spectrometry*, John Wiley & Sons, New York.
3. Loudon, G. M., *Organic Chemistry*, Oxford University Press, New York.
4. Lambert, J. B.; Shurvell, H. F.; Lightner, D. A.; Cooks, R. G., *Introduction to Organic Spectroscopy*, Macmillan Publishing Company, New York.
5. Anderson, R. J.; Bendell, D.; Groundwater, P., *Organic Spectroscopic Analysis*, The Royal Society of Chemistry, Cambridge.

Elective Course-I**ENVIRONMENTAL CHEMISTRY****Course Code: CHEM-674-IV****Credit Hours: 03****Marks: 100****Credit Hours: 03****Marks: 100****The atmosphere and air pollution:**

Structure and properties of the atmosphere, temperature inversion and air pollution, atmosphere photochemistry, possible depletion of stratospheric ozone, natural vs polluted air, particulate matter, analysis and control of particulations, sulphur oxides, effects of sulphur dioxides and particulates, other industrial air pollutants, carbon monoxide, oxides of nitrogen photochemicals smog, airborne load, control of automobile emissions.

Water and water treatment:

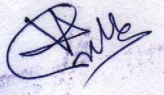
Unique physical and chemical properties of water, criteria of water quality, natural water-eutrophication, detergents and phosphates, importance of micro organisms in water purification, primary and secondary treatment of water, advanced waste water treatment, removal of nitrogen and phosphorus, sources of industrial water pollution, heavy metals and mercury.

The green revolution:

Pest control, pesticides, toxicity of pesticides, pest management.

Books Recommended:

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
4. Staneley E. Manahan, Environmental chemistry, Brooks, California



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BS 4th Year

Semester-VII

CHEMISTRY COURSE (ORGANIC CHEMISTRY)

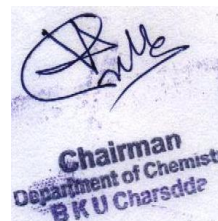
Practical-I

Course Title: Laboratory work illustrating topics covered in the lectures of papers I, II & III.

Course code: CHEM-676-V

Credit Hours: 01

Marks: 25



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BS 4th Year

Semester-VII

ORGANIC CHEMISTRY

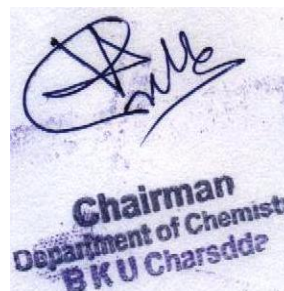
Special Practical-I/Research-I

Course Title: Special Practical/Research Project/Position Paper (Literature Survey)

Course code: THES/CHEM -676-VI

Credit Hours: 03

Marks: 100



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PHSICAL CHEMISTRY

COURSE WISE BREAKUP

Fourth Year

Seventh Semester

SPECILIZATION

PHYSICAL CHEMISTRY

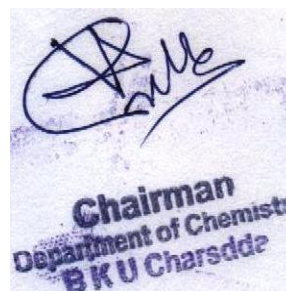
THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM -677-I	PAPER-I: PHYSICAL CHEMISTRY	03	100
CHEM-677-II	PAPER-II: PHYSICAL CHEMISTRY	03	100
CHEM-677-III	PAPER-III: PHYSICAL CHEMISTRY	03	100
CHEM-674-VI	PAPER-IV- ENVIRONMNETAL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
THES/CHEM-677-VI	Research Thesis/Research Project/Advanced	03	100
CHEM-677-V	Physical Chemistry Lab. I	01	25

- Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)
- Maximum Marks = 525 (theory 400 & practicals 125 marks)



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BS 4th Year

Semester-VII

Physical Chemistry

Course Title: Statistical Thermodynamics and Electrochemistry

Course Code: CHEM-677-I

Credit Hours: 03

Marks: 100

Course Objectives

To acquire advanced knowledge about Statistical Thermodynamics and Electrochemistry.

Course Contents

Statistical Thermodynamics

Probability concepts. Partition functions. Transitional, vibrational and rotational partition functions, The relationship of partition function to the various thermodynamic functions. (Total Internal Energy, Translational energy, Rotational energy, Heat capacity, Pressure, Work, Entropy, Enthalpy, Gibb's free energy, Chemical potential, Helmholtz free energy), Study of monoatomic gas on the basis of Partition function, Partition function and equilibrium constant. Relationship between entropy and probability.

Theories of heat capacities of solids i.e. The Einstein model and The Debye model.

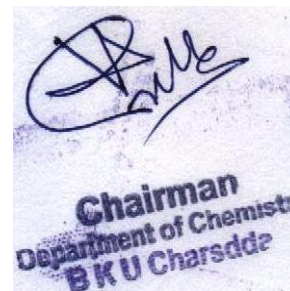
ELECTROCHEMISTRY-II

Types of electrodes, Standard Electrode, SHE, Calomel electrode, Ag-AgCl electrode & Amalgam electrode.

Chemical reactions and Electrode potential, Nernst's equation and its application, Electrochemical series and its application.

Books Recommended

1. Calvert J.G. and Pitts J.N. "Photochemistry" John Wiley, New York (1966).
2. Suppan P. "Principles of Photochemistry", the Chemical Soc., UK (1973).
3. Albert R.A., Robert J.S. and Moungi G.B. "Physical Chemistry". 4th ed., John Wiley and Sons (2004).
4. Alberty R. "Physical Chemistry" 17th ed., John Wiley and Sons (1987).
5. Atkins, P.W. "Physical Chemistry" 6th ed., W.H. Freeman and Co. New York (1998).
6. Laidler K.J., John H.M. and Bryan C.S. "Physical Chemistry" 4th ed., Houghton Mifflin Publishing Company Inc.(2003).
7. Ball D.W. "Physical Chemistry" 1st ed., Brooks/Cole Co. Inc. (2003).
 1. 8. Bockris J.O.M. and Reddy A.K.N. "Modern Electrochemistry" Vol-I and II, 4th ed. Plenum Press, London (2003).



Physical Chemistry**Course Title: Polymer Chemistry and Colloids****Course Code: CHEM-677-II****Credit Hours: 03****Marks: 100****Course Objectives**

To acquire knowledge about the physical properties and structure of polymers.

Course Contents**POLYMER CHEMISTRY**

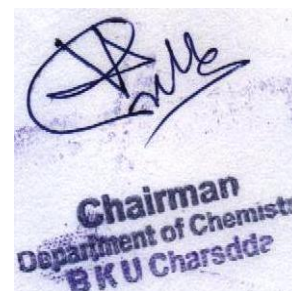
Introduction to Polymers, Types of polymers i.e. Natural and synthetic Polymers, Types of polymerizations i.e. Addition polymerization, step-growth polymerization, Ionic polymerization, Copolymerization, Emulsion Polymerization, Physical aspects of polymers, Molecular Weight of Polymers: Number average and Weight average molecular weight, Distribution, Degree of polymerization, methods of determination of molecular weight (viscosity, osmometry, light scattering method, Diffusion, Sedimentation, Optical rotation method), Kinetics of polymerization, Physical properties of polymers (Crystallinity, Plasticity, Elasticity) Structure of Polymer Chain, Introduction to chain isomerism, stereochemistry, configurations, and conformations.

Colloids and Emulsions

Introduction of colloids and its classification, Preparation, purification and properties of colloidal solution, Stability of colloidal dispersion, surface active agents, micelle formation and cleaning action, applications of colloidal solution. Emulsion its types, factors affecting emulsion stability, properties of emulsions its application.

Recommended Books

1. Hiemenz P.C. "Polymer Chemistry: The Basic Concepts" Marcel Dekker (1984).
2. Stevens M.P. "Polymer Chemistry: An Introduction" Oxford University Press (1999).
3. Sperling L.H. "Introduction to Physical Polymer Science" Wiley Interscience (1992).
4. Boyd R.H. and Phillips P.J. "The Science of Polymer Molecules" Cambridge (1993).
5. Malcolm P.S. "Polymer Chemistry" Oxford University Press (2005).



Physical Chemistry

Paper-III

Course Title: Quantum Chemistry**Course Code: CHEM-677-III****Credit Hours: 03****Marks: 100****Course Objectives**

To acquire advanced knowledge about quantum chemistry.

Course Contents**Quantum Chemistry**

Fundamental concepts used in Quantum mechanics i.e. dynamic variables, state functions, Observable, Eigen function and Eigen values Operators and their properties. Types of operators, Linear operator, Commutator operator, Vector operator, Laplacian operator, Hermitian operator, Hermitian operator, Angular momentum, General wave equation, Schrodinger wave equation and its applications to free particle system, particle in 1-dimensional box and 3-dimensional box, Laws of quantum mechanics, Simple harmonic oscillator, Treatment of simple harmonic oscillator, Selection rules for simple harmonic oscillator, comparison between general wave equation and Schrödinger wave equation, Complex number, diatomic rigid rotor, Treatment of rigid rotor, Selection rules of rigid rotor, Valence bond and molecular orbital theories pi-electron calculations.

MOLECULAR SPECTROSCOPY

Electromagnetic radiation, its interaction with matter, Absorption/emission of radiation, different spectral regions.

MICROWAVE SPECTROSCOPY

Rotational motion of molecules and their classification, moment of inertia, rigid and non rigid rotor, quantum equations, selection rules, Spectra, Energy level diagrams, Bond length determination for Linear and symmetric top molecules.

INFRA RED SPECTROSCOPY

Vibrational motion of molecule, Degree of freedom, Harmonic and inharmonic oscillator, Their quantum equations, Selection rules, Spectra and energy level diagram for linear and symmetric top molecules, bond length determination, Born oppenheimer approximation.

ROTATIONAL-VIBRATION SPECTRA

Vibrating rotor, Harmonic and inharmonic, Quantum equations, Selection rules, Energy level diagram for linear and symmetric top molecule

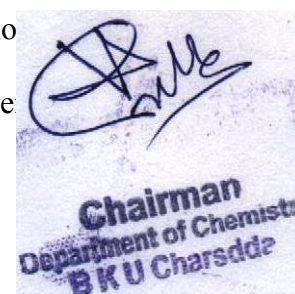
ELECTRONIC SPECTRA

Introduction to electronic spectroscopy, Electronic transitions, Vibrational fine structure of electronic spectra, Rotational fine structure of electronic spectra, Frank-Condon's principle.

Introduction to symmetry of molecules & Group Theory

Recommended Books

1. Micheal D.F. "Elements of Quantum Mechanics" Oxford University Press (2005).
2. Atkin P., Friedman R. "Molecular Quantum Mechanics", 4th ed., Oxford Univ. Press (2005)
3. Becker E. D. "High Resolution NMR; Theory & Chemical Application" Academic Press (1980).
4. Griffiths, David J., "Introduction to Quantum Mechanics" 2nd ed., Pre (2004).



BS 4th Year

Semester-VII

Elective Course-I
ENVIRONMENTAL CHEMISTRY

PAPER-IV
Course Code:CHEM-674-IV

Credit Hours: 03

Marks: 100

Credit Hours: 03

Marks: 100

The atmosphere and air pollution:

Structure and properties of the atmosphere, temperature inversion and air pollution, atmosphere photochemistry, possible depletion of stratospheric ozone, natural vs polluted air, particulate matter, analysis and control of particulations, sulphur oxides, effects of sulphur dioxides and particulates, other industrial air pollutants, carbon monoxide, oxides of nitrogen photochemicals smog, airborne load, control of automobile emissions.

Water and water treatment:

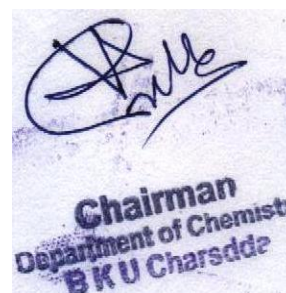
Unique physical and chemical properties of water, criteria of water quality, natural water-eutrophication, detergents and phosphates, importance of micro organisms in water purification, primary and secondary treatment of water, advanced waste water treatment, removal of nitrogen and phosphorus, sources of industrial water pollution, heavy metals and mercury.

The green revolution:

Pest control, pesticides, toxicity of pesticides, pest management.

Books Recommended:

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi. J. W. Moore & E. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
4. Stanley E. Manahan, Environmental chemistry, Brooks, California



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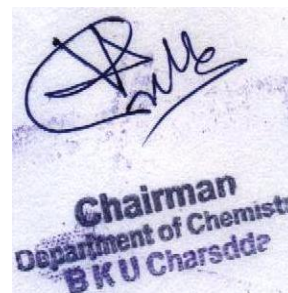
BS 4th Year
Course Title: Physical Chemistry Practical

Semester-VII
Course Code: CHEM-677-V

Credit Hours: 01

Marks: 25

Laboratory work illustrating topics covered in the lecture of papers I, II & III.



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BS 4th Year

Semester-VII

Special Practicals/Research

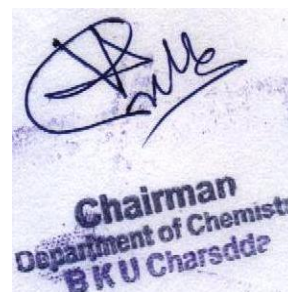
Course Title: Physical Chemistry

Course Code: THES/CHEM-677-VI

Credit Hours: 03

Marks: 100

Title of the Course: Special Practicals/Research Project/Position Paper (Literature Survey)



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ANALYTICAL CHEMISTRY

COURSE WISE BREAKUP

Fourth Year

Seventh Semester

SPECILIZATION

ANALYTICAL CHEMISTRY

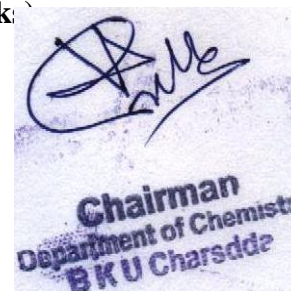
THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM - 671-I	PAPER-I: ANALYTICAL CHEMISTRY	03	100
CHEM -671- II	PAPER-II: ANALYTICAL CHEMISTRY	03	100
CHEM - 671-III	PAPER-III: ANALYTICAL CHEMISTRY	03	100
CHEM -674-IV	PAPER IV-ENVIRONMENTAL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
THES/CHEM -671-VI	Research Thesis/Research Project/Advanced Lab./Position paper (Literature survey)	03	100
CHEM -671-V	Analytical Chemistry Lab. I	01	25

- Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)
- Maximum Marks = 525 (theory 400 & practicals 125 marks)



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BS 4th year

Semester-VII

ANALYTICAL CHEMISTRY

Paper: I

Course Title: ATOMIC SPECTROSCOPY

Course Code: CHEM-671-I

Credit Hours: 03

Marks: 100

Course Objectives:

Students will acquire knowledge about theoretical aspects and instrumentation of different atomic spectroscopic methods as well as learn about the applications of these techniques in the field of chemical sciences.

Course Contents:

Flame Photometry:

Origin and classification of atomic spectroscopic methods, origin of atomic spectrum, position of the signal, intensity of the signal, spectral line width, principle of flame photometry, fate of the sample in the flame, flame and its characteristics, instrumentation for flame photometry, merits and limitations.

Atomic Absorption Spectrophotometry:

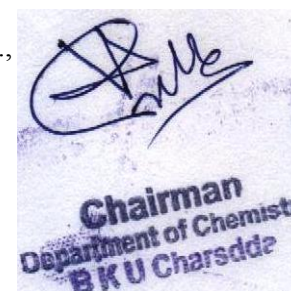
Principle of atomic absorption spectrophotometry, concentration dependence of absorption, quantitative methodology, instrumentation for atomic absorption spectrophotometry, radiation sources, atomizers, flames, graphite furnaces and electrochemical atomizers, monochromators, detectors, handling background absorption, interferences in atomic absorption spectrophotometry, sample handling in atomic absorption spectrophotometry, preparation of the sample, use of organic solvents, microwave, digestion, sample introduction methods, applications of atomic absorption spectrophotometry.

Atomic Emission Spectrophotometry:

Introduction, principle of atomic emission spectrometry, atomic emission spectrometry using plasma sources, plasma and its characteristics, inductively coupled plasma, direct current plasma, microwave induced plasma, choice of argon as plasma gas, instrumentation for ICP-MS.

Recommended Books:

1. Christian, G. D., *Analytical Chemistry*, 6th ed., John-Wiley & Sons, New York, (2006).
2. Harris, D. C., *Quantitative Chemical Analysis*, 8th ed., W. H. Freeman and Company, New York, (2011).
3. Kealey, D. and Haines, P. J., *BIOS Instant Notes in Analytical Chemistry*, Bios Scientific Publishers Limited, Oxford, UK, (2002).
4. Sharma, B. K., *Instrumental Methods of Chemical Analysis*, 24th ed., Goel Publishing House, Meerut, India, (2005).
5. Skoog, D. A. and West., D. M., *Fundamentals of Analytical Chemistry*, 8th ed., Hot Reinehart Inc., London, (2008).
6. Ebdon, L., Evas, E.H, Fischer, A., and Hill, S.J., *An Introduction to Analytical Atomic Spectrometry*, John Wiley & Sons, England. (1998).
7. Bernhard Welz, Michael Sperling, *Atomic Absorption Spectrometry*, 3rd ed., (1998).
8. Farrukh, M. A., *Atomic Absorption Spectroscopy*, In Tech, (2012).



BS 4th year

ANALYTICAL CHEMISTRY

Course Title: ELECTROANALYTICAL TECHNIQUES Course Code: CHEM-671-II

Semester-VII

Paper: II

Credit Hours: 03

Marks: 100

Course Objectives:

Students will acquire sound knowledge regarding the theoretical, instrumental as well as application related aspects of different electroanalytical techniques

Course Contents:

Potentiometry:

Electrode potential, Nernst equation and its use for measuring half-cell potential, different kinds of electrodes including glass and calomel electrodes, working of potentiometer and its applications including pH measurements, Ion selective electrode systems, Potentiometric titrations.

Coulometry and Electrogravimetry:

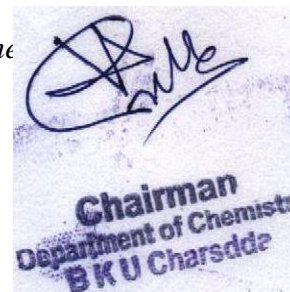
Basic electrochemistry, principle, instrumentation of coulometry, principle, instrumentation of electrogravimetry, consequences of electrogravimetry, concentration and gas polarization, basic difference and merits/demerits of coulometry and electrogravimetry.

Voltammetry and Polarography:

Basic principle, voltammogram, polarizable and non-polarizable electrodes, solid electrodes, their scope and limitations, cyclic voltammetry, anodic stripping voltammetry. voltammetric equation, basic concept of polarography and interpretation of various polarographic curves, measurement of decomposition potential, diffusion and limiting currents, derivation of Ilkovic equation, advantages and limitation of dropping mercury electrode.

Recommended Books:

1. Christian, G. D., *Analytical Chemistry*, 6th ed., John-Wiley & Sons, New York, (2006).
2. Harris, D. C., *Quantitative Chemical Analysis* 8th ed., W.H. Freeman and Company, New York, (2009).
3. Kealey, D. and Haines, P. J., *BIOS Instant Notes in Analytical Chemistry*, Bios Scientific Publishers Limited, Oxford, UK, (2002).
4. Sharma, B. K., *Instrumental Methods of Chemical Analysis*, 24th ed., Goel Publishing House, Meerut, India, (2005).
5. Skoog, D. A. and West, D. M., *Fundamentals of Analytical Chemistry*, 8th ed., Hot Reinehart Inc., London, (2008).
6. Fritz, Schulz, *Electroanalytical Methods: Guide to Experimental Applications*. 2nd revised, Springer-Verlag Berlin, Germany, (2010).
7. Monk, P.M.S, *Fundamentals of Electroanalytical Chemistry*, John-Wiley & England, (2001).



BS 4th year

ANALYTICAL CHEMISTRY

Course Title: ADVANCED SEPARATION TECHNIQUES Course Code: CHEM-671-III

Credit Hours: 03

Semester-VII

Paper: III

Marks: 100

Course Objectives:

Students will acquire knowledge about the principles and instrumentation of advanced chromatographic techniques namely GLC, HPLC and capillary electrophoresis along with their applications in different fields such as food, pharmaceuticals, petroleum, environmental and other industrial sectors.

Course Contents:

Introduction:

Classifications of chromatographic techniques, the chromatographic processes, rate theory of chromatography, Van-Deemter equation and its significance in evaluating column efficiency.

Gas Liquid Chromatography:

General principle, sample preparation/derivatization, separation process, and instrumental aspects and its applications.

HPLC:

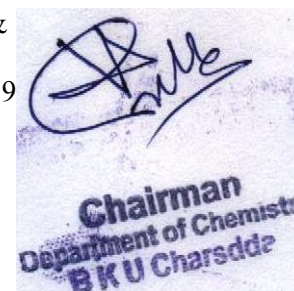
General principle, sample preparation, separation process (normal phase and reverse phase separation), instrumentation, method development and applications.

Capillary electrophoresis:

Theory and principle of CE, mobility, electro-osmotic flow separation by CE, instrumentation, modes of operation, applications.

Recommended Books:

1. Skoog, D. A., West, P. M., Holler, F. J. and Crouch, S. R., *Fundamentals of Analytical Chemistry*, 9th ed., Cengage Learning, (2013).
2. Christian, G. D., *Analytical Chemistry*, 6th ed., John-Wiley & Sons, New York, (2004).
3. Kealey, D. and Haines, P. J., *BIOS Instant Notes in Analytical Chemistry*, 1st ed., Taylor & Francis, (2002).
4. Sharma, B.K. *Instrumental Methods of Chemical Analysis*, 24th ed., Goel Publishing House, Meerut, India, (2005).
5. Grob, R. L., Eugene, F. Barry, *Modern Practice of Gas Chromatography*, 4th ed., John-Wiley & Sons, USA, (2004).
6. Kellner, R., Mermet, J. M., Otto, M., Valcarcel, M. and Widmer, H. M., *Analytical Chemistry: A Modern Approach to Analytical Science*, Wiley- VCH, (2004).
7. Meyer, V. R., *Practical High-Performance Liquid Chromatography*, 5th ed., John-Wiley & Sons, Ltd., (2010).
8. Lindsay, S., *High Performance Liquid Chromatography*, 2nd ed., John- Wiley & Sons, Ltd., (1992).
9. Braitwaite, A. and Smith, F. J., *Chromatographic Methods*, 5th ed., Kluwer Academic Publishers, (1999).
10. Miller, J. M., *Chromatography: Concepts and Contrasts*, 2nd ed., John- Wiley & (2005).
11. Camilleri, P., *Capillary Electrophoresis: Theory and Practice*, 2nd ed., CRC Press, (19



BS 4th Year

Semester-VII

Elective Course-I

PAPER-IV

ENVIRONMENTAL CHEMISTRY

Course Code:CHEM-674-IV

Credit Hours: 03

Marks: 100

Credit Hours: 03

Marks: 100

The atmosphere and air pollution:

Structure and properties of the atmosphere, temperature inversion and air pollution, atmosphere photochemistry, possible depletion of stratospheric ozone, natural vs polluted air, particulate matter, analysis and control of particulations, sulphur oxides, effects of sulphur dioxides and particulates, other industrial air pollutants, carbon monoxide, oxides of nitrogen photochemicals smog, airborne load, control of automobile emissions.

Water and water treatment:

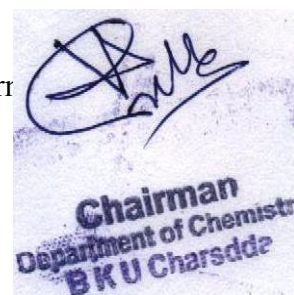
Unique physical and chemical properties of water, criteria of water quality, natural water-eutrophication, detergents and phosphates, importance of micro organisms in water purification, primary and secondary treatment of water, advanced waste water treatment, removal of nitrogen and phosphorus, sources of industrial water pollution, heavy metals and mercury.

The green revolution:

Pest control, pesticides, toxicity of pesticides, pest management.

Books Recommended:

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi. J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
4. Staneley E. Manahan, Environmental chemistry, Brooks, California



BS 4th Year

Semester-VII

CHEMISTRY COURSE (ANALYTICAL CHEMISTRY)

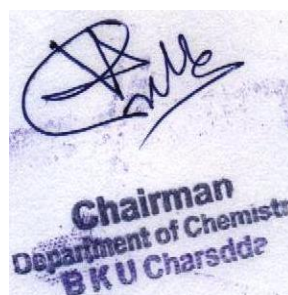
Special Practical/Research –I

Course Code: THES/CHEM-671-VI

Credit Hours: 03

Marks: 100

Title of Course: Special Practical/Research Project/Position Paper (Literature Survey)



Handwritten signature: *Dr. M. S. Khan*
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BS 4th Year

Semester-VII

ANALYTICAL CHEMISTRY

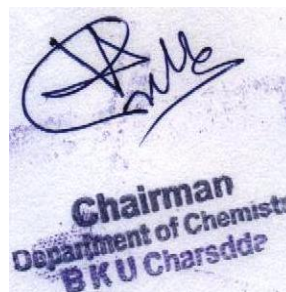
Practical-I

Course Code: CHEM-671-V

Credit Hours: 01

Mark: 25

Experiments based on theory topics covered in Paper I, II, and III.



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APPLIED CHEMISTRY

COURSE WISE BREAKUP

Fourth Year

Seventh Semester

SPECILIZATION

APPLIED CHEMISTRY

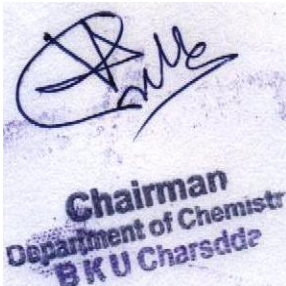
THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM -672-I	PAPER-I: APPLIED CHEMISTRY	03	100
CHEM -672-II	PAPER-II: APPLIED CHEMISTRY	03	100
CHEM -672-III	PAPER-III: APPLIED CHEMISTRY	03	100
CHEM -674-IV	PAPER-IV-ENVIRONMENTAL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
THES/CHEM -672-VI	Research Thesis/Research Project/Advanced Lab./Position paper	03	100
CHEM -672-V	Applied Chemistry Lab. I	01	25

- Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)
- Maximum Marks = 525 (theory 400 & practicals 125 marks)



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BS 4th Year

Semester-VII

CAPPLIED CHEMISTRY

Paper-I

Title of Course: COMMON INDUSTRIES-I

Course Code: CHEM-672-I

Credit Hours: 03

Marks: 100

Course Objectives:

To cater the students about the sugar manufacturing industry, starch production industry and leather tannery.

Course Contents

Course Contents:

Sugar Industry

Scope of sugar industry; Manufacture of raw sugar from cane and beet; Refining of raw sugar; Methods of clarification of cane juice and chemistry involved in the clarification processes: Defecation Remelt Carbonation (DRC), Defecation Remelt Sulphitation (DRS), Defecation Remelt Phosphitation (DRP) and Double Carbonation Double Sulphitation (DCDS); Utilization of by-products of sugar industry.

Starch Industry

Scope of starch industry; Raw materials for starch production; Manufacture of starch from various raw materials such as corn, rice, wheat, potatoes; Industrial applications of starch; Chemistry involved in the conversion of starch; Synthesis of d-glucose and dextrin from starch.

Leather Industry

Leather, gelatine and adhesives; Preparation of hides; Methods of tanning, Vegetable and chrome tanning processing of leather; Production of glue and gelatine.

Recommended Books

Chittararjan Kumar., Sugar Industry Management, (1994).

Birch, G. G.; Parker, K. J., Sugar Science & Technology (1979).

George T. Auston., Shreve's Chemical Process Industries, 5th Edition., McGraw Hill Book Company Inc. New York, (1984).

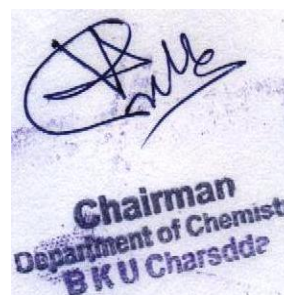
Riegel, E. R., Industrial Chemistry, 5th Ed., Reinhold Publishing Corporation New York, (1997).

Supplementary Reading Materials

Google/[topic/book/publication](#) /search.

<http://en.wikipedia.org>.

<http://www.sciencedirect.com>.



BS 4th Year

Semester-VII

APPLIED CHEMISTRY

Paper-II

Title of Course: Agro Based Industries and Pollution control

Course Code: CHEM-672-II

Credit Hours: 03

Marks:100

Fertilizers

Importance of chemical fertilizers; Classification of chemical fertilizers; Manufacture and chemistry involved in the production of various fertilizers i.e. Urea, Single Super phosphate (SSP), Triple super phosphate (TSP), Nitrophos (NP), Diammonium phosphate (DAP), Calcium ammonium nitrate (CAN), Ammonium nitrate (AN), Ammonium sulphate (AS), Zinc sulphate (ZS) and Complex fertilizers.

Agrochemical Industry

Classification of pesticides; Formulation and toxicity of pesticides; Future trends of pest control; Control of weeds; Household agrochemicals; Plant growth regulators and background chemistry; Hazards associated with the use of agrochemicals and environmental aspects.

Industrial Pollution and Environmental Protection

Sources of air, water and soil pollution; Industrial waste and its control for environmental protection; Modern trends for waste treatment; Industrial gases and pollution control methods; Role and production of free radicals and atmospheric chemistry.

Recommended Books

George T. Austin., Shreve's Chemical Process Industries, 5th Edition., McGraw Hill Book Company Inc. New York, (1984).

Riegel, E. R., Industrial Chemistry, 5th Ed., Reinhold Publishing Corporation New York, (1997).

Jain. P. C., A Textbook of Applied Chemistry, (1993).

K. Wark Cecil F. Warner, Air Pollution its origin & Control.(1976).

Henry C. Perkin, Air Pollution, (1974).

Glele Mamantov W. D. Shults, Determination of Air Quality, (1974).

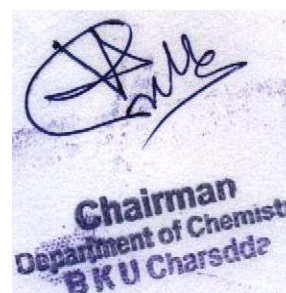
Nelson L. Nemerow, Industrial Water Pollution, (1978).

Supplementary Reading Materials

Google/[topic/book/publication](#) /search.

<http://en.wikipedia.org>.

<http://www.sciencedirect.com>.



BS 4th Year

Semester-VII

APPLIED CHEMISTRY

Paper-III

Title of the Course: Common Industries -II

Course Code: CHEM-672-III

Credit Hours: 03

Marks: 100

Oils, Fats, Waxes and Vegetable Ghee Industry

Oils, Fats and Waxes; Extraction of oils such as soybean and cotton seed oils; Purification and refining of oils; Chemistry involved in the production of vegetable ghee; Selective hydrogenation of oil and fats during the manufacture of vegetable ghee; Interesterification of crude fats.

Soaps and Detergents

Raw materials for the manufacture of soap and detergents; Chemistry involved in the production of soap and detergents; Action of builders, additives brighteners and surfactants; Cleansing action of soaps; Effect of acidic species and hard water on soap; Production of transparent soap.

Surface Coating Industry / Paint industry

Raw materials for paints and pigments; Classification and properties of surface-coating constituents; Classification and manufacture of pigments; Production of paints, varnishes, distempers, enamals and lacquers; Chemistry involved in the drying phenomena of paints; Drying oils for paint and classification of drying oils..

Recommended Books

George T. Austin., Shreve's Chemical Process Industries, 5th Edition., McGraw Hill Book Company Inc. New York, (1984).

Riegel, E. R., Industrial Chemistry, 5th Ed., Reinhold Publishing Corporation New York, (1997).

Jain, P. C., A Textbook of Applied Chemistry, (1993).

Deb, P. C., Modern Trends in Formulating Soaps and Detergents, (1996).

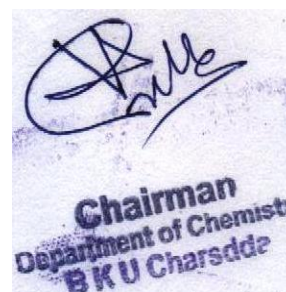
Deb, P. C., Soaps and Detergents, 1st Edition, C. B. S. Publisher and distributes, (1996).

Supplementary Reading Materials

Google/[topic/book/publication](#) /search.

<http://en.wikipedia.org>.

<http://www.sciencedirect.com>.



BS 4th Year

Semester-VII

Elective Course-I

PAPER-IV

ENVIRONMENTAL CHEMISTRY

Course Code:CHEM-674-IV

Credit Hours: 03

Marks: 100

Credit Hours: 03

Marks: 100

The atmosphere and air pollution:

Structure and properties of the atmosphere, temperature inversion and air pollution, atmosphere photochemistry, possible depletion of stratospheric ozone, natural vs polluted air, particulate matter, analysis and control of particulations, sulphur oxides, effects of sulphur dioxides and particulates, other industrial air pollutants, carbon monoxide, oxides of nitrogen photochemicals smog, airborne load, control of automobile emissions.

Water and water treatment:

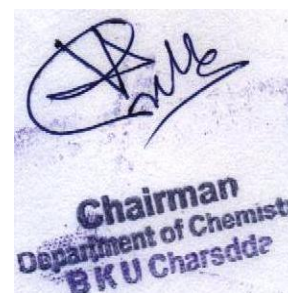
Unique physical and chemical properties of water, criteria of water quality, natural water-eutrophication, detergents and phosphates, importance of micro organisms in water purification, primary and secondary treatment of water, advanced waste water treatment, removal of nitrogen and phosphorus, sources of industrial water pollution, heavy metals and mercury.

The green revolution:

Pest control, pesticides, toxicity of pesticides, pest management.

Books Recommended:

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi. J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
4. Stanley E. Manahan, Environmental chemistry, Brooks, California



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BS 4th Year

Semester-VII

APPLIED CHEMISTRY

Title of the Course: Special Practical/Research Project/Review Paper (Literature Survey)

Course code : THES/CHEM-672-VI

Credit Hours: 03

Marks: 100

BS 4th Year

Semester-VII

CHEMISTRY COURSE (APPLIED CHEMISTRY)

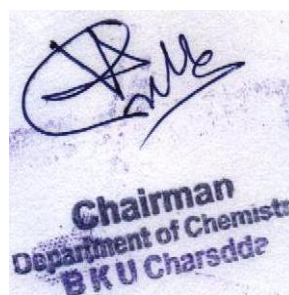
PRACTICAL-1

Course code : CHEM-672-V

Credit Hours: 01

Marks: 25

Laboratory work illustrating topics covered in the lecture of papers I, II & III.



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BIOCHEMISTRY

COURSE WISE BREAKUP

Fourth Year

Seventh Semester

SPECILIZATION

BIOCHEMISTRY

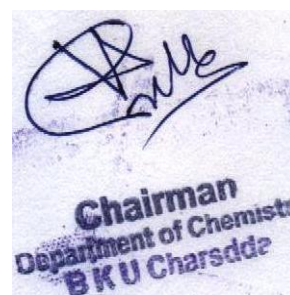
THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM -673-I	PAPER-I: BIOCHEMISTRY	03	100
CHEM -673-II	PAPER-II: BIOCHEMISTRY	03	100
CHEM -673-III	PAPER-III: BIOCHEMISTRY	03	100
CHEM -674-IV	PAPER-IV: ENVIRONMENTAL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
THES/CHEM -673-VI	Research Thesis/Research Project/Advanced	03	100
CHEM -673-V	Biochemistry Lab. I	01	25

- Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)
- Maximum Marks = 525 (theory 400 & practicals 125 marks)



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BS 4th Year

Semester-VII

BIOCHEMISTRY

Paper-I

Title of the Course: General Biochemistry Related to Biomedical Sciences

Course Code: CHEM-673-I

Credit Hours: 03

Marks: 100

Prerequisites: Course I and concept of basic human physiology

Course Objectives

This course provides fundamental concepts. Biochemical and molecular aspects of endocrinology and chemistry of blood and other extra cellular fluids. Emphasis is on relation of the above topics to medicine.

Course Contents

Endocrinology:

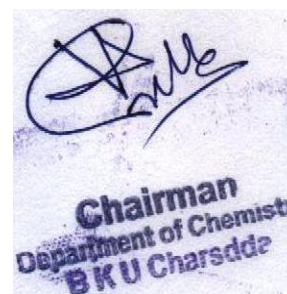
General introduction, chemical nature, common characteristics and mode of action of hormones. Hormone receptors. Chemistry, Biosynthesis, Metabolism and biological functions of pituitary, adrenal, thyroid, parathyroid, pancreatic and gonadal hormones. Hormones of GIT and Pineal glands.

Blood and Other Body Fluids

General composition of blood. Functions of blood. Blood plasma. Plasma proteins; composition and functions. Composition, development and functions of red blood cells, white blood cells and platelets. Haemoglobin; chemistry, properties, synthesis, functions and derivatives. Degradation of haemoglobin. Blood Coagulation and clotting factors. Blood pressure. Blood groups. Composition of Urine, Extracellular Fluids Like: cerebrospinal fluid, lymph, sweat, tears, synovial and interstitial fluid.

Recommended Books:

1. Smith, E.L.; Hill, R.L.; Lehman, I.R.; Lefkowitz, R.J.; Handler, P.; White, A., *Principles of Biochemistry (Mammalian Biochemistry)*, 7th ed. McGraw-Hill Companies Inc., New York, 1984.
2. Guyton, A.C.; and Hall, J. E., *Text Book of Medical Physiology*, 9th ed. W. B. Saunders Company, Tokyo, 1996.
3. Murray, R. K.; Mayes P. A.; Granner, D. K.; and Rodwell, V. W., *Harper's Biochemistry*, Appleton & Lange, 2000.



BS 4th Year

BIOCHEMISTRY

Title of the Course: Physical Techniques in Biochemistry

Course Code: CHEM-673-II

Semester-VII

Paper-II

Credit Hours: 03

Marks: 100

Course objectives: This course is designed to impart a fundamental understanding of biochemical techniques used to isolate and characterize various macromolecules.

Course Contents

Extraction, Fractionation and Purification of macromolecules

Homogenization, Solubilization and Concentration including ultrasonication, lyophilization and ultra decantation. Purification based on differential solubility techniques, Ion-exchange chromatography, Gel chromatography, Affinity chromatography, Paper & Thin layer chromatography and HPLC.

Electrophoresis

Paper and Gel electrophoresis. Two-dimensional electrophoresis. Capillary electrophoresis.

Electro focusing

Preparative and Analytical electro focusing.

Centrifugation

Principle. Preparative centrifugation. Application of density gradient and differential centrifugation. Ultracentrifugation. Sedimentation equilibrium and sedimentation velocity methods. Application of analytical centrifugation.

Tracer techniques

Detection and measurement of radioactivity. Application of radioisotopes in biological system.

U.V. and Visible Spectroscopy

Basic principles. Instrumentation and applications.

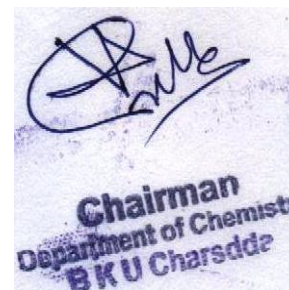
ELISA Techniques

Recommended Books

1. Cooper, T. G., The Tools of Biochemistry, John Wiley & Sons, New York, 1977.
2. Bryan, L. W.; Keith, W.; Arnold, E., A Biologists Guide to Principles and Techniques of Practical Biochemistry, London, 1981.
3. Scope, R. K., Protein Purification: Principle and Practice, 3rd ed., Springer-Verlag, New York, 1994.

Supplementary Reading Material

1. Dawes, E.A., Quantitative Problems in Biochemistry, 6th ed., Livingstone, 1980.
2. www.bio.mtu.edu/campbell/401sch1.html



BS 4th Year

Semester-VII

BIOCHEMISTRY

Paper-III

Title of the Course: Molecular Biology

Course Code: CHEM-673-III

Credit Hours: 03

Marks: 100

Course Objectives

The contents of the course mainly covers the fundamental concepts of molecular biology, molecular manipulations and associated applications. Focus is placed on understandings of the chemistry, and relations between structure and properties of the nucleic acids.

Course Contents

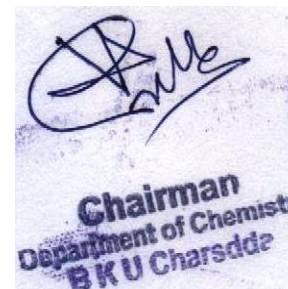
DNA; the primary genetic material. Structure, Replication in prokaryotes and comparison with eukaryotes. DNA sequencing. Chemical synthesis of polynucleotides. DNA repair and recombination. Different types of RNA and their role in protein synthesis. Transcription and its regulation. Genetic code. Post transcriptional processing. Structure of transfer RNA. Protein synthesis inhibitors. Control of translation . Post translational modification. Plasmids, bacteriophage and cosmids. In vitro mutagenesis: Deletion, Insertion and Substitution. Recombinant DNA and genetic diseases.

Recommended Books

1. Karp. G., *Cell and Molecular Biology*, John Wiley & Sons, 1996.
2. Doonan. S., *Nucleic Acids*, Royal Society of Chemistry, Cambridge, 2004.
3. Watson, J.D.; Baker, T.A.; Bell, S.P., et al, *Molecular Biology of the Gene*, 5th ed. Pearson Benjamin Cummings, 2004.

Supplementary Reading Material

1. Watson, J.D.; Tooze, J.; Kurtz, D.T., *Recombinant DNA*, Scientific American Books, W.H. Freeman, New York, 1983.
2. Lewin B., *Gene VII*, Oxford University Press, New York, 2000.
3. Alberts, B.; Johnson, A.; Lewis, J.; Raff, M.; Roberts, K.; Walter, P., *Molecular Biology of the Cell*, 5th ed. Taylor & Francis, 2008.
4. Brown, T. A., *Genomes*, 3rd ed. Taylor & Francis, 2006.



BS 4th Year

Semester-VII

Elective Course-I

PAPER-IV

ENVIRONMENTAL CHEMISTRY

Course Code:CHEM-674-IV

Credit Hours: 03

Marks: 100

Credit Hours: 03

Marks: 100

The atmosphere and air pollution:

Structure and properties of the atmosphere, temperature inversion and air pollution, atmosphere photochemistry, possible depletion of stratospheric ozone, natural vs polluted air, particulate matter, analysis and control of particulations, sulphur oxides, effects of sulphur dioxides and particulates, other industrial air pollutants, carbon monoxide, oxides of nitrogen photochemicals smog, airborne load, control of automobile emissions.

Water and water treatment:

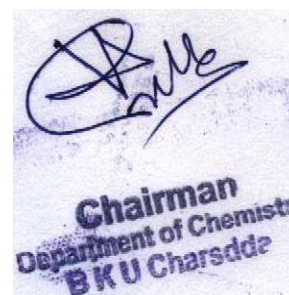
Unique physical and chemical properties of water, criteria of water quality, natural water-eutrophication, detergents and phosphates, importance of micro organisms in water purification, primary and secondary treatment of water, advanced waste water treatment, removal of nitrogen and phosphorus, sources of industrial water pollution, heavy metals and mercury.

The green revolution:

Pest control, pesticides, toxicity of pesticides, pest management.

Books Recommended:

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi. J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
4. Stanley E. Manahan, Environmental chemistry, Brooks, California



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BS 4th Year

Semester-VII

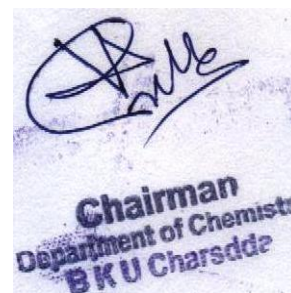
BIOCHEMISTRY)

Title of Course: Special Practicals/Research Project/Position Paper (Literature Survey)

Course Code: THES/CHEM-673-VI

Credit Hours: 03

Marks: 100



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BS 4th Year

Semester-VII

BIOCHEMISTRY

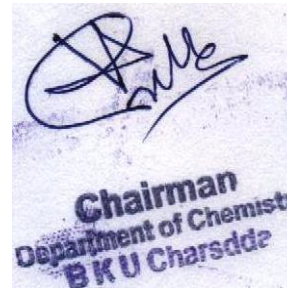
Practical-I

Course Code: CHEM-673-V

Credit Hours: 01

Marks: 25

Experiments based on theory topics covered in Paper I, II, and III.



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FUEL CHEMISTRY

COURSE WISE BREAKUP

Fourth Year

Seventh Semester

SPECIALIZATION

FUEL CHEMISTRY

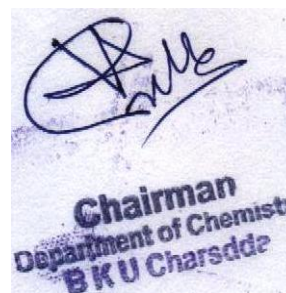
THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-678-I	PAPER-I: FUEL CHEMISTRY	03	100
CHEM-678-II	PAPER-II: FUEL CHEMISTRY	03	100
CHEM-678-III	PAPER-III: FUEL CHEMISTRY	03	100
CHEM-674-IV	PAPER-IV: ENVIRONMENTAL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-678-VI	Research Thesis/Research Project/Advanced Lab./Position	03	100
CHEM-678-V	Fuel chemistry Lab. I	01	25

- Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)
- Maximum Marks = 525 (theory 400 & practicals 125 marks)



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BS 4th Year

Semester-VII

FUEL CHEMISTRY

Paper-I

Title of the Course: Chemistry of Coal Conversion Processes-I

Course Code: CHEM-671-I

Credit Hours: 03

Marks: 100

Course Objectives

The students will acquire knowledge about environmentally friendly utilization of coal and how to extract maximum energy and convert coal in to a variety of highly demanding chemicals used as feed stock in a number of Industries.

Course Contents

Coal: composition, structure, coalification and classification of coal. Coal mining and exploration, pretreatment and preparation of coal. Coal uses in different industries. Environmental problems associated with coal mining and combustion.

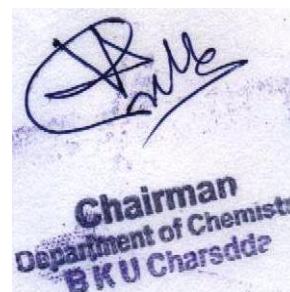
Gasification: Thermodynamics, kinetics and catalytic aspects of coal gasification, fixed bed gasifier, fluidized bed gasifier, transport reactor, liquid medium gasifier and underground gasification. Gas upgrading by carbon monoxide shift, gas purification, methanation and dehydration. Properties and processing of gaseous fuels and environmental consideration.

Recommended Books:

1. Wen, C.Y. and Stanley, E. "Coal conversion Technology" Addison-Wesley, New York. (1979).
2. Probst, R.F and Hicks, R.E. "Synthetic Fuels" McGraw Hill, New York. (1982).
3. Francis, W. "Fuels and Fuel Technology" Pergamon Press, London. (1980).

Supplementary Reading Materials:

1. Merick, D. "Coal Combustion and Conversion Technology" McMillan Ltd., London (1984).
2. Berkowitz, N. "The Chemistry of Coal" Elsevier Amsterdam. (1985)



BS 4th Year

Semester-VII

FUEL CHEMISTRY

Paper-II

Title of the Course: Petroleum and Petrochemicals-I Course Code: CHEM-678-II

Credit Hours: 03

Marks: 100

Course Objectives

The students will acquire knowledge about the modern refining operations for maximum recovery of petroleum products and to get knowledge using crude petroleum and its distillate products in commercial manufacture of highly demanding petrochemicals.

Course Contents

Cracking and Reforming of Petroleum Fractions: Preparation, structure and properties of cracking and reforming catalysts. Mechanism of cracking and reforming. Effect of operating conditions on cracking and reforming products. Construction and operation of thermal and catalytic cracking and reforming units. Hydro forming and desulphurisation of petroleum products.

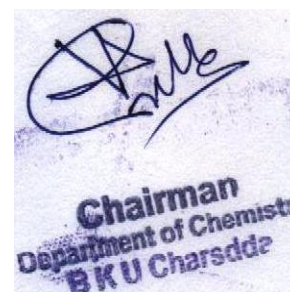
Petroleum and Petrochemicals: Ethylene production by thermal cracking from ethane. Propane and naphtha. Petrochemicals from oxidation processes. Production of petrochemicals from halogenation processes. Hydrogenation of Benzene, Fats, and adiponitrite, nitration of benzene and toluene, sulphonation of benzene and toluene, alkylation of aromatics.

Recommended Books:

1. Hobson, G.D. "Modern Petroleum Technology" Part 2, John Wiley and Sons, New York. (1984).
2. Gates, B.C, Katzer, J.R and Schuit, G.C.A. "Chemistry of Catalytic Processes". McGraw Hill Book company, London (1979).

Supplementary Reading Materials:

- a. List, H.L. "Petrochemical Technology" Printice-Hall Englewood Cliffs, New Jersey. (1986).
- b. Smith, M.L, Stinson. K.W. "Fuels and Combustion" McGraw Hill Book Company. Reprint by National Book Foundation in (1972).
- c. Goodger, E.M. "Hydrocarbon Fuels" Union Brothers Ltd, London. (1975).
- d. Maleev, V.L. "Internal Combustion Engines" McGraw Hill Book Company London, (1985).
- e. Hughes, J.R., and Swindells, N.S. "Storage and Handling of Petroleum Liquids" Charless Griffin and Company Ltd, London. (1987).



BS 4th Year

Semester-VII

FUEL CHEMISTRY

Paper-III

Title of the Course: Characterization of Fossil Fuels Course Code: CHEM-678-III

Credit Hours: 03

Marks: 100

Course Objectives

The students will acquire knowledge of the advanced spectroscopic techniques currently used in modern refineries and research organizations for characterization and identification of various fossil fuels.

Course Contents

Physicochemical: Determination of properties of petrochemicals i.e. API gravity, Flash point, Pour point, Aniline point, Distillation behavior, Octane number, Cetane number and Reid vapor pressure (RVP)

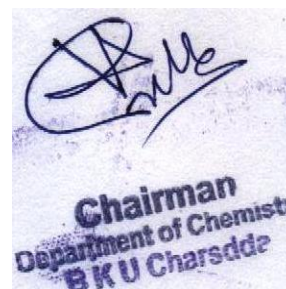
Analytical Methods: Characterization and quality assurance of petroleum products using UV-Visible, Infra-Red Spectroscopy, Gas Chromatography and Atomic Absorption techniques.

Recommended Books:

1. Ewing, G.W. "Instrumental Methods of Chemical Analysis" McGraw Hill, London. (1985).
2. Crisition, G.D. "Instrumental Analysis" Allyn and Bacon, Inc, Boston, London. (1986).
3. Kagler, S.H. "Spectroscopic and Chromatographic Analysis of Mineral Oils" John, Wiley and Sons, New York. (1983).

Supplementary Reading Materials:

1. Karr. C. "Analytical Methods for Coal and Coal Products" Academic Press, New York. (1978).
2. Kemp, W. "Organic Spectroscopy" The MancMillan Press Ltd London (1994).
3. Skooge, D.A. "Instrumental Analysis". Sanat Printer, Indian Edition, 2009.



Elective Course-I

ENVIRONMENTAL CHEMISTRY**Course Code: CHEM-674-IV****Credit Hours: 03****Marks: 100****Credit Hours: 03****Marks: 100****The atmosphere and air pollution:**

Structure and properties of the atmosphere, temperature inversion and air pollution, atmosphere photochemistry, possible depletion of stratospheric ozone, natural vs polluted air, particulate matter, analysis and control of particulations, sulphur oxides, effects of sulphur dioxides and particulates, other industrial air pollutants, carbon monoxide, oxides of nitrogen photochemicals smog, airborne load, control of automobile emissions.

Water and water treatment:

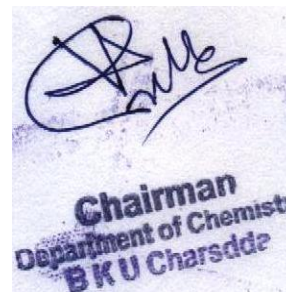
Unique physical and chemical properties of water, criteria of water quality, natural water-eutrophication, detergents and phosphates, importance of micro organisms in water purification, primary and secondary treatment of water, advanced waste water treatment, removal of nitrogen and phosphorus, sources of industrial water pollution, heavy metals and mercury.

The green revolution:

Pest control, pesticides, toxicity of pesticides, pest management.

Books Recommended:

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi. J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
4. Staneley E. Manahan, Environmental chemistry, Brooks, California



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BS 4th Year

Semester-VII

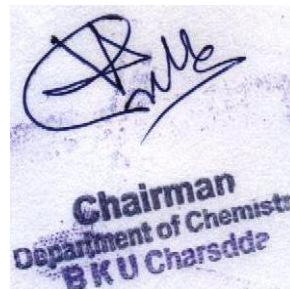
FUEL CHEMISTRY

Title of the Course: Special Practical/Research Project/Review Paper (Literature Survey)

Course code: THES/CHEM-V-678

Credit Hours: 03

Marks: 100



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Credit Hours: 01

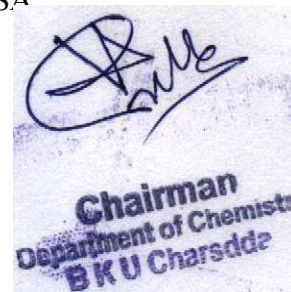
Marks: 25

Course Objectives:

Determination of electrical conductivity, total base number, neutralization number and total salts contents of lube oils using potentiometric and conductometric methods. Determination of heat of combustion and calorific values of oils and chlorine and sulphur contents of coal using bomb calorimeter.

Recommended Books

- i. Speight: J.G Handbook of Petroleum Analysis Wiley Interscience (2002)
- ii. Speight: J.G Handbook of Coal Analysis. John Wiley and Sons, New Jersey (2005).
- iii. ASTM 2000, Annual Book of ASTM standards American Society for Testing Materials West Conshohokm PA USA



YEAR-IV
SEMESTER-VIII

INORGANIC CHEMISTRY

COURSE WISE BREAKUP

Fourth Year

Eighth Semester

SPECILIZATION

INORGANIC CHEMISTRY

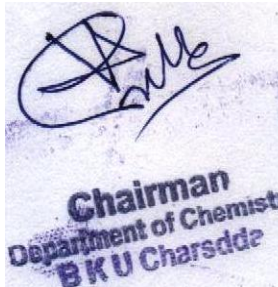
THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-685-I	PAPER-V: INORGANIC CHEMISTRY	03	100
CHEM-685-II	PAPER-VI: INORGANIC CHEMISTRY	03	100
CHEM-685-III	PAPER-VII: INORGANIC CHEMISTRY	03	100
CHEM-684-IV	PAPER VIII: ENVIRONMENTAL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-685-VI	Research Thesis/Research Project/Advanced Lab./Position	03	100
CHEM-685-V	Inorganic Chemistry	01	25

- Total Credits of the Semester = 15 (theory 12 & practicals 03 credits)
- Maximum Marks = 525 (theory 400 & practicals 125 marks)



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BS 4th Year

Semester-VIII

INORGANIC CHEMISTRY

Course Title: SYMMETRY AND MAGNETOCHEMISTRY

Course Code: CHEM-685-I

Credit Hours: 03

Marks: 100

Course Objectives:

Students will acquire knowledge about magnetic properties from chemistry point of view and group theory.

Course Contents:

Symmetry and Group Theory:

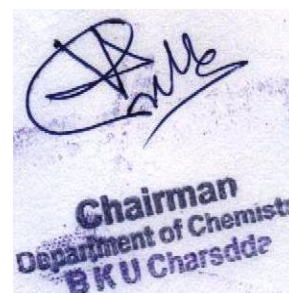
Symmetry and group theory, point groups, multiplication tables, group representation and development of character tables. Introduction to the interpretation of spectra and structure elucidation.

Magnetochemistry:

Theory of magnetism, diamagnetism, paramagnetism, ferro, ferri and antiferromagnetism, magnetic susceptibility, magnetic moments, Faraday's & Gouy's methods, effect of temperature on magnetic properties of complexes. Electron spin resonance spectroscopy, Magnetic moment of lanthanides.

Recommended Books:

1. Douglas, B., McDaniel, D., Alexander, J., Concepts and Models of Inorganic Chemistry, 3rd ed., John-Wiley & Sons Inc., (1997).
2. Huheey, J. E, Keiter, E. A., Keiter, R. L., Inorganic Chemistry: Principles of Structure and Reactivity", 4th ed., Prentice Hall, (1997).
3. Mackay, K. M., Mackay, R. A. and Henderson, W., Introduction to Modern Inorganic Chemistry, 6th ed., CRC Press, (2002).
4. Miessler, G. L., Fisher, P. J. and Tar, D, A., Inorganic Chemistry, 5th ed., Prentice Hall, (2013).67
5. Purcell, K. F., Kotz, J. C., An Introduction to Inorganic Chemistry, W. B. Saunders, Company Holt-Saunders, International ed., (1980).
6. Cotton, F. A., Wilkinson, G., Murillo, C. A., Bochmann, M., Advanced Inorganic Chemistry, 6th ed., Wiley-Interscience, New York, (1999).
7. Jolly, W. L., Modern Inorganic Chemistry, 2nd ed., McGraw-Hill Company, (1991).
8. Carter, R. L., Molecular Symmetry and Group Theory, 1st ed., John-Wiley & Sons, Inc., New York, (1997).
9. Orchin, M., Jaffe, H. H., Symmetry, Orbitals, and Spectra, John-Wiley & Sons, Inc., New York, (1971).
10. McWeeny, R., Symmetry: An Introduction to Group Theory and its Applications, Dover Publications, Inc., (2002).
11. Vincet, A., Molecular Symmetry and Group Theory, 2nd ed., John Wiley & sons Ltd, (2001).



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INORGANIC CHEMISTRY**Course Title: RADIO AND NUCLEAR CHEMISTRY Course Code: CHEM-685-II****Credit Hours: 03****Marks: 100****Course Objectives:**

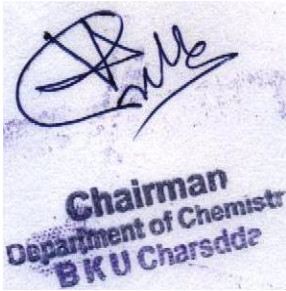
Students will acquire knowledge about radio and nuclear chemistry and nuclear reactions.

Course Contents:

Fundamentals and applied aspects of radioactivity and nuclear chemistry. types and characteristics of nuclear radiation, structure of nucleus, half-life, nuclear binding energy, and artificial radioactivity, fission and fusion reactions, acceleration of charged particles and applications of radioisotopes. Radioactivity hazards, Nuclear medicine, radiotherapy, applied nuclear chemistry.

Recommended Books:

1. Friedlander, G., Kennedy, J. W., Miller, J. M. and Maciuas, E. S., Nuclear and Radiochemistry, 3rd ed., John-Wiley & Sons, Inc., (1981).
2. Choppin, G. R., Rydberg, J., Liljenzin, J., Radiochemistry and Nuclear Chemistry, 3rd ed., Butterworth-Heinemann Ltd., (2002).
3. Arnikar, H. J., Essentials of Nuclear Chemistry, 4th ed., New Age International Pvt. Ltd. Publishers, (1996).
4. Naqvi, I. I. and Farrukh, M. A., Radiotracers in Chemical Applications VDM Verlag Dr. Müller, Germany, (2010).
5. Loveland, W., Morrissey, D. J. and Seaborg, J. T., Modern Nuclear Chemistry, John Wiley and Sons, Inc., (2006) 68



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INORGANIC CHEMISTRY**Course Title: ORGANOMETALLICS****Course Code: CHEM-685-III****Credit Hours: 03****Marks: 100****Course Objectives:**

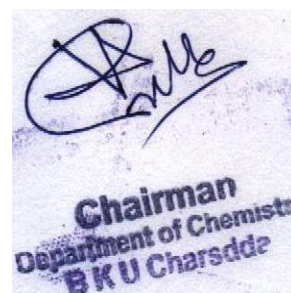
Students will acquire knowledge about chemistry of organometallics especially with reference to their types and bonding, and reactivity of organometallic compounds in homogeneous catalysis.

Course Contents:

Fundamentals of organometallic compounds, types of bonding in organometallics, single, double and triple bonds to carbon (compound types, acyls, alkylidene complexes and alkylidyne complexes), delocalized hydrocarbon systems (alkenes, olefins, allyl and butadienes), alkyne complexes, cyclic π -complexes (five and six membered rings). Homogeneous catalytic hydrogenation, dimerization, oligomerization, polymerization, hydroformylation of olefins, catalytic polymerization of acetylenes. Insertion reactions and uses of organometallic compounds in organic synthesis.

Recommended Books:

1. Powell, P., Principles of Organometallics Chemistry, 2nd ed., Springer, (1998).
2. Yamamoto A., Organotransition Metal Chemistry: Fundamental Concepts and Applications, 1st ed., John-Wiley & Sons, Inc., (1986).
3. Cotton, F. A., Wilkinson, G., Murillo, C. A., Bochmann M., Advanced Inorganic Chemistry, 6th ed., Wiley-Interscience, New York, (1999).
4. Miessler, G. L., Fisher, P. J. and Tar, D. A., Inorganic Chemistry, 5th ed., Prentice Hall, (2013).66
5. Douglas, B., McDaniel, D. and Alexander, J., Concepts and Models of Inorganic Chemistry, 3rd ed., John-Wiley & Sons, Inc., (1994).
6. Haiduc, I. and Zuckerman, J. J., Basic Organometallic Chemistry, Walter De Gruyter Inc., (1985).
7. Jolly, W. L., Modern Inorganic Chemistry, 2nd ed., McGraw-Hill Company, (1991).
8. Porterfield, W. W., Inorganic Chemistry: A Unified Approach, 2nd ed., Academic Press, (1993).
9. Vincent, A., Molecular Symmetry and Group Theory: 2nd ed., John-Wiley & Sons, Ltd., (2001).
10. Malik, W. U., Tuli, G. D., Madan, R. D., Selected Topics in Inorganic Chemistry, S. Chand and Co. Ltd., (2010).



ENVIRONMENTAL CHEMISTRY

Course Code:CHEM-684-VI

Credit Hours: 03

Marks: 100

Credit Hours: 03

Marks: 100

Fossil fuels and energy sources

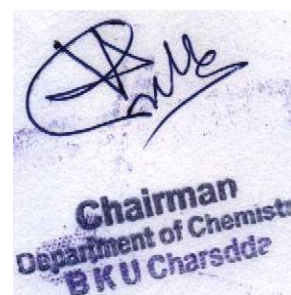
Origin and development of coal: Origin and reserves of petroleum and natural gas, composition and classification of petroleum, refining, and environmental problems associated with petroleum, nuclear fission reactors, solar energy, power synthesis, tidal and geothermal energy, synthetic chemical fuels, the H economy, electrochemical energy conversion, conservation of free energy, the energy balance of the earth.

Soils and mineral resources

Estimating reserves of mineral resources of earth, extraction of metal-general principles, iron, steel, aluminium, copper and other metals, sulphur and nitrogen. Organic matter in soil, soil nutrients, ion exchange in soils, solid pH and nutrients availability.

Books Recommended

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
4. Staneley E. Manahan, Environmental chemistry, Brooks, California.



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BS 4th Year

Semester-VIII

CHEMISTRY COURSE (INORGANIC CHEMISTRY)

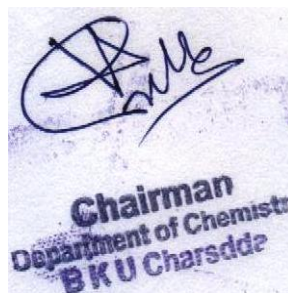
Course Title: Inorganic Chemistry Special Practical/Research-II

Course Code: THES/CHEM-689-VI

Credit Hours: 03

Marks: 100

Title of Course: Special Practicals/Research Project/Position Paper (Literature Survey)



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BS 4th Year

Semester-VIII

INORGANIC CHEMISTRY

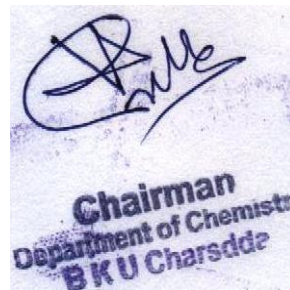
Course Title: Inorganic Chemistry Practical-II

Course Code: CHEM-685-V

Credit Hours: 01

Marks: 25

Experiments based on theory topics covered in Paper IV, V, and VI.



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ORGANIC CHEMISTRY

COURSE WISE BREAKUP

Fourth Year

Eight Semester

SPECILIZATION

ORGANIC CHEMISTRY

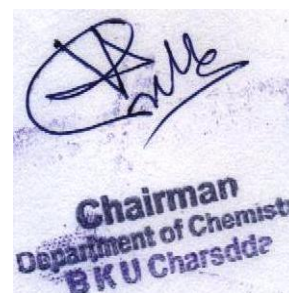
THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-686-I	PAPER-V: ORGANIC CHEMISTRY	03	100
CHEM-686-II	PAPER-VI: ORGANIC CHEMISTRY	03	100
CHEM-686-III	PAPER-VII: ORGANIC CHEMISTRY	03	100
CHEM-684-IV	PAPER-VIII: ENVIRONMENTAL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-686-VI	Research Thesis/Research Project/Advanced Lab./Position	03	100
CHEM-686-V	Organic Chemistry Lab.	01	25

- Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)
- Maximum Marks = 525 (theory 400 & practicals 125 marks)



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BS 4th Year

Semester-VIII

ORGANIC CHEMISTRY

Course Title: Bio Molecules, Synthetic Drugs and Polymer

Course code: CHEM-686-I

Credit Hours: 03

Marks: 100

Course Objectives

On completing this course the student should be able to:

1. Predict the mechanism of the sequence of reactions.
2. Determine the mechanism of the reaction using kinetic and thermodynamic techniques.
3. Have introductory knowledge of the chemistry and applications of lipids, proteins, carbohydrates and nucleic acids.
4. Have exposure to the chemistry and application of the classes of medicines under study.

Course Contents

Lipids, Proteins, Carbohydrates and Nucleic Acids:

Chemistry of lipids, proteins, carbohydrates, nucleic acids and their importance in living systems.

Drugs-Pharmaceutical Compounds:

Introduction; classification; chemistry of analgesics and antipyretics, sulpha drugs/sulphonamides, antimalarials and antibiotics.

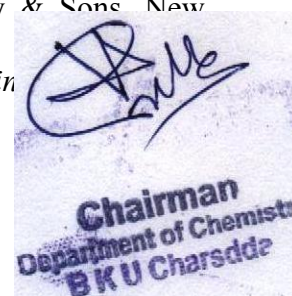
Synthetic Polymers

Introduction to polymer chemistry; step growth polymerization; free radical polymerization; ionic polymerization; stereochemistry in polymers; polymerization using Ziegler-Natta catalyst; stereo-regulation and conformation polymers; molecular weight determination of polymers; structure-property relationship; reactions of synthetic polymers; degradation and stability with special emphasis on thermal and photo-degradation.

Recommended Books

(Latest available editions of the following books)

1. Carroll, F. A., *Perspectives on Structure and Mechanism in Organic Chemistry*, Brooks/Cole Publishing Company, New York.
2. Jones, R. A. Y., *Physical and Mechanistic Organic Chemistry*, Cambridge University Press, Cambridge.
3. Carey, F. A.; Sundberg, R. J., *Advanced Organic Chemistry Part B: Reactions and Synthesis*, Plenum Press, New York.
4. March, J., *Advanced Organic Chemistry*, John Wiley & Sons, New York.
5. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P., *Organic Chemistry*, Oxford University Press, New York.
6. Blei, I.; Odian, G., *General Organic and Biochemistry*, W.H. Freeman & Company, New York.
7. Burger, A., *Medicinal Chemistry Part I & II*, John Wiley & Sons, New York.
8. Wolff, M. E., *Burger's Medicinal Chemistry Part II*, John Wiley & Sons, New York.
9. Williams, D. A.; Lemke, T. L., *Foye's Principles of Medicines*, Lippincott Williams & Wilkins, New York.
10. Isaacs, N. S., *Physical Organic Chemistry*, Longman, London.



Credit Hours: 03

Marks: 100

Course Objectives

1. Understand the field of natural products chemistry.
2. Identify natural products and their probable biosynthetic pathways.
3. Enhance their understanding of biological and biochemical sciences.
4. Natural products chemistry endeavors to examine the natural source, mechanisms whereby the source biosynthetically constructs the product, processes whereby the product can be isolated from the source and techniques used to identify the product/s.
5. Understand classical and modern synthetic routes to the natural products.
6. Learn process whereby the product can be isolated from the source and techniques used to identify it.

Course Contents**Alkaloids:**

Introduction; classification; isolation; general methods for structure elucidation; discussion with particular reference to structure and synthesis of ephedrine, nicotine, atropine, quinine, papaverine and morphine.

Terpenoids

Introduction; classification; isolation; general methods for structure elucidation; discussion with particular reference to structure and synthesis of citral, α -terpineol, α -pinene, camphor and α -cadinene.

Steroids

Introduction; nomenclature and stereochemistry of steroids; structure determination of cholesterol and bile acids; introduction to steroidal hormones with particular reference to adrenal cortical hormones.

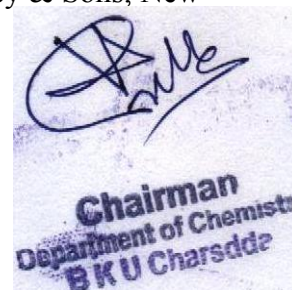
Recommended Books

(Latest available editions of the following books)

1. Finar, I. L., *Organic Chemistry*, Vol. 2, Pearson Education Ltd., Delhi.
2. Shoppee, C. W., *Chemistry of the Steroids*, Butterworths, London.
3. Hesse, M., *Alkaloid Chemistry*, John Wiley & Sons, New York.
4. Fieser, L. F.; Fieser, M., *Steroids*, Asia Publishing House, London.

Supplementary Reading Material

5. Morrison, R. T.; Boyd, R. N., *Organic Chemistry*, Prentice-Hall of India, New Delhi.
6. Solomons, T. W. G.; Fryhle, C. B., *Organic Chemistry*, John Wiley & Sons, New York.



Course Objectives

Upon completion of this class, all students should be able to:

1. Generate a new carbon-carbon bond by the transition metal catalyzed cross coupling of aromatic and other substrates.
2. Prepare/characterize a coordination compound for use as a catalyst for the coupling reaction.
3. Determine the effect of ligand on the regiochemistry of the cross-coupling reaction.
4. Analyze products of catalytic reactions by gas chromatography.
5. Draw chemical structures of some representative polymers; define and understand basic polymer concepts; derive and apply the basic principles behind polymer molecular weights and molecular weight determination; and identify the different types of polymer isomerism and conformational changes and what effect these changes have on polymer properties.
6. Outline synthetic procedures and mechanisms for polymer formation, derive and manipulate chemical kinetic equations describing polymer formation in order to specify reaction conditions to achieve target molecular weights and polymer or copolymer architectures.
7. Describe different methods for the production of polymeric materials such as solution, bulk, suspension and emulsion polymerizations.

Course Contents***Transition Metal Catalyzed Coupling Reactions***

Transition metals and their complexes; oxidation states; the d^n notations; electron counting; the 16- and 18- electron rules; fundamental reactions of transition metal complexes; the Heck reaction and other examples of transition metal catalyzed reactions.

Reterosynthesis

Introduction to reterosynthesis and disconnection approach; synthesis of aromatic compounds with one and two group carbon C-X disconnections; donor and acceptor synthons; C-C disconnections and 1,2-, 1,3-, 1,4-, 1,5- and 1,6- difunctionalized compounds.

Recommended Books

1. Bruckner, R., *Advanced Organic Chemistry Reaction Mechanisms*, Harcourt Science & Technology Company, New York.
2. Powell, P., *Principles of Organometallic Chemistry*, Chapman & Hall, New York.
3. Parkins, A. W.; Poller, R. C., *An Introduction to Organometallic Chemistry*, Macmillan, London.
4. Waren, S., *Organic Synthesis- The Disconnection Approach*, John Wiley & Sons, New York.
5. Waren, S., *Workbook for Organic Synthesis-The Disconnection Approach*, John Wiley & Sons, New York.
6. Smith, M. B., *Organic Synthesis*, McGraw-Hill, New York..
7. Parker, D. B. V., *Polymer Chemistry*, Applied Science Publishers, London.
8. Challa, G., *Polymer Chemistry an Introduction*, Ellis Horwood, New York.
9. Stevens, M. P., *Polymer Chemistry an Introduction*, Addison-Wesley Publishi London.

ENVIRONMENTAL CHEMISTRY

Course Code:CHEM-684-IV

Credit Hours: 03

Marks: 100

Credit Hours: 03

Marks: 100

Fossil fuels and energy sources

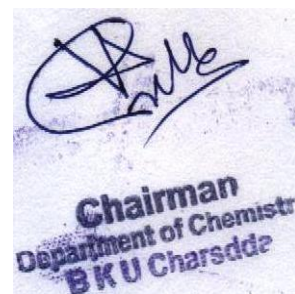
Origin and development of coal: Origin and reserves of petroleum and natural gas, composition and classification of petroleum, refining, and environmental problems associated with petroleum, nuclear fission reactors, solar energy, power synthesis, tidal and geothermal energy, synthetic chemical fuels, the H economy, electrochemical energy conversion, conservation of free energy, the energy balance of the earth.

Soils and mineral resources

Estimating reserves of mineral resources of earth, extraction of metal-general principles, iron, steel, aluminium, copper and other metals, sulphur and nitrogen. Organic matter in soil, soil nutrients, ion exchange in soils, solid pH and nutrients availability.

Books Recommended

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
4. Staneley E. Manahan, Environmental chemistry, Brooks, California.



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BS 4th Year

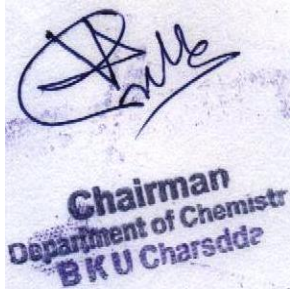
Semester-VIII

ORGANIC CHEMISTRY

Course Title: Special Practical-II/Research-II Special Practical/Research Project/Position
Paper (Literature Survey) Course Code:THES/CHEM-686-VI

Credit Hours: 03

Marks: 100



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Semester-VIII

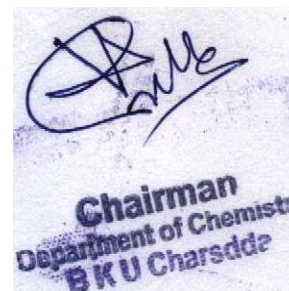
ORGANIC CHEMISTRY

Course Title: Practical-II Experiments based on theory topics covered in Paper IV, V, and VI.

Course Code: CHEM-686-V

Credit Hours: 01

Marks: 25



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PHYSICAL CHEMISTRY

COURSE WISE BREAKUP

Fourth Year

Eighth Semester

SPECILIZATION

PHYSICAL CHEMISTRY

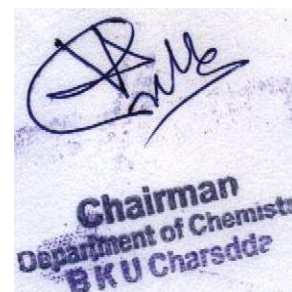
THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-687-I	PAPER-IV: PHYSICAL CHEMISTRY	03	100
CHEM-687-II	PAPER-V: PHYSICAL CHEMISTRY	03	100
CHEM-687-III	PAPER-VI: PHYSICAL CHEMISTRY	03	100
CHEM-684-IV	PAPER VII: ENVIRONMENTAL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-687-VI	Research Thesis/Research Project/Advanced Lab./Position	03	100
CHEM-687-V	Physical Chemistry Lab. II	01	25

- **Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)**
- **Maximum Marks = 525 (theory 400 & practicals 125 marks)**



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Credit Hours: 03

Marks: 100

Course Objectives

To develop deep understanding of chemical kinetics.

Course Contents

ADVANCE CHEMICAL KINETICS

Chemical Kinetics

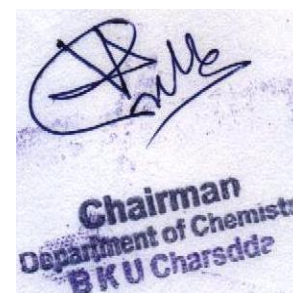
Kinetics of third order reactions and its different cases, methods for determination of order of Chemical reaction, Effect of temperature on the reaction rate, Steady state approximation, Lindeman's mechanism for unimolecular reactions, Bimolecular collision theory,

Influence of ionic strength on the reaction rate (Primary and Secondary Salt Effects), Theory of absolute reaction rate, comparison of collision and absolute reaction theories.

Kinetics of complex reactions: opposing, parallel, consecutive, chain reactions, kinetics of photochemical and thermal reactions, Thermal decomposition of nitrogen penta oxide.

Recommended Books

1. Albery J., Electrode Kinetics, Clarendon, Oxford (1975).
2. Espenson, J. H. Chemical Kinetics and Reaction Mechanism 2nd ed., McGraw Hill London (2002).
3. Espenson J.H. "Chemical Kinetics and Reaction Mechanisms" 2nd ed. McGraw Hill, New York (1995).
4. Frost A.A. and Pearson R.G. "Kinetic and Mechanism" 2nd ed. John Wiley and Sons Inc, New York (1961).
5. Laidler K.J. "Chemical Kinetics" 3rd ed. Pearson Education Company, New York (1987).
6. Laidler L.J. "Reaction Kinetic VII, II Reaction in Solution" Pergamon Press, New York (1963).



Credit Hours: 03

Marks: 100

NUCLEAR CHEMISTRY

An introduction to electrochemistry, Ohm's law, conductance, molar conductance and equivalent conductance, Kohlraush's law of independent migration of ion, Activity and activity coefficient, Debye-Huckel Theory, Electrochemical cells, Voltaic cell, Electrolytic cell, Cell notation, Types of electrochemical cell (Concentration cell & Redox cell), Types of electrodes, Standard Electrode, SHE, Calomel electrode, Ag-AgCl electrode & Amalgum electrode.

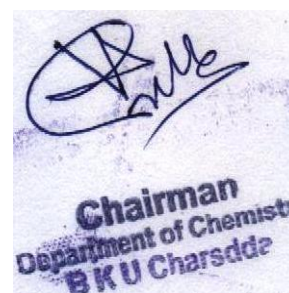
Chemical reactions and Electrode potential, Nernst's equation and its application, Electrochemical series and its application.

PHOTOCHEMISTRY

Scope of photochemistry. Photochemical reactions and their quantum yields, Energy transfer in photochemical reaction. Kinetics of photochemical reaction (Absorption of light), Laws of absorption of radiation, Laws of photochemistry. Einstein's law of photochemical equivalence. radioactive and nonradioactive process (fluorescence, phosphorescence, internal conversion, intersystem crossing, quenching process),. Flash photolysis. Techniques in photochemistry.

Books Recommended

1. Calvert J.G. and Pitts J.N. "Photochemistry" John Wiley, New York (1966).
2. Suppan P. "Principles of Photochemistry", the Chemical Soc., UK (1973).
3. Albert R.A., Robert J.S. and Mounji G.B. "Physical Chemistry". 4th ed., John Wiley and Sons (2004).
4. Alberty R. "Physical Chemistry" 17th ed., John Wiley and Sons (1987).
5. Atkins, P.W. "Physical Chemistry" 6th ed., W.H. Freeman and Co. New York (1998).
6. Laidler K.J., John H.M. and Bryan C.S. "Physical Chemistry" 4th ed., Houghton Mifflin Publishing Company Inc.(2003).
7. Ball D.W. "Physical Chemistry" 1st ed., Brooks/Cole Co. Inc. (2003).
8. Bockris J.O.M. and Reddy A.K.N. "Modern Electrochemistry" Vol-I and II, 4th ed. Plenum Press, London (2003).
9. Muhammad M. and Amjad M. "Principles of Electrode Kinetics" Rooha Printers, Lahore (2001).



Credit Hours: 03

Marks: 100

Course Objectives

To acquire advanced knowledge about Surface chemistry and Catalysis.

Surface Chemistry and catalysis

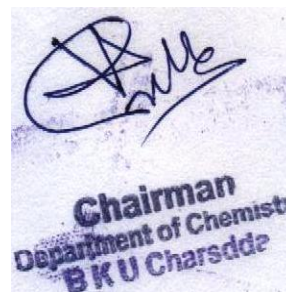
Adsorption, types of adsorption, Factors effecting adsorption of gases on solid surface, Comparison between physiosorption and Chemisorption, Characteristic of adsorption. Adsorption isotherm, Freundlich adsorption isotherm, Langmuir adsorption isotherm, Langmuir adsorption isotherm applied to adsorption with dissociation, B.E.T adsorption isotherm, Surface area determination using BET isotherm, Gas adsorption isotherm or Henry equation, Surface active and surface inactive substances & Gibbs adsorption isotherm, Adsorption from solution at liquid surfaces. Adsorption from solution on solid surface, Factor effecting adsorption from solution at liquid surface, Applications of adsorption.

CATALYSIS

Homogeneous & Heterogeneous catalysis, Application of heterogeneous catalysis, Enzyme catalysis, Mechanism of enzyme catalysis (Key-lock model & Michaelis–Menten kinetics).

Books Recommended

1. Segal H. "Enzyme Kinetics" John Wiley New York (1975).
2. Schlutz A.R. "Enzyme Kinetics" (1964) Cambridge University Press England
- 3- 3. West A.R" Solid State Chemistry" J.wiley, New York(1989)



ENVIRONMENTAL CHEMISTRY

Course Code:CHEM-684-IV

Credit Hours: 03

Marks: 100

Credit Hours: 03

Marks: 100

Fossil fuels and energy sources

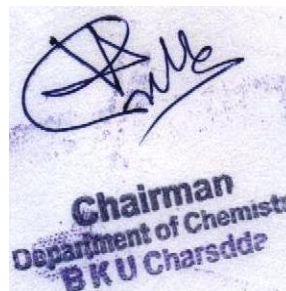
Origin and development of coal: Origin and reserves of petroleum and natural gas, composition and classification of petroleum, refining, and environmental problems associated with petroleum, nuclear fission reactors, solar energy, power synthesis, tidal and geothermal energy, synthetic chemical fuels, the H economy, electrochemical energy conversion, conservation of free energy, the energy balance of the earth.

Soils and mineral resources

Estimating reserves of mineral resources of earth, extraction of metal-general principles, iron, steel, aluminium, copper and other metals, sulphur and nitrogen. Organic matter in soil, soil nutrients, ion exchange in soils, solid pH and nutrients availability.

Books Recommended

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
4. Staneley E. Manahan, Environmental chemistry, Brooks, California.



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BS 4th Year

Semester-VIII

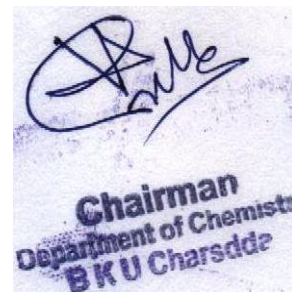
CHEMISTRY COURSE (PHYSICAL CHEMISTRY)

Course Title: Special Practical/Research-II Course code: THES/CHEM-687-VI

Credit Hours: 03

Marks: 100

Title of Course: Special Practicals/Research Project/Position Paper (Literature Survey)



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BS 4th Year

Semester-VIII

PHYSICAL CHEMISTRY

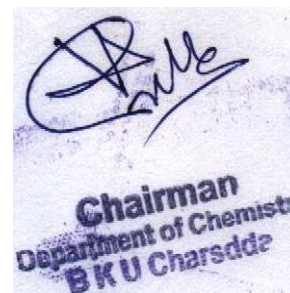
Course Title: Practical-II

Course code: CHEM-687-V

Credit Hours: 01

Marks: 25

Experiments based on theory topics covered in Paper I, II, and III.



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ANALYTICAL CHEMISTRY

COURSE WISE BREAKUP

Fourth Year

Eighth Semester

SPECILIZATION

ANALYTICAL CHEMISTRY

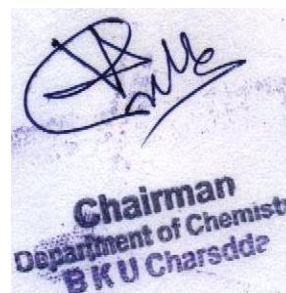
THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-681-I	ANALYTICAL CHEMISTRY	03	100
CHEM-681-II	ANALYTICAL CHEMISTRY	03	100
CHEM-681-III	ANALYTICAL CHEMISTRY	03	100
CHEM-684-IV	ENVIRONMENTAL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
THES/CHEM-681-VI	Research Thesis/Research Project/Advanced	03	100
CHEM-681-V	Analytical Lab II	01	25

- Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)
- Maximum Marks = 525 (theory 400 & practicals 125 marks)



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BS 4th Year

Semester-VIII

ANALYTICAL CHEMISTRY

Course Title: LUMINESCENCE SPECTROSCOPY AND THERMAL ANALYSIS

Course Code : CHEM-6t81-I

Credit Hours: 03

Marks: 100

Course Objectives:

Students will acquire knowledge about the theoretical and instrumental aspects of luminescence spectroscopy and thermal techniques of analysis in addition to learning about their applications.

Course Contents:

Luminescence Spectrophotometry:

Introduction, origin of fluorescence and phosphorescence spectra, Jablonski diagram, activation, deactivation, fluorescence spectrum, fluorescent and phosphorescent species; photoluminescence and structure, factors affecting fluorescence and phosphorescence, fluorescence quenching, quantum yield, instrumentation for fluorescence measurement, sources, wavelength selectors, sampling, detectors, read out devices, instrumentation for phosphorescence measurement, sampling, recording procedure, applications of fluorescence and phosphorescence

Atomic Fluorescence Spectrometry:

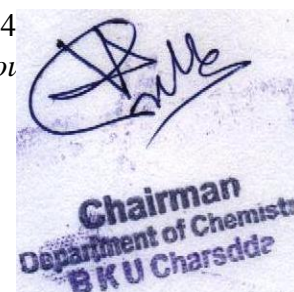
Origin of atomic fluorescence, atomic fluorescence spectrum, types of atomic fluorescence transitions, principle of atomic fluorescence spectrometry, fluorescence intensity and analyte concentration, instrumentation for atomic fluorescence spectrometry, applications of atomic fluorescence spectrometry, interferences, merits and limitations.

Thermal Methods of Analysis:

Introduction, instrumentation, sources of errors, interpretation of data, Factors affecting curve, applications of TGA, DTA and DSC.

Recommended Books:

1. Christian, G. D., *Analytical Chemistry*. 6th ed., John-Wiley & Sons, New York, (2006).
2. Harris, D. C., *Quantitative Chemical Analysis*, 8th ed., W. H. Freeman and Company, New York, (2011).
3. Braun, R. D., *Introduction to Chemical Analysis*, International Student Edition, (1985).
4. Haines, P. J., Whitby, On Canada Mcgraw Hill Ltd., *Thermal Methods of Analysis Principles, Applications and Problems*, 1st ed., Springer, (1995).
5. Lakowicz, J. R., *Principles of Fluorescence Spectroscopy*, 3rd ed., Springer (2006).
6. Gabbot, P., *Principles & Applications of Thermal Analysis*, Wiley-Blackwell, (2007).
7. Brown, M. E., *Introduction to Thermal Analysis: Techniques and Applications*, 2nd ed., Kluwer Academic Publishers, (2001).
8. Skoog, D. A., West, D. M. and Holler, F. J. and Crouch, S. R., *Fundamentals of Analytical Chemistry*, 8th ed., (Int.), Cengage Learning, (2004)
9. Burgess, C. and Jones, D. G., *Spectrophotometry, Luminescence and Color Compliance*, Vol. 6, Elsevier Science, (1995).



BS 4th Year

ANALYTICAL CHEMISTRY

Title of Course: NUCLEAR ANALYTICAL TECHNIQUES

Course Code: CHEM-681-II

Semester-VIII

Paper: V

Credit Hours: 03

Marks: 100

Course Objectives:

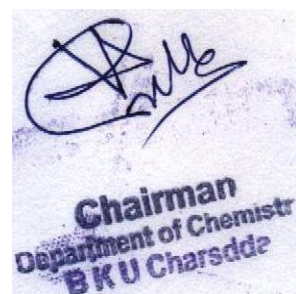
Students will acquire knowledge about different nuclear analytical techniques with special emphasis on the theoretical, instrumental and applications

Course Contents:

Radiotracer techniques, choice of radiotracers, factors affecting choice of radiotracers, isotope dilution analysis (IDA), principle and equation, instrumentation, applications, advantages and limitations, sub-stoichiometric isotope dilution analysis (SIDA), activation analysis (AA), principle of NAA, neutron sources, interferences, sensitivity and detection limits, classification, instrumentation, applications, advantages and limitations, comparison of NAA and IDA with other methods, radiometric titrations (RT), procedure, advantages and limitations, radio chromatography and radioimmunoassay.

Recommended Books:

1. Friedlander, G., Kennedy, J. W., Macias, E. S. and Miller. M. J., *Nuclear and Radiochemistry*, 3rd ed., Wiley, New York, (1981).
2. Arnikan, H. J., *Essentials of Nuclear Chemistry*, 4th ed., New Age International Pvt. Ltd.(1995)
3. Harvey, B. G., *Nuclear Physics and Chemistry*, 2nd ed., Prentice Hall Inc., (1969).
4. Naqvi, I. I., Farrukh, M. A, *Radiotracers in Chemical Applications: Radiochemistry*, VDM Verlag Dr. Muller, (2010).



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Credit Hours: 03

Marks: 100

Course Objectives:

Students will acquire knowledge about sample preparation, derivations and analysis of different types of foods, pharmaceuticals and forensics.

Course Contents:

Food Products:

Introduction to food analysis, sampling of food, general methods of analysis. Analysis of milk, butter, wheat flour, meat, beverages, tea, coca, honey and soft drinks.

Pharmaceuticals:

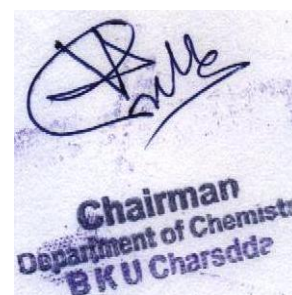
Classification of drugs, tests for analysis of different pharmaceuticals, introduction to US and British pharmacopeia.

Forensics:

History and scope of Forensic Science, Forensic Ethics, Forensic Toxicology. Classification and analysis of narcotics & dangerous drugs, examination of crime scene evidences, fingerprinting, skeletal material to provide scientific opinion for legal.

Recommended Books:

1. Skoog, D. A., West, D. M. and Holler, F. J., *Fundamentals of Analytical Chemistry*, 7th ed., Saunders College Publishing, (1995).
2. Christian, G. D., *Analytical Chemistry*, John-Wiley & Sons, Inc., 6th ed., (2004).
3. Eckert, W. G., *Introduction to Forensic Science*, 2nd ed., CRC Press, (1997).
4. Nielsen, S. S., *Food Analysis*, 4th ed., Springer, (2010).
5. Thomas, G., *Medicinal Chemistry: An Introduction*, 2nd ed., John-Wiley & Sons, (2007).
6. Kobilinsky, L. F., *Forensic Chemistry Handbook, 1st ed.*, John-Wiley & Sons, USA, (2012).
7. Watson, D. G., *Pharmaceutical Analysis: A Textbook for Pharmacy Students and Pharmaceutical Chemists*, Elsevier, (2012).
8. Stuart H. Barbara, "*Forensic Analytical Techniques*", 1st ed., John-Wiley & Sons, (2013).
9. Jackson, A. R. W. and Jackson, J. M., *Forensic Science*, 2nd ed., Pearson Education, (2008).



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ENVIRONMENTAL CHEMISTRY

Course Code:CHEM-684-IV

Credit Hours: 03

Marks: 100

Credit Hours: 03

Marks: 100

Fossil fuels and energy sources

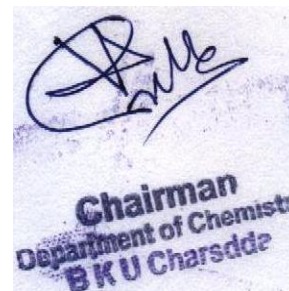
Origin and development of coal: Origin and reserves of petroleum and natural gas, composition and classification of petroleum, refining, and environmental problems associated with petroleum, nuclear fission reactors, solar energy, power synthesis, tidal and geothermal energy, synthetic chemical fuels, the H economy, electrochemical energy conversion, conservation of free energy, the energy balance of the earth.

Soils and mineral resources

Estimating reserves of mineral resources of earth, extraction of metal-general principles, iron, steel, aluminium, copper and other metals, sulphur and nitrogen. Organic matter in soil, soil nutrients, ion exchange in soils, solid pH and nutrients availability.

Books Recommended

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
4. Staneley E. Manahan, Environmental chemistry, Brooks, California.



BS 4th Year

Semester-VIII

ANALYTICAL CHEMISTRY)

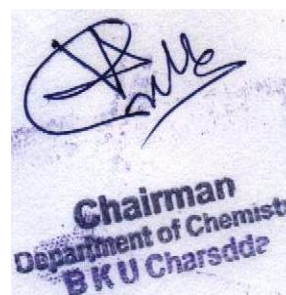
Special Practical/Research-II

Course Code: THES/CHEM-681-V

Credit Hours: 03

Marks: 100

Title of Course: Special Practical/Research Project/Position Paper (Literature Survey)



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BS 4th Year

Semester-VIII

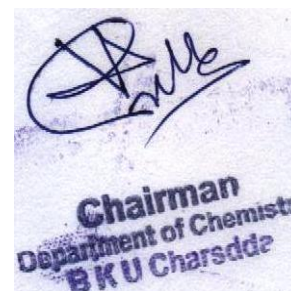
**ANALYTICAL CHEMISTRY
Practical-II**

Course Code: CHEM-681-VI

Credit Hours: 01

Mark: 25

Experiments based on theory topics covered in Paper I, II, and III.



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APPLIED CHEMISTRY

COURSE WISE BREAKUP

Fourth Year

Eighth Semester

SPECILIZATION

APPLIED CHEMISTRY

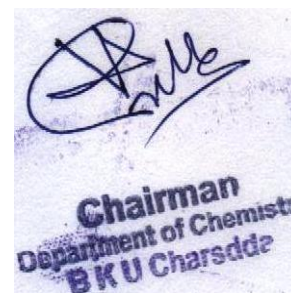
THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-682-I	PAPER-IV: APPLIED CHEMISTRY	03	100
CHEM-682-II	PAPER-V: APPLIED CHEMISTRY	03	100
CHEM-682-III	PAPER-VI: APPLIED CHEMISTRY	03	100
CHEM-684-IV	PAPER VII: ENVIRONMENTAL CHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-682-VI	Research Thesis/Research Project/Advanced Lab./Position	03	100
CHEM-682-V	Applied Chemistry Lab. II	01	25

- **Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)**
- **Maximum Marks = 525 (theory 400 & practicals 125 marks)**



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APPLIED CHEMISTRY**Title of the Course: Organic Based Industries Course Code: CHEM-682-I**Credit Hours: **03**Marks: **100****Course Contents:****Paper and Pulp Technology**

Raw materials for pulp and paper industries; Classification of paper products; Chemistry involved in the processing of kraft pulp, sulphite pulp and semi-chemical pulp; Manufacture of paper and regeneration of spent liquor.

Polymers

General classification and characterization of polymers; Mechanism and chemistry of polymerization; Thermoplastic and thermosetting polymerization; A brief outline for the production and applications of polymers i.e. polyethylene, polystyrene, polyurethanes, polyesters and urea phenol formaldehyde resins; Production of drug delivery polymers.

Cosmetics and Perfumes

Chemistry and production of hair products and shampoos; Chemistry involved in hair curling and styling products; Hair tonics and depilatory products; Production of cold cream, vanishing cream, bleach cream and shaving creams; Tooth paste and face powders; Production of nail polish, lipsticks and mascaras.

Production of Explosives, Propellants and their Applications

Raw materials; Manufacture of industrial explosives and propellants; Types of explosives and their safety measures; Chemistry involved in production of military explosives.

RECOMMENDED BOOKS:

1. George T. Auston., Shreve's Chemical Process Industries, 5th Edition., McGraw Hill Book Company Inc. New York, (1984).
2. Riegel, E. R., Industrial Chemistry, 5th Ed., Reinhold Publishing Corporation New York, (1997).
3. P. C. Jain., A Textbook of Applied Chemistry, (1993).
4. Leighou, R. B., Chemistry of Engineering Materials, Fourth Edition 1953, McGraw-Hill Book Company Inc. New York, (1953).
5. Octave Levenspiel, Chemical Reaction Engineering, 2nd Ed., (1979)
6. Furnas, C. C., Industrial Chemistry, Vol-II 6th Ed., D. Van Nostrand Inc. Princeton New Jersey, New York

4th Year 8th Semester

PAPER-II: APPLIED CHEMISTRY

Title of the Course: Industrial Processes

Course Code: CHEM-682-II

Credit Hours: 03

Marks: 100

Course Contents:

Petroleum Refinery and Petrochemicals

Origin of petroleum; Constituents and classification of petroleum; Cracking and distillation of various fractions in distillation towers; Control of distillation tower in refinery; Manufacture of monomers such as acetylene, ethylene, propylene; Separation and purification of benzene, toluene and xylene.

Pharmaceutical Industry

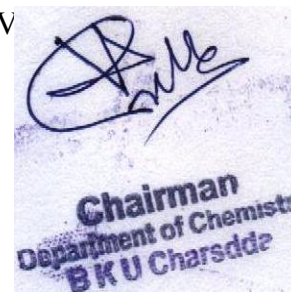
Classification of pharmaceutical products and pharmaceutical processing; Manufacture of paracetamol/disprom and aspirin; Chemistry involved in the production and manufacture of various antibiotics such as streptomycin, erythromycin, penicillin etc.

Fermentation and Biotechnology

Micro-organisms, conditions for their growth and biochemical activity. Production of ethanol, acetic acid, citric acid, penicillin and amylase; Microbial growth rate and its modelling.

RECOMMENDED BOOKS:

1. George T. Auston., Shreve's Chemical Process Industries, 5th Edition., McGraw Hill Book Company Inc. New York, (1984).
2. Riegel, E. R., Industrial Chemistry, 5th Ed., Reinhold Publishing Corporation New York, (1997).
3. J. C Kuriacase & J Rajaran, Chemistry in Engineering and Technology, 2nd Ed., (1984).
4. P. C. Jain., A Textbook of Applied Chemistry, (1993).
5. G. N. Pandey, A Text Book of Chemical Technology, 2nd Edition, Vikas Publishing house, (2000).
6. Leighou, R. B., Chemistry of Engineering Materials, Fourth Edition 1953, McGraw-Hill Book Company Inc. New York, (1953).
7. Furnas, C. C., Industrial Chemistry, Vol-II 6th Ed., D. Van Nostrand Reinhold, New York, Inc. Princeton New Jersey, New York (1957).



4th Year: 8th Semester

APPLIED CHEMISTRY

PAPER-III

Title of the Course: Metallurgy and Nuclear Energy Course Code: CHEM-682-III

Credit Hours: **03**

Marks: **100**

Course Contents:

Iron, Steel and Alloys Industries

Iron ores, constituents and their classification; Manufacture of iron and steel; Types of iron and steel; Metal Extractions and production of Alloys.

Corrosion and its Prevention

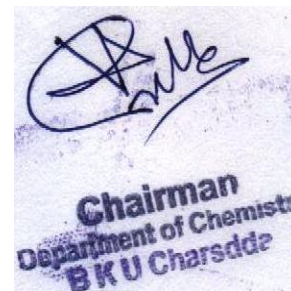
Chemistry and causes of corrosion phenomena; Types and theories of corrosion; Corrosion prevention and inhibitors; Surfaces coating and Electroplating.

Nuclear Industry and Peaceful Applications

Extraction of uranium from rocks; Importance of nuclear technology; Nuclear energy and its peaceful applications; Production of nuclear energy and control of nuclear reactors; Chemistry of fission and fusion reactions; Reprocessing of nuclear spent fuel; Industrial application of nuclear radiations.

RECOMMENDED BOOKS:

1. George T. Auston., Shreve's Chemical Process Industries, 5th Edition., McGraw Hill Book Company Inc. New York, (1984).
2. Riegel, E. R., Industrial Chemistry, 5th Ed., Reinhold Publishing Corporation NewYork, (1997).
3. Chuis A. Clauses III Guy Matison, Principles of Industrial Chemistry, (1978).
4. R. Lambourne., Paint & Surface Coatings Theory & Practice, (1987).
5. Mattsson, E. Basic Corrosion Technology for Scientists and Engineers, 1st Ed., Ellis Horwood, Ltd. UK (1989).
6. Furnas, C. C., Industrial Chemistry, Vol-II 6th Ed., D. Van Nostrand Company, Inc. Princeton New Jersey, New York (1957).



4th Year: 8th Semester

Title of the Course: **PAPER-IV:ENVIRONMENTAL CHEMISTRY**

Course Code: **CHEM-684-IV**

Credit Hours: **03**

Marks: **100**

Course contents

Credit Hours: 03

Marks: 100

Fossil fuels and energy sources

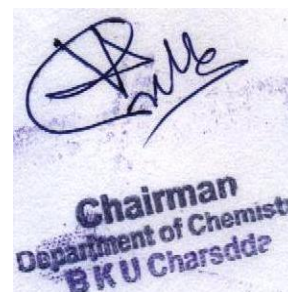
Origin and development of coal: Origin and reserves of petroleum and natural gas, composition and classification of petroleum, refining, and environmental problems associated with petroleum, nuclear fission reactors, solar energy, power synthesis, tidal and geothermal energy, synthetic chemical fuels, the H economy, electrochemical energy conversion, conservation of free energy, the energy balance of the earth.

Soils and mineral resources

Estimating reserves of mineral resources of earth, extraction of metal-general principles, iron, steel, aluminium, copper and other metals, sulphur and nitrogen. Organic matter in soil, soil nutrients, ion exchange in soils, solid pH and nutrients availability.

Books Recommended

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
4. Staneley E. Manahan, Environmental chemistry, Brooks, California.



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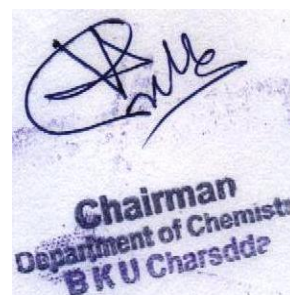
4th Year: 8th Semester

Title of the Practicals: **Research Thesis/Research Project/Advanced Lab./Position paper
(Literature survey)**

Course Code: THES/CHEM-682-VI

Credit Hours: **03**

Marks: **100**



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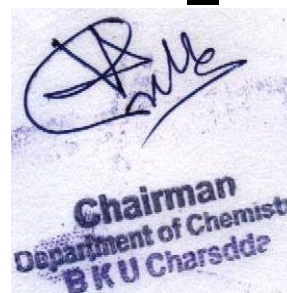
4th Year: 8th Semester

Title of the Practicals: **APPLIED CHEMISTRY LAB**

Credit Hours: **01**

Code: **CHEM-682-V**

Marks: **25**



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BIOCHEMISTRY

COURSE WISE BREAKUP

Fourth Year

Eighth Semester

SPECILIZATION

BIOCHEMISTRY

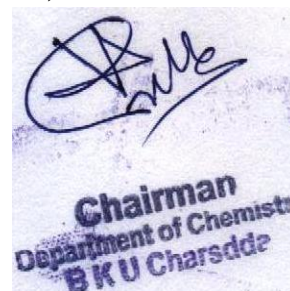
THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-683-I	PAPER-IV: BIOCHEMISTRY	03	100
CHEM-683-II	PAPER-V: BIOCHEMISTRY	03	100
CHEM-683-III	PAPER-VI: BIOCHEMISTRY	03	100
CHEM-684-IV	PAPER-VII: ENVIRONMENTAL CHEMISRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
THES/CHEM-683-VI	Research Thesis/Research Project/Advanced	03	100
CHEM-683-V	Biochemistry Lab. II	01	25

- **Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)**
- **Maximum Marks = 525 (theory 400 & practicals 125 marks)**



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BS 4th Year

Semester-VIII

BIOCHEMISTRY

Title of the Course: Physiological Chemistry and Chemotherapy

Course Code: CHEM-683-I

Credit Hours: 03

Marks: 100

Course Objectives

The course presents a comprehensive account of the principles of physiological chemistry and the structure and applications of some important drugs and antibiotics.

Course Contents

Physiological Chemistry

Respiration: Structure and function of lungs. Physical exchange of gases, Transport of oxygen by blood, Transport of CO₂ in blood. Buffer system of the blood. Acid-Base balance.

Kidney: Structure and function of nephrons. Formation of urine, Filtration, Glomerular filtration rate. Action of the tubule, Reabsorption of Na, Cl and water. Loop of Henle. Structure and function of muscle tissues, Nerve tissues and Connective tissues. Nerve conduction and sensory system.

Chemotherapy

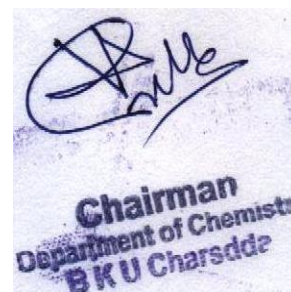
Structure and mode of action of antipyretics, analgesic, antimalarials, supra-drugs, antibiotics with special reference to penicillin, sulphanilamides. Mechanism of drugs action and resistance.

Recommended Books

1. Guyton, A.C.; and Hall, J. E., *Text Book of Medical Physiology*, 9th ed. W. B. Saunders Company, Tokyo, 1996.
2. Wilson, C.O.; Gisvold, O.; Deorge, R. F., *Text Book of Organic Medicinal & Pharmaceutical Chemistry*, 7th ed. J.B. Lippincott Company, Philadelphia, Toronto, 1977.
3. Gilman, A. G.; Goodman, L. S.; Rail, T. W.; Murad, F., *The Pharmacological basis of Therapeutics*, Macmillan, 7th ed. New York, 1985.

Supplementary Reading Material

1. Smith, E.L.; Hill, R.L.; Lehman, I.R.; Lefkowitz, R.J.; Handler, P.; White, A., *Principles of Biochemistry (Mammalian Biochemistry)*, 7th ed. McGraw-Hill Companies Inc., New York, 1984.
2. West, W. R.; Todd, H. S., *Text Book of Biochemistry*, 4th ed. Macmillan, London, 1968.
3. Jacob, L. S., *Pharmacology*, 3rd ed. Harwal publishing Company, Malvern, Pennsylvania, 1992.



BS 4th Year

Semester-VIII

BIOCHEMISTRY

Course Title: Microbiology and Immunology

Course Code: CHEM-683-II

Credit Hours: 03

Marks: 100

Course objectives

The course aims at giving introduction to full range of microbial life, beneficial and adverse interactions between microbes and humans and an overview of environmental, industrial and food microbiology. The course will also provide basic knowledge of chemical, cellular and molecular immunology required to understand basic concepts of immune responses.

Course Contents

Fundamentals of Microbiology: Prokaryotic cell structure and function, Prokaryotic growth and nutrition. Prokaryotic genetics.

Introduction to virus (bacteriophage): fungi, bacteria and common parasites.

Bacterial Diseases: Airborne, Food borne and waterborne bacterial diseases.

Industrial Microbiology and Biotechnology: Microorganisms in industry. Alcoholic beverages. Other important microbial products

Immunology:

Chemistry of immunoglobulins, antigens. Characteristics of antigens and antibody reactions. myeloma and hybridoma immunoglobulins. Immune system and its abnormalities. Allergy and inflammation. Complement system, peripheral leucocytes and macrophages.

Immune Disorders

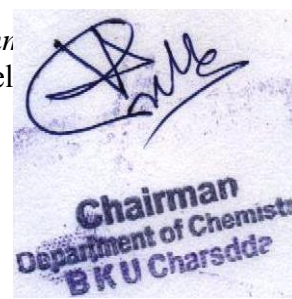
Type I IgE-Mediated Hypersensitivity, other types of hypersensitivity. Autoimmune disorders. Immunodeficiency disorders.

Recommended Books

1. Prescott, L.M.; Harley, J.P.; Klein, D.A., *Microbiology*, 6th ed. McGraw Hill Companies Inc. New York, 2005.
2. Kuby. J., *Immunology*, 2nd ed. W. H. Freeman & Company, New York, 1994.
3. Nester, E.W.; Anderson, D.G.; Roberts, C.E.; Pearsall, N.N.; and Nester, M.T., *Microbiology*, 4th ed. McGraw Hill Companies Inc, New York, 2004.

Supplementary Reading Material

1. Stanier, R. Y.; Ingraham, J.L.; Wheelis, M. L.; Painter, P. R., *The Microbial World*, 5th ed. Prentice- Hall, New Jersey, 1986.
2. Doan, T.; Melvold, R.; Viselli, S.; and Waltenbaugh, C., *Imr Illustrated Reviews*, Lippincott Williams& Wilkins, Philadel



3. Stroll, W.A.; Rouse, H.; Champe, P.C.; Harvey, R.A., *Microbiology Lippincott Illustrated Reviews*, Lippincott Williams & Wilkins.

BS 4th Year

Semester-VIII

BIOCHEMISTRY

Title of the Course: Nutrition

Course Code: CHEM-683-III

Credit Hours: 03

Marks: 100

Course Objectives

The course is designed to assist the students to acquire knowledge of biochemical composition of different foods, energy needs and nutritional requirements of different age groups. The course will also cover a comprehensive account on minerals and vitamins as essential components of nutrition.

Course Contents

Major Dietary Constituents. Principles of nutrition. Nutritional importance of Carbohydrates, Proteins, Amino Acids, Lipids, and Dietary fiber. Energy Needs. Assessment and requirement of energy in different age groups. Calorimetry, RQ and BMR. Nutrition in Growth and Aging (Nutritional requirement during infancy, childhood, adolescence and elderly).

Minerals.

Biochemical role of Calcium, Chromium, Copper, Iron, Iodine, Magnesium, phosphorous, Selenium, and Zinc. Their dietary sources, daily requirements and deficiency diseases.

Vitamins

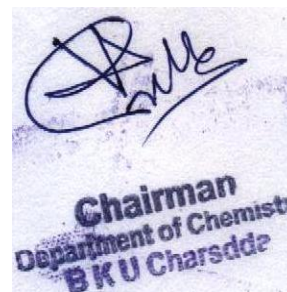
Role of vitamins as coenzymes. Structure, physiological functions, deficiency diseases and recommended dietary allowances of the following vitamins. Fat Soluble vitamins: A, D, E, and K. Water Soluble vitamins: Thiamine, Riboflavin, Niacin, Pantothenic acid, Folic acid, Biotin and Ascorbic acid.

Recommended Books

1. Thorpe, W. V.; Bray, H. G.; James, S., *Biochemistry for Medical students*, 8th ed. J. & A. Churchill Ltd., London, 1996.
2. Shils, M.E.; Olson, J.A.; Shike, M., *Modern Nutrition in Health and Disease*, 8th ed. Lea & Febiger, Philadelphia, 1994.
3. Brody, t., *Nutritional Biochemistry*, 2nd ed. Academic Press, San Diego, CA, 1999.

Supplementary Reading Material

1. Wardlaw, G. M.; Lusel, P. M.; Seyler, M. F., *Contemporary Nutrition issues & insights*, Mosly Year Book, Inc. USA, 1992.
2. Passmore, R.; Eastwood, M.A., *Human Nutrition and Dietetics*, 8th ed. Churchill Livingstone, London, 1986.
3. www.foodsci.ucdavis.edu/fst/courses/fstexpcourse.html
4. www.tanf.co.uk/journals
5. **Belitz, H.; Schieberle, P.; Grosch, W.**, *Food Chemistry*, 3rd ed. Springer-Verlag, 2004.



BS 4th Year
Elective Course-II

Semester-VIII

ENVIRONMENTAL CHEMISTRY

Course Code:CHEM-684-IV

Credit Hours: 03

Marks: 100

Credit Hours: 03

Marks: 100

Fossil fuels and energy sources

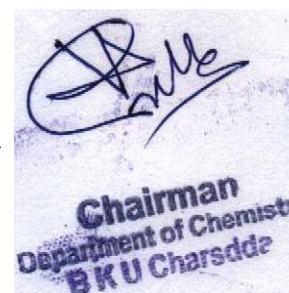
Origin and development of coal: Origin and reserves of petroleum and natural gas, composition and classification of petroleum, refining, and environmental problems associated with petroleum, nuclear fission reactors, solar energy, power synthesis, tidal and geothermal energy, synthetic chemical fuels, the H economy, electrochemical energy conversion, conservation of free energy, the energy balance of the earth.

Soils and mineral resources

Estimating reserves of mineral resources of earth, extraction of metal-general principles, iron, steel, aluminium, copper and other metals, sulphur and nitrogen. Organic matter in soil, soil nutrients, ion exchange in soils, solid pH and nutrients availability.

Books Recommended

1. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
2. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
3. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
4. Staneley E. Manahan, Environmental chemistry, Brooks, California.



BS 4th Year

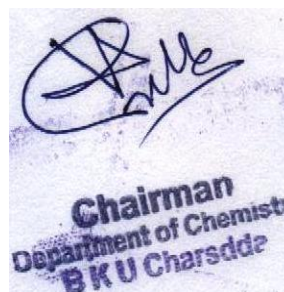
Semester-VIII

BIOCHEMISTRY

Title of Course: Special Practical/Research-II Special Practicals/Research Project/Position
Paper (Literature Survey) Course Code: THES/CHEM-683-VI

Credit Hours: 03

Marks: 100



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BS 4th Year

Semester-VIII

CHEMISTRY COURSE (BIOCHEMISTRY)

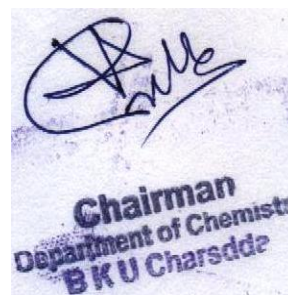
Practical-II

Course Code: CHEM-683-V

Credit Hours: 01

Marks: 25

Experiments based on theory topics covered in Paper IV, V, and VI.



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FUEL CHEMISTRY

COURSE WISE BREAKUP

Fourth Year

Eighth Semester

SPECILIZATION

FUEL CHEMISTRY

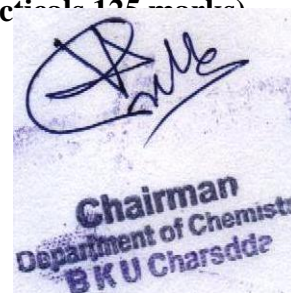
THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-688-I	PAPER-IV: FUEL CHEMISTRY	03	100
CHEM-688-II	PAPER-V: FUEL CHEMISTRY	03	100
CHEM-688-III	PAPER-VI: FEUL CHEMISTRY	03	100
CHEM-684-IV	PAPER-VII: ENVIRONMENTAL CHEMISRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
THES/CHEM-688-VI	Research Thesis/Research Project/Advanced Lab./Position	03	100
CHEM-688-V	FuEl chemistry Lab. II	01	25

- Total Credits of the Semester = 16 (theory 12 & practicals 04 credits)
- Maximum Marks = 525 (theory 400 & practicals 125 marks)



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FUEL CHEMISTRY**Course Title: Chemistry of Coal Conversion Processes-II****Course Code: CHEM-688-I****Credit Hours: 03****Marks: 100****Course Objectives**

The students will acquire knowledge about the coal conversion processes like solvent extraction, hydrogenation, and importance of catalysis in such reactions, product up gradation and analysis and environmental problems relating to synthetic fuels obtained from coal.

Course Contents**Liquefaction of Coal**

Historical Developments: Historical developments of coal liquefaction, earlier coal liquefaction processes; (a) Pott and Broch Process (b) Bergius process.

Solvent Extraction: Solvent extraction of coal, some experiments on solvent extraction, mechanism of solvent extraction, types of solvent extraction, solvent systems, super critical gas extraction, commercial processes of solvent extraction like SRC-I, SRC-II, EDS, Super critical gas extraction.

Direct Liquefaction: Direct liquefaction of coal through catalytic hydrogenation, mechanism, catalysts system, catalyst poisoning, catalytic role of coal minerals, commercial processes of catalytic hydrogenation like H-coal and Synthoil process.

Indirect Liquefaction: Indirect liquefaction through Fischer Tropsch synthesis, methanol synthesis and MTG (Methanol to Gasoline) processes.

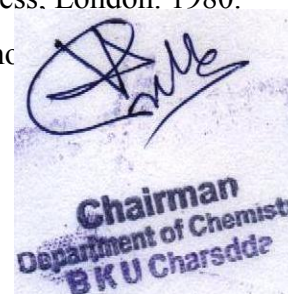
Effect of Parameters: Effect of coal properties, catalyst and solvent on liquefaction behaviour of coal, effect of coal properties like rank, maceral components and mineral matter on liquefaction, effect of operating condition like temperature, pressure, residence time, solvent, catalyst, etc.

Recommended Books:

1. Wen, C.Y. and Stanley, E. "Coal Conversion Technology" Addison-Wesley, New York. 1979.
2. Probst, R.F and Hicks, R.E. "Synthetic Fuels" McGraw Hill, New York. 1982.

Supplementary Reading Materials:

1. Francis, W. "Fuels and Fuel Technology" Pergamon Press. London. 1980.
2. Merick, D. "Coal Combustion and Conversion Techno... , London 1984



FUEL CHEMISTRY**Course Title: Petroleum and Petrochemicals-II****Course Code: CHEM-682-II****Credit Hours: 03****Marks: 100****Course objectives**

The students will acquire knowledge about the modern thermodynamics and combustion of hydrocarbons fuels. The students will also be able to learn about the safe storage and transportation of hydrocarbons fuels.

Course Contents

Thermo chemistry and Combustion of Hydrocarbon Fuels: Basic thermodynamics principles, standard enthalpy of formation, standard enthalpy of reaction, enthalpy of combustion products, mechanism of combustion of gaseous and liquid hydrocarbon, theory of flame propagation, method of measuring flame speed, fuel performances in reciprocating piston engines, environmental pollution from hydrocarbon fuel utilization.

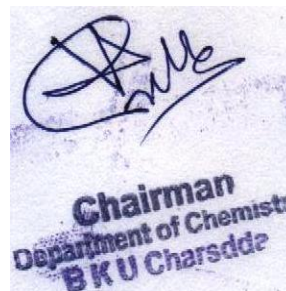
Storage and Handling of Hydrocarbon Fuels: Various types of storage tanks, different methods of transportation of crude and refined petroleum products. Health hazards associated with petroleum handling, volatility losses, fire hazards and its prevention. Extinguishing of oil fire methods.

Recommended Books:

1. Hobson, G.D. "Modern Petroleum Technology" Part 2, John Wiley and Sons, New York. 1984.
2. Gates, B. C, Katzer, J.R, and Schuit, G.C.A. "Chemistry of Catalytic Processes". McGraw Hill Book company, London 1979.

Supplementary Reading Materials:

1. List, H.L. "Petrochemical Technology" Printice-Hall Englewood Cliffs, New Jersey. 1986.
2. Smith, M.L, Stinson, K.W. "Fuels and Combustion" McGraw Hill Book Company. Reprint by National Book Foundation in 1972.
3. Goodger, E.M. "Hydrocarbon Fuels" Union Brothers Ltd, London. 1975.
4. Maleev, V.L. "Internal Combustion Engines" McGraw Hill Book Company London, 1985.
5. Hughes, J.R., and Swindells, N.S. "Storage and Handling of Petroleum Liquids" Charless Griffin and Company Ltd, London. 1987.



BS 4th Year

Semester-VIII

FUEL CHEMISTRY

Course Title: Alternate Energy resources

Course Code: CHEM-683-III

Credit Hours: 03

Marks: 100

Course objectives:

This course will enable the students to know about the challenging sources of alternate energy sources. The students will also be able to learn about the safe use of natural resources

Course contents:

Biomass resources: Biomass conversion process, bio gas technology. Various traditional methods of alcohol production. Alcohol and its uses as alternate energy sources

Biofuels: Production of bioethanol, and biodiesel, uses of bioethanol as supplement with petroleum gasoline as E10 and E20 etc

Hydrogen: Hydrogen production, storage handling, and its uses as alternative fuel. Fuel cells and its application

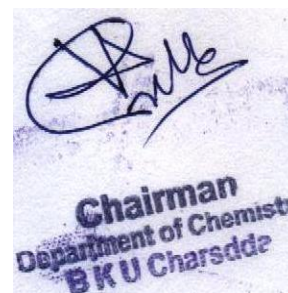
Solar Energy: Photovoltaic power conversion and solar energy collectors.

Nuclear fuels: Nuclear fuels processing, fission and fusion nuclear reactors .

Hydal energy: Introduction to hydal energy prospecting in Pakistan

Recommended Books:

1. Gyngelkl E.S. Applied Chemistry for Engineers .Edward Arnold Publishers Ltd. London (1989)
2. Harker J.B. and Bakurst J.R. Fuel and Energy Academic Press London and New York (1988)
3. Goodger, E.M. "Alternatrive Fuels(Chemical energy rsources)" The Macmillan Press Ltd, London. (1980).
4. Twidell J and Wier T. Renewable Energy Resources John Wiley and Sons, New York. (1986).



FUEL CHEMISTRY**Elective Course-II****Environmental chemistry****Course Code:CHEM-684-VI****Credit Hours: 03****Marks: 100****Credit Hours: 03****Fossil fuels and energy sources**

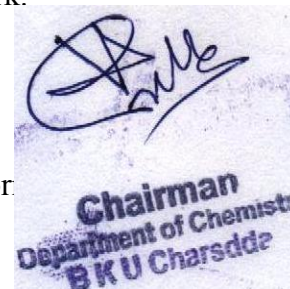
Origin and development of coal: Origin and reserves of petroleum and natural gas, composition and classification of petroleum, refining, and environmental problems associated with petroleum, nuclear fission reactors, solar energy, power synthesis, tidal and geothermal energy, synthetic chemical fuels, the H economy, electrochemical energy conversion, conservation of free energy, the energy balance of the earth.

Soils and mineral resources

Estimating reserves of mineral resources of earth, extraction of metal-general principles, iron, steel, aluminium, copper and other metals, sulphur and nitrogen. Organic matter in soil, soil nutrients, ion exchange in soils, soil pH and nutrients availability.

Books Recommended

4. Anil Kumar, Environmental chemistry, Wiley Eastern, New Delhi J. W. Moore & E. 2). A. Moore, Environmental chemistry, Academic Press, New York.
5. S. K. Banerji, Environmental chemistry, Prentice Hall, Delhi.
6. S. K. Banerji, Environmental chemistry, Tata Publisher, Delhi.
7. Staneley E. Manahan, Environmental chemistry, Brooks, Califor



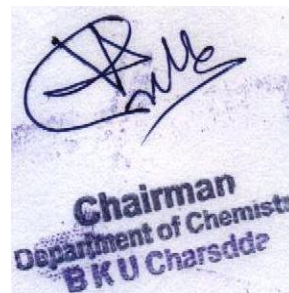
BS 4th Year
FUEL CHEMISTRY

Semester-VIII

Title of Course: Special Practicals/Research Project/Position Paper (Literature Survey)
Special Practical/Research-II Course Code: THES/CHEM-688-VI

Credit Hours: 03

Marks: 100



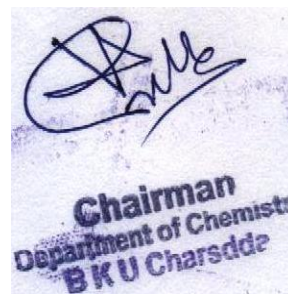
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FUEL CHEMISTRY
Practical-II**Course Code: CHEM-688-V****Credit Hours: 01****Marks: 25**

Determination of ash, calcium and barium in lube oil. Determination of acidity and alkalinity of greases. Determination of mercaptane sulphur in fuels, determination of total solids and sediments in used engine oils. Determination of total sulphur and chlorine in coal and coke by Eschka Mixture Method. Determination of aniline point, diesel index and cetane number of diesel fuel.

Recommended books

1. Speight: J.G Handbook of Petroleum Analysis Wiley Interscience (2002)
2. Speight: J.G Handbook of Coal Analysis. John Wiley and Sons, New Jersey (2005).
3. ASTM 2000, Annual Book of ASTM standards American Society for Testing Materials West Conshohockm PA USA.



Annex – I Natural Science - I

NATURAL SCIENCE – I COURES OF BOTANY

Title of the Course: Diversity of Plants-I

Course Code: BOT-311 Credit Hours: 3 (2+1)

Specific Objectives of course: To introduce the students to the diversity of plants and their structures and significance.

Course Outline

Comparative study of life form, structure, reproduction and economic significance of:

Viruses (RNA and DNA types) with special reference to TMV.

Bacteria and Cyanobacteria (*Nostoc*, *Anabaena*, *Oscillatoria*) with specific reference to biofertilizers, pathogenicity and industrial importance.

Algae: (*Chlamydomonas*, *Spirogyra*, *Chara*, *Vaucheria*, *Pinnularia*, *Ectocarpus*, *Polysiphonia*)

Fungi: (*Mucor*, *Penicillium*, *Puccinia*, *Agaricus*), their implication on crop production and industrial applications.

Lichens: (*Physcia*)

Lab Outline

- Culturing, maintenance, preservation and staining of microorganisms.
- Study of morphology and reproductive structures of the types mentioned in theory.
- Identification of various types mentioned from prepared slides and fresh collections.
- Field trip to study local plant of different area of Pakistan.

Recommended Books

1. Agrios, G.N. 2004. Plant pathology. 8th ed. Academic press London.
2. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology. 4th ed. John Wiley and Sons Publishers.
3. Hussain, F. 2014. Phycology. A Text book of Algae. Pak Book Empire, Lahore.
4. Lee, R.E. 1999. Phycology. Cambridge University Press, UK
5. Mauseth, J.D. 2003. Botany: An Introduction to Plant Biology. 3rd ed., Jones and Bartlett Pub. UK
6. Prescott, L.M., Harley, J.P. and Klein, A.D. 2004. Microbiology, 3rd ed. WM. C. Brown Publishers.
7. Vashishta, B.R. 1991. Botany for Degree Students (all volumes). S. Chand and Company. Ltd. New Delhi.



Credit Hours: (03)

Course Objectives:

Students will acquire knowledge about the key introductory concepts of chemical bonding, acid-base chemistry, Students will acquire knowledge to enable themselves to understand the fundamental principles and laws of thermodynamics and chemical equilibria

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.

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.

Recommended Books

- 1 Miessler, G. L.; Tarr, D.A., *Inorganic Chemistry*, Prentice-Hall International, New Jersey, USA, 1991.
- 2 Day, M.C.; Selbin, J., *Theoretical Inorganic Chemistry*, 2nd ed., Van Nostrand Reinhold Company, New York, USA, 1969.
- 3 Shriver, D. F.; Atkins, P. W.; Langford, C. H., *Inorganic Chemistry*, 2nd ed., Oxford University Press, 1994.

Supplementary Reading Material

- 1 Huheey, J. E.; Keiter, E. A.; Keiter, R. L., *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed., Harper and Row, New York, **2001**.
- 2 Cotton, F. A.; Wilkinson, G. *Basic Inorganic Chemistry*, 3rd ed., Wiley, New York, **1995**.
- 3 Lee, J.D., *Concise Inorganic Chemistry*, Chapman and Hall, 5th ed., **1996**.



Course Title: INTRODUCTION TO EARTH SCIENCE

Course Code: GEOE. 311.1

Course Credit Hours: 03

Course Objectives:

This course is designed to acquire the knowledge about the basic concepts of earth science. This will help the students to get knowledge about various types of resources and its processes of formation.

Course Contents:

Introduction and scope of geology its importance and relationship with other sciences. Introduction to petroleum, mineral, gemstone, water resources, dam, water, tunnel, road, mountain building processes earthquake and volcanoes, GIS and RS. The oil Rigs and its components brief description.

Lab:

Study of relief features with the help of models and topographic maps. The study of various map regarding the mineral resources.

Books Recommended:

1. Principles of Physical Geology by Holmes, A., 1978, Nelson.
2. Physical Geology by Plummer, McGeay & Carlson, 2005.


Chairman
Department of Geology
Bacha Khan University
Charsadda

POOL COUSES FOR NATURAL SCIENCES-I

MATH-313 MATHEMATICS-I

Credit Hours: 3(3+0)

Objectives:

This is the first course of the basic sequence, Calculus I-III, serving as the foundation of advanced subjects in all areas of mathematics. The sequence, equally, emphasizes basic concepts and skills needed for mathematical manipulation. Calculus I & II focus on the study of functions of a single variable.

Course Detail:

- Limits and continuity.
- Derivative of a function and its applications.
- Optimization problems.
- Mean value theorem (Taylor's theorem and the infinite Taylor series with applications) & curve sketching; anti-derivative & integral.
- Definite integral and applications.
- The fundamental theorem of Calculus.
- Inverse functions (Chapters 1-6 of the text)

RECOMMENDED BOOKS:

1. Anton H, *Calculus: A New Horizon* (6th edition), 1999. John Wiley, New York.
2. Stewart J, *Calculus* (3rd edition), 1995, Brooks/Cole (suggested text)
3. Thomas G. B, Finney A. R., *Calculus* (10th edition), 2002. Addison-Wesley, Reading, Ma, U.S.A.
4. Anton, H., 1999. *Calculus: A New Horizon*, 6th Edition, John Wiley, New York.
5. Stewart J, 1995. *Calculus*, 3rd Edition, Brooks/Cole
6. Thomas, G. B. and Finney, A. R, 2002. *Calculus*

STATISTICS-I

COURSE CODE: STAT-314

CREDIT HOURS: 03

Theory

Definition and importance of Statistics, Data and different types of data, Observation and variables, Discrete and Continuous variables, Collection of data: Primary and Secondary data, Limitation of statistics, Measurement Scale, Presentation of data: Introduction, Classification, Basic Principles and types of Classification, Tabulation: Main parts of a table and its Construction, Frequency distribution, Constructing a Grouped frequency Distribution from raw data, Class boundaries, Class-marks, Relative and Cumulative frequency distribution, Diagrams, Graphs and their Construction, Bar charts, Pie chart, Histogram, Frequency polygon and Frequency curve, Exercises. Measure of Central tendency: Introduction, Types of Averages, (Arithmetic Mean, Geometric Mean, Harmonic Mean, Median and Mode), Quantiles in Grouped

and Ungrouped data. Measure of Dispersion: Introduction, Rang, Quartile Deviation, quartile deviation, the Mean (or Average) deviation, Standard deviation and Variance, Coefficient of variation, Skewness and Kurtosis. Simple Correlation And Regression, Exercise.

Book Recommended

1. Introduction to Statistical Theory Part- I by Sher Muhammad and Dr. Shahid Kamal (Latest Edition)
2. Statistical Methods and Data Analysis by Dr. Faquir Muhammad
3. A. Concise Course in A. Level Statistic with world examples by J. Crawshaw and J. Chambers (1994)
4. Basic Statistics an Inferential Approach 2nd Ed. (1986) Fran II. Dietrich-II and Thomes J. Keans
5. Morgan, George A. ; Leech, Nancy L.; Gloeckner, Gene W. ; and Barret, Karen C. (2nd Ed) 2004 SPSS for Introductory Statistics: Use and Interpretations' New Jersey: Kawrence Erlbaum Associates, Inc.
6. Muhammad, F. 2005. "Statistical Methods and Data Analysis", Kitab Markaz, Bhawana Bazar Faisalabad.



Course design for the loop Natural Science (NS-I*)

Course Code: PHY-313,

Course Title: Physics-I

(Credit hours: 03)

Objectives

The main objectives of this course are: to provide students with a thorough understanding of the basic concepts of physics and the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis. To instruct students of the fundamental laws of physics and the application of scientific data, concepts, and models for use in the natural sciences and real world situations. To provide students with problem solving skills by an approach that describes physical phenomena with relevant mathematical models and formulae.

Course Contents

Vector: Vector notation, vector addition, vectors in the Cartesian coordinate system, scalar product (of two vectors) vector product (of two vectors), scalar of triple product, vector triple product, gradient of a scalar, divergence of a vector, divergence theorem and Stock's theorem; conservation of energy: concept of conservation laws, conservation of energy, worked and kinetic energy, power, conservation forces, rotational energy, potential energy in an electric and gravitational field; dynamics of rigid bodies, center of mass, conservation of angular momentum, equation of motion of rotating body, moment of inertia, perpendicular axes and parallel axis theorems; calculation of moment of inertia for a disc and solid sphere; Euler's theorem, Gyroscope coriolis forces; Inverse Square Law of forces: Newton laws, forces, Newton law of Universal Gravitation b/w point mass and solid spheres, Kepler's laws, satellite in circular orbit escape velocity.

Recommended Books

1. Fundamental of Physics by Jearl Walker, Holiday & Resnick, 10th Edition, Wiley
2. Physics I Practice Problems For Dummies (+ Free Online Practice) by Consumer Dummies. 2015. ISBN 978-1-188-85327-6.
3. Physics I: Mechanics, Waves, and Heat by Michael Thackston. 10th Edition. Tavenner Publishing Company, 2013. ISBN 193743558X, 9781937435585
4. Physics I: For BPUT by Dr. Mani Naidu. Pearson Education India, 2011. ISBN813179878X, 9788131798782.

Head
Deptt. of physics
Signature

NATURAL SCIENCE – I COURSES OF ZOOLOGY

Title of the Course: Animals, Diversity (Non Chordates)

Course code: ZOO- 311 **Credit Hours:** 3 (2+1)

Objectives

Concepts of evolutionary relationship of animal kingdom. Knowledge about animal kingdom, emphasizing their phylogenetic relationships and simple to complex mode of animal life.

Course Contents

Introduction:

Classification of organisms; five kingdom classification, evolutionary relationships/ evolutionary perspective and tree diagrams; patterns of organization.

Animal-Like Protists: The Protozoa

Classification (up to phyla, subphyla and super classes, wherever applicable). Pseudopodia and amoeboid locomotion; cilia and other pellicular structures; nutrition; genetic control and reproduction; symbiotic ciliates.

Multicellular and Tissue Levels of Organization

Phylum porifera: cell types, body wall, and skeletons; reproduction. Phylum cnidaria (coelenterata) the body wall and nematocysts; alternation of generations; maintenance functions; reproduction and classification up to class. Phylum ctenophora; further phylogenetic considerations.

Triploblastics and Acoelomate Body Plan

Phylum Platyhelminthes: classification up to class; the free-living flatworms and the tapeworms; phylum Nemertea; phylum gastrotricha; further phylogenetic considerations.

Aschelminths

Classification up to phyla with external features; feeding and the digestive system; other organ systems; reproduction and development of phylum rotifera and phylum nematoda; phylum kinorhyncha. Some important nematode parasites of humans.

Annelida

Metamerism and tagmatization; classification up to class. External structure and locomotion, feeding and the digestive system, gas exchange and circulation, nervous and sensory functions, excretion, regeneration, reproduction and development, in polychaeta, oligochaeta and hirudinea.

Arthropods



classification, metamerism and tagmatization; the exoskeleton; metamorphosis; classification up to class.

Molluscs. Important characteristics, classification upto class.

Echinoderms Evolutionary perspective: relationships to other animals; echinoderm characteristics; classification up to class, Ambulacral system, tube feet, larvae

Lab out line

- Study of *Euglena*, *Amoeba*, *Entamoeba*, *Plasmodium*, *Trypanosoma*, *Paramecium* as representative of animal like protists. (Prepared slides).
- Study of sponges and their various body forms.
- Study of principal representative classes of phylum Coelenterata.
- Study of principal representative classes of phylum Platyhelminthes.
- Study of representative of phylum Rotifera, phylum Nematoda.
- Study of principal representative classes of phylum Mollusca.
- Study of principal representative classes of phylum Annelida.
- Study of principal representative classes of groups of phylum Arthropoda.
- Brief notes on medical/economic importance of the following: *Plasmodium*, *Entamoeba histolytica*, *Leishmania*, Liverfluke, Tapeworm, Earthworm, Silkworm, Citrus butterfly.
- Collection and preservation techniques, collection of specimens by students.

Books Recommended

1. Hickman, C.P., Roberts, L.S. and Larson, A. Integrated Principles of Zoology, 11th Edition (International), 2004. Singapore: McGraw Hill.
2. Miller, S.A. and Harley, J.B. Zoology, 5th Edition (International), 2002. Singapore: McGraw Hill.
3. Pechenik, J.A. Biology of invertebrates, 4th Edition (International), 2000. Singapore: McGraw Hill.
4. Kent, G.C. and Miller, S. Comparative Anatomy of vertebrates. 2001. New York: McGraw Hill
5. Hickman, C.P. and Kats, H.L. Laboratory Studies in integrated principles of Zoology. 2000. Singapore: McGraw Hill

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Annex - I Natural Science - II

NATURAL SCIENCE – II COURSES OF BOTANY

Title of the Course: Plant Systematics, Anatomy and Development/Embryology

Course Code: BOT- 321 **Credit Hours:** 3 (2+1)

Objectives of course:

To understand: Various systems of classification, identification and nomenclature of Angiosperms. Structures and functions of tissues and organs at embryonic level.

Course outline

a) Plant Systematics

Introduction to Plant Systematics: aims, objectives and importance.

Classification: brief history of various systems of classification with emphasis on Takhtajan.

Brief introduction to nomenclature, importance of Latin names and binomial system with an introduction to International Code of Botanical Nomenclature (ICBN).

Morphology: a detailed account of various, Morphological characters root, stem, leaf, inflorescence, flower, placentation and fruit types.

Diagnostic characters, economic importance and distribution pattern of the following families:

- i. Brassicaceae (Cruciferae) ii. Fabaceae (Leguminosae)
- iii. Rosaceae iv. Solanaceae v. Poaceae vi. Liliaceae (Sen. Lato)

b) **Anatomy**

Concept, structure and function of various tissues like: Parenchyma, Collenchyma, Sclerenchyma, Epidermis (including stomata and trichome) Xylem and Phloem

Meristem: types,

Primary and secondary growth of dicot stem, periderm

Characteristics of wood: diffuse porous and ring –porous, sap and heart wood, soft and hard wood, annual rings.

Development / Embryology

Early development of plant body: *Capsella bursa-pastoris*

Structure and development of Anther Microsporogenesis, Microgametophyte

Structure of Ovule Megasporogenesis Megagametophyte

Endosperm formation, Parthenocarpy, Polyembryony

Lab Outline

- Anatomy and Embryology



- Study of stomata, epidermis,
- Tissues of primary body of plant
- Study of xylem 3-dimensional plane of wood.
- T.S of angiosperm stem and leaf.
- Anatomy of germinating seeds
- Study of pollens
- Taxonomy
- Identification of families given in syllabus with the help of keys.
- Technical description of common flowering plants belonging to families mentioned in theory syllabus.
- Field trips shall be undertaken to study and collect local plants.
- Students shall submit 40 fully identified herbarium specimens.

Recommended Books

1. Eames A.J. and L.H Mac Daniels. 2002. An Introduction to Plant Anatomy. Tata-Mac Graw-Hill Publishing Company, Limited New Delhi.
2. Fahn, A. 1990. Plant Anatomy. Pergamon Press, Oxford.
3. Panday, B.P. 2004. A textbook of Botany (Angiosperms). S. Chand and Co. New Delhi.
4. Rajput, M. T., S. S. Hassney and K. M. Khan. 1996. Plant Taxonomy. New Trends Computer Service, Hyderabad, Sindh, Pakistan
5. Raymond E, S. E. Eichhorn. 2005. Esau's Plant Anatomy. Meristems cells and tissues of the plant body, 3rd ed. John Wiley & Sons. Inc.
6. Stuessy, T.F. 1990. Plant Taxonomy. Columbia University Press, USA.

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Credit Hours: (03)

Course Objectives

The objectives of Organic Chemistry offered in this semester are to provide the beginning student with the necessary knowledge and experience to be able to:

1. Draw proper chemical structures and ways in which organic structures may be drawn.
2. Get familiarized with the systematic nomenclature of hydrocarbons beside compounds having heteroatomic functional groups.
3. Understand the basic concepts of chemical bonding, molecular structure, inductive and field effects, resonance theory, aromaticity and tautomerism besides the Lewis and Bronsted-Lowry theories of acids and bases.
4. Learn characteristic reactions of basic organic functional groups and use this knowledge to predict products of reactions and distinguish related compounds.
5. Get familiarized with the units of measurement.
6. To know about the various classical methods of analysis.
7. To know the different instruments used for measuring mass, volume and sample drying.

Course Contents

Nomenclature of Organic Compounds:

Classification of organic compounds; development of systematic nomenclature of organic compounds; IUPAC nomenclature of hydrocarbons and heteroatom functional groups.

Basic Concepts in Organic Chemistry:

Localized and delocalized chemical bonding; concept of hybridization leading to bond angles, bond lengths, bond energies and shapes of organic molecules; dipole moment; inductive and field effects, resonance; aromaticity; tautomerism; hyperconjugation; hydrogen bonding, acids and bases; factors affecting the strengths of acids and bases.

Introductory Spectroscopy:

Introduction to IR, UV, ¹H-NMR and Mass spectrometric methods, and their usage for structure elucidation of some simple organic compounds

Classical Methods of Analysis

Introduction to gravimetric, volumetric and complexometric method of analysis.

Recommended Books

(Latest available editions of the following books)

1. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P., *Organic Chemistry*, Oxford University Press, New York.
2. Wade Jr., L. J., *Organic Chemistry*, Pearson Education, Delhi.
3. Younas, M., *A Text Book of Organic Chemistry*, IlmiKitabKhana, Lahore.
4. Morrison, R. T.; Boyd, R. N., *Organic Chemistry*, Prentice-Hall of India, New Delhi.

5. Panico, R.; Powell, W. H.; Richer, J. C., *A Guide to IUPAC Nomenclature of Organic Compounds*, Jain-Interscience Press, Delhi.

Supplementary Reading Material

1. Loudon, G. M., *Organic Chemistry*, Oxford University Press, New York. Sorrel, T. N., *Organic Chemistry*, Viva Books Private Ltd., New Delhi.
2. Finar, I. L., *Organic Chemistry*. Vol. 1, Pearson Education, Delhi.
3. Carey, F. A., *Organic Chemistry*, McGraw-Hill, New York.
4. Ahluwalia, V. K.; Goyal, M., *A Text Book of Organic Chemistry*, Narosa Publishing House, New Delhi.
5. March, J., *Advanced Organic Chemistry*, John Wiley & Sons, New York.
6. Bansal, R. K., *Organic Reaction Mechanisms*, Tata McGraw-hill Publishing Company Ltd., New Delhi.
7. Pine, S. H., *Organic Chemistry*, National Book Foundation, Islamabad.
8. Bailey Jr., P. S.; Bailey, C. A., *Organic Chemistry-A Brief Survey of Concepts and Applications*, Prentice-Hall, New Jersey.
9. Morrison, R. T.; Boyd, R. N., *Organic Chemistry*, Prentice-Hall of India, New Delhi.
10. Carey, F. A.; Sundberg, R. J., *Advanced Organic Chemistry Part A: Structure and Mechanisms*, Kluwer Academic/Plenum Publishers, New York.
11. Sykes, P., *A Guide Book to Mechanism in Organic Chemistry*, Longman, London.
12. Hand, C. W.; Blewitt, H. L., *Acid-Base Chemistry*, Macmillan Publishing Company, New York.
13. McMurry, J., *Organic Chemistry*, Brooks/Cole Publishing Company, California.
14. Solomons, T. W. G.; Fryhle, C. B., *Organic Chemistry*, John Wiley & Sons, New York.
15. Panico, R.; Powell, W. H.; Richer, J. C., *A Guide to IUPAC Nomenclature of Organic Compounds*, Jain-Interscience Press, Delhi.
16. Streitwieser Jr., A.; Heathcock, C. H., *Introduction to Organic Chemistry*, Macmillan Publishing Company, New York.
17. Fox, M. A.; Whitesell, J. K., *Organic Chemistry*, Jones and Bartlett Publishers, London.



POOL COUSES FOR NATURAL SCIENCES-II

MATH-414 MATHEMATICS-II

Credit Hours: 3(3+0)

Specific Objectives of the Course: To prepare the students, not majoring in mathematics, with the essential tools of calculus to apply the concepts and the techniques in their respective disciplines.

Course Outline:

Preliminaries: Real-number line, functions and their graphs, solution of equations involving absolute values, inequalities. Limits and Continuity: Limit of a function, left-hand and right-hand limits, continuity, continuous functions.

Derivatives and their Applications: Differentiable functions, differentiation of polynomial, rational and transcendental functions, derivatives.

Integration and Definite Integrals: Techniques of evaluating indefinite integrals, integration by substitution, integration by parts, change of variables in indefinite integrals.

Recommended Books:

- Anton H, Bevens I, Davis S, *Calculus: A New Horizon* (8th edition), 2005, John Wiley, New York
 - Stewart J, *Calculus* (3rd edition), 1995, Brooks/Cole (suggested text) Swokowski EW, *Calculus and Analytic Geometry*, 1983, PWS-Kent Company, Boston
- Thomas GB, Finney AR, *Calculus* (11th edition), 2005, Addison-Wesley, Reading, Ma, USA

STATISTICS-II

COURSE CODE: STAT-414

CREDIT HOURS: 03

Theory

Probability theory, Sample Space, counting sample points, Subsets, Events, Independent and Dependent Events, Classical Probability, Laws of Probability, Conditional Probability, Sampling Techniques, Sampling Probability and non-Probability Sampling, Sampling with and without replacement, Simple random Sampling, Stratified random sampling, Systematic sampling, Sampling and Non-sampling Error, Sampling distribution of mean and difference between two means. Estimation and testing of hypothesis, Type-I and type-II error, Confidence Interval for Difference of Means, Confidence Interval for Population Proportion, Confidence Interval for the Differences Between Proportion, Formulation of Hypothesis, Testing of hypothesis about mean and difference between two means using Z-test and t-test, Paired t-test, One-tailed and Two-tailed tests, Test of association of attributes using χ^2 (chi-square) Testing hypothesis about variance.

Practical's

- a. Sampling random sampling

- b. Stratified random sampling.
- c. Sampling distribution of mean
- d. Testing of hypotheses regarding population mean
- e. Testing of hypotheses about the difference between population means
- f. Chi-square test
- g. One-way ANOVA
- h. Two-way ANOVA

Recommended Book

1. Introduction to Statistical Theory Part-II by Sher Muhammad and Dr. Shahid Kamal (Latest Edition)
2. Introduction to Statistical Theory Part-I by Sher Muhammad and Dr. Shahid Kamal (Latest Edition)
3. Statistical Methods and Data Analysis by Dr. Faquir Muhammad

SMO

Course design for the loop Natural Science (NS-II*)

Course Code: PHY-413

Course Title: Physics-II

(Credit hours: 03)

Objectives


Students completing this course successfully will be able to: Understand basic concepts and principles of electricity and magnetism. Analyze and solve analytical as well as numerical problems in a variety of electrical systems. Understand and interpret information presented in tables, graphs and mathematical equations. Formulate, analyze and report experimental results obtained from practical work. Carry out careful measurements and develop a hand-on experience on experimental techniques and skills.

Course Contents

Electrostatics: electro charges as source of electric flux, Gauss's theorem, Electrostatic potential, Poisson's equation, Laplace Equation Potential due to: (a) Point Charge (b) dipole capacity of spherical condenser, dielectrics. Magnetism Explanation and ferromagnetism on atomic structure of an atom, magnetic circuit, relation b/w susceptibility and permeability, Hysteresis determination of B-H curve using a Ballistic galvanometer, Magnetic Shell and Ampere's law and method of measuring magnetic field; Current Electricity: Magnetic flux density B. Ampher's law and calculation of B due to current in (a) Long Straight, (b) Solenoid, (c) Toriod, Biot and Sarvat's law and its applications, Faraday's Law , Lenz's Law, Motional electromotive force (EMF). Inductance and its types.

Recommended Books

1. Fundamental of Physics by Jearl Walker, Holiday & Resnick, 10th Edition, Wiley
2. An Introduction to the Standard Model of Particle Physics for the Non-Specialist by Gerald E Marsh. World Scientific Publishing Company (2017). ISBN-10: 9813232587.
3. Advanced Modern Physics: Theoretical Foundations by John Dirk Walecka. World Scientific Publishing Co. Pte. Ltd. (2010) ISBN-13: 978-981-4291-51-4.
4. Physics, Volume 1, 5th Edition by Resnick Halliday Wiley India (2007). ISBN-13: 978-8126510887.
5. University Physics 11th Edition by Hugh D Young. Addison Wesley Publishing Company. (2006) ISBN-10: 0805387684.
6. Physics, by Robert Resnick, David Halliday, Kenneth S. Krane. (2001). Volume 1, 5th Edition. ISBN: 978-0-471-32057-9.


Head
Deptt. of Physics
BKUC

NATURAL SCIENCE – II COURSES OF ZOOLOGY

Title of the course: Animal Diversity-II (Chordates)

Code: ZOO- 321 Credit Hours: 3 (2+1)

Aims and Objectives: The course provides knowledge and understanding about the different animal groups, emphasizing their phylogenetic relationships.

Course Outline

1. Hemichordates and Invertebrate Chordates

Evolutionary perspective Introduction to hemichordates

2. Fishes: Vertebrate Success in Water

Evolutionary perspective, Introduction and brief classification of fishes, adaptations in locomotion, circulation, gas exchange, lateral line system, excretion and osmoregulation, reproduction and development.

3. Amphibians: The First Terrestrial Vertebrates

Evolutionary perspective, brief classification of amphibians, adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, temperature regulation, nervous and sensory functions, excretion and osmoregulation, reproduction, development, and metamorphosis; further phylogenetic considerations.

4. Reptiles: The First Amniotes

Evolutionary perspective cladistic interpretation of the amniotic lineage; survey of order testudines or chelonians, rhynchocephalia, squamata, and crocodilia; evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, and temperature regulation, nervous and sensory functions, excretion and osmoregulation, reproduction and development; further phylogenetic considerations.

5. Birds: Feathers, Flight, and Endothermy

Evolutionary perspective, ancient birds and the evolution of flight; diversity of modern birds; evolutionary pressures: adaptation in external structure and locomotion, nutrition and the digestive system, circulation, gas exchange, and temperature regulation, nervous and sensory systems, excretion and osmoregulation, reproduction and development; migration and navigation.

6. Mammals: Specialized Teeth, Endothermy, Hair, and Viviparity

Evolutionary perspective: diversity of mammals; evolutionary pressures: adaptations in external structure and locomotion, nutrition and the digestive system, circulation, gas



xchange, and temperature regulation, nervous and sensory functions, excretion and osmoregulation, behaviour, reproduction and development.

Lab outline:

- Study of representatives of group Fishes.
- Study of representative groups of class Amphibia.
- Study of representative groups of class Reptilia.
- Study of representative groups of class Aves.
- Study of representative groups of class Mammalia.
- Field trips to study animal diversity in an ecosystem.
- Visit to zoo and Wildlife Park.
- Collection and preservation techniques, collection of specimens by students.
- Note: Preserved specimen and/or colored projection slide and/or CD ROM projection of computer must be used.

Books Recommended:

1. Hickman, C.P., Roberts, L.S. and Larson, A. Integrated Principles of Zoology, 11th Edition (International), 2004. Singapore: McGraw Hill.
2. Miller, S.A. and Harley, J.B. Zoology, 5th Edition (International) 2002. Singapore: McGraw Hill.
3. Kent, G.C. and Miller, S. Comparative anatomy of Vertebrates. 2001. New York: McGraw Hill.
4. Campbell, N.A. Biology, 6th Edition. 2002. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.



Annex-II Arts and Humanities-I (Languages)

کورس کوډ: PASH-323

درې ساعتونه

Arts and Humanities-1 (Language) Pashto Course Pool

پښتو ژبه: پېژندگلو او پرمختګ

- املاء او رسم الخط کښې فرق
- د رسم الخط مختلف قسمونو بیان
- د پښتو املا ارتقاء
- پښتو املاء کښې روښاني اختراعات
- پښتو املاء ته د خوشحال خان خټک بڅښنې
- د باره گلي، سیمنارونه او پښتو املاء
- د پښتو د املاء او رسم الخط په لړ کښې انفرادي کوششونه
- د پښتو ژبې په اړه بېلابېلې نظریې:
(سامي النسل نظریه - اریایي النسل نظریه - پښتانه بني اسرائیل دي؟ - پښتانه اریا دي؟)

- د نوموړو پښتو شاعرانو د ژوند احوال:
(خوشحال خان خټک - رحمان بابا - حمید بابا - کاظم خان شیدا - حمزه بابا - غني خان - اجمل خټک - قلندر مومند)

- د لاتدینو شاعرانو د ورکړو شوو غزلونو تشریحات:
 - توره چې تهریوي خو گزار لره کنه خوشحال خان خټک
 - په ښه خوي له بدخواهانو بې پروا یم رحمان بابا
 - ستا د شونډو په څېر کله دې د گل رنگ حمید بابا
 - د یارانو د هجران له جور و جرمه علي خان
 - ستا غمونه به ختمېږي هم که نه حمزه بابا
 - پوهه مې او زدکړه مې د مینې له آئینه ده - ډاکټر محمد اعظم اعظم

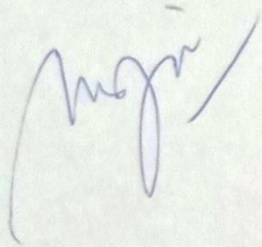
- د لاتدینو افسانه نگارونو د افسانو فني او فکري جایزه:

- قلندر مومند: گجرې
- زیتون بانو: ژوندي غمونه

مجوزہ کتابونه؛

1. لیکوالي املا او انشاء، از گل باچا الفت
2. د خبر البیان لیک دود، مشموله خبر البیان، کابل چاپ، پوهاند عبدالشکور رشاد، مخ ۵۵ تا ۸۰ پورې

3. پښتو ليک دود، از پرېشان خټک
4. پښتو املاء، پروفېسر ډاکټر راج ولي شاه خټک
5. پښتو ليک دود، از خان شهيد عندالصمد خان
6. معياري پښتو، ډاکټر عبدالرزاق پالوال
7. پښتو ليک دود — ډاکټر نصرالله جان — پښتو اکېډمي
8. ساهو پښتو — مشتاق مجروح
9. پښتانه ليکوال — همېش خليل
10. د ياد شوو شاعرانو د شاعرۍ دېواوين/شعري ټولگې



Arabic language عربی زبان Course code: AL-323

Marks:100

Title	Description
Semesters	2nd
Nature of Course	General Course
No. of C.Hrs.	03
Teaching weeks	16
Objectives of the Course	۱۔ طلباء کو عربی زبان کی علوم اسلامیہ میں اہمیت سے آگاہ کرنا ۲۔ طلباء کو علم صرف اور نحو کے بنیادی قواعد سے آگاہ کرنا تاکہ اسلامی علوم سے کما حقہ استفادہ کیا جا سکے ۳۔ طلباء کو علم صرف کے بنیادی اصولوں سے آگاہ کرنا

Course Description

S.No	Topic	Description
1	عربی زبان کا تعارف و اہمیت	۱۔ عربی زبان کا آغاز و ارتقاء ۲۔ عربی زبان کی اہمیت ۳۔ علوم اسلامیہ کے فہم میں عربی زبان کا کردار
2	ماضی اور مضارع	۱۔ فعل ماضی اور مضارع کا تعارف ۲۔ فعل ماضی اور مضارع کی اقسام اور گردائیں ۳۔ فعل ماضی اور مضارع کے بنیادی صرفی قواعد
3	فعل امر و نہی	۱۔ فعل امر و نہی کا تعارف ۲۔ فعل امر و نہی کی اقسام اور گردائیں ۳۔ فعل امر و نہی کے بنیادی صرفی قواعد
4	اسماء - 1	۱۔ اسم فاعل کا تعارف اور صرفی قواعد ۲۔ اسم مفعول کا تعارف اور صرفی قواعد
5	اسماء - 2	۱۔ اسم تفضیل کا تعارف اور صرفی قواعد ۲۔ اسم ظرف (زمان و مکان) کا تعارف اور صرفی قواعد ۳۔ اسم آلہ کا تعارف اور صرفی قواعد
6	اسماء - 3	۱۔ اسم اشارہ (قریب اور بعید) ۲۔ اسم موصول اور جملہ موصولہ کا تعارف
7	معرب و مبنی	۱۔ اسم معرب کا تعارف اور اس کی اقسام ۲۔ اسماء مبنی کا تعارف اور ان کی اقسام
8	حروف	۱۔ حروف نداء ۲۔ حروف نواصب مضارع ۳۔ حروف جوازم مضارع
9	ثلاثی مجرد	۱۔ فعل ثلاثی مجرد کا تعارف ۲۔ فعل ثلاثی مجرد کے ابواب
10	ثلاثی مزید فیہ (۱)	۱۔ فعل ثلاثی مزید فیہ کا تعارف ۲۔ فعل ثلاثی مزید فیہ کے ابواب
11	ثلاثی مزید فیہ (۲)	ثلاثی مزید فیہ کے ابواب کا تفصیلی مطالعہ

Dr. Rizwanullah
Rizwanullah

12	بفت اقسام (۱)	۱- صحیح ۲- مثال (واوی- یائی) ۳- مضاعف ۴- لقیف (مفروق اور مقرون)
13	بفت اقسام (۲)	۱- ناقص (واوی- یائی) ۲- مہموز (الفاء والعین واللام) ۳- اجوف
14	معلم الانشاء سے منتخب مطالعہ	استاد تفصیلات خود طے کرے اور ان کو پڑھانے میں اطلاقی انداز اختیار کیا جائے۔
15	معلم الانشاء سے منتخب مطالعہ	استاد تفصیلات خود طے کرے اور ان کو پڑھانے میں اطلاقی انداز اختیار کیا جائے۔

نصابی کتب

نام کتاب	نام مصنف	نمبر شمار
عربی کا معلم (چاروں حصے)	عبدالستار خان	1
تمرین صرف	معین اللہ ندوی	2
تمرین النحو	محمد مصطفیٰ ندوی	3
معلم الانشاء	مولانا عبدالماجد ندوی	4
مختار النحو	مولانا مختار احمد	5

حوالہ جاتی کتب

نام کتاب	نام مصنف	نمبر شمار
النحو الواضح	علی جارم	1
اساس عربی	نعیم الرحمن	2
مبادئ العربية في الصرف و النحو	رشید الشراطوی	3
کتاب النحو	عبدالرحمن امرتسری	4
تمرین النحو	محمد مصطفیٰ ندوی	5
قواعد القرآن	عبدالرحمن طاہر	6
اللغة العربية لغير الناطقين بها	جامعۃ الملک السعود، ریاض	7
قرآنی عربیک	ڈاکٹر ابراہیم سورتی	8

Dr. Rizwanullah
N. Ullah Khan

کورس کوڈ Urdu 323

جنرل کورس کریڈٹ آور : 03

Arts and Humanities-I Urdu Course pool

اردو زبان تعارف اور ارتقاء

اردو کے مختلف نام اور ان کی وجہ تسمیہ. اردو کی حروف تہجی
اردو ادب کا تعارف:

۱. داستان ۲. ناول ۳. افسانہ ۴. ڈرامہ ۵. آپ بیتی ۶. خاکہ ۷. سوانح
۸. انشائیہ ۹. مکتوب نگاری ۱۰. حمد ۱۱. نعت ۱۲. منقبت ۱۳. مثنوی
۱۴. مرثیہ ۱۵. قصیدہ ۱۶. شہر آشوب ۱۷. نظم ۱۸. آزاد نظم ۱۹. پابند نظم
۲۰. مصرعہ نظم ۲۱. غزل

دبستان دہلی-دبستان لکھنؤ- رومانوی تحریک- ترقی پسند تحریک (اجمالی جائزہ)

اقبال کی منتخب غزلیں :

۱. جب عشق سکھاتا ہے آداب خود آگاہی
۲. جنہیں میں ڈھونڈتا تھا آسمانوں میں زمینوں میں

غالب کی منتخب غزلیں :

۱. حیران ہوں دل کو روؤں کہ پیٹوں جگر کو میں
۲. دائم پڑا ہوا تیرے در پر نہیں ہوں میں

منتخب افسانے:

۱. پریم چند _____ کفن
۲. منٹو _____ نیا قانون

مجوزہ کتب :

۱. کشاف تنقیدی اصلاحات (ابوالاعجاز صدیقی)
۲. اقبال کی طویل نظمیں (رفیع الدین ہاشمی)
۳. اردو زبان کی مختصر ترین تاریخ (ڈاکٹر سلیم اختر)
۴. اردو کی ابتداء کے بارے محققین کے نظریات (پروفیسر ایوب صابر)

Dr. Saïd Sher
Associate Prof.
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Annex-II Arts and Humanities-II

Pool Course: Arts & Humanities-II
Course Title: Introduction to Education
Course Code: EDU-414
Credit Hours: 03

COURSE CONTENTS:

Introduction:

- Meaning and Definition of Education
- Importance of Education
- Modes of Education.

Foundation/Perspectives of Education:

- Philosophical
- Psychological
- Socio-Cultural, and
- Economic

Instructional Objectives:

- Goals
- Aim
- Objectives
- Importance of Learning Objectives.
- Taxonomy of educational Objectives.

Teaching Methodology:

- Traditional
- Modern
- Instructional Material.
- Instructional Techniques.

Class Room Management:

- Criteria for students classification
- Need for classification
- Psychological factors of classification in system of examination.

Learning:

- Introduction
- Meaning and Definition
- Nature of Learning.
- Factors effecting learning.
- Approaches of Learning (Behavioral and Cognitive).



Educational Guidance and Counseling:

- Definition and Nature of Guidance.
- Role and Function of Guidance.
- Counseling and its Principles.

COURSE RECOMMENDED BOOKS:

1. Elias, John L. and Merriam, Sharan.(1984). Philosophical Foundation of Education. Malabar Florida: Krieger Publishing Company.
2. Friere, P.(1970). Pedagogy of the Oppressed: What we Consume. W.W.F and Richmond Publishing Company.
3. Gutek, Gerald L. (1988). Philosophical Thinking in Educational Practice. Westport: Con,Praeger Publisher.
4. Iqbal, M. (2001). Reconstruction of Religion Thoughts in Islam.National Education policies, (1972, 1979, 1998, 2010).

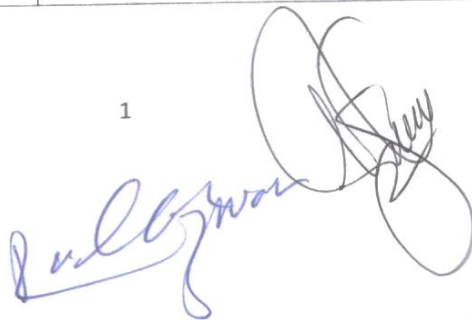


Pool Course: Arts & Humanities-II
Course Title: Islamic History & Culture
Course Code: IS-422

Title	Description
Semester	4 th
Nature of Course	Major (M-10)
Credit Hours	03
Objectives of the Course	۱- اسلامی تہذیب و تمدن کا تعارف کروانا ۲- دنیا کے مختلف علاقوں میں اسلامی تہذیب کے عروج و زوال کا جائزہ لینا ۳- دوسری تہذیبوں سے اخذ استفادہ اور ان پر اسلامی تہذیب کے اثرات کا جائزہ لینا

Course Description

S.No.	Title	Description
1	تہذیب و تمدن کا تعارف I.	۱- تہذیب کا مفہوم ۲- تمدن کا مفہوم ۳- ثقافت کا مفہوم
2	تہذیب و تمدن کا تعارف II.	۱- تہذیب و تمدن کی بنیاد ۲- تہذیب و تمدن کے ارکان ۳- تہذیب و تمدن کی اہمیت
3	دور نبوی سے قبل اہم تہذیبیں	۱- قبل از اسلام کی جاہلی تہذیب ۲- یونانی تہذیب ۳- رومی تہذیب ۴- مصری تہذیب ۵- ہندوستانی تہذیب
4	اسلامی تہذیب کے اصول و مبادئ	اسلامی تہذیب کی بنیادیں
5	عہد نبوی و دور خلافت راشدہ میں اسلامی تہذیب	۱- عہد نبوی ﷺ و خلافت راشدہ میں اسلامی تہذیب کے ارتقاء کے اسباب ۲- خلافت راشدہ میں اسلامی تہذیب کے مظاہر
6	دور بنو امیہ میں اسلامی تہذیب I.	۱- دور بنو امیہ کا تعارف ۲- دور بنو امیہ میں علمی ترقی ۳- دور بنو امیہ کے علمی مراکز
7	دور بنو امیہ میں اسلامی تہذیب II.	۱- دور بنو امیہ کی معاشرتی ترقی ۲- دور بنو امیہ کے تہذیبی ترقی کے اسباب ۳- دور بنو امیہ کی تہذیبی ترقی کے نتائج
8	دور بنو امیہ میں اسلامی تہذیب III.	۱- دور بنو امیہ کی مذہبی تحریکیں ۲- دور بنو امیہ میں اندرونی خلفشار ۳- امویوں کے زوال کے اسباب
9	دور بنو عباس میں اسلامی تہذیب I.	۱- عباسی تہذیب کا آغاز ۲- دور عباسی کی علمی تحریکیں ۳- دور عباسی کے علمی مراکز
10	دور بنو عباس میں اسلامی تہذیب II.	۱- دور بنو عباس میں تہذیبی ترقی ۲- دور بنو عباس میں معاشرتی ترقی ۳- دور بنو عباس میں اسلامی تہذیب کا دوسری تہذیبوں سے مکالمہ



11	دور بنو عباس میں اسلامی تہذیب-III	۱- دور بنو عباس میں مسلمانوں کے کارنامے ۲- دور بنو عباس کی مذہبی تحریکیں ۳- دور بنو عباس کی سیاسی تحریکیں
12	دور بنو عباس میں اسلامی تہذیب-IV	۱- صلیبی جنگیں ۲- ناتاری حملے ۳- عباسیوں کے زوال کے اسباب اور اس کے اسلامی تہذیب پر اثرات
13	اسپین میں اسلامی تہذیب I	۱- اسپین میں اشاعت اسلام ۲- اسپین میں مسلمانوں کے علمی کارنامے ۳- اسپین میں مسلمانوں کے علمی مراکز
14	اسپین میں اسلامی تہذیب II	۱- اسپین میں اسلامی تہذیب کی اشاعت کے اسباب ۲- اسپین میں اسلامی تہذیب کے مظاہر ۳- اسپین میں اسلامی تہذیب کے یورپی تہذیب پر اثرات
15	برصغیر پاک و ہند میں اسلامی تہذیب و تمدن	۱- برصغیر پاک و ہند میں اسلامی تہذیبی کارنامے ۲- برصغیر پاک و ہند میں اسلامی تہذیب کی اشاعت کے اسباب ۳- برصغیر پاک و ہند میں اسلامی تہذیب کی اشاعت کے اثرات دوسری تہذیبوں پر

نصابی کتب

نمبر	نام مصنف	نام کتاب
1	شاہ معین الدین ندوی	تاریخ تمدن اسلامی
2	اکبر شاہ نجیب آبادی	تاریخ اسلام
3	حسن ابراہیم حسن	تاریخ الاسلام السياسي
4	ابن کثیر	البدایة النہایة
5	مصطفی سباعی	اسلامی تہذیب کے درخشاں پہلو

حوالہ جاتی کتب

نمبر	نام مصنف	نام کتاب
1	ابن اثیر	الکامل
2	ڈاکٹر یسین مظہر صدیقی	تاریخ تہذیب اسلامی (چاروں حصے)
3	ثروت صولت	ملت اسلامیہ کی مختصر تاریخ
4	H.W Hazard	An Atlas of Islamic History
5	S.F.Mehmood	A Short History of Islam

R. Ullah Khan

Pool Course: Arts & Humanities-II
Course Title: Introduction to Philosophy
Course Code: PHIL-411
Credit Hours: 03

Course Description:

The course introduces undergraduate students to some of the main concerns in philosophy concentrating on the works of major thinkers such as Plato, Aristotle, Descartes, Hume, Kant, Hegel, Marx, Kierkegaard, Husserl, Sartre, Foucault, and Derrida, to name a few. The class discussions will center on broad philosophical concerns: the nature of philosophy, the nature and limits of human knowledge, the scope and limits of human freedom, the differences between right and wrong conduct, the nature of good life, and the meaning and the value of human existence. The students will thus be given introductory overview of different areas of philosophy beginning with Plato. The topics for discussion will include: Morality, Free Will, Metaphysics and Knowledge. The basic principles and methods of logical reasoning will be introduced and students will be given opportunity to participate actively in class discussions.

Course Objectives:

- Understanding basic concepts of philosophy in the fields of metaphysics, axiology, and epistemology.
- Understanding of philosophical terms.

Course Contents:

- A review of the history of philosophy.
- A discussion on the major problems and methods of philosophy.
- Studying the work of at least two philosophers from each of the following groups: 1. Greco-Roman Philosophers Plato, Aristotle, Democritus, Pythagoras, Heraclitus, Protagoras, Epicurus, Seneca, and Epictetus 2. Medieval Religious Philosophers Avicenna, Averroes, St. Thomas Aquinas 3. Renaissance Philosophers Machiavelli, Erasmus, Thomas More.
- Enlightenment and Sui Generis Philosophers: Copernicus, Descartes, Hobbes, Spinoza, Leibniz, Locke, Berkeley, Hume, Kant.
- Idealists: Fichte, Schelling, Schiller, Hegel.
- Utilitarian Philosophers: Jeremy Bentham, J.S. Mill.
- Romantic Reactionaries: Rousseau, Schopenhauer, Kierkegaard.
- Materialist Philosophers: Feuerbach, Marx.
- The Irrational Philosophers: Bergson, Freud.
- Phenomenologists and Existentialists: Husserl, Heidegger, Sartre, Camus, Fanon.



- **Marxist Philosophers:** Lukacs, Gramsci, Croce, Althusser.
- **Linguists, Semiotician, Structuralist, and Deconstructionists:** Saussure, Levi-Strauss, Lacan, Barthe, Foucault, Derrida.

Recommended Books:

1. Adorno, T.W., Aesthetic Theory. Tr. By C. Lenhardt. London: Routledge & Kegan Paul, 1984
2. Ahmad, Absar, Concept of Self and Self-Identity in Contemporary Philosophy. Lahore: Iqbal Academy, 1986
3. Aldrich, Virgil. Philosophy of Art, New Jersey: Prentice Hall, 1963
4. Anne, Bruce, Metaphysics: The Elements. Oxford: Basil Blackwell, 1986
5. Aristotle, The Works of Aristotle, edited by W.D. Ross. Vol x. Politica, translated by Benjamin Jowett. Oxford: Clarendon Press

Two handwritten signatures in blue ink. The signature on the left is more stylized and appears to be 'Ahmad' with a flourish underneath. The signature on the right is more cursive and appears to be 'Absar'.

POOL COURSE OF ECONOMICS FOR SOCIAL SCIENCE-II

COURSE TITLE: INTRODUCTION TO ECONOMICS

COURSE CODE: ECON-425

CREDIT HOURS: 03

COURSE DESCRIPTION

Introduction to Economics is an introductory undergraduate course that teaches the fundamentals of economics. This course introduces microeconomic concepts i.e. supply and demand analysis, theories of the firm and individual behaviour, competition and monopoly, and Macroeconomics concepts i.e. macroeconomic indicators and issues such as national income, unemployment, inflation etc.

Students will be introduced to the use of microeconomic and macroeconomic applications to address problems in current economic policy throughout the semester. The course will rely heavily on graphical analysis and simple numerical calculations.

COURSE OBJECTIVES

By the end of the course, students will be able to understand introductory microeconomic and macroeconomic theory, solve basic micro and macro-economic problems, and use these techniques to think about a number of basic policy questions relevant to the operation of the economy. More specifically, this course aims:

- To develop an understanding of introductory microeconomic theory and its relevance to the real world
- To sharpen the problem solving tactics required to solve basic microeconomic/Macroeconomic problems
- To give a broader implications of micro and macro-economic principles and their applications
- To train the students to work with others as a part of team to solve problems

COURSE LEARNING OUTCOMES:

After completing this course, students should have developed a range of skills enabling them to understand economic concepts and use those concepts to analyse specific questions. By the end of this course, students should be able to:

- Understand consumer and firm behaviour apply graphical analysis for a variety of economic situations.
- Calculate and Interpret elasticities
- Define and derive short-run and long run production costs
- Explain various market structures

COURSE CONTENT

- 1.1 The Economic Problem
- 1.2 Economic Decision Makers
- 1.3 The Circular Flow Model
- 1.4 Distinction between Microeconomics and Macroeconomics
- 1.5 The Market System

2. Demand & Supply:

- 2.1 Demand Function, Demand Curve, Engel Curve, Changes in Demand, Law of Demand, Shift in Demand, Factors Affecting Demand, Consumer Surplus
- 2.2 Supply, Supply Function, Supply Curve, Changes in Supply, Factors Affecting Supply, Law of Supply, Producer Surplus
- 2.3 Equilibrium of Demand and Supply, Market Equilibrium, Price Controls, Taxes and Subsidies


Head of Department
Department of Economics
Bacha Khan University Charsadda

3. Elasticity of Demand & Supply:

- 3.1 Price Elasticity of Demand & Supply
- 3.2 Point Elasticity of Demand & Supply
- 3.3 Arc Elasticity of demand & Supply
- 3.4 Income Elasticity of Demand & Supply
- 3.5 Cross Elasticity of demand & Supply

4. Consumer Behavior:

- 4.1 Utility Analysis (Cardinal Approach), Marginal Utility
- 4.2 Law of Diminishing Marginal Utility and Law of Equi-Marginal Utility, Consumer Equilibrium
5. Introduction to Macroeconomics
 - 5.1 What is macroeconomics and how economist thinks?
 - 5.2 The economy in aggregate,
 - 5.3 Complexities of the world of business,
 - 5.4 Scope of macroeconomics,
 - 5.5 Brief account of classical and the development of macro-economic after the World War-II
 - 5.6 Concept of business cycles: Boom and Depression,
 - 5.7 Three concerns of macroeconomics, Inflation, GDP growth and unemployment,
 - 5.8 Macroeconomic variables and their mutual relationship,
 - 5.9 Macro-models as abstraction from the real economy.

6. National Income Accounting:

- 6.1 Definition and concept of national income,
- 6.2 Measures of national income: Gross Domestic Product (GDP) and Gross National Product (GNP), GDP at factor cost and at market prices, GDP deflator
- 6.3 Computation of national income: Product, Income and Expenditure approaches,
- 6.4 Circular flow of income,
- 6.5 Nominal versus Real income,
- 6.6 Per capita income and the standard of living.
- 6.7 Measuring the cost of living: the consumer price index, CPI versus GDP deflator
- 6.8 Measuring Unemployment rate

7. Components of Aggregate Demand:

- 7.1 The Concept of Open and closed economy models,

TEACHING METHODOLOGY:

- Lectures
- In Class Activities
- Written Assignments

TEXT AND REFERENCE BOOKS:

1. Michael J. Swann, William A. McEachern Microeconomics: A Contemporary Introduction, 3rd edition (or latest available)
2. Mankiw N. Gregory, Principles of Microeconomics 7th edition (or latest available).
3. Campbell R. McConnell, Stanley L. Brue, Principles of Economics, 17th edition (or latest available).
4. Paul A. Samuelson, William D. Nordhaus, Economics, Latest Edition
5. N. Gregory Mankiw. Principles of Macroeconomics, (latest edition)
6. Samulson and Nordrons. Economics, 18th Edition, (or latest available)
7. Parkin, Michael. Macroeconomics, Edition Wesley International Inc. (latest edition)

SOCIAL SCIENCES-II

COURSE TITLE: INTRODUCTION TO HISTORY
COURSE CODE: HIS-411
CREDIT HOURS: 03

Course Objectives:

The purpose of this course is:

- To make students aware of the nature of historical knowledge and research.
- To introduce to the students of History the basic concepts and controversies related to historical understanding.
- To inculcate among the students a sense of historical evolution of human knowledge, development and progress
- To develop among the students of history an ability to understand the common themes of historical knowledge.

Course Contents:

1. What is History?
Literal, terminological and conceptual meaning of history
History as Fact
History as Process
History as Narrative
2. Memory, Record and History
3. Nature of History:
Being and Becoming;
Continuity and Change;
Evolution, Progress and Development
Macrocosm & Microcosm: Time, Space, Causation,
Facts and opinion/ objectivity & Subjectivity
4. Utility, Benefits & importance of History:
History as a corrective/cohesive force;
History as a repetitive force
Continuity of History from Past to Future
Lessons from Past
Historical determinism, etc.
History as Mother of All Sciences/Knowledge
5. Epistemological nature of History:
Relationship of History with other forms of knowledge:
Natural Sciences
Social Sciences
Literature and Arts



6. Forms and Classification of History

Suggested Readings:

1. Burke, Varieties of Cultural History, Cornell University Press, 1977
2. Carlo, Ginzburg. Clues. Myths, and the Historical Method, John Hopkins: University Press, 1992
3. Carr, E. H., What is History? Harmondsworth: Penguin, 1961
4. Cohn, Bernard. An Anthropologist among Historians and Other Essay, Oxford University Press, 1988
5. Collingwood, R. G. The Idea of History. Oxford: Oxford University Press, 1978.
6. Daniels, Studying History: How and Why, New Jersey, 1981.
7. Gertrude Himmelfarb. The New History and the Old, Cambridge: Harvard University Press, 1987
8. Govranski. History Meaning and Methods, USA, 1969
9. Hegel. Elements of the Philosophy of Right. Cambridge University Press, 1991
10. Qadir, Khurram, Tarikh Nigari Nazriyat-o-Irtiqa, Lahore: Palgrave, 1994.
11. Qureshi, Muhammad Aslam. A Study of Historiography. Lahore: Pakistan Book Centre, Latest Edition.
12. Steedman. Caroline, Dust: The Archive and Cultural History, Manchester University Press, 2002
13. Stern Fritz, .Varieties of History: from Voltaire to the Present, Vintage, nd Edition 1975
14. Tahir Kamran, The Idea of History Through Ages, Lahore: Progressive Publisher, 1993
15. Lemon, M. C., Philosophy of History, London: Routledge, 2003
16. Marwick, Arthur, The New Nature of History, London, 1989, pp.31-35.
17. Roberts, Geoffrey, ed., History and Narrative Reader, London: Routledge, 2001.
18. Shafique, Muhammad, British Historiography of South Asia: Aspects of Early Imperial Patterns and Perceptions, Islamabad, NIHCR, Quaid-i- Azam University, 2016



Pool Course: Social Sciences-II
Course Title: Introduction to Law
Course Code: LAW-411
Credit Hours: 03

COURSE OBJECTIVE: To give knowledge about different sources of Muslim law and its Importance to students in particular and Muslim society in general.

COURSE CONTENTS:

Introduction

- Definition of law and Muslim law
- Importance of law and Muslim law
- Subject matter of law and Muslim law.

Will (Wasiyat)

- Introduction and definition of will
- Forms of will (Wasiyat)

Gift (Hiba)

- Introduction of gift
- Definition of gift
- Essentials of gift
- Forms of gift (Hiba).

Waqf

- Introduction of Waqf
- Definition of Waqf
- Requisites of Waqf
- Principles of Waqf
- Forms of Waqf.

Marriage

- Introduction and definition
- Essentials of marriage.
- Differences between shia and sunni marriages.
- Valid (sahih)
- Irregular (fasid)
- Void (batil)
- Muta marriage.

Dower

- Introduction and definition of dower.
- Kinds of dower.

Divorce (Talaq)

- Introduction and definition of divorce
- Different modes and kinds of divorce (Talaq).

Explanation of Islamic jurisprudence.

Sources of islamic law:

- Quran,
- Sunnah and hadith,
- Ijma,qiyas,
- Masaleh-i-mursala-istislah,
- Ijtihad, and
- Taqlid.

COURSE RECOMMENDED BOOKS:

1. Ahmad. Nazir. (2006). Muslim law & Islamic jurisprudence. Peshawar: islamia book agency.



SOCIAL SCIENCES-II

COURE TITLE: BASICS OF POLITICAL SCIENCE

COURSE CODE: POL-414

CREDIT HOURS: 03

COURSE OBJECTIVE:

To give knowledge about the basics of Political science, its evolutions and its implication to traditional and Modern Societies. The subject also provide knowledge about the Political dynamics and new trends and debates emerging in the discipline of Political Science.

COURSE CONTENTS:

- ✓ Meaning and Definition of Political Science
- ✓ Subfields in Political Science
- ✓ Methods and Techniques in Political Science
- ✓ HISTORICAL DEVELOPMENT
 - Ancient influences
 - Early modern developments
 - 19th-century roots of contemporary political science
 - The early 20th century
 - Developments in the United States
 - Developments outside the United States
- ✓ POLITICAL DYNAMICS
 - Public Opinion
 - Pressure Groups
 - Propaganda
 - Political Parties & Leadership
 - Local Government System in Pakistan
- ✓ POST-WORLD WAR-II TRENDS AND DEBATES
 - Behavioralism
 - Political Culture
 - Systems Analysis
 - Theory of Rational choice
 - Democracy

Recommended Books:



1. Agarwal, R.C. (2006). Political theory: Principles of political science. New Delhi: S. Chand & Co.
2. Haq, Mazhar. (1996). Theory and practice in Political Science. Lahore: Book Land.
3. Roskin, Michael. G. (1997). Political Science: an Introduction. London: Prentice Hall.
4. SA. Syed (2007). Political Science: Part-1. Nowshera: Classic Publishers Nowshera.
5. S.A.Syed. (2007). Political Science: Part-II Nowshera: Classic Publishers Nowshera.
6. Sarwar, M. (1996). Introduction to Political Science. Lahore: IlmiKutubKhana.
7. Ahmad , Sheikh Bashir, Riyasat Jo Ilm (Sindhi meaning Science of State), Jamshoro, Institute of Sindhalogy, University of Sindh, 1985.
8. Haq, Mazher ul, Theory and Practice in Political Science, Lahore Bookland, 1996.
9. Ian Mackenzi (Ed.), Political Concepts: A Reader and Guide, Edinburgh, University Press, 2005.
10. Mohammad Sarwar, Introduction to Political Science, Lahore Ilmi Kutub Khana, 1996.
11. R. C. Agarwal, Political Theory (Principles of Pol. Science), New Delhi, S. Chand & Co., 2006.
12. Robert Jackson and Dorreen Jackson, A Comparative Introduction to Political Science, New Jersey, Prentice – Hall, 1997
13. Rodee Anderson etc. Introduction to Political Science, Islamabad, National Book Foundation, Latest Edition.
14. Roskin, Michael G., Political Science: An Introduction, London: Prentice Hall, 1997.
15. Shafi, Choudhry Ahmad, Usul-e-Siyasiat (Urdu), Lahore Standard Book Depot, 1996.
16. V. D. Mahajan, Political Theory- Principles of Pol. Science, New Delhi, S. Chand & Co., 2006.

Pool Course: Social Sciences -II

Course Title: Introduction to Psychology

Course Code: PSY -411

Credit Hours: 03 Hours

Course Description

This course provides some basic knowledge of the key terms, facts and principles designed to aid the students in understanding individual behaviour. Behaviour is analyzed and interpreted through activities and discussion of such topics as motivation, emotion, perception, learning and intelligence.

Course Objectives

- To describe psychology with major areas in the field,
- To identify the parameters of this discipline. Distinguish between the major perspectives on human thought and behaviour. Appreciate the variety of ways psychological data are gathered and evaluated.
- To gain insight into human behaviour and into one's own personality or personal relationships. Explore the ways that psychological theories are used to describe, understand, predict, and control or modify behaviour.

Course Outlines

1. Introduction to Psychology:

- a. Nature and Application of Psychology with special reference to Pakistan.
- b. Historical Background and Schools of Psychology (A Brief Survey)

2. Methods of Psychology

- a. Observation
- b. Case History Method Experimental Method
- c. Survey Method
- d. Interviewing Techniques

3. Biological Basis of Behaviour

- a. Neuron: Structure and Functions
- b. Central Nervous System and Peripheral Nervous System
- c. Endocrine Glands

4. Sensation, Perception and Attention

- Sensation
 - Characteristics and Major Functions of Different Sensations
 - Vision: Structure and function of the Eye
 - Audition: Structure and functions of the Ear
 - Perception
 - Nature of Perception



- Factors of Perception: Subjective, Objective and Social
- Kinds of Perception
- Spatial Perception
- Temporal Perception; Auditory Perception
- Attention
 - Factors, Subjective and Objective
 - Span of Attention
 - Fluctuation of Attention
 - Distraction of Attention (Causes and Control)

5. Motives

- Definition and Nature
- Classification
- Primary (Biogenic) Motives: Hunger, Thirst, Defecation and Urination, Fatigue, Sleep, Pain, Temperature, Regulation, Maternal Behaviour, Sex
- Secondary (Sociogenic) Motives: Play and Manipulation, Exploration and Curiosity, Affiliation, Achievement and Power, Competition, Cooperation, Social Approval and Self Actualization.

6. Emotions

- Definition and Nature
- Physiological changes during Emotions (Neural, Cardial, Visceral, Glandular),
- Theories of Emotion
- James Lange Theory; Canon-Brad Theory
- Schechter-Singer Theory

7. Learning

- Definition of Learning
- Types of Learning: Classical Operant Conditioning, Methods of Learning: Trial and Error; Learning by Insight; Observational Learning

8. Memory

- Definition and Nature
- Memory Processes: Retention, Recall and Recognition
- Forgetting: Nature and Causes

9. Thinking

- Definition and Nature
- Tools of Thinking: Imagery, Language, Concepts
- Kinds of Thinking
- Problem Solving, Decision Making, Reasoning

Recommended Books

1. Atkinson R. C., & Smith E. E. (2000). Introduction to psychology (13th ed.). Harcourt Brace College Publishers.
2. Fernald, L. D., & Fernald, P. S. (2005). Introduction to psychology. USA: WMC Brown Publishers.
3. Glassman, W. E. (2000). Approaches to psychology. Open University Press. Hayes, N. (2000). Foundation of psychology (3rd ed.). Thomson Learning. Lahey, B. B. (2004). Psychology: An introduction (8th ed.). McGraw-Hill Companies, Inc.
4. Leahey, T. H. (1992). A history of psychology: Main currents in psychological thought. New Jersey: Prentice-Hall International, Inc.
5. Myers, D. G. (1992). Psychology. (3rd ed.). New York: Wadsworth Publishers.
6. Ormord, J. E. (1995). Educational psychology: Developing learners. Prentice- Hall, Inc



POOL COURSES: SOCIAL SCIENCES- II

COURSE TITLE: INTRODUCTION TO SOCIOLOGY

COURSE CODE: SOC-413

CREDIT HOURS: 03

COURSE OBJECTIVES

- To equip student with the basic concepts of sociology and various social phenomenon.
- To familiar the students with social process on the basis of which society is smoothly functioning
- To train students to understand and interpret objectively the role of social process, culture and socialization in their lives.

COURSE CONTENTS:

Introduction

- Introduction, Scope, Nature, and Subject Matter of Sociology
- Historical background
- Sociology as a Science
- Relationship of Sociology with other Social Sciences
- Sociological perspectives in Sociology.
- Role of Sociologists in Society.

Group, Community and Society

- Definition, elements, characteristics of community and society.
- Difference between society and community.
- Various types of societies.
- Difference between rural and urban community.
- Definition and types of social group.

Culture

- Definition, aspects, characteristics, elements, and types of Culture
- Norms, values and social sanctions
- Cultural Universality, Variability, Relativism, Ethnocentrism and Xenocentrism
- Cultural Lag

Socialization & Personality Development

- Meaning, definition and Agencies of Socialization.
- Meaning and definition of self.
- Meaning, definition and types of Personality
- Responsible Factors in Personality Formation.



- Theories of socialization, self and personality development.

Role and Status

- Definition and types of role.
- Definition and types of status.
- Determinants of status

Social Processes

- Social interaction and forms of social interaction
- Cooperation
- Competition
- Conflict
- Assimilation and acculturation
- Accommodation

Social Stratification and Mobility

- Introduction, Definitions, Determinants and types of social stratification.
- Difference between caste and class.
- Theories of social stratification.
- Introduction, meaning and definition of social mobility.
- Dynamics and types of social mobility
- Difference between mobility and migration
- Advantages and disadvantages of social mobility.

Collective Behaviors and Social Movements

- Meaning, definitions, types and nature of collective behaviors.
- Meaning, definitions, types and theories of Crowded.
- Meaning, definitions, kinds, theories, and life cycle of social movements

COURSE RECOMMENDED BOOKS:

1. Ballantine, Jeanne H. and Roberts, Keith A. (Condensed Version) 2010. *Our Social World*. California: Pine Forge Press/Sage Publication.
 2. Brown, Ken 2004. *Sociology*. United Kingdom: Polity Press
 3. Brym, Robert J. and Lie, John. *Sociology: Your compass for a new world* (Brief Edition) 2007 Belmont: Thomson Wadsworth.
 4. Colander, David C. and Hunt, Elgin F. (Thirteenth Edition) (2010) *Social Sciences: An introduction to the study of Society*. India: Pearson Education/Dorling Dindersley.
 5. Gidden, Anthony 2002. *Introduction to Sociology*. UK: Polity Press.
 6. Rao, C. N. Shankar (2008) 'Sociology: Principles of Sociology with an Introduction to Social Thoughts' New Delhi: S. Chand & Company.
 7. James M. Henslin. (2004). *Sociology: A Down to Earth Approach*. Toronto: Allen and Bacon.
 8. Macionis, John J. (2006). 10th Edition *Sociology* New Jersey: Prentice-Hall
 9. Montuschi, Eleonora. (2006). *The Objects of Social Sciences* New York: Continuum.
- Hortun, Paul B. and Hunt, Chester L. 1984. *Sociology*. New York: McGraw-Hill,