Instructions

*Please follow the scheme of studies of relevant prospectus strictly.

*Course Code and Course Title should be carefully noted.

*Prospectus are available in soft form at university website.

*For any clash of scheme of studies in prospectus and outlines, please contact any of the following Focal Persons (Department of Chemistry)

Dr. Matloob Ahmad

Matloob.Ahmad@gcuf.edu.pk

Dr. Samreen Gul Khan

samreenravian@gmail.com

Dr. Tahir Maqbool

drtahirmaqbool@gcuf.edu.pk

BS Chemistry

Session 2019-2023

Semester 1 (Session 2019-2023)

Semester 1		
CHM-301	Fundamental Organic Chemistry	4(3-1)
ENG-321	Functional English	3(3–0)
PST-321	Pakistan Studies	2(2–0)
MTH-301	Calculus-I	4(4–0)
PHY-301	Mechanics-1	4(3-1)
ZOL-301	Principle in Animal Life – I	4(3–1)
BOT-301	Diversity of Plants	4(3–1)
Optional (Any two subjects): Math & Physics or Botany & Zoology		

CHM-301	Fundamental Organic Chemistry	4(3-1)

Basic concepts in chemical bonding

Localized and delocalized bonding. Concept of hybridization leading to bond angles, bond energies and geometry of simple organic molecules; dipole moment; inductive effect; resonance, resonance energy, rules of resonance, resonance effect, steric inhibition of resonance; hyperconjugation; tautomerism; hydrogen bonding.

Nomenclature of organic compounds

Common and trivial name of organic compounds; and introduction to the systematic nomenclature of mono and bi-bunfctional organic compounds by IUPAC rules.

Aromatic Hydrocarbons

Aromatic Compounds Structure of benzene, aromaticity, electrophilic substitution including orientation and reactivity, addition and oxidation reactions, preparation and reactivity of naphthalene.

Isomerism

Geometrical isomerism Determination of configuration of geometrical isomers, Z, E convention and cis- and trans- isomerism in compound containing two double bonds; Optical isomerismOptical activity, chirality and optical activity, racemisation and resolution of racemic mixture, R, S notation, diasteroisomers. Conformational isomerism A brief introduction to conformation of ethane, n-butane and cyclohexane.

Chemistry of the Hydroxyl Group and Ethers

Brief review of the physical properties, preparation and reactions of alcohols. Phenols acidity, preparation and reactions, Ethers preparation, properties and reactions.

Chemistry of Carboxylic Acids and Their Derivatives

Physical properties of carboxylic acids, effect of substitution and structure on the strengths of acidity of carboxylic acids. Preparation, properties and reactions of carboxylic acids and their derivatives i.e. ester, amides, acid halides and acid anhydrides.

CHM-301 Practicals

Sixteen experiments shall be conducted based on the following

a. Techniques

Melting and boiling point determination
Distillation, solvent extraction, crystallization.

b. Qualitative Organic Analysis

Systematic identification of organic compound (1Compounds)

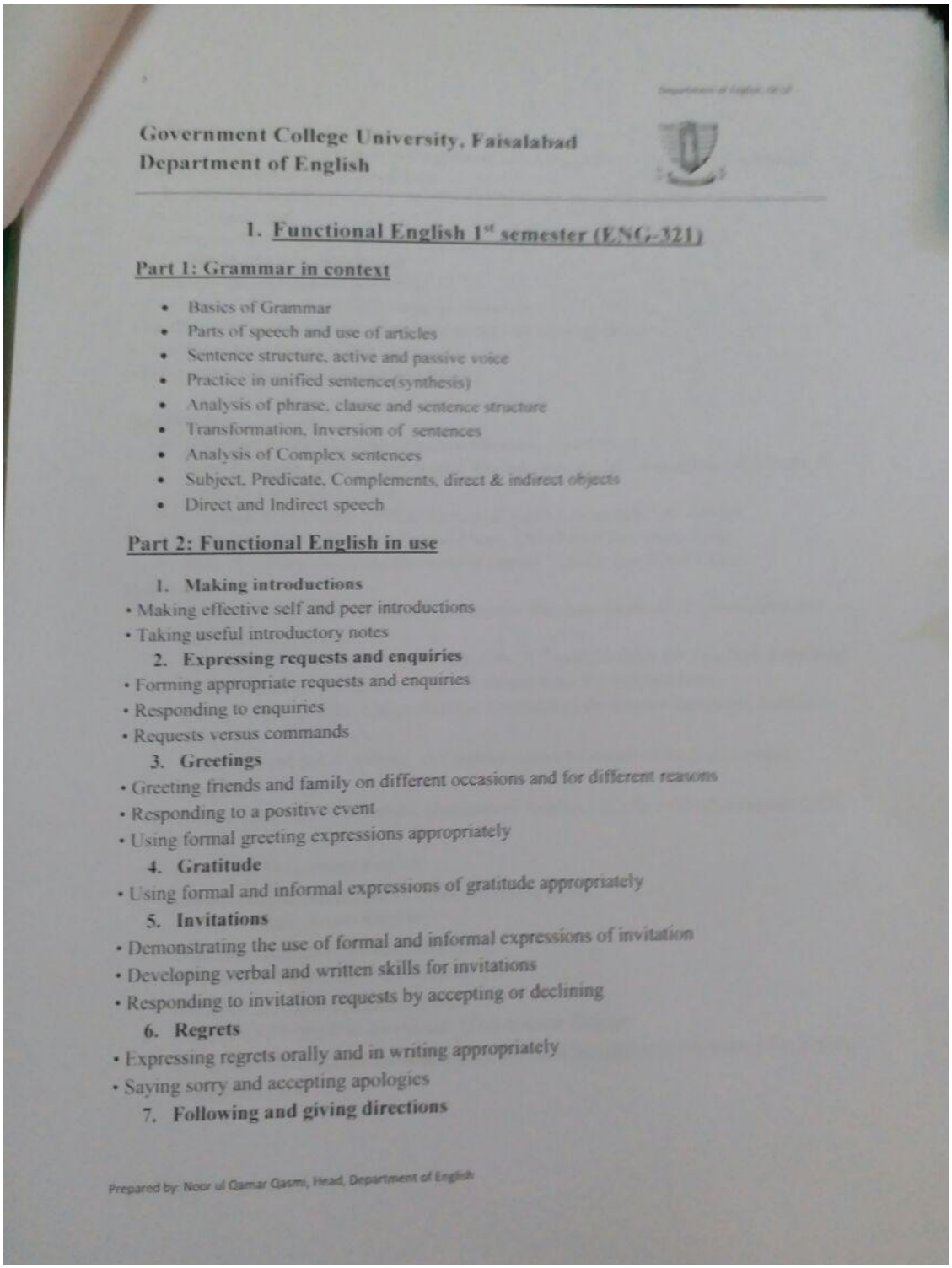
c. Preparation of Organic Compounds

Preparation of simple organic compound like iodoform, aspirin, acetanilide etc (1preparations)

Books Recommended:

1. R. K. Bansal, "A Text book of Organic Chemistry" 2nd Ed, Wiley Eastern Ltd; (1990).
2. I. L. Finar, "Fundamental Principles of Organic Chemistry" 3rd Ed, Vol.1, Longman, (1959).
3. J. March, "Advanced Organic Chemistry Reactions, Mechanisms and Structure" 6th Ed, John Wiley & Sons (2007).
4. J. McMurry, "Organic Chemistry" 5th Ed, Thomson Asia Ltd; Singapore (2000).
5. R. T. Morrison, R. N. Boyd, "Organic Chemistry" 6th Ed, Prentice-Hall, Inc; (1992).
6. S. H. Pine, J. B. Hendrickson, G. S. Hammond, "Organic Chemistry" 4th Ed, McGraw-Hill, Inc; (1992).

ENG-321	Functional English	3(3–0)



Government College University, Faisalabad
Department of English

1. Functional English 1st semester (ENG-321)

Part 1: Grammar in context

- Basics of Grammar
- Parts of speech and use of articles
- Sentence structure, active and passive voice
- Practice in unified sentence(synthesis)
- Analysis of phrase, clause and sentence structure
- Transformation, Inversion of sentences
- Analysis of Complex sentences
- Subject, Predicate, Complements, direct & indirect objects
- Direct and Indirect speech

Part 2: Functional English in use

1. **Making introductions**

• Making effective self and peer introductions
• Taking useful introductory notes

2. **Expressing requests and enquiries**

• Forming appropriate requests and enquiries
• Responding to enquiries
• Requests versus commands

3. **Greetings**

• Greeting friends and family on different occasions and for different reasons
• Responding to a positive event
• Using formal greeting expressions appropriately

4. **Gratitude**

• Using formal and informal expressions of gratitude appropriately

5. **Invitations**

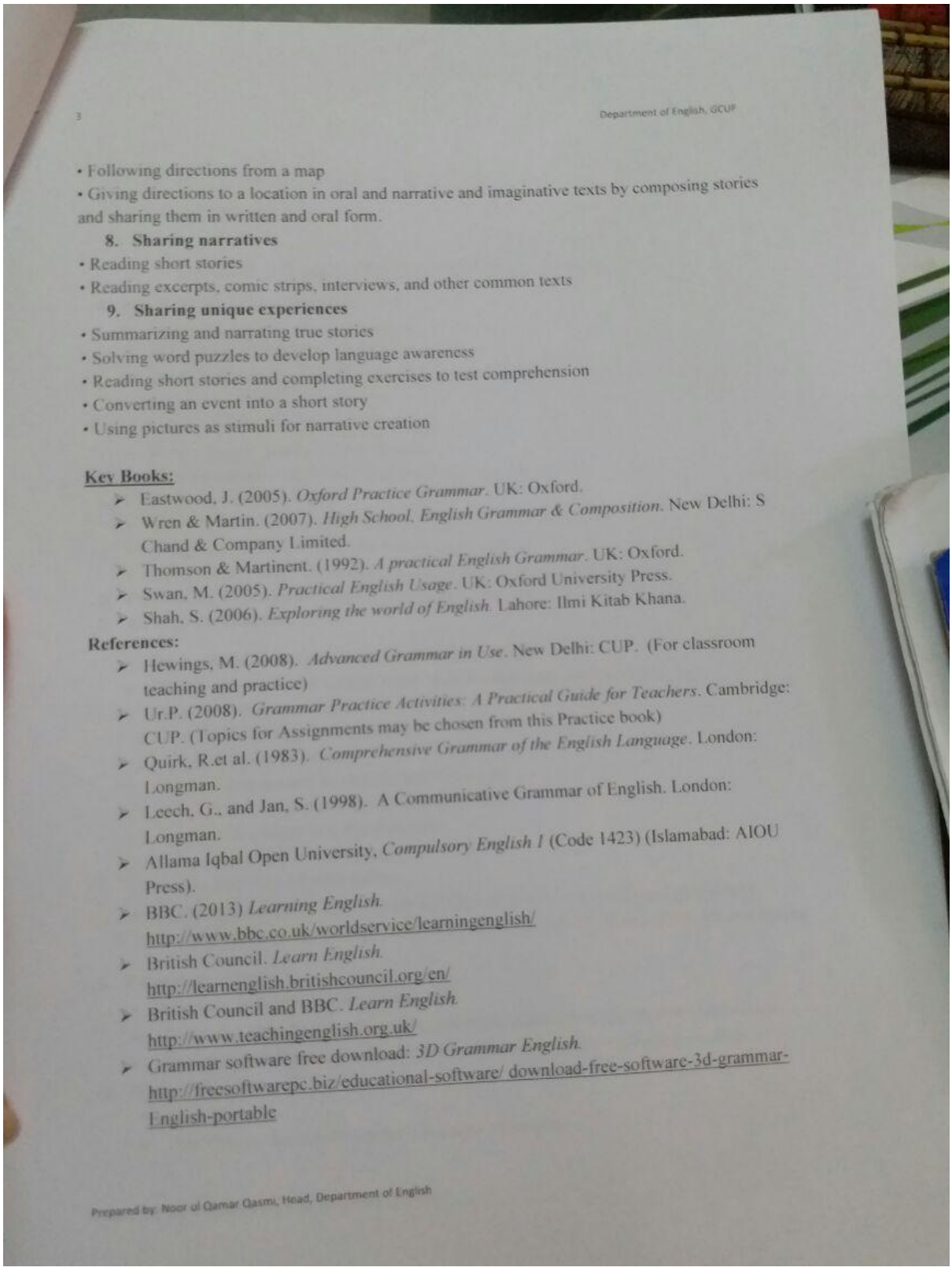
• Demonstrating the use of formal and informal expressions of invitation
• Developing verbal and written skills for invitations
• Responding to invitation requests by accepting or declining

6. **Regrets**

• Expressing regrets orally and in writing appropriately
• Saying sorry and accepting apologies

7. **Following and giving directions**

Prepared by: Noor ul Qamar Qasmi, Head, Department of English



- Following directions from a map
- Giving directions to a location in oral and narrative and imaginative texts by composing stories and sharing them in written and oral form.

8. Sharing narratives

- Reading short stories
- Reading excerpts, comic strips, interviews, and other common texts

9. Sharing unique experiences

- Summarizing and narrating true stories
- Solving word puzzles to develop language awareness
- Reading short stories and completing exercises to test comprehension
- Converting an event into a short story
- Using pictures as stimuli for narrative creation

Key Books:

- Eastwood, J. (2005). *Oxford Practice Grammar*. UK: Oxford.
- Wren & Martin. (2007). *High School, English Grammar & Composition*. New Delhi: S Chand & Company Limited.
- Thomson & Martinent. (1992). *A practical English Grammar*. UK: Oxford.
- Swan, M. (2005). *Practical English Usage*. UK: Oxford University Press.
- Shah, S. (2006). *Exploring the world of English*. Lahore: Ilmi Kitab Khana.

References:

- Hewings, M. (2008). *Advanced Grammar in Use*. New Delhi: CUP. (For classroom teaching and practice)
- Ur.P. (2008). *Grammar Practice Activities: A Practical Guide for Teachers*. Cambridge: CUP. (Topics for Assignments may be chosen from this Practice book)
- Quirk, R.et al. (1983). *Comprehensive Grammar of the English Language*. London: Longman.
- Leech, G., and Jan, S. (1998). A Communicative Grammar of English. London: Longman.
- Allama Iqbal Open University, *Compulsory English 1* (Code 1423) (Islamabad: AIOU Press).
- BBC. (2013) *Learning English.* http://www.bbc.co.uk/worldservice/learningenglish/
- British Council. *Learn English.* http://learnenglish.britishcouncil.org/en/
- British Council and BBC. *Learn English.* http://www.teachingenglish.org.uk/
- Grammar software free download: *3D Grammar English.* http://freesoftwarepc.biz/educational-software/ download-free-software-3d-grammar-English-portable

PST-321	Pakistan Studies	2(2–0)

COURSE OUTLINE:

1. Regeneration of Muslim Society in sub-continent and causes of decline of Muslim Rule
2. War of Independence 1857 and its impacts upon the politics of South Asia.
3. Sir Syed Ahmed Khan and Aligarh Movement:
   - i) Educational Services
   - ii) Political Services
   - iii) Rational Interpretation of Islam
4. All India Muslim League:
   - i) Multiple approaches and causes of the formation of Muslim League.
   - ii) Objectives of the party.
   - iii) Comparison of the policies of All Indian National congress and All India Muslim League.
   - iv) Politics of Muslim League after the creation of Pakistan
5. Luckhnow Pact 1916, high water mark of Hindu-Muslim Unity.
6. Khilafat Movement:
   - i) Khilafat as an institution.
   - ii) Hindu-Muslim Unity.
   - iii) Role of Gandhi
   - iv) Emergence of Muslim Ulma in Indian politics.
   - v) Causes of the failure and impacts of the movement.
7. Iqbal's Address at Allahabad 1930 and political thoughts of Ch. Rehmat Ali.
8. Congress Ministries.
9. Pakistan Resolution 1940.
10. Muhammad Ali Jinnah:
    - i) Jinnah's role in Indian politician.
    - ii) As a governor General
11. Initial problems and constitutional development in Pakistan.
12. The study of constitutions of Pakistan (1956-1962-1973)
13. Political culture of Pakistan.
14. Foreign Policy of Pakistan:
    - i) Major determinants and objectives
    - ii) Overview.

Recommended Books:

1. Ikram Rabbani, *Pakistan Studies*, Carvaan Publishers.
2. M. R. Kazimi, *Pakistan Studies*, Oxfiord University Press.
3. Khalid Bin Saeed, *Pakistan the Formative Phase*.
4. I.H. Qureshi, *Struggle for Pakistan*, Karachi: Oxford, 1995.

5. Safdar Mahmood, *Pakistan: Political Roots and Development*, 1947-1999, Karachi, Oxford, 2000.

MTH-301	Calculus-I	4(4–0)

Prerequisites: Knowledge of Intermediate Calculus

Functions and graphs: Functions. Domains and Ranges. Sum of functions. Composition of functions. Inverse functions. Symmetry. Even and odd functions. Translations. Reflections. Rational, algebraic, trigonometric, logarithmic and exponential functions. Functions defined in pieces.

Limits and continuity: Limit of a function. Graphical approach. Properties of limits. Limits of polynomials, rational and transcendental functions. Infinite limits and vertical asymptotes. Limits at infinity and horizontal asymptotes. One-sided limits. Continuity, Continuity of polynomials, rational functions and composition of functions. Properties of continuous functions. Continuity from the left and right.

Derivatives: Slopes and rates of change. Definition of derivative. Differentiability and continuity. Derivatives at the end point of an interval. Techniques of differentiation. Derivatives of polynomials and rational, exponential, logarithmic and trigonometric functions. Chain rule. Implicit differentiation. Rates of change in natural and social sciences. Related rates. Linear approximations and differentials. Higher derivatives. Leibnitz's theorem.

Applications of derivatives: Increasing and decreasing functions. Relative extrema and optimization. First derivative test for relative extrema. Convexity and point of inflection. Second derivative test for extrema. Curve sketching. Mean value theorem (without proof). Indeterminate forms. L'Hospital's rule (without proof) and its applications.

Recommended Books:

1. H. Anton, I. Bevens, S. Davis, *Calculus* (10th ed.), John Wiley & Sons, 2012.
2. J. R. Hass, C. E. Heil, M. D. Weir, *Thomas's Calculus* (14th ed.), Pearson, 2017.
3. D. Hughes-Hallett, A. M. Gleason, W. G. McCallum et al. *Calculus: Single Variable* (6th ed.), Wiley, 2012.
4. J. Stewart, *Calculus* (8th ed.), Cengage Learning, Boston, 2012.
5. E. W. Swokowski, *Calculus with Analytic Geometry* (6th ed.), PWS-Kent Publishing Company, 1994.

PHY-301	Mechanics – I	4(3 – 1)

Vectors in 3-dimensions & fundamental operations, Stoke's theorem, Gauss's Divergence theorem, Dynamics of Uniform circular motion, The Conical pendulum, The Rotor, The Banked curve, Equations of motion, Time-dependent forces, Velocity-dependent forces, Non-Inertial frames & Pseudo forces, projectile motion, Work done by constant & variable forces (one, & two dimension cases), K.E & the work-energy theorem, general proof of work-energy theorem, power, conservative forces, P.E, one-dimensional conservative system, Two & many particle system, calculation of c.m. of different objects, Linear momentum of Particle & system of particles, conservation of linear momentum, system of variable mass, Rocket equation, collision, impulse and momentum, Elastic and inelastic collisions in one dimension & two dimensions, centre of mass reference frame.

Practicals:-

1. To Study the damping features of an oscillation system using simple pendulum of variable mass.
2. To determine the value of 'g' by compound pendulum.
3. To determine the modulus of rigidity of a flat spiral spring.
4. To determine the modulus of rigidity of a wire by solid cylindrical rod

Recommended Books:

1. Halliday, Resnick and Walker, 2011. Fundamental of Physics 9th Ed. John Wiley and Sons Inc, New York.
2. Resnick, Halliday and Krane, 2002. Physics Vol. I, 5th Ed. John Wiley and Sons Inc, New York.
3. Sears, Zemansky and Young, 2000. University Physics 8th Ed. Addison-Wesley, Reading (MA), USA.
4. Alonso and Finn, 1999. Physics. Addison-Wesley, Reading (M.A), USA

ZOL-301	Principle in Animal Life – I	4(3–1)

Course Title	PRINCIPLES in ANIMAL LIFE – I
Course Code	ZOL-301
Credit Hours	4(3-1)
Theory	3
Practical	1
Follow up	**BS**
Aims and Objectives	The course aims to impart knowledge and understanding of: a. The concept and status of Zoology in life sciences. b. The common processes of life through its chemistry, biochemical and molecular processes. c. The structure and function of cell organellae and how common animal cell diversified in various tissues, organs and organ systems.

	d. Biochemical mechanisms eventually generating energy for animal work. e. Animals and their relationship with their environment.
Learning Outcomes	
Syllabus in Brief	**Course Contents** 1. Place of Zoology in Science A one-world view: genetic unity, the fundamental unit of life, evolutionary oneness and the diversity of life, environment and world resources; what is Zoology? The classification of animals; the scientific method. 2. The Chemical Basis of Animal Life Atoms and elements: building blocks of all matter; compounds and molecules: aggregates of atoms; acids, bases, and buffers; the molecules of animals: fractional account of carbohydrates, lipids, proteins, nucleotides and nucleic acids based on their structural aspects. 3. Cells, Tissues, Organs, and Organ System of Animals Structure and functions of cell membranes; various movements across membranes; cytoplasm, organelles, and cellular components: functional account of ribosomes, endoplasmic reticulum, golgi apparatus, lysosomes, mitochondria, cytoskeleton, cilia and flagella, centrioles and microtubules, and vacuoles based on their structural aspects. The nucleus: nuclear envelope, chromosomes and nucleolus. Tissues: diversity in epithelial tissue, connective tissue, muscle tissue and nervous tissue to perform various functions. Structural integrations for functions in organs and organ systems. 4. Energy and Enzymes: Life's Driving and Controlling Forces Energy and the laws of energy transformation; activation energy; enzymes: structure, function and factors affecting their activity; cofactors and coenzymes; ATP: how cells convert energy? An overview. 5. How Animals Harvest Energy Stored in Nutrients: Glycolysis: the first phase of nutrient metabolism; fermentation: "life without oxygen"; aerobic respiration: the major source of ATP; metabolism of fats and proteins; control of metabolism; the metabolic pool. 6. Ecology I: Individuals and Populations Animals and their abiotic environment; populations; interspecific interactions. 7. Ecology II: Communities and Ecosystems Community structure and diversity; ecosystems; ecosystems of the earth; ecological problems; human population growth, pollution, resource depletion and biodiversity. Practicals 1. Tests for different carbohydrates, proteins and lipids. Note: Emphasis on the concept that tests materials have been

	ultimately obtained from living organisms and constituted their body. 2. Study of the prepared slides of epithelial tissue (squamous, cuboidal, columnar), connective tissue (adipose, cartilage, bone, blood), nervous tissue and muscle tissue (skeletal, smooth and cardiac). *Note*: *Prepared microscopic and/or projection slides and/or CD ROM computer projections must be used.* 3. Plasmolysis and deplasmolysis in blood. 4. Protein digestion by pepsin. 5. Ecological notes on animals of a few model habitats. 6. Field observation and report writing on animals in their ecosystem (a terrestrial and an aquatic ecosystem study). Books Recommended 1. Hickman, C.P., Roberts, L.S. and Larson, A. INTEGRATED PRINCIPLES OF ZOOLOGY, 12th Edition (International), 2004. Singapore: McGraw Hill. 2. Miller, S.A. and Harley, J.B. ZOOLOGY, 6th Edition (International), 2005. Singapore: McGraw Hill. 3. Pechenik, J.A. BIOLOGY OF INVERTEBRATES, 5th Edition (International), 2000. Singapore: McGraw Hill. 4. Kent, G.C. and Miller, S. COMPARATIVE ANATOMY OF VERTEBRATES, 2001. New York: McGraw Hill. 5. Campbell, N.A. BIOLOGY, 6th Edition. 2002. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc. 6. Miller, S.A. GENERAL ZOOLOGY LABORATORY MANUAL. 5th Edition (International), 2002. Singapore: McGraw Hill. 7. Hickman, C.P. and Kats, H.L., LABORATORY STUDIES IN INTEGRATED PRINCIPLES OF ZOOLOGY. 2000. Singapore: McGraw Hill. 8. Molles, M.C. ECOLOGY: CONCEPTS AND APPLICATIONS. 6th Edition. 2005. McGraw Hill, New York, USA. 9. Odum, E. P. FUNDAMENTALS OF ECOLOGY. 3rd Edition. 1994. W.B. Saunders.Philadelphia. 10. Slingby, D. and Cook, C., PRACTICAL ECOLOGY. 1986. McMillan Education Ltd. UK.

BOT-301	Diversity of Plants	4(3–1)

Title of the Course: Bot-301 Diversity of Plants
Credit Hours: 4 (3+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:

a) Viruses (RNA and DNA types) with special reference to TMV;
b) Bacteria and Cyanobacteria (Nostoc, Anabaena, Oscillatoria) with specific reference to biofertilizers, pathogenicity and industrial importance;
c) Algae (Chlamydomonas, Spirogyra, Chara, Vaucheria, Pinnularia, Ectocarpus, Polysiphonia)
d) Fungi (Mucor, Penicillium, Phyllactinia, Ustilago, Puccinia, Agaricus), their implication on crop production and industrial applications.
e) Lichens (Physcia)
f) Bryophytes
   i. Riccia
   ii. Anthoceros
   iii. Funaria

g) Pteridophytes.
   i. Psilopsida (Psilotum)
   ii. Lycopsida (Selaginella)
   iii. Sphenopsida (Equisetum)
   iv. Pteropsida (Marsilea)

h) Gymnosperms
   i. Cycas
   ii. Pinus
   iii. Ephedra
i) Angiosperms
   i. Monocot (Poaceae)
   ii. Dicot (Solanaceae)

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.

Recommended Books:

1. Lee, R. E. 1999. Phycology. Cambridge University Press, UK
1. Prescott, L. M., Harley, J. P. and Klein, A. D. 2004. Microbiology, 3rd Ed. WM. C. Brown Publishers.
2. Alexopoulos, C. J., Mims, C. W. and Blackwell, M. 1996. Introductory Mycology. 4th Ed. John Wiley and Sons Publishers.
3. Agrios, G. N. 2004. Plant pathology. 8th Ed. Academic Press London.
4. Vashishta, B. R. 1991. Botany for degree students (all volumes). S. Chand and Company. Ltd. New Delhi.
5. Andrew, H. N. 1961. Studies in Paleobotany. John Willey and Sons.
6. Ingrouille , M. 1992. Diversity and Evolution of Land Plants. Chapman & Hall.
7. Mauseth, J. D. 2003. Botany: An Introduction to Plant Biology 3rd Ed., Jones and Bartlett Pub. UK
8. Marti. J. Ingrouille & Plant: Diversity and Evolution. 2006 CUP
9. Taylor, T. N. & Taylor, E. D. 2000. Biology and Evolution of Fossil Plants. Prentice Hall. N. Y.
10. Hussain, F. 2012. A Text Book of Botany and Biodiversity. Pak Book Empire.

Journals / Periodicals:

Pakistan Journal of Botany, American Journal of Botany, Canadian Journal of Botany, Annals of Botany.

Semester 2 (Session 2019-2023)

Semester 2		
CHM-302	Fundamental Inorganic Chemistry	4(3-1)
ENG-322	English Comprehension and Composition	3 (3-0)
ISL-321	Islamic Studies	2(2–0)
MTH-302	Calculus-II	4(4–0)
PHY-302	Mechanics-II	4(3–1)
ZOL-302	Principle in Animal Life – II	4(3–1)
BOT-302	Systematic, Anatomy and Development	4(3–1)
Optional (Any two subjects): Math & Physics or Botany & Zoology		

CHM-302	Fundamental Inorganic Chemistry	4(3-1)

The periodic Law and Periodicity

Development of periodic table; Classification of elements based on s, p, d, and f orbitals, group trends and periodic properties in s, p, d and f block elements i.e., atomic radii, ionic radii, ionization potentials. Electron affinities, electronegativities and redox potential.

Chemical Bonding in Main Block Elements

Nature and types of chemical bonding, lewis concepts, ionic, covalent, coordinate covalent bond; Valence bond theory (VBT), Molecular orbital theory (MOT). Interpretation of shapes of inorganic molecules on the basis of valence shell electron pair repulsion (VSEPR) theory and hybridization.

Acid and Bases

Concepts of acids and bases including soft and hard acid base concepts. Relative strengths of acids and bases, significance of pH, pKa, pKb and buffers solutions. Theories of indicators; (acid base, redox, adsorption). Solubility, solubility product, common ion effect and their industrial applications.

Chemistry of the p-block Elements

General characteristics of the following group of p-block elements with reference to the aspects given against each

Carbon and Silicon:

Group anomalies. Allotropic forms of carbon, fullerenes and their applications. Production of pure silicon for solar energy and silicon chips, silicates and silicones and industrial applications.

Nitrogen and Phosphorus

Group anomalies. Preparation, structures, properties and the environmental role of oxides of nitrogen. Industrial superphosphate fertilizers. Causes of fog and smog.

Oxygen and Sulfur

Group anomalies. Preparation, structure, properties and environmental role of oxides and oxyacids of sulphur, manufacturing of sulphric acid and its reactions. Thionic acids and use of hypo in industry.

The Halogens

Anomalous behavior of fluorine. Industrial preparation of chlorine. Preparation, structures, properties and uses of oxides, oxyacids of chlorine, interhalogens and pseudohalogens.

The Noble Gases

Preparation, properties, structures and uses of xenon fluorides; commercial uses of noble gases.

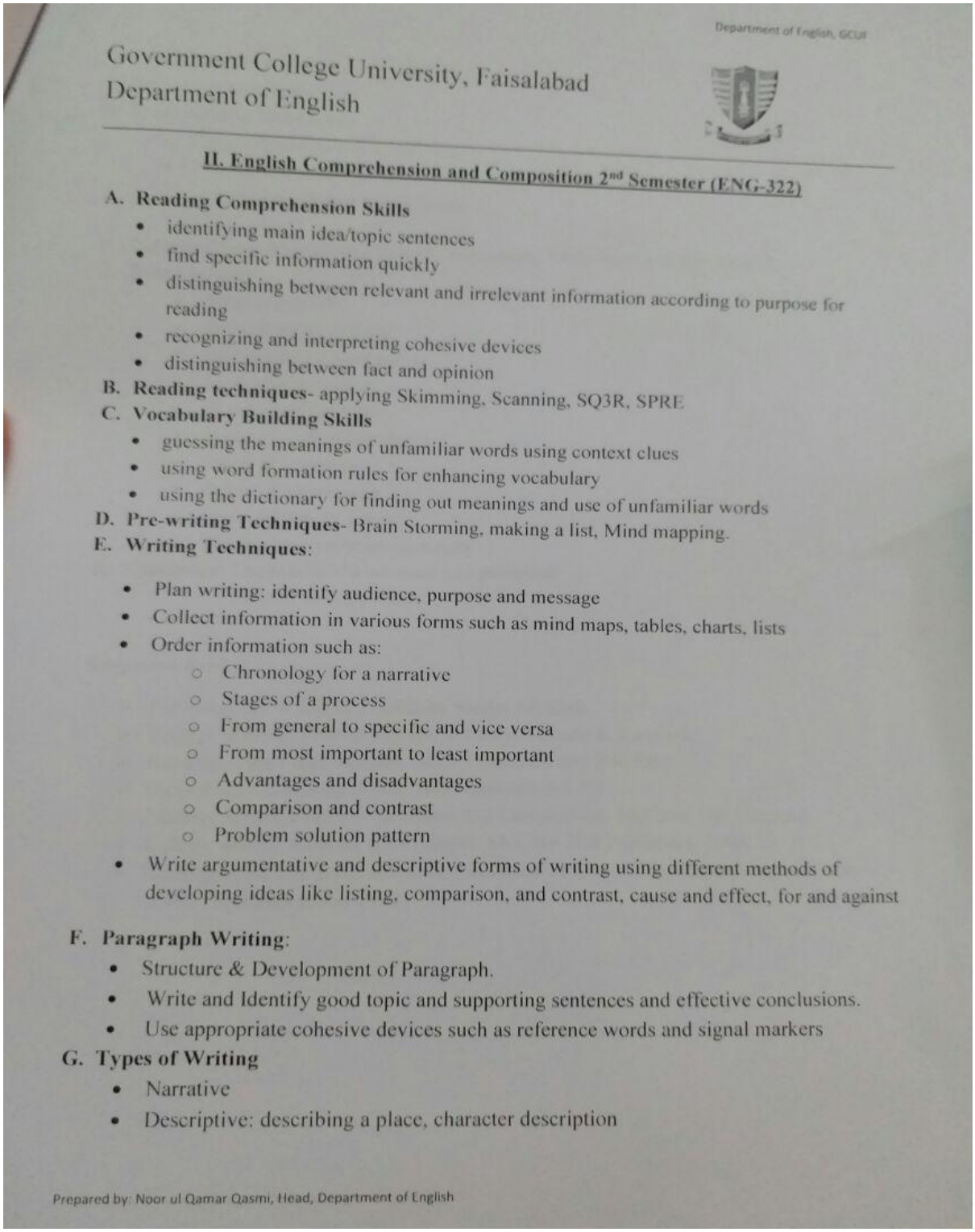
CHM-302 Practicals

1. **Laboratory Ethics and Safety Measures:**
   Awareness about the toxic nature of chemicals and their handling, cleaning of glassware, safe laboratory operations.
2. **Qualitative Analysis**
   Analysis of four ions (two cations and two anions) from mixture of salts.
3. Preparation and standardization of normal and molar solutions of HCl, NaOH and $KmnO_4$.
4. **Quantitative analysis**
   - Determination of total hardness of water using EDTA.
   - Estimation of magnesium using EDTA.
   - Estimation of copper (iodometrically).
   - Determinstion of ferricyanide using KI solution
   - Determination of chloride by Volhard and Mohr methods.
   - Estimation of chloride/bromide ions using adsorption (fluorescein) indicator.
   - Percentage determination of ferric ions in ferric alum using $KMnO_4$ solution.
   - Determination of purity of commercial potassium oxalate using $KMnO_4$ solution
   - Estimation of ferrous / ferric ions using $K_2Cr_2O_7$ solution.
   - Percentage determination of barium in barium nitrate by gravimetric method.
   - Gravimetric determination of nickel.

Books Recommended:

1. F. A. Cotton, G. Wilkinson, C. A. Murillo, M. Bockhmann, "Basic Inorganic Chemistry" 2nd Ed, John Wiley & Sons, USA (1987).
2. B. Douglas, D. McDaniel, J. Alexander, "Concepts and Models of Inorganic Chemistry" 3rd Ed, John Wiley & Sons, Inc. (1994).
3. J. W. Hill, R. H. Petrucci, "General Chemistry" 8th Ed, Prentice-Hall, Inc. (1996).
4. J. E. Huheey, "Inorganic Chemistry Principles of Structure and Reactivity" 2nd Ed, Harper and Row Publishers (1978).
5. J. D. Lee, "Concise Inorganic Chemistry" 5th Ed, Chapman and Hall (1996).
6. G. L. Miessler, A. T. Donald, "Inorganic Chemistry" 2nd Ed., Prentice-Hall International, Inc. (1991).
7. B. Moody, "Comparative Inorganic Chemistry" 3rd Ed, Routledge, Chapman and Hall, Inc.(1991).
8. D. F. Shriver, P.W. Atkins, C. H. Langford, "Inorganic Chemistry" Oxford University Press USA (1994).

ENG-322	English Comprehension and Composition	3 (3 – 0)



Department of English, GCUF

Government College University, Faisalabad
Department of English

II. English Comprehension and Composition 2nd Semester (ENG-322)

A. **Reading Comprehension Skills**
- identifying main idea/topic sentences
- find specific information quickly
- distinguishing between relevant and irrelevant information according to purpose for reading
- recognizing and interpreting cohesive devices
- distinguishing between fact and opinion

B. **Reading techniques**- applying Skimming, Scanning, SQ3R, SPRE

C. **Vocabulary Building Skills**
- guessing the meanings of unfamiliar words using context clues
- using word formation rules for enhancing vocabulary
- using the dictionary for finding out meanings and use of unfamiliar words

D. **Pre-writing Techniques**- Brain Storming, making a list, Mind mapping.

E. **Writing Techniques**:
- Plan writing: identify audience, purpose and message
- Collect information in various forms such as mind maps, tables, charts, lists
- Order information such as:
  - Chronology for a narrative
  - Stages of a process
  - From general to specific and vice versa
  - From most important to least important
  - Advantages and disadvantages
  - Comparison and contrast
  - Problem solution pattern
- Write argumentative and descriptive forms of writing using different methods of developing ideas like listing, comparison, and contrast, cause and effect, for and against

F. **Paragraph Writing**:
- Structure & Development of Paragraph.
- Write and Identify good topic and supporting sentences and effective conclusions.
- Use appropriate cohesive devices such as reference words and signal markers

G. **Types of Writing**
- Narrative
- Descriptive: describing a place, character description

Prepared by: Noor ul Qamar Qasmi, Head, Department of English

- Expository
- Argumentative

H. Essay writing techniques:

- Structure and outline of an essay.
- Writing Introductions and conclusions of an essay.
- Unity and coherence in an essay

I. Paraphrasing: What is Paraphrase? Paraphrasing Techniques and how to apply

J. Précis writing

- What is Précis?
- Uses of précis writing
- Essentials of a good précis
- Method of procedure
- How to find the title
- Précis of a phrase or clause
- Précis of a Sentence
- Précis of a Paragraph
- Summarizing an article
- Writing an assignment summary

K. Expansion: Expansion of a sentence into paragraph
Method of Expansion

Suggested Books:

- Exploring the World of English by Saadat Ali Shah
- College Writing: From paragraph to Essay: Zemach & Rumisek
- Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis.
- Oxford Supplementary Skills. Third Impression 1992.
- Glencoe Writer's Choice: Grammar and Composition. McGraw Hill Glencoe
- College writing skills by John Langan. McGraw Hill Publishers, 2004
- Reading upper intermediate. Brain Tomlinson and Rod Ellis. Oxford supplementary skills. Third impression 1992

ISL-321	Islamic Studies	2(2–0)

BA BSc (Complusory, Elective, Optional)

سلیبس اسلامیات (لازمی) بی اے دوسالہ پروگرام

نصاب مطالعہ اسلامیات (لازمی)

برائے بی اے، بی ایس سی اور بی کام

مطالعہ اسلامیات (لازمی) کے لیے 60 نمبر مختص ہوں گے۔

نصابی خاکہ

۱۔قرآن مجید	20نمبر
۲۔حدیث شریف	10نمبر
۳۔سیرت النبی ﷺ	10نمبر
۴۔اسلامی تہذیب وثقافت	10نمبر
۵۔معروضی سوالات	10نمبر

(معروضی سوالات پورے نصاب پر مشتمل ہوں گے)

اس مضمون کی تدریس وامتحانات کے لیے اردو، عربی اور انگریزی زبانوں کی اجازت ہے۔

نصابی تفصیلات

اہداف ومقاصد:

۱۔ طلبہ کو قرآن وحدیث سے استفادہ کے قابل بنانا۔

۲۔ طلبہ کے قلوب واذہان میں قرآن وسنت کی روح اور علم کو راسخ کرنا۔

۳۔ طلبہ میں اسوہ ختم المرسلین صلی اللہ علیہ وسلم کی اتباع اور حب رسول کا جذبہ پیدا کرنا۔

۴۔ اسلام کی بنیادی تعلیمات کا فہم آسان بنانا اور طلبہ کی اسلامی بنیادوں پر تربیت کرنا۔

۵۔ امت مسلمہ کو درپیش عصر جدید کے چیلنجوں سے طلبہ کو آگاہ کرنا۔

نصابی تفصیلات:

۱۔القرآن الکریم

(الف) قواعد لغۃ القرآن (قرآنی گرائمر)

الماضی والمضارع، الامر والنهی، الجملة الاسمیة والفعلیة، المرکب الاضافی والتوصیفی، الضمائر و حروف الجر.

(ب) منتخب قرآنی آیات کا لغوی و بامحاورہ ترجمہ و تشریح

مطالعہ قرآن مجید کی ضرورت و اہمیت

قرآن مجید سے متعلق موضوعات کے بارے میں آیت دی جائے گی اور آیت کی تشریح طلب کی جائے گی۔

<u>قرآن مجید کی مندرجہ ذیل آیات کا ترجمہ و تشریح کریں</u>

(i) (سورۃ البقرۃ (2) آیات 1 تا 5 و 284 تا 286) ایمانیات۔

(ii) (سورۃ الاحزاب (33) آیات: 6,21,32,33,40,56 تا 59)

(تخصصات نبویہ: اسوہ حسنہ، ختم نبوت، مقام رسالت، ناموس رسالت، ازواج النبیؐ)۔

(iii) الفتح (48) آیت: (29). (رسالت محمدیہ اور خصائص اصحاب رسولؐ)

(iv) سورۃ الصف (61) آیات: 1 تا 14 (بشارت بعثت ختم المرسلین، ہجرت، جہاد، نصرت اور غلبہ دین)

(v) سورۃ الحجرات: (49) آیات: 1 تا 18. (ادب نبوی و معاشرتی احکام)

(vi) سورۃ الانعام: (06) آیات: 151 تا 153۔ (حقوق العباد)۔

(vi) سورۃ الفرقان: (25) آیات: 63 تا 77۔ (آداب معاشرت)۔

(vii) (سورۃ النحل: 16) آیات: 12 تا 14۔ (تفکر و تدبر)۔

<u>الاحادیث النبویة</u>

<u>منتخب احادیث نبویہ کا لغوی و بامحاورہ ترجمہ اور تشریح</u>

(نوٹ) اساتذہ کرام آیات و احادیث کی تعلیم و تدریس کے دوران لغوی اور بامحاورہ ترجمہ کے ضمن میں مندرجہ بالا قواعد عربیہ کی تطبیق کریں۔

۱. عَنْ عُمَرَ بْنِ الْخَطَّابِ رَضِیَ اللّٰہ عَنْہُ قَالَ سَمِعْتُ رَسُوْلَ اللّٰہِ صَلَّی اللّٰہُ عَلَیْہِ وَسَلَّمَ یَقُوْلُ: اِنَّمَا الاَعْمَالُ بِالنِّیَّاتِ، وَ اِنَّمَا لِامْرِیءٍ مَانَوٰی، فَمَنْ کَانَتْ ھِجْرَتُہٗ اِلٰی اللّٰہِ وَرَسُوْلِہٖ فَھِجْرَتُہٗ اِلَی اللّٰہِ وَرَسُوْلِہٖ. وَ مَنْ کَانَتْ ھِجْرَتُہٗ اِلٰی دُنْیَا یُصِیْبُھَا ، اَوِ امْرَاَۃٍ یَتَزَوَّجُھَا فَھِجْرَتُہٗ اِلٰی مَا ھَاجَرَ اِلَیْہِ (بخاری: ۱)

۲. عَنْ عُثْمَانَ بْنِ عَفَّان رَضِیَ اللّٰہ عَنْہُ عَنِ النَّبِیِّ صَلَّی اللّٰہُ عَلَیْہِ وَسَلَّمَ قَالَ: خَیْرُکُمْ مَنْ تَعَلَّمَ الْقُرْآنَ وَعَلَّمَہٗ (بخاری نمبر ۵۰۲۷)

۳. عَن مالِک بنِ اَنَسٍ رَضِیَ اللّٰہ عَنْہُ قَالَ: قَالَ رَسُوْلُ اللّٰہِ صَلَّی اللّٰہُ عَلَیْہِ وَسَلَّمَ: تَرَکْتُ فِیْکُمْ اَمْرَیْنِ لَنْ تَضِلُّوْا مَا تَمَسَّکْتُم بِھِمَا کِتَابُ اللّٰہِ وَسُنَّۃُ رَسُوْلِہ (رواہ مالک فی الموطا مرسلا)

۴. عَنْ عَبْدِاللّٰہِ بْنِ عُمَرَرَضِیَ اللّٰہُ عَنْھُمَا قَالَ: قَالَ رَسُوْلُ اللّٰہِ صَلَّی اللّٰہُ عَلَیْہِ وَسَلَّمَ بُنِیَ الْاِسْلَامُ عَلٰی خَمْسٍ شَھَادَۃِ اَنْ لَّآ اِلٰہَ اِلَّا اللّٰہُ وَاَنَّ مُحَمَّدًا عَبْدُہٗ وَرَسُوْلُہٗ وَ اِقَامِ الصَّلٰوۃِ وَاِیْتَآءِ الزَّکٰوۃِ وَحَجِّ الْبَیْتِ وَصَوْمِ رَمَضَانَ (صحیح مسلم: ۱۱۳)

۵. عَن عُمَرَ بنِ الْخَطَّابِ رَضِیَ اللّٰہ عَنْہُ قَالَ بَیْنَمَا نَحْنُ عِنْد رَسُوْلِ اللّٰہِ صَلَّی اللّٰہُ عَلَیْہِ وَسَلَّمَ ذَاتَ یَوْمٍ اِذ طَلَعَ عَلَیْنَا رَجُلٌ شَدِیْدُ بَیَاضِ الثِّیَابِ شَدِیْدُ سَوَادِ الشَّعْرِ لَایُرٰی عَلَیْہِ اَثَرُ السَّفَرِ وَمَا یَعْرِفُہٗ مِنَّا اَحَدٌ حَتّٰی جَلَسَ اِلَی النَّبِیِّ صَلَّی اللّٰہُ عَلَیْہِ وَسَلَّمَ فَاَسْنَدَ رُکْبَتَیْہِ اِلٰی رُکْبَتَیْہِ وَ وَضَعَ کَفَّیْہِ عَلٰی فَخِذَیْہِ وَقَالَ: یَا مُحَمَّدُ اَخْبِرْنِیْ عَنِ الْاِسْلَامِ؟ فَقَالَ رَسُوْلُ اللّٰہِ صَلَّی اللّٰہُ عَلَیْہِ وَسَلَّمَ: الاِسْلَامُ

اَنْ تَشْهَدَ اَنْ لَا اِلٰهَ اِلَّا اللّٰهُ وَاَنَّ مُحَمَّداً رَّسُوْلُ اللّٰهِ صَلَّى اللّٰهُ عَلَيْهِ وَسَلَّمَ وَتُقِيْمَ الصَّلٰوةَ وَتُؤْتِيَ الزَّكٰوةَ وَتَصُوْمَ رَمَضَانَ وَتَحُجَّ الْبَيْتَ اِنِ اسْتَطَعْتَ اِلَيْهِ سَبِيْلاً ،قَالَ صَدَقْتَ، قَالَ فَعَجِبْنَا لَهٗ يَسْأَلُهٗ وَيُصَدِّقُهٗ ،قَالَ: فَاَخْبِرْنِيْ عَنِ الْاِيْمَانِ؟ قَالَ اَنْ تُؤْمِنَ بِاللّٰهِ وَ مَلٰئِكَتِهٖ وَكُتُبِهٖ وَرُسُلِهٖ وَالْيَوْمِ الْاٰخِرِ وَتُؤْمِنَ بِالْقَدْرِ خَيْرِهٖ وَشَرِّهٖ ، قَالَ صَدَقْتَ، قَالَ:فَاَخْبِرْنِيْ عَنِ الْاِحْسَانِ؟ قَالَ :اَنْ تَعْبُدَ اللّٰهَ كَاَنَّكَ تَرَاهُ فَاِنْ لَّمْ تَكُنْ تَرَاهُ فَاِنَّهٗ يَرَاكَ،قَالَ:فَاَخْبِرْنِيْ عَنِ السَّاعَةِ؟ قَالَ: مَا الْمَسْئُوْلُ عَنْهَا بِاَعْلَمَ مِنَ السَّائِلِ، قَالَ:فَاَخْبِرْنِيْ عَنْ اَمَارَاتِهَا ؟ قَالَ: اَنْ تَلِدَ الْاَمَةُ رَبَّتَهَا وَ اَنْ تَرَى الْحُفَاةَ الْعُرَاةَ الْعَالَةَ رِعَاءَ الشَّاءِ يَتَطَاوَلُوْنَ فِي الْبُنْيَانِ، قَالَ: ثُمَّ انْطَلَقَ، فَلَبِثْ مَلِيًّا ثُمَّ قَالَ لِيْ: يَا عُمَرُ اَ تَدْرِيْ مَنِ السَّائِلُ؟ قُلْتُ اَللّٰهُ وَرَسُوْلُهٗ اَعْلَمُ، قَالَ فَاِنَّهٗ جِبْرِيْلُ اَتَاكُمْ يُعَلِّمُكُمْ دِيْنَكُمْ (رواه مسلم : ۹۳)

۶. عَنْ شِبْرُمَةَ ابْنِ مَعْبَدٍ رَضِيَ اللّٰهُ عَنْهُ قَالَ: قَالَ رَسُوْلُ اللّٰهِ صَلَّى اللّٰهُ عَلَيْهِ وَسَلَّمَ مُرُوْا الصَّبِيَّ بِالصَّلٰوةِ اِذَا بَلَغَ سَبْعَ سِنِيْنَ وَ اِذَا بَلَغَ عَشْرَ سِنِيْنَ فَاضْرِبُوْا عَلَيْهَا اَخْرَجَه اَبُوْدَاوُدَ وَ التِّرْمِذِيُّ وَلَفْظُهٗ عَلِّمُوْا الصَّبِيَّ الصَّلٰوةَ اِبْنَ سَبْعِ سِنِيْنَ وَاضْرِبُوْا عَلَيْهَا ابْنَ عَشْرَةٍ (صحیح بخاری،ترمذی:۴۰۷)

۷.عَنْ مُعَاوِيَةَ رَضِيَ اللّٰهُ عَنْهُ قَالَ: قَالَ رَسُوْلُ اللّٰهِ صَلَّى اللّٰهُ عَلَيْهِ وَسَلَّمَ مَنْ يُّرِدِ اللّٰهُ بِهٖ خَيْراً يُّفَقِّهْهُ فِي الدِّيْنِ (رواہ البخاری:۳۱۱۶)

۸.عَنْ اَبِيْ هُرَيْرَةَ رَضِيَ اللّٰهُ عَنْهُ قَالَ: قَالَ رَسُوْلُ اللّٰهِ صَلَّى اللّٰهُ عَلَيْهِ وَسَلَّمَ مَنْ سَلَكَ طَرِيْقاً يَلْتَمِسُ فِيْهِ عِلْمًا سَهَّلَ اللّٰهُ بِهٖ طَرِيْقًا اِلَى الْجَنَّةِ وَمَا اجْتَمَعَ قَوْمٌ فِيْ بَيْتٍ مِّنْ بُيُوْتِ اللّٰهِ يَتْلُوْنَ كِتَابَ اللّٰهِ وَيَتَدَارَسُوْنَ بَيْنَهُمْ اِلَّا نَزَلَتْ عَلَيْهِمُ السَّكِيْنَةُ وَغَشِيَتْهُمُ الرَّحْمَةُ وَحَفَّتْهُمُ الْمَلٰئِكَةُ وَذَكَرَهُمُ اللّٰهُ فِيْ مَنْ عِنْدَهٗ وَمَنْ بَطَّاَ بِهٖ عَمَلُهٗ لَمْ يُسْرِعْ بِهٖ نَسَبُهٗ (رواہ مسلم)

۹.عَنْ اَبِيْ هُرَيْرَةَ رَضِيَ اللّٰهُ عَنْهُ قَالَ كَانَ رَسُوْلُ اللّٰهِ صَلَّى اللّٰهُ عَلَيْهِ وَسَلَّمَ يَقُوْلُ اَللّٰهُمَّ اِنِّيْ اَعُوْذُبِكَ مِنَ الْاَرْبَعِ مِنْ عِلْمٍ لَّا يَنْفَعُ وَ مِنْ دُعَاءٍ لَا يُسْمَعُ وَ مِنْ قَلْبٍ لَا يَخْشَعُ وَمِنْ نَفْسٍ لَا تَشْبَعُ . (رواہ مسلم و احمد، ابو داؤد ، مشکوۃ المصابیح:۲۴۶۸ . سنن ابن ماجہ :۲۵۰)

۱۰.عَنِ ابْنِ مَسْعُوْدٍ رَضِيَ اللّٰهُ عَنْهُ عَنِ النَّبِيِّ صَلَّى اللّٰهُ عَلَيْهِ وَسَلَّمَ قَالَ:لَا تَزُوْلُ قَدَمَا ابْنِ اٰدَمَ يَوْمَ الْقِيٰمَةِ مِنْ عِنْدِ رَبِّهٖ حَتّٰى يُسْئَلَ عَنْ خَمْسٍ: عَنْ عُمُرِهٖ فِيْمَا اَفْنَاهُ وَعَنْ شَبَابِهٖ فِيْمَا اَبْلَاهُ وَ عَنْ مَالِهٖ مِنْ اَيْنَ اكْتَسَبَهٗ وَ فِيْمَا اَنْفَقَهٗ وَمَاذَا عَمِلَ فِيْمَا عَلِمَ. (جامع الترمذی:۲۴۱۶)

۱۱.عَنْ عَبْدِاللّٰهِ رَضِيَ اللّٰهُ عَنْهُ قَالَ: قَالَ رَسُوْلُ اللّٰهِ صَلَّى اللّٰهُ عَلَيْهِ وَسَلَّمَ طَلَبُ كَسْبِ الْحَلَالِ فَرِيْضَةٌ بَعْدَ الْفَرِيْضَةِ (شعب الایمان بیہقی)

۱۲. عَنْ اَبِيْ سَعِيْدٍ رَضِيَ اللّٰهُ عَنْهُ عَنِ النَّبِيِّ صَلَّى اللّٰهُ عَلَيْهِ وَسَلَّمَ قَالَ التَّاجِرُ الصَّدُوْقُ الْاَمِيْنُ مَعَ النَّبِيِّيْنَ وَ الصِّدِّيْقِيْنَ وَالشُّهَدَاءِ (جامع ترمذی: ۱۲۰۹ ، سنن دارمی سنن دارقطنی)

۱۳.عَنْ اَبِيْ هُرَيْرَةَ رَضِيَ اللّٰهُ عَنْهُ اَنَّ رَسُوْلَ اللّٰهِ صَلَّى اللّٰهُ عَلَيْهِ وَسَلَّمَ قَالَ: اَتَدْرُوْنَ مَا الْمُفْلِسُ؟ قَالُوْا اَلْمُفْلِسُ فِيْنَا مَنْ لَّا دِرْهَمَ لَهٗ وَلَا مَتَاعَ فَقَالَ:اِنَّ الْمُفْلِسَ مِنْ اُمَّتِيْ مَنْ يَّاْتِيْ يَوْمَ الْقِيٰمَةِ بِصَلَاةٍ وَصِيَامٍ وَزَكَاةٍ وَيَاْتِيْ قَدْ شَتَمَ هٰذَا وَقَذَفَ هٰذَا وَاَكَلَ مَالَ هٰذَا وَسَفَكَ دَمَ هٰذَا وَضَرَبَ هٰذَا فَيُعْطٰى هٰذَا مِنْ حَسَنَاتِهٖ فَاِنْ فَنِيَتْ حَسَنَاتُهٗ قَبْلَ اَنْ يُّقْضٰى مَا عَلَيْهِ اُخِذَ مِنْ خَطَايَاهُمْ فَطُرِحَتْ عَلَيْهِ ثُمَّ طُرِحَ فِي النَّارِ.(رواہ مسلم، کتاب البر:۶۵۷۹)

۱۴.عَنْ اَبِي الدَّرْدَآءِ رَضِيَ اللّٰهُ عَنْهُ اَنَّ النَّبِيَّ صَلَّى اللّٰهُ عَلَيْهِ وَسَلَّمَ قَالَ : مَا شَيْءٌ اَثْقَلُ فِيْ مِيْزَانِ الْمُؤْمِنِ يَوْمَ الْقِيٰمَةِ مِنْ خُلُقٍ حَسَنٍ فَاِنَّ اللّٰهَ تَعَالٰى يُبْغِضُ الْفَاحِشَ الْبَذِيَّ (ترمذی:۲۰۰۲)

۱۵.عَنِ ابْنِ عَبَّاسٍ رَضِیَ اللّٰهُ عَنْهُ اَنَّ النَّبِیَّ صَلَّی اللّٰهُ عَلَیْهِ وَسَلَّمَ قَالَ:اَرْبَعٌ مَنْ اُعْطِیَهُنَّ فَقَدْ اُعْطِیَ خَیْرَ الدُّنْیَا وَالْاٰخِرَةِ: قَلْبًا شَاکِرًا وَّلِسَانًا ذَاکِرًا وَّ بَدَنًا عَلَی الْبَلَاءِ صَابِرًا وَّزَوْجَةً لَا تَبْغِیْهِ حُوْبًا فِیْ نَفْسِهَا وَمَالِهٖ(معجم طبرانی ومشکوٰۃ :۳۲۷۳)

(سنن نسائی، کنز العمال :۴۳۴۰۹)

۱۶.عَنْ اَبِیْ هُرَیْرَةَ رَضِیَ اللّٰهُ عَنْهُ قَالَ قَالَ:رَسُوْلُ صَلَّی اللّٰهُ عَلَیْهِ وَسَلَّم : اِجْتَنِبُوْا السَّبْعَ الْمُوْبِقَاتِ،قَالُوْا یَا رَسُوْلَ اللّٰهِ وَمَا هُنَّ قَالَ:اَلشِّرْکُ بِاللّٰهِ وَالسِّحْرُ وَقَتْلُ النَّفْسِ الَّتِیْ حَرَّمَ اللّٰهُ اِلَّا بِالْحَقِّ وَاَکْلُ الرِّبٰوا وَاَکْلُ مَالِ الْیَتِیْمِ وَالتَّوَلِّی یَوْمَ الزَّحْفِ وَ قَذْفُ الْمُحْصَنَاتِ الْمُؤْمِنَاتِ الْغَافِلَاتِ (متفق علیہ)

۱۷.عَنْ اَبِیْ سَعِیْدِ الْخُدْرِی رَضِیَ اللّٰهُ عَنْهُ قَالَ سَمِعْتُ رَسُوْلَ اللّٰهِ صَلَّی اللّٰهُ عَلَیْهِ وَسَلَّم یَقُوْلُ مَنْ رَّاٰی مِنْکُمْ مُنْکَرًا فَلْیُغَیِّرْهُ بِیَدِهٖ فَاِنْ لَّمْ یَسْتَطِعْ فَبِلِسَانِهٖ فَاِنْ لَّمْ یَسْتَطِعْ فَبِقَلْبِهٖ وَذٰلِکَ اَضْعَفُ الْاِیْمَانِ (رواہ مسلم:۱۷۷)

۱۸.عَنْ اُسَامَةَ بْنِ زَیْدٍ رَضِیَ اللّٰهُ عَنْهُ قَالَ:قَالَ رَسُوْلُ اللّٰهِ صَلَّی اللّٰهُ عَلَیْهِ وَسَلَّم یُجَآءُ بِرَجُلٍ یَوْمَ الْقِیٰمَةِ فَیُلْقٰی فِی النَّارِ فَتَنْدَلِقُ اَقْتَابُهٗ فِی النَّارِ فَیَطْحَنُ فِیْهَا کَطَحْنِ الْحِمَارِ بِرَحَاهُ فَیَجْتَمِعُ اَهْلُ النَّارِ عَلَیْهِ فَیَقُوْلُوْنَ اَیْ فُلَانُ مَا شَاْنُکَ؟اَلَیْسَ کُنْتَ تَاْمُرُنَا بِالْمَعْرُوْفِ وَتَنْهَانَا عَنِ الْمُنْکَرِ؟قَالَ کُنْتُ اٰمُرُکُمْ بِالْمَعْرُوْفِ وَلَا اٰتِیْهِ وَاَنْهَاکُمْ عَنِ الْمُنْکَرِ وَاٰتِیْهِ (بخاری:۳۲۶۷ و مسلم)

۱۹.عَنْ اَنَسٍ رَضِیَ اللّٰهُ عَنْهُ قَالَ رَسُوْلُ اللّٰهِ صَلَّی اللّٰهُ عَلَیْهِ وَسَلَّمَ وَالَّذِیْ نَفْسِیْ بِیَدِهٖ لَا یُؤْمِنُ عَبْدٌ حَتّٰی یُحِبَّ لِاَخِیْهِ مَا یُحِبُّ لِنَفْسِهٖ.(رواہ مسلم:۱۷۰)

۲۰.وَعَنِ النُّعْمَانِ بْنِ بَشِیْرٍ رَضِیَ اللّٰهُ عَنْهُ قَالَ قَالَ رَسُوْلُ اللّٰهِ صَلَّی اللّٰهُ عَلَیْهِ وَسَلَّمَ تَرَی الْمُؤْمِنِیْنَ فِیْ تَرَاحُمِهِمْ وَتَوَادِّهِمْ وَتَعَاطُفِهِمْ کَمَثَلِ الْجَسَدِ اِذَا اشْتَکٰی عُضْوٌ تَدَاعٰی لَهٗ سَآئِرُ الْجَسَدِ بِالسَّهَرِ وَالْحُمّٰی (متفق علیہ بخاری: ۶۰۱۱)

۲۱.عَنْ عَبْدِاللّٰهِ ابْنِ عُمَرَرَضِیَ اللّٰهُ عَنْهُما قَالَ قَالَ رَسُوْلُ اللّٰهِ صَلَّی اللّٰهُ عَلَیْهِ وَسَلَّمَ اَلَا کُلُّکُمْ رَاعٍ وَّ کُلُّکُمْ مَسْئُوْلٌ عَنْ رَّعِیَّتِهٖ فَالْاِمَامُ الاعظم الَّذِیْ عَلَی النَّاسِ رَاعٍ وَهُوَمَسْئُوْل عَنْ رَّعِیَّتِهٖ وَالرَّجُلُ رَاعٍ عَلٰی اَهْلِ بَیْتِهٖ وَهُوَمَسْئُوْلٌ عَنْ رَّعِیَّتِهٖ وَالْمَرْاَةُ رَاعِیَةٌ عَلٰی بَیْتِ زَوْجِهَا وَوَلَدِهٖ وَهِیَ مَسْئُوْلَةٌ عَنْهُمْ وعَبْدُ الرَّجُلِ رَاعٍ عَلٰی مَالِ سَیِّدِهٖ وَهُوَمَسْئُوْلٌ عَنْهُ اَلَا فَکُلُّکُمْ رَاعٍ وَکُلُّکُمْ مَسْئُوْلٌ عَنْ رَعِیَّتِهٖ (بخاری:۷۱۳۸ و ترمذی:۱۷۰۵)

۲۲.عَنْ اَبِیْ هُرَیْرَةَ رَضِیَ اللّٰهُ عَنْهُ قَالَ، قَالَ رَسُوْلُ اللّٰهِ صَلَّی اللّٰهُ عَلَیْهِ وَسَلَّمَ: مَثَلِیْ وَ مَثَلُ الْاَنْبِیَاءِ کَمَثَلِ قَصْرٍ اُحْسِنَ بُنْیَانُهٗ، تُرِکَ مِنْهُ مَوْضِعُ لَبِنَةٍ فَطَافَ بِهِ النُّظَّارُ یَتَعَجَّبُوْنَ مِنْ حُسْنِ بَنَائِهٖ اِلَّا مَوْضِعَ تِلْکَ اللَّبِنَةِ فَکُنْتُ اَنَا سَدَدْتُ مَوْضِعَ اللَّبِنَةِ، خُتِمَ لِیَ الْبُنْیَانُ وَخُتِمَ بِیَ الرُّسُلُ وَ فِیْ رِوَایَةٍ: فَاَنَا اللَّبِنَةُ وَاَنَا خَاتَمُ النَّبِیِّیْنَ. (رواہ البخاری :۳۵۳۵)

۲۳.عَنْ اَنَسٍ رَضِیَ اللّٰهُ عَنْهُ عَنِ النَّبِیِّ صَلَّی اللّٰهُ عَلَیْهِ وَسَلَّمَ قَالَ: اَرْحَمُ اُمَّتِیْ بِاُمَّتِیْ اَبُوْ بَکْرٍ وَ اَشَدُّهُمْ عُمَرُ وَ اَصْدَقُهُمْ حَیَآءً عُثْمَانُ، وَاَقْضَاهُمْ عَلِیٌّ وَ اَفْرَضُهُمْ زَیْدُ بْنُ ثَابِتٍ، وَ اَقْرَءُهُمْ اُبَیُّ بْنُ کَعْبٍ وَ لِکُلِّ اُمَّةٍ اَمِیْنٌ وَ اَمِیْنُ هٰذِهِ الْاُمَّةِ اَبُوْ عُبَیْدَةَ بْنُ الْجَرَّاحِ .

(رواہ احمد والترمذی ،مشکوۃ المصابیح ، باب مناقب العشرۃ)

۲۴.عَنْ اَبِیْ بَکْرَةَ رَضِیَ اللّٰهُ عَنْهُ قَالَ: رَاَیْتُ رَسُوْلَ اللّٰهِ صَلَّی اللّٰهُ عَلَیْهِ وَسَلَّم عَلَی الْمِنْبَرِ وَالْحَسَنُ بْنُ عَلِیٍّ اِلٰی جَنْبِهٖ وَهُوَ یُقْبِلُ عَلَی النَّاسِ مَرَّةً وَعَلَیْهِ اُخْرٰی وَیَقُوْلُ: اِنَّ ابْنِیْ هٰذَا سَیِّدٌ وَ لَعَلَّ اللّٰهَ اَنْ یُّصْلِحَ بِهٖ بَیْنَ فِئَتَیْنِ عَظِیْمَتَیْنِ مِنَ الْمُسْلِمِیْنَ(بخاری: ۲۷۰۴)

۲۵.وَعَنْ عِمْرَانَ بْنِ حُصَیْنٍ رَضِیَ اللّٰهُ عَنْهُ قَالَ قَالَ:رَسُوْلُ اللّٰهِ صَلَّی اللّٰهُ عَلَیْهِ وَسَلَّمَ : خَیْرُ اُمَّتِیْ قَرْنِیْ ثُمَّ الَّذِیْنَ یَلُوْنَهُمْ،ثُمَّ الَّذِیْنَ یَلُوْنَهُمْ.....(متفق علیہ بخاری: ۳۶۵۰)

۲۶. عَنْ جَابِرِبْنِ عَبْدِاللّٰهِ رَضِیَ اللّٰهُ عَنْهُ قَالَ: خَطَبَنَا رَسُوْلُ صَلَّی اللّٰهُ عَلَیْهِ وَسَلَّمَ فِیْ وَسْطِ اَیَّامِ التَّشْرِیْقِ خُطْبَةَ الْوَدَاعِ فَقَالَ: یَاَیُّهَا النَّاسُ: اِنَّ رَبَّکُمْ وَاحِد ،وَاِنَّ اَبَاکُمْ وَاحِد اَلَا لَا فَضْلَ لِعَرَبِی عَلٰی عَجَمِی وَلَا لِعَجَمِی عَلٰی عَرَبِیّ، وَلَا لِاَحْمَرَ عَلٰی اَسْوَدَ وَلَا لِاَسْوَدَ عَلٰی اَحْمَرَ اِلَّا بِالتَّقْوٰی. اِنَّ اَکْرَمَکُمْ عِنْدَ اللّٰهِ اَتْقٰکُمْ، اَلَا هَلْ بَلَّغْتُ؟ قَالُوْا بَلٰی یَا رَسُوْلَ اللّٰهِ، قَالَ: فَلْیُبَلِّغِ الشَّاهِدُ الْغَائِبَ فَلْیُبَلِّغِ الشَّاهِدُ الْغَائِبَ.(البیھقی، شعب الایمان، باب فی حفظ اللسان، فصل فی حفظ اللسان عن الفخر یا لأباء)

3۔سیرت النبی ﷺ

(i) مطالعہ سیرت کی ضرورت واہمیت۔

(ii) نبی کریم صلی اللہ علیہ وسلم کی حکمت انقلاب۔(ہجرت، میثاق مدینہ، صلح حدیبیہ اور خطبہ حجۃ الوداع)

(iii) تزکیہ نفس اور تعمیر سیرت وشخصیت کا نبوی منہاج اور عملی نمونے۔

(عشرہ مبشرہؓ، امہات المومنین اور اولاد النبیؐ)

(iv) تشکیل اجتماعیت ومعاشرت اور اسوہ حسنہ۔

4۔ اسلامی تہذیب وثقافت

(الف) اسلامی تہذیب وثقافت کے خصائص۔

توحید، روحانیت، تصور مسؤلیت، انسانی عظمت ومساوات اور عالمگیر اخوت۔

عدل اجتماعی، اخلاقی اقدار، انسانی حقوق، رواداری، اعتدال وتوازن۔

(ب) اسلامی تہذیب وثقافت کے عالمی اثرات

(ج) مغربی تہذیب وثقافت اور اسلام

(i) مغربی تہذیب وثقافت کے خصائص واثرات

(ii) تہذیبوں کے تصادم کے نظریہ کا تنقیدی جائزہ

مجوزہ کتب عربی:

القرآن الحکیم

۲۔	الخطیب التبریزی	مشکوۃ المصابیح
۳۔	ابن کثیر الدمشقی	تفسیر ابن کثیر
۴۔	شھاب الدین محمود آلوسی	تفسیر روح المعانی
۵۔	سید قطب	فی ظلال القرآن
۶۔	ابن ہشام	السیرۃ النبویۃ
۷۔	ابوالحسن علی ندوی	قصص النبیین (جلد اول تا پنجم)
۸۔	مصطفی امین وعلی الجارم	النحو الواضح فی قواعد اللغۃ العربیۃ (جلد اول تا ششم)
۹۔	ڈاکٹر فاء عبدالرحیم	دروس اللغۃ العربیۃ
۱۰۔	جماعۃ المؤلفین	دائرۃ المعارف الاسلامیۃ (عربی)

MTH-302	Calculus-II	4(4–0)

Integration: Anti derivatives and integrals. Riemann sums and the definite integral. Properties of Integral. The fundamental theorem of calculus.

Techniques of integration: Integrals of elementary, hyperbolic, trigonometric, logarithmic and exponential functions. Integration by parts, substitution and partial fractions. Approximate integration. Improper integrals. Gamma functions.

Applications of integrals: Area between curves, average value. Volumes. Arc length. Area of a surface of revolution. Applications to Economics, Physics, Engineering and Biology.

Infinite series: Sequences and series. Convergence and absolute convergence. Tests for convergence: divergence test, integral test, p-series test, comparison test, limit comparison test, alternating series test, ratio test, root test. Power series. Convergence of power series. Representation of functions as power series. Differentiation and integration of power series. Taylor and Maclaurin series. Approximations by Taylor polynomials.

Conic section, parameterized curves and polar coordinates: Curves defined by parametric equations. Calculus with parametric curves: tangents, areas, arc length. Polar coordinates. Polar curves, tangents to polar curves. Areas and arc length in polar coordinates.

Recommended Books:

1. H. Anton, I. Bevens, S. Davis, *Calculus* (10th ed.), John Wiley & Sons, 2012.
2. J. R. Hass, C. E. Heil, M. D. Weir, *Thomas's Calculus* (14th ed.), Pearson, 2017.
3. D. Hughes-Hallett, A. M. Gleason, W. G. McCallum et al. *Calculus: Single Variable* (6th ed.), Wiley, 2012.
4. J. Stewart, *Calculus* (8th ed.), Cengage Learning, Boston, 2012.
5. E. W. Swokowski, *Calculus with Analytic Geometry* (6th ed.), PWS-Kent Publishing Company, 1994.

PHY-302	Mechanics-II	4(3–1)

Rotational dynamics, Relation between Linear & angular variables, K.E of Rotation & Rotational Inertia of Solid bodies, Torque acting on a particle, Parallel & Perpendicular axes theorem, combined Rotational & translational motion, rolling without slipping, Angular momentum of a Particle & system of Particles, Relation between torque & angular momentum. Conservation of angular momentum, spinning top, stability of spinning objects, Newton's law of universal gravitation, gravitational effects of spherical distribution of matter, gravitational P.E, Gravitational field & Potential, Motion of planets & satellites, Kepler's laws, Energy consideration in planetary & satellite motion, Bulk Properties of matter, Hook's Law , Types of elasticity, variation of pressure in earth's atmosphere, surface tension, general concepts of fluid flow, Bernoulli's equations, viscosity, Poiseuille's law.

Practicals:

1. To Determine the Young's Modulus of the material of a spiral spring.
2. To determine the Modulus of rigidity of a wire by Dynamic Method
3. Surface tension of water by capillary tube method.
4. Projectile motion: (a) To determine the range as a function of the angle of inclination (b) to determine the maximum height of a projectile as a function of angle of inclination (c) To determine the range /height as function of initial velocity of projectile

ZOL-302	Principle in Animal Life – II	4(3–1)

Course Title	PRINCIPLES IN ANIMAL LIFE – II
Course Code	ZOL-302
Credit Hours	4(3-1)
Theory	3
Practical	1
Follow up	**BS**
Aims and Objectives	The course imparts knowledge and understanding of: a. cell division and its significance in cell cycle. b. concepts and mechanisms of inheritance pattern, chromosome and gene linkage and molecular basics of genetics. c. animal behaviour and communication. d. theories of evolution, gene flow and mechanism of evolution with reference to animals and diversity.
Learning Outcomes	
Syllabus in Brief	Course Contents 1. Cell Division Mitosis, cytokinesis, and the cell cycle: an overview; control of the cell cycle; meiosis: the basis of sexual reproduction; gamete formation. 2. Inheritance Patterns The birth of modern genetics; Mendelian inheritance patterns;

	other inheritance patterns; environmental effects and gene expression. 3. Chromosomes and Gene Linkage Eukaryotic chromosomes; linkage relationships; changes in chromosome number and structure. 4. Molecular Genetics: Ultimate Cellular Control DNA: the genetic material; DNA replication in eukaryotes; genes in action; control of gene expression in eukaryotes; mutations; applications of genetic technologies; recombinant DNA. 5. Animal Behaviour Four approaches to animal behaviour; proximate and ultimate causes; anthropomorphism; development of behavior; learning; control of behavior; communication; behavioral ecology; social behavior. 6. Evolution: A Historical Perspective Pre-Darwinian theories of change; Lamarck: an early proponent of evolution; early development of Darwin's ideas of evolution and evidences; the theory of evolution by natural selection; evolutionary thought after Darwin; biogeography. 7. Evolution and Gene Frequencies The modern synthesis: a closer look; the Hardy-Weinberg theorem; evolutionary mechanisms: population size, genetic drift, natural selection, gene flow, mutation, and balanced polymorphism; species and speciation; rates of evolution; molecular evolution; mosaic evolution. 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. 2000. New York: McGraw Hill. 5. Campbell, N.A. BIOLOGY, 6th Edition. Menlo Park, California: 2002. Benjamin/Cummings Publishing Company, Inc. Practicals 1. Study of mitosis in onion root tip. 2. Study of meiosis in grasshopper testis (students should prepare the slide). *Note for 1-2: Prepared microscopic and/or projection slides and/or CD ROM computer projections must be used).* 3. Problem based study of Mendelian ratio in animals.

	4. Multiple alleles study in blood groups. 5. Survey study of a genetic factor in population and its frequency. 6. Study of karyotypes of *Drosophila*, mosquito. 7. Study of cytochemical detection of DNA in protozoa and avian blood cell. 8. Study to demonstrate nervous or endocrine basis of behaviour (conditioned reflex or aggression or parental behavior). 9. Study to demonstrate social behaviour (documentary film be shown, honey bee, monkey group in a zoo). Books Recommended 1. Miller, S.A. GENERAL ZOOLOGY LABORATORY MANUAL. 5th Edition (International), 2002. Singapore: McGraw Hill. 2. Hickman, C.P. and Kats, H.L. LABORATORY STUDIES IN INTEGRATED PRINCIPLES OF ZOOLOGY. 2000. Singapore: McGraw Hill.

BOT-302	**Systematic, Anatomy and Development**	**4(3–1)**

Title of the Course: Bot-302 Plant Systematics, Anatomy and Development/Embryology
Credit Hours: 4 (3+1)

Specific Objectives of course:

To understand: 1. various systems of classification, identification and nomenclature of Angiosperms, 2- Structures and functions of tissues and organs at embryonic level.

Course Outline:

a) Plant systematics

1. Introduction to Plant Systematics: aims, objectives and importance.
2. Classification: brief history of various systems of classification with emphasis on Takhtajan.
3. Brief introduction to nomenclature, importance of Latin names and binomial system with an introduction to International Code of Botanical Nomenclature (ICBN).Vienna code.
4. Morphology: a detailed account of various morphological characters root, stem, leaf, inflorescence, flower, placentation and fruit types.
5. Diagnostic characters, economic importance and distribution pattern of the following families:
   i. Ranunculaceae

ii. Brassicaceae (Cruciferae)
iii. Fabaceae (Leguminosae)
iv. Rosaceae
v. Euphorbiaceae
vi Cucurbitaceae
vii. Lamiaceae (Labiatae)
viii. Apiaceae (Umbelliferae)
ix. Asteraceae (Compositae)
x. Liliaceae (Sen. Lato)

b) Anatomy

1. Cell wall: structure and chemical composition
2. Concept, structure and function of various tissues like:
   i. Parenchyma
   ii. Collenchyma
   iii. Sclerenchyma
   iv. Phloem Epidermis (including stomata and trichomes)
   v. Xylem
3. Meristem: types, stem and root apices
4. Vascular cambium
5. Structure and development of root, stem and leaf. Primary and secondary growth of dicot stem, periderm
6. Characteristics of wood: diffuse porous and ring porous, sap and heart wood, soft and hard wood, annual rings.

c) Development/Embryology

1. Early development of plant body:
2. Capsella bursa-pastoris
3. Structure and development of Anther Microsporogenesis, Microgametophyte
4. Structure of Ovule Megasporogenesis Megagametophyte
5. Endosperm formation
6. Parthenocarpy
7. Polyembryony

Lab Outline:

Plant Systematics

1. Identification of families given in syllabus with the help of keys.
2. Technical description of common flowering plants belonging to families mentioned in theory.
3. Field trips shall be undertaken to study and collect local plants.
4. Students shall submit 40 fully identified herbarium specimens.

Anatomy and Embryology

1. Study of stomata and epidermis.
2. Tissues of primary body of plant.
3. Study of xylem 3-dimensional plane of wood.
4. T. S of angiosperm stem and leaf.
5. Anatomy of germinating seeds
6. Study of pollens

Recommended Books:

1 Mauseth, J. D. 1998. An Introduction to Plant Biology: Multimedia Enhanced. Jones and Bartlett Pub. UK
2. Moore, R. C., W. D. Clarke and Vodopich, D. S. 1998. Botany. McGraw Hill Company, U.S.A.
3. Raven, P. H., Evert, R. E. and Eichhorn, S. E. 1999. Biology of Plants. W. H. Freeman and Company Worth Publishers.
5. Stuessy, T. F. 1990. Plant Taxonomy. Columbia University Press, USA.
6. Lawrence, G. H. M. 1951 Taxonomy of Vascular Plants. MacMillan & Co. New York.
7. Panday, B. P. 2004. A textbook of Botany (Angiosperms). S. Chand and Co. New Delhi.
8. Raymond E, S. E. Eichhorn. 2005. Esau's Plant Anatomy. Meristems cells and tissues of the plant body, 3rd Ed. John Wiley & Sons. Inc.
9. Fahn, A. 1990. Plant Anatomy. Pergamon Press, Oxford.
10. Esau, K. 1960. Anatomy of Seed Plants. John Wiley, New York.
11. Maheshwari, P. 1971. Embryology of Angiosperms, McGraw-Hill. New York.
12. Eames A. J. and L. H Mac Daniels. 2002. An Introduction to Plant Anatomy. Tata-Mac Graw-Hill Publishing Company, Limited, New Delhi.
13. Pullaiah, T. 2007. Taxonomy of Angiosperms. 3rd Edition, Regency Publications, New Delhi.
14. Naik, V. N. 2005 Taxonomy of Angiosperms. 20th Reprint. TataMacGraw-Hill Publishing Company, Limited New Delhi.
15. Rajput, M. T., S. S. Hassney and K. M. Khan. 1996. Plant Taxonomy. New Trends Computer Service, Hyderabad, Sindh, Pakistan.

Semester 3

Semester 3		
CHM-401	Fundamental Physical Chemistry	4(3-1)
ENG-421	Communications Skills	3(3–0)
CSI-401	Computer Applications & Web-I	3(3-0)
MTH-405	Differential Equations – I	4(4–0)
PHY-401	Electricity & Magnetism-I	4(3–1)
ZOL-401	Animal Diversity: Invertebrates	4(3–1)
BOT-401	Cell Biology, Genetics and Evolution	4(3–1)
Optional (Any two subjects): Math & Physics or Botany & Zoology		

CHM-401	Fundamental Physical Chemistry	4(3-1)

Chemical Kinetics:
Introduction, rate, molecularity and order of reaction, zero, first and second with same and different initial concentrations, half-lives of reactions, experimental techniques and methods for determination of rate and order of reaction (integration, half-life, initial rate, and graphical methods), activation energy and Arrhenius equation. Collision theory, transition state theory.

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

Basic Quantum Chemistry
Limitations of classical mechanics, Wave and particle nature of matter, de Broglie equation, Heisenberg uncertainty principle. Schrodinger wave equation and its solution for particle in one dimensional box. Concept of quantization of energy

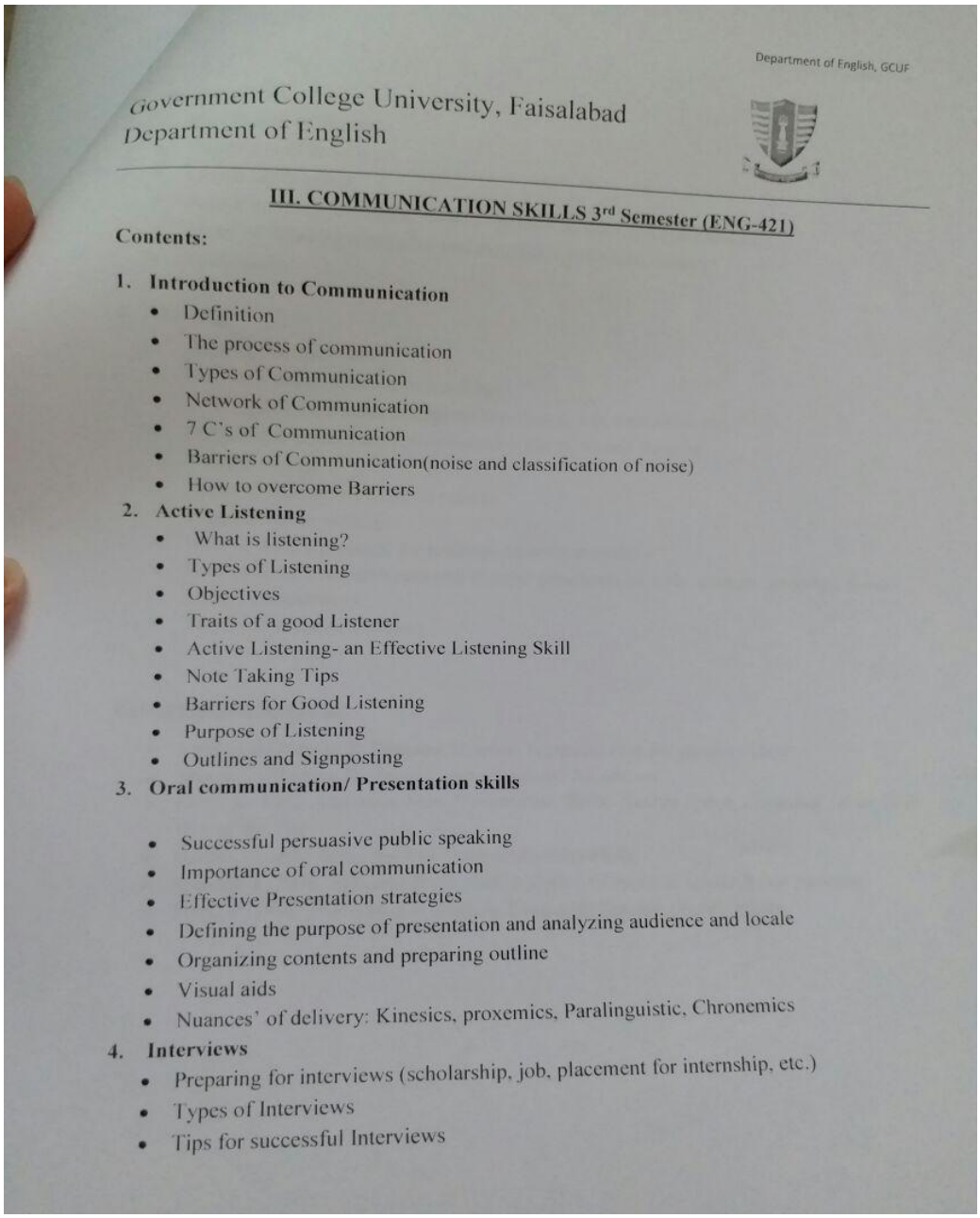
CHM-401 Practicals

- Determination of viscosity and parachor values of liquids.
- Determination of percent composition of liquid solutions by viscometer
- Determination of refractive index and molar refractivity.
- Determination of percent composition of liquid solutions by refractive index measurements.
- Determination of molecular weight of a compound by elevation of boiling point (ebullioscopic method).
- Determination of molecular weight of a compound by lowering of freezing point (cryoscopic method).
- Determination of heat of solution by solubility method.
- Determination of heat of neutralization of an acid with a base.

Books Recommended:

1. R. Albert, "Physical Chemistry" 17th Ed., John Wiley and Sons, USA (1987).
2. P. W. Atkins, "Physical Chemistry" 6th Ed, W. H. Freeman and co. New York, USA (1998).
3. K. J. Laidler, "The World of Physical Chemistry" 1st Ed., Oxford University Press USA (1993).
4. K. J. Laidler, H. M. John, C. S. Bryan, "Physical Chemistry" 4th Ed., Houghton Mifflin Publishing Company Inc. (2003).
5. P. A. Peter, "Chemical Thermodynamics", 4th Ed, Oxford University Press, USA (1983).
6. S. E. Brain, "Basic Chemical Thermodynamics" 4th Ed., E. L. B. S. Publishers, (1990).
7. M. G. Barrow, "Physical Chemistry" 5th Ed, Mc Graw Hill (1992).

ENG-421	Communications Skills	3(3–0)



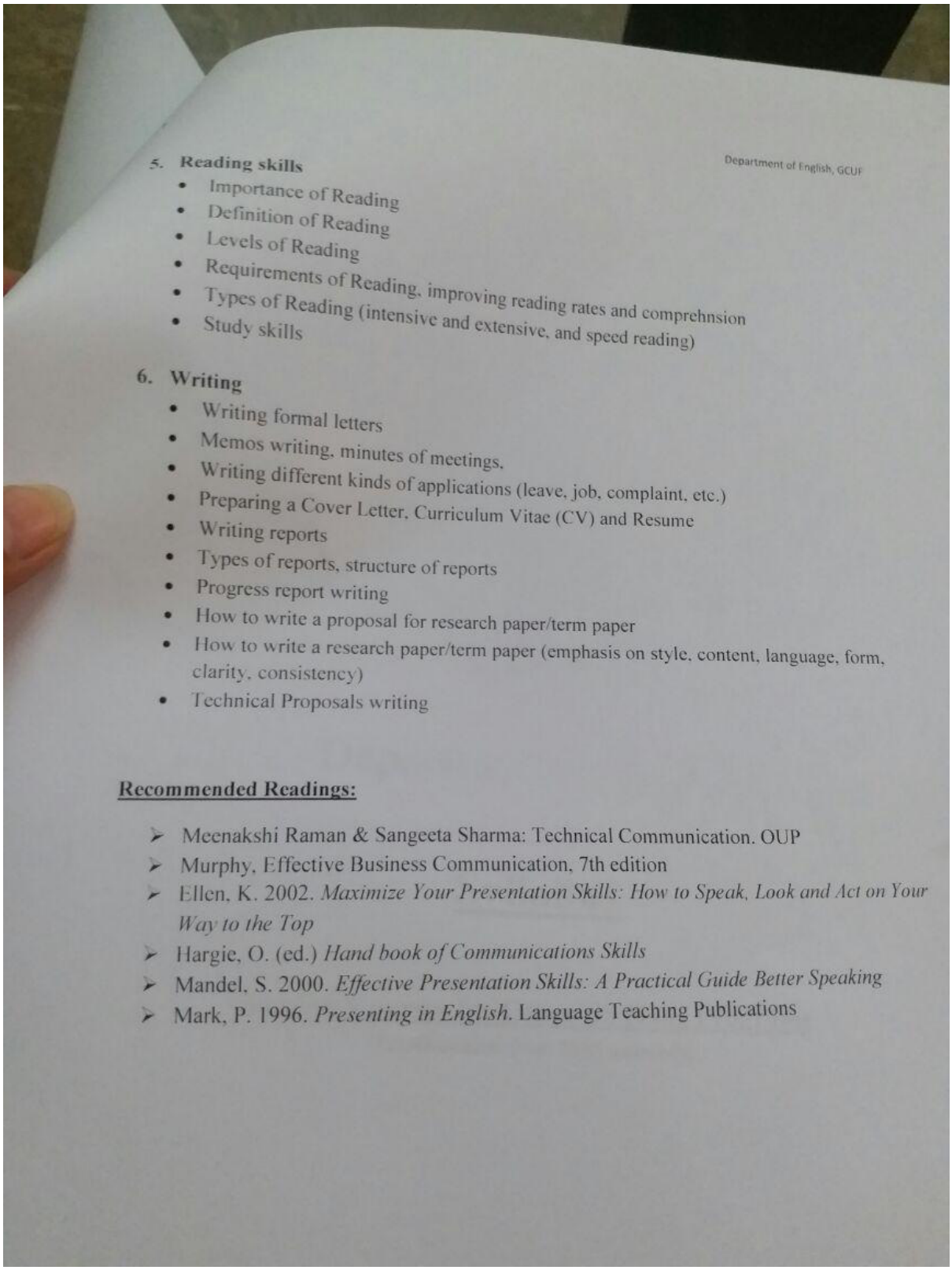
Department of English, GCUF

Government College University, Faisalabad
Department of English

III. COMMUNICATION SKILLS 3rd Semester (ENG-421)

Contents:

1. **Introduction to Communication**
   - Definition
   - The process of communication
   - Types of Communication
   - Network of Communication
   - 7 C's of Communication
   - Barriers of Communication(noise and classification of noise)
   - How to overcome Barriers
2. **Active Listening**
   - What is listening?
   - Types of Listening
   - Objectives
   - Traits of a good Listener
   - Active Listening- an Effective Listening Skill
   - Note Taking Tips
   - Barriers for Good Listening
   - Purpose of Listening
   - Outlines and Signposting
3. **Oral communication/ Presentation skills**
   - Successful persuasive public speaking
   - Importance of oral communication
   - Effective Presentation strategies
   - Defining the purpose of presentation and analyzing audience and locale
   - Organizing contents and preparing outline
   - Visual aids
   - Nuances' of delivery: Kinesics, proxemics, Paralinguistic, Chronemics
4. **Interviews**
   - Preparing for interviews (scholarship, job, placement for internship, etc.)
   - Types of Interviews
   - Tips for successful Interviews



5. **Reading skills**
   - Importance of Reading
   - Definition of Reading
   - Levels of Reading
   - Requirements of Reading, improving reading rates and comprehnsion
   - Types of Reading (intensive and extensive, and speed reading)
   - Study skills

6. **Writing**
   - Writing formal letters
   - Memos writing, minutes of meetings,
   - Writing different kinds of applications (leave, job, complaint, etc.)
   - Preparing a Cover Letter, Curriculum Vitae (CV) and Resume
   - Writing reports
   - Types of reports, structure of reports
   - Progress report writing
   - How to write a proposal for research paper/term paper
   - How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)
   - Technical Proposals writing

Recommended Readings:

- Meenakshi Raman & Sangeeta Sharma: Technical Communication. OUP
- Murphy, Effective Business Communication, 7th edition
- Ellen, K. 2002. *Maximize Your Presentation Skills: How to Speak, Look and Act on Your Way to the Top*
- Hargie, O. (ed.) *Hand book of Communications Skills*
- Mandel, S. 2000. *Effective Presentation Skills: A Practical Guide Better Speaking*
- Mark, P. 1996. *Presenting in English*. Language Teaching Publications

CSI-401	Computer Applications & Web-I	3(3-0)

BS (Chemistry) Course Code: CSI-401 Semester: 3rd

Course Outline

- Introduction to Computers
- Different Input and Output devices(Specially modern devices)
- Software and its different types
- Operating System Concepts
- Services and functions of operating system
- Network and its types
- Network Topologies and its types
- Introduction to Internet
- Different Web terminologies (Http, Web Browsers, Ftp, Search Engines, WWW)
- Introduction to common web devices specially modems.
- Introduction to protocols and use of protocols in Web.

MTH-405	Differential Equations – I	4(4–0)

Differential Equations and their classification, Formation of Differential Equations, Initial values and boundary values Problem, Separation of Variables. Homogenous Differential Equations, Exact Differential Equations, Differential equations reduceable to homogenous form, Linear Differential Equations of 1st Order, Bernonlli's Equations,Ricatti and Clairaut Differential Equations, Differential Equations Reduced to Separable Variables and Linear Forms. Orthogonal Trajectories. Applications of First Order Differential Equations.

RECOMMENDED BOOKS

1. Zill D G, Cullen M.R. *Differential Equations with Boundary-Value Problems (3rd Edition),* 1997, PWS Publishing Co.
2. Eisgolts L, *Differential Equations and the Calculus of Variations*, 1970, Mir Publishers Moscow.
3. Jerri A.J *Introduction to Integral Equations with Applications,* 1985, Marcel Dibber New York.
4. Muhammad Amin, *Mathematical Methods,* 2007, IlmiKitabKhana Lahore.

PHY-401	Electricity & Magnetism-I	4(3–1)

Would be shared soon

ZOL-401	Animal Diversity: Invertebrates	4(3–1)

Course Title	**Animal Diversity -1 (Invertebrates Diversity)**
Course Code	ZOL – 401
Credit Hours	4
Theory	3
Practical	1
Follow up	Animal Diversity -1 (Vertebrates)
Category	BS (Hons)
Aims and Objectives	The students will be able to make comparison from simple unicellular to complex multicellular organization along with phylogenetic relationship
Learning Outcomes	The students will be able to achieve the aims and objectives of the course
Syllabus in Brief	Theory 1. Introduction fication of organisms; evolutionary relationships and tree diagrams; patterns of organization. 2. Animal-Like Protists: The Protozoa ionary perspective; life within a single plasma membrane; symbiotic life-styles. Protozoan taxonomy: (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; further phylogenetic considerations. 3. Multicellular and Tissue Levels of Organization ionary perspective: origins of multicellularity; animal origins. Phylum porifera: cell types, body wall, and skeletons; water currents and body forms; maintenance functions; 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. 4. Triploblastics and Acoelomate Body Plan ionary perspective; phylum platyhelminthes: classification up to class; the free-living flatworms and the tapeworms; phylum nemertea; phylum gastrotricha; further phylogenetic considerations. 5. Pseudocoelomate Body Plan: Aschelminths ionary perspective; general characteristics; 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; further phylogenetic considerations. 6. Molluscan Success ionary perspective: relationships to other animals; origin of the coelom; molluscan characteristics; classification up to class. The characteristics of shell and associated structures, feeding, digestion, gas exchange, locomotion, reproduction and development, other maintenance functions and diversity in gastropods, bivalves and cephalopods; further phylogenetic considerations. 7. Annelida: The Metameric Body Form ionary perspective: relationship to other animals, 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; further phylogenetic considerations. 8. Arthropods: Blueprint for Success ionary perspective: classification and relationships to other animals; metamerism and tagmatization; the exoskeleton; metamorphosis; classification up to class; further phylogenetic considerations. 9. Hexapods and Myriapods: Terrestrial Triumphs ionary perspective; classification up to class. External structure and locomotion, nutrition and the digestive system, gas exchange, circulation and temperature regulation, nervous and sensory functions, excretion, chemical regulation, reproduction and development in hexapoda; insect behavior; insects and humans; further phylogenetic considerations. Practicals 1.Study of *Euglena, Amoeba, Entamoeba, Plasmodium, Trypanosoma, Paramecium* as representative of animal like protists. (Prepared slides and from fresh water). 2. Study of sponges and their various body forms (prepared slides). 3. Study of principal representative classes of phylum Cnidaria. 4. Study of principal representative classes of phylum Platyhelminthes. 5. Study of representative of phylum Rotifera, phylum Nematoda. 6. Study of principal representative classes of phylum Mollusca. 7. Study of principal representative classes of phylum Annelida. 8. Study of principal representative classes of groups of phylum

	Arthropoda. 9. Brief notes on medical/economic importance of the following: *Plasmodium, Entamoebahistolitica, Leishmania*, Liverfluke, Tapeworm, Earthworm, Silkworm, Citrus butterfly. 10. Preparation of permanent stained slides of the following: *Obelia, Daphnia*, Cestode, Parapodia of *Nereis.* Reference Books 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, 9th Edition (International), 2009. Singapore: McGraw Hill. 3. Pechenik, J.A. BIOLOGY OF INVERTEBRATES, 4th Edition (International), 2000. Singapore: McGraw Hill. 4. Hickman, C.P. and Kats, H.L. LABORATORY STUDIES IN INTEGRATED PRINCIPLES OF ZOOLOGY. 2000. Singapore: McGraw Hill. 5. Miller, S.A., GENERAL ZOOLOGY LABORATORY MANUAL. 5th Edition (International), 2002. Singapore: McGraw Hill. 6. Hickman, C.P. and Kats, H.L. LABORATORY STUDIES IN INTEGRATED PRINCIPLES OF ZOOLOGY. 2000. Singapore: McGraw Hill.

BOT-401	Cell Biology, Genetics and Evolution	4(3–1)

Title of the course: Bot-401 Cell Biology, Genetics and Evolution
Credit hours: 4 (3+1)

Specific objectives of course: To understand:

1. Structure and function of cell.
2. Nature of genetic material and hereditary process
3. Familiarization with evolutionary processes.

Course outline:

a) Cell Biology

1. Structure and Function of Bio-molecules
   i. Carbohydrates
   ii. Lipids
   iii. Proteins
   iv. Nucleic Acids

2. Cell: Cell theory, cell types (prokaryotes, eukaryotes), basic properties of cell.

3. Brief description of following cell organelles

   i Cell wall
   ii Cell membrane
   iii Nucleus
   iv Endoplasmic reticulum
   v Plastids
   vi Mitochondria
   vii Ribosomes
   viii Dictyosomes
   ix Vacuoles

4. Reproduction in somatic and embryogenic cell, mitosis, meiosis and cell cycle

b) Genetics

1. Introduction, scope and brief history of genetics. Mendelian inheritance; Laws of segregation and independent assortment, back cross, test cross, dominance and incomplete dominance.
2. Molecular genetics; DNA replication. Nature of gene, genetic code, transcription, translation, protein synthesis, regulation of gene expression (e.g. *lac* operon).
3. Chromosomal aberrations; Changes in the number of chromosomes. Aneuploidy and Euploidy. Changes in the structure of chromosomes, deficiency, duplication, inversion and translocation.

c) Evolution: Introduction and theories.

Lab Outline:

Cell Biology

1. Study of cell structure using compound microscope and elucidation of ultrastructure from electron microphotographs
2. Measurement of cell size.
3. Study of mitosis and meiosis by smear/squash method and from prepared slides.
4. Study of chromosome morphology and variation in chromosome number.
5. Extraction and estimation of carbohydrate, protein, RNA and DNA from plant sources.

Genetics

1. Genetical problems related to transmission and distribution of genetic material.
2. Identification of chromosomes in plant material. Carmine/orcein staining.
3. Determination of blood groups

Recommended Books:

1. Hoelzel, A. R. 2001. Conservation Genetics. Kluwer Academic Publishers.
2. Dyonsager, V. R. (1986). Cytology and Genetics. Tata and McGraw-Hill Publication Co. Ltd,, New Delhi.
3. Lodish. H. 2001. Molecular Cell Biology. W. H. Freeman and Co.
4. Sinha, U. and Sinha, S. (1988). Cytogenesis Plant Breeding and Evolution, Vini Educational Books, New Delhi.
5. Strickberger, M. V. (1988), Genetics, MacMillan Press Ltd., London.
6. Carroll, S. B., Grenier, J. K. and Welnerbee, S. D. 2001. From DNA to Diversity - Molecular Genetics and the Evolution of Animal Design. Blackwell Science.
7. Lewin, R, 1997. Principles of Human Evolution. Blackwell Science.
8. Strickberger, M. W. 2000 Evolution. Jones & Bartlet Publishers Canada
9. Ingrouille M. J. & B. Eddie. 2006. Plant Diversity and Evolution. Cambridge University Press.
10. Bruce Albert et al. 2009. Essential cell biology. Garland Sciences Publishers.

Semester 4

Semester 4		
CHM-402	Fundamental Analytical Chemistry	4(3–1)
ENG-422	Technical Writing	3(3–0)
CSI-422	Computer Applications & Web– II	3(3–0)
MTH-406	Differential Equations – II	4(4–0)
PHY-402	Electricity & magnetism- II	4(3–1)
ZOL-402	Animal Form & Function	4(3–1)
BOT-402	Plant Physiology and Ecology	4(3–1)
Optional (Any two subjects): Math & Physics or Botany & Zoology		

CHM-402	Fundamental Analytical Chemistry	4(3–1)

Introduction to analytical chemistry, Application of analytical chemistry in other disciplines of sciences, Qualitative and quantitative analysis, Classification of analytical techniques, Steps of a typical chemical analysis, Analytical concepts of errors, precision, accuracy (sources, control and applications), Measuring Apparatus, Expression of Quantities and Concentrations, Specifications of chemicals and reagents, their use and handling, Sample and sampling, Principals of Solvent extraction, Concept of electromagnetic radiations and basics of spectroscopic analysis (UV/Visible and IR spectroscopy and Atomic Emission and Atomic Absorption Spectroscopy) and chromatographic separations (Definition, Classification, Principals and overview of Applications).

Practicals

Laboratory materials, reagents and safety measures, Separation and identification of metal ions and biomolecules by paper chromatography and TLC, Verification of Bear Lambert Law, qualitative and quantitative analysis by UV/Visible spectroscopy, Preparation and standardization of reagents and solutions.

Books Recommended

1. Christian, G.D. 2003. Analytical Chemistry. Sixth edition, John Wiley and Sons, New York
2. Hargis, L.G. 1988. "Analytical Chemistry: Prentice Hall Publishers, London
3. Skoog, D.A. and J.J. Leary. 1992. "Principles of Instrumental Analysis. Saunders College
   Publishing Co., London
4. Bender, G.T. 1987. "Principles of Chemical Instrumentation" W.B. Saunders Co., London.
5. Skoog D.A., D.M. West and F.J. Holler, 1997. Fundamentals of Analytical Chemistry. 7Th Ed. Harcout College Publishers.
6. Reilley, C. 1993. Laboratory Manual of Analytical Chemistry. Allyn& Bacon, London

ENG-422	Technical Writing	3(3–0)

Contents:

1. **Basic factors of Technical Writing**
2. **Basic principles of technical writing style**
3. **Report Writing (Academic)**
   - What is Report Writing?
   - When we need to write reports.
   - Prior preparation and planning
   - Structure and sections of a report
   - Writing style and written language appropriate for report writing:
   - Write a short report on any social or university issue**.**
4. **Proposal Writing:**

   Types of proposals:
   - Business proposal
   - Research proposal
   - Factors to consider while preparing an academic research proposal
   - Structure and sections of an academic research proposal
   - Writing style and written language appropriate for an academic research proposal:
   - Analysis of a sample academic research proposal
5. **Plagiarism and Citation:**
   - What is plagiarism
   - How to avoid plagiarism
   - How to cite:
   - Different styles to cite others' work.
6. **How to do and write an academic research**

- Sources of research (primary, secondary and tertiary source)
- Sections of an academic research paper

7. **Analysis and synthesis in Academic writing**

Compiled and prepared by: Ms. Fareeha Saleem
Approved and recommended by: Chairman of English Department
Dr. Mazhar Hayat

CSI-422	Computer Applications & Web– II	3(3–0)

Computer Applications and Web-II

BS (Chemistry) Course Code: CSI-422 Semester: 4th

Course Outline

- Some new advanced online computer applications
- Word Processing (Word)
- Presentation (PowerPoint)
- Spreadsheet (Excel)
- Desktop Publishing (Publisher)
- Microsoft Front page
- Introduction to Internet, Search engines, Web browsers
- Introduction to HTML and Web Page Design
- Introduction to Protocols, Http, TCP/IP, FTP
- Simple web page making using HTML
- Introduction to XML
- Database, Introduction to SQL as well as the use of emerging technologies.

MTH-406	Differential Equations – II	4(4–0)

Higher Order Differential Equations:

Initial and Boundary value problem, Existence of a unique solution,Homogeneous DEs', Linear Dependence and Independence, Wronskian and non-homogeneous Linear Differential Equation.Non-Homogenous Differential Equations with constant Coefficient, D & Inverse D^{-1}, Operators, General & Particular Integrals. Cauchy-Eluer's equations, Reduction of order, Method of Variation of Parameter's, Exact Linear Equations, System of Linear Differential Equations. Power Series Solutions of first order Differential Equations. Laplace and Inverse Transformations with simple Application to Differential Equation.

RECOMMENDED BOOKS

1. Zill D G, Cullen M.R. *Differential Equations with Boundary-Value Problems (3rd Edition)*, 1997, PWS Publishing Co.
2. Eisgolts L, *Differential Equations and the Calculus of Variations*, 1970, Mir Publishers Moscow.
3. Jerri A.J *Introduction to Integral Equations with Applications*, 1985, Marcel Dibber New York.

PHY-402	Electricity & Magne sm – II	4(3–1)

Will be updated soon

ZOL-402	Animal Form & Function	4(3–1)

Course Title ANIMAL FORM AND FUNCTION (A COMPARATIVE PERSPECTIVE) Course Code ZOL-402
Credit Hours 4(3-1)
Theory 3 Practical 1
Follow up BS Category
Aims and Objectives The course deals with the: a. Basis of structure and functions of animal nutrition, digestion, homeostasis and temperature regulation. b. It introduces the basic concepts in reproduction and development in animal kingdom. c. Provides knowledge about the development of chordate body plan and fate of germinal layers. Learning Outcomes
Syllabus in Brief Course Contents

1. Nutrition and Digestion Evolution of nutrition; the metabolic fates of nutrients in heterotrophs; digestion; animal strategies for getting and using food, diversity in digestive structures of invertebrates and vertebrates; the mammalian digestive system: gastrointestinal motility and its control, oral cavity, pharynx and esophagus, stomach, small intestine: main site of digestion; large intestine; role of the pancreas in digestion; and role of the liver and gallbladder in digestion.

2. Temperature and Body Fluid Regulation Homeostasis and Temperature Regulation; The Impact of Temperature on Animal Life; Heat Gains and Losses; Some Solutions to Temperature Fluctuations; Temperature Regulation in Invertebrates, Fishes, Amphibians, Reptiles, Birds and Mammals; Heat Production in Birds and Mammals; Control of Water and Solutes (Osmoregulation and Excretion); Invertebrate and Vertebrate Excretory Systems; How Vertebrates Achieve Osmoregulation; Vertebrate Kidney Variations; Mechanism in Metanephric Kidney Functions.

3. Reproduction and Development Asexual reproduction in invertebrates; advantages and disadvantages of asexual reproduction; sexual reproduction in invertebrates; advantages and disadvantages of sexual reproduction; sexual reproduction in vertebrates; reproductive strategies; examples of reproduction among various vertebrate classes; the human male reproductive system: spermatogenesis, transport and hormonal control, reproductive function; the human female reproductive system: folliculogenesis, transport and hormonal control, reproductive function; hormonal regulation in gestation; prenatal development and birth: the placenta; milk production and lactation.

4. Descriptive Embryology Fertilization; embryonic development: cleavage, and egg types; the primary germ layers and their derivatives; echinoderm embryology; vertebrate embryology: the chordate body plan, amphibian embryology, development in terrestrial environments, avian embryology, the fate of mesoderm.

Books Recommended

1. Hickman, C.P., Roberts, L.S. and Larson, A. INTEGRATED PRINCIPLES OF ZOOLOGY, 11 th Edition (International), 2004. Singapore: McGraw Hill.

2. Miller, S.A. and Harley, J.B. ZOOLOGY, 5 th Edition (International), 2002. Singapore: McGraw Hill.

3. Pechenik, J.A. BIOLOGY OF INVERTEBRATES, 4 th Edition (International), 2000. Singapore: McGraw Hill.

4. Kent, G.C. and Miller, S. COMPARATIVE ANATOMY OF VERTEBRATES. 2001. New York: McGraw Hill.
5. Campbell, N.A. BIOLOGY, 6 th Edition. 2002. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.

Practicals

1. Study of excretory system in an invertebrate and a vertebrate representative (Model).
2. Study of nutritive canal in an invertebrate and a vertebrate representative (Dissection).
3. Study of male reproductive system in an invertebrate and a vertebrate representative (Dissection).
4. Study of female reproductive system in an invertebrate and a vertebrate representative (Dissection).
5. Study of hormonal influence of a reproductive function (Model).
6. Study of preserved advanced stages of avian and mammalian development for amniotic membranes and placenta (Model).
7. Study of stages in the development of an Echinoderm.
8. Study of early stages in the development of a frog, chick and a mammal.

Note for 9-10: Prepared slides and preserved specimen and/or projection slides and/or CD ROM computer projections may be used.

Books Recommended

1. Hickman, C.P. and Kats, H.L. LABORATORY STUDIES IN INTEGRATED PRINCIPLES OF ZOOLOGY. 2000. Singapore: McGraw Hill.
2. Miller, S.A. GENERAL ZOOLOGY LABORATORY MANUAL. 5 th Edition (International), 2002. Singapore: McGraw Hill.

BOT-402	**Plant Physiology and Ecology**	**4(3–1)**

Title of the course: **Bot-402** **Plant Physiology and Ecology**
Credit hours: 4 (3+1)

Specific objectives of course:

1. To provide comprehensive knowledge of functioning of organs, organelles and biomolecules,
2. To enable the students to assess the effects of various environmental factors on plant growth and development.

Course Outline:

a) Plant Physiology

1. Water relations (water potential, osmotic potential, pressure potential, matric potential). Absorption and translocation of water. Stomatal regulation.

2. Mineral nutrition: Soil as a source of minerals. Passive and active transport of nutrients. Essential mineral elements, role and deficiency symptoms of macronutrients.

3. Photosynthesis: Introduction, Oxygenic and non-oxygenic photosynthesis Mechanism: light reactions (electron transport and photophosphorylation) and dark reactions (Calvin cycle). Differences between C_3 and C_4 plants. Factors affecting this process, Products of photosynthesis.

4. Respiration: Definition and respiratory substrates. chanism-Glycolysis, Krebs cycle. Electron transport and oxidative phosphorylation. Anaerobic respiration. Energy balance in aerobic and naerobic respiration, Respiratory quotients.

b) Ecology

1. Introduction, aims and applications of ecology.
2. Soil: Physical and Chemical properties of soil (soil formation, texture. pH, EC, organism and organic matter etc) and their relationships to plants.
3. Light and Temperature. Quality of light, diurnal and seasonal variations. Ecophysiological responses.
4. Water: Field capacity and soil water holding capacity. Characteristics of xerophytes and hydrophytes. Effect of precipitation on distribution of plants.
5. Wind: Wind as an ecological factor and its importance.
6. Population Ecology: Introduction. A brief description of seed dispersal and seed bank.

7. Community Ecology
    i. Ecological characteristics of plant community
    ii. Methods of sampling vegetation (Quadrat and line intercept)
    iii. Major vegetation types of the local area.

8. Ecosystem Ecology
    i. Definition, types and components of ecosystem.
    ii. Food chain and Food web.

9. Applied Ecology: Causes, effects and control of water logging and salinity with respect to Pakistan

Lab Outline:

a) Plant Physiology

1. Preparation of solutions of specific normality of acids/bases, salts, sugars, molal and molar solutions and their standardization.
2. Determination of uptake of water by swelling seeds when placed in sodium chloride solution of different concentrations.
3. Measurement of leaf water potential by the dye method.
4. Determination of the temperature at which beet root cells lose their permeability.
5. Determination of the effects of environmental factors on the rate of transpiration of a leafy shoot by means of a porometer/cobalt chloride paper method.
6. Extraction of chlorophyll from the leaves and separation of component pigments on a paper chromatogram. Study of absorption spectra using spectrophotometer.
7. Estimation of oxygen utilized by a respiring plant by Winkler's method.

b) Ecology

1. Determination of physical and chemical characteristics of soil.
2. Measurements of various population variables
3. Measurement of vegetation by Quadrat and line intercept methods.
4. Field trips to ecologically diverse habitats.
5. Measurements of wind velocity.
8. Measurement of light and temperature.
9. Effect of light and temperature on seed germination.

Recommended Books:

1. Ihsan, I. 1995. Plant Physiology, Biochemical Processes in Plants, UGC Press.
2. Witham and Devlin. 1986 Exercises in Plant Physiology, AWS Publishers, Boston.
3. Taiz, L. and Zeiger, E. 2006. Plant Physiology. 4th. Ed. Sinauers Publ. Co. Inc. Calif.
4. Salisbury F. B. and Ross C. B. 1992. Plant Physiology. 5th Edition. Wadsworth Publishing Co. Belmont CA.
5. Hopkins, W. B. 1999. Introduction to Plant Physiology. 2nd Ed. John Wiley and Sons. New York
6. Schultz, J. C. 2005. Plant Ecology. Springer-Verlag, Berlin.

7. Ricklefs, R. E. 2000. Ecology. W. H. Freeman and Co., UK.
8. Ricklefs, R. E. 2001. The Economy of Nature. W. H. Freeman and Co., UK.
9. Barbour, M. G., J. H. Burke and W. D. Pitts. 1999. Terrestrial Plant Ecology, The Benjamin, Cumming Publishing Co. Palo Alto, California, USA.
10. Chapman, J. L. and Reiss, M. J. 1995. Ecology: Principles and Applications. Cambridge University Press.
11. Hussain F. 1989. Field and Laboratory Manual of Plant Ecology. National Academy of Higher Education, Islamabad.
12. Hussain, S. S. 1989. Pakistan Manual of Plant Ecology; National Book Foundation, Islamabad.
13. Larcher, W. 2003 Physiological Plant Ecology: Ecophysicology and Stress Physiology of Functions Groups – Springer Verlag.
14. Krebs, C. J. 1997. Ecology. Harper and Row Publishers.
15. Smith, R. L. 1996. Ecology and Field Biology. Addison Wesley Longman, Inc., New York.
16. Smith, R. L. 1998. Elements of Ecology. Harper and Row Publishers, New York.
17. Smith, R. L. 2004.Ecology and field biology. Addison Wesley Longman, Inc., New York.
18. Subrahmanyam, N. S. and Sambamurthy, A. V. S. S. 2000. Ecology. Narosa Publishing House, New Delhi.
19. Townsend, C. R., Harper, J. L. and Begon, M. E. 2002. Essentials of Ecology. Blackwell Scientific Publications, UK.
20. Odum, E. P. 1985. Basic Ecology. W. B. Saunders.

Semester 5

Semester 5		
CHM-501	Inorganic Chemistry - I	4(3–1)
CHM-503	Organic Chemistry – I	4(3–1)
CHM-505	Physical Chemistry - I	4(3–1)
CHM-507	Analytical Chemistry – I	4(3-1)
MTH-525	Mathematics for Chemists	2(2–0)

CHM-501	Inorganic Chemistry - I	4(3–1)

CHM-501 Inorganic Chemistry-I 4(3-1)

1. BONDING MODELS FOR NON TRANSITIION ELEMENTS

(a) Covalent bond. VSEPR model followed by VBT for prediction of geometries of molecules and ions containing sigma bonds as well as pi bonds. MOT for homonuclear and heteronuclear diatomic molecules.

(b) Metallic bond. Band theory to describe conductors, insulators and semiconductors.

(c) 3 center 4 electrons bond, 3 center 2 electrons bond, bent bond, H bonding.

2. CHEMISTRY OF COORDINATION COMPOUNDS

Nomenclature, theories of bonding (Werners theory, Sigwick theory, Chain theory, VBT, CFT, LFT). Stereochemistry of coordination compounds, Coordination geometries (CN 2 6). Preparation of coordination compounds Stability of coordination compounds. Spectrochemical series. Application of coordination compounds in Chemistry, life and industry.

3. LANTHANIDES AND ACTINIDES

Historical survey, occurrence, separation and preparation. Oxidation states, magnetic properties of Lanthanides and Actinides. Lanthanides contraction. Applications and uses of elements and their compounds.

CHM-501 Practicals

1. Separation of cations by paper chromatography: ($Pb^{2+,}Cd^{2+}$,$Cu^{2+,}Co^{2+,}Ni^{2+,}Ag^{1+}$)
2. Preparation And Characteristation Of Complex Compounds:
   (i) Sodium Cobaltinitrate (ii)Potassium trioxalato aluminate (iii) Ammonium Nicke II Sulphate (iv) Hexa aqua Chromium III chloride).
3. Complexometric Titration (Any four) Cu^{2+} / Ni^{2+};Ca^{2+} /$Ba^{2+;}Au^{2+}$ /$Pb^{2+;}Cd^{2+}$ /Zn^{2+};Ni^{2+} /Mg^{2+};Ca^{2+} /Zn^{2+}

Books Recommended:

1. P. Atkins, L. Jones, "Chemical Principles" 2nd Ed, Freeman and Company (2002).
2. F. Basolo, R. C. Johnson, "Coordination Chemistry: The Chemistry of Metal Complexes" W. A. Benjamin, Inc. (1964).
3. J. E. Brady, J. R. Holum, "Chemistry-The Study of Matter and Its Changes" 3rd Ed, John Wiley and Sons, Inc. (2000).
4. B. Douglas, D. McDaniel, J. Alexander, "Concepts and Models of Inorganic Chemistry" 3rd Ed John Wiley & Sons, Inc. (1994).

5. S. F. A. Kettle, "Coordination Compounds" 1st Ed, Thomas Nelson & Sons Ltd. (1969).
6. G. L. Miessler, A. T. Donald, "Inorganic Chemistry" 2nd Ed, Prentice-Hall International, Inc. Prentice-Hall, (1991).
7. D. F. Shriver, P.W. Atkins, C. H. Langford, "Inorganic Chemistry". 2nd Ed, Oxford University Press. USA (1994).

CHM-503	Organic Chemistry – I	4(3–1)

CHM-503 Organic Chemistry-I 4(3-1)

Acids and Bases

Concepts of acids and bases; scale of acidity and basicity; pka values; predicting acids/basis reactions from pKa values; the effect of structure on the strengths of acids and bases, field effects, resonance effects, steric effects, hydrogen bonding effects and hybridization effects, the effect of the medium on the strengths of acids and bases; the Hammett and Tafts equations, applications and limitations.

Stereochemistry

Introduction; optical isomerism; optical activity, chirality, symmetry elements and optical inactivity, relative and absolute configuration, R, S notation, methods of determining configuration. Racemic mixtures and their resolution, asymmetric synthesis, optical activity in biphenyls, alkenes and spiro compounds, stereospecific and stereoselective reactions; Geometrical isomerism. Determination of configuration of geometrical isomers, Z, E, conventions cis-and trans- isomerism in cyclic systems; Conformational isomerism conformational analysis of monosubstituted cyclohexanes, disubstituted cyclohexanes and decalin systems.

Oxidation Reduction Reactions:

a) Oxidation: Introduction. Oxidation of saturated, olefinic and aromatic compounds. System containing oxygen and nitrogen compounds.

b) Reduction Introduction. Reduction of cycloalkanes, olefins, alkynes and aromatic rings. Hydrogenolysis. Reduction of systems containing oxygen and nitrogen compounds.

CHM-503 Practicals

Purification Techniques: Fractional distillation, fractional distillation under reduced pressure and fractional crystallization

Mixture Analysis: Analysis of two component mixture.

Books Recommended:

1. B. S. Fumiss, A. J. IIannaford, P.W.G. Smith, A. R. Tatchell "Vogel's Practical Organic Chemistry", 5th Ed, Addition Wesley Longman, Harlow, England(1989).
2. J. Leonard, B. Lygo, G. Proctro, "Advanced Practical Organic Chemistry" 2nd Ed, Chapman, & Hall, London (1995).
3. H. L. Clarke, D. Hynes, "A Hand Book of Organic Analysis", Edward Arnold, London, (1995).

4. F. A Carey, R. J Sunderg, "Advanced Organic Chemistry". 3rd Ed, Part A & B, Pleman Press, New York, USA (1990).
5. K. Mislow "Stereochemistry", 2nd Ed, W. A. Benjamin Inc. New York, USA (1965).
6. E. L Eleil, S. H Wilen, L. N Mander, "Stereochemistry of Organic Compounds", 4th Ed, John Wiley & Sons, USA (1994).
7. S. H. Pine, "Organic Chemistry", 5th Ed, McGraw Hill, New York, USA (1987).
8. G. M. London, "Organic Chemistry", Addison Wesley, London, UK (1998).

CHM-505	Physical Chemistry - I	4(3–1)

CHM-505 Physical Chemistry-I 4 (3-1)

Kinetic Theory of Gases

Virial equations. Maxwells law of molecular velocities. Calculation of molecular velocities and binary collisions. Maxwell-Boltzmanns law of energy distribution.

Chemical Thermodynamics

Relation of entropy and energy with equilibrium constant and their dependence on temperature. Clausius-Clapeyron equation. Chemical potential. Partial molar quantities.

Chemical Kinetics

Integrated rate laws second and third order reactions with same and different initial concentrations of reactants. Elementary and complex reactions opposing, parallel and consecutive reactions. Steady state approximation, Lindemann theory of unimolecular reactions. Chain reactions, kinetics of interfacial reactions.

CHM-505 Practicals

- Equilibrium constant of the $KI + I_2 = Kl_3$ reaction
- Kinetics of saponification of ethyl acetate
- Acid catalyzed hydrolysis of sucrose
- Study of the adsorption isotherms of acetic acid charcoal system
- Study of the charge transfer complex formation between iodine and benzene
- Determination of activation energy for the acid catalyzed hydrolysis of ethyl acetate
- Determination of partial molar volumes
- Determination of partition coefficient of a substance in two immiscible liquids.

Books Recommended:

1. R. A. Alberty, J. S. Robert, G. B. Moungi, "Physical Chemistry". 4th Ed, John Wiley and Sons (2004).
2. D. W. Ball, "Physical Chemistry" 1st Ed, Brooks/Cole Co. Inc. (2003).
3. Engel, Thomas, P. Reid, "Thermodynamics, Statistical Thermodynamics, and Kinetics" 1st Ed, Benjamin Cummings (2006).
4. K. James, P. Wothers, "Why Chemical Reactions Happen". 5th Ed, Oxford University Press, USA (2003).
5. Smith, E. Brian, "Basic Chemical Thermodynamics" 5th Ed, Imperial College Press, (2004).

6. B. R. Stephen, S. A. Rice, J. Ross, "Physical Chemistry" 2nd Ed., Oxford University Press, USA (2000).
7. I. Chorkendorff, J. W. Niemantsverdriet, "Concepts of Modern Catalysis and Kinetics" 1st Ed, John Wiley and Sons, USA (2003).
9. J. H. Espenson, "Chemical Kinetics and Reaction Mechanism" 2nd Ed, McGraw Hill (2002).

CHM-507	Analytical Chemistry – I	4(3-1)

CHM-507 Analytical Chemistry-I 4(3-1)

Chemical Analysis and Data Handling: Accuracy of analytical processes such as sampling, weighing, volume measurements, precipitation, washing, filtration and ignition. Recent developments in the sampling techniques, Statistical analysis; random and systematic errors, rounding off the data, arithmetic mean, median, mode, standard deviation, relative standard deviation, student t-test, F-test etc., Quality control and quality assurance, The use of computer in data handling.

Ionic Equilibria in Solutions: Activity and activity coefficients, Hydrogen ion activity and pH for weak acids and bases, Determination of pKa and pKb value, common ion effect and its industrial applications. Buffer its composition and mechanism and buffer capacity. Stability and formation constants of complexes, methods for their determination.

Separation Techniques: Solvent extraction Principle, factors affecting the extraction efficiency, Types and practical applications of solvent extraction in chemical analysis.

Chromatographic methods General theory of chromatography, classification of chromatographic methods, column, paper, thin-layer, and ion-exchange chromatography and their applications.

Practicals

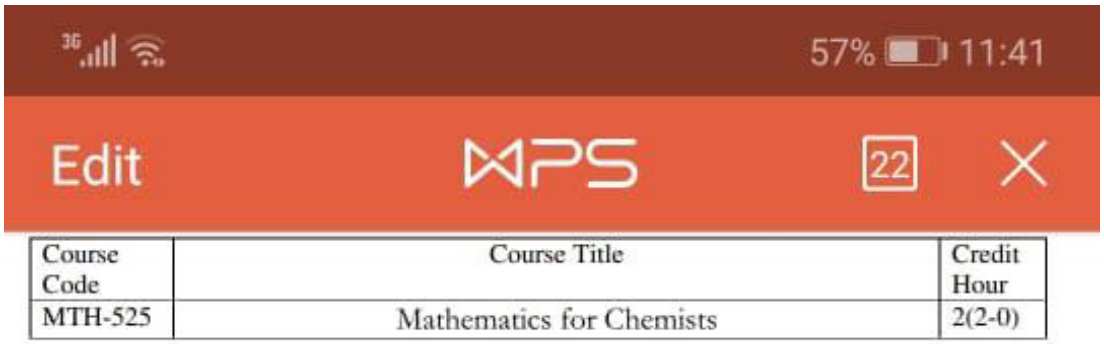
1. Laboratory materials, reagents and safety measures, Calibration of glassware used for volumetric analysis
2. Preparation and standardization of reagents and solutions.
3. Solvent extraction of organic compounds
4. Single step and multiple batch solvent extraction and comparison of efficiency
5. Analysis of iron sodium and potassium in tap water/food samples by spectrophotometry
6. Separation of mixture of organic and inorganic compounds by chromatography methods

Books Recommended:

1. Blackburn, R. Thomas, "Equilibrium- A Chemistry of Solutions", 2nd Ed, Holt, Rinehart and Winston, Inc., (1969).

2. G. D. Christian, "Analytical Chemistry" 6th Ed, John Wiley & Sons, New York, USA (2003).
3. D. C. Harris, "Quantitative Chemical Analysis" 4th Ed, Freeman (1995).
4. D. A. Skoog, D. D. West, F. J. Holler, "Fundamentals of Analytical Chemistry" 6th Ed., Saunders College Publishing (1992).

MTH-525	Mathematics for Chemists	2(2–0)



Course Code	Course Title	Credit Hour
MTH-525	Mathematics for Chemists	2(2-0)

Simple Cartesian Curves, Functions and Graphs, Symmetrical Properties, Curve Tracing, Composition of functions, Limit and Continuity, Differentiation of Functions. Derivative as Slope of Tangent to a Curve and as Rate of Change, Application to Tangent and Normal. Integral as Anti-derivative, Indefinite Integration of Simple Functions. Methods of Integration: Integration by Substitution, by Parts, and by Partial Fractions, Definite Integral as Limit of a Sum.

RECOMMENDED BOOKS

1. Swokowski, Olinick and Pence, *Calculus and Analytical Geometry*, 6th edition, 1994, Brooks/Cole Publishers.
2. Howard Anton, *Calculus*, 7th edition. 2002, John Wiley and Sons (WIE).
3. William E. Boyce Richard C. Diprima, *Calculus*, John Wiley & Sons, ISBN: 0471093335.
4. Thomas Finny, Calculus and Analytical Geometry, 10th edition, John Wiley and Sons.
5. Erwin Kreyzig, Advanced Engineering Mathematics, 7th edition, 1993, John Wiley & Sons Inc.

Semester 6

Semester 6		
CHM-502	Inorganic Chemistry – II	4(3-1)
CHM-504	Organic Chemistry - II	4(3-1)
CHM-506	Physical Chemistry - II	4(3-1)
CHM-508	Analytical Chemistry – II	4(3-1)
CHM-510	Environmental Chemistry	3(3–0)

CHM-502	Inorganic Chemistry – II	4(3-1)

CHM-502 Inorganic Chemistry-II 4(3-1)

1. Chemistry of Non-Aqueous Solvents

Classification of solvents. Type of reactions in non-aqueous solvents. Physical and chemical properties of solvents. Study of reactions in liquid NH_3, HF, SO_2, BrF_3, CH_3COOH and HCN. Reactions in molten salt system.

2. Pi-Acceptor Ligands

Class of ligands. Metal carbonyls, molecular structure, localized bonding (EAN rule, 18 electron rule). Delocalized bonding (Wades rule), spectroscopic evidence of bonding situation. Chemical properties of metal-carbonyls (carbonylate anions, carbonyl hydrides and carbonyl halides). Metal nitrosyls and their derivatives. Applications of metal carbonyls and their derivatives to catalysis and organic synthesis.

3. Kinetics and mechanism of inorganic reactions

Rate law, Stationary state approximation, Labile and inert complexes. Mechanism of substitution reactions in octahedral complexes(hydrolysis reactions, anation reactions, reactions of substituted ligand and redox reactions). Thermodynamic and kinetic stability. Half life.

CHM- 502 Practicals

1. Estimation Of Anions (Any four)

Chloride/Phospate; Chloride/Nitrate; Bromide/Nitrate; Iodide/Nitrate; Borate/ Acetate; Oxalate/ Chloride; Sulphate/Phosphate

2. KIO_3 Titrations (Any two)

3. Gravimetric Estimations:

Estimations of Ba^{2+} ; Oxalate ions.

Books Recommended:

1. J. E. Huheey, "Inorganic Chemistry Principles of Structure and Reactivity" 2nd Ed. Harper and Row Publishers (1978).
2. J. D. Lee, "Concise Inorganic Chemistry" 5th Ed. Chapman and Hall (1996).
3. K. M. Mackay, R. A. Mackay, W. Henderson, "Introduction to Modern Inorganic Chemistry" 5th Ed. Stanley Thornes (Publishers) Ltd. (1996).
4. G. L. Miessler, A. T. Donald, "Inorganic Chemistry". 2nd Ed, Prentice-Hall

Prentice-Hall International, Inc. (1991).
5. F. A. Cotton, G. Wilkinson, "Advance Inorganic Chemistry", 5th Ed, John Wiley & Sons, Inc. (1988).
6. F. A. Cotton, G. Wilkinson, C. A. Murillo, M. Bockhmann, "Advanced Inorganic Chemistry" 6th Ed, John Wiley & Sons, Inc. USA (1999).
7. A. K. Holliday, A. G. Massey, "Inorganic Chemistry in Non-Aqueous Solvents", 6th Ed., Pergamon Press. (1985).

CHM-504	Organic Chemistry - II	4(3-1)

CHM-504 Organic Chemistry-II 4(3-1)

Aliphatic nucleophilic substitution and Elimination reactions

Aliphatic nucleophilic substitution reactions Meachanisms and study of SN1, SN2, SN1, SN2, mechanism; neighbouring group participationintra molecular displacement by neighbouring oxygen, nitrogen, sulphur and halogen; The effects of the substrate structure, entering group, leaving group and reaction medium on the mechanisms and rates of substitution reactions.

Elimination ReactionsMechanisms study of E1, E1cB and E2 mechanisms; attacking base, leaving group and the reaction medium on the rates and mechanisms of elimination reactions; competition between elimination andsubstitution reactions.

Aromatic Substitution reactions

Electrophilic substitution Aromaticity; mechanisms of substitution; orientation sulfonation, Friedel-Crafts reactions, diazo-coupling, formylation and carboxylation.

Nucleophilic substitutionMechanisms-Study of SNAr, SN1 and benzyne mechanisms; The effects of substrate structure, leaving group and the attacking nucleophile on the rates of substitution reactions.

Named Organic Reactions

Cannizzaro reaction, Perkin reaction, Michael reaction, Claisen-Schmidt reaction, Darzens Glycidic Ester reaction, Stobbe reaction, Mannich reaction, Wittig reaction, Ene reaction and Reformatsky reaction, Diels-Alder reaction.

CHM-504 Practicals

Organic Synthesis at least four experiments involving two step synthesis

Estimation of Amide and Carboxyl groups, Phenol and other functional groups.

Determination of Saponification value and acid value in oil.

Books Recommended:

1. F. A. Carey, R. J. Sundberg, "Advanced Organic Chemistry (Part B: Reactions and Synthesis)", 3rd Ed, Plenum Press, New York, USA (1990).
2. B. K. Carpenter, "Determination of Organic Reaction Mechanisms, "John Wiley & Sons, Inc. (1984).
3. G. R. Chatwal, "Reaction Mechanism and Reagents in Organic Chemistry", 1st Ed., Himalaya Publishing House (1987).
4. J. Fuhrhop, G. Penzlin, "Organic Synthesis Concepts, Methods, Starting Materials", 2nd Ed., Weinheim Germany (1983).

5. R. K. Mackie, D. M. Smith, "Guide book to Organic Synthesis", Longman Group Ltd. (1982).
6. J. March, "Advanced Organic Chemistry Reactions, Mechanisms and Structure", 4th Ed, John Wiley & Sons, Inc; USA (1992).
7. A. Streitwieser, C. H.H. Cock, "Introduction to Organic Chemistry", 3rd Ed, Macmillan Publishing Company (1989).
8. P. Sykes, "A Guide Book to Mechanism in Organic Chemistry", 6th Ed, Longman Group Ltd. (1986).
9. A. L. Vogel, "Elementary Practical Organic Chemistry Part III: Quantitative Organic Analysis", 1st Ed., Longman Group Ltd (1958).

CHM-506	Physical Chemistry - II	4(3-1)

CHM 506 Physical Chemistry II 4(3-1)

Electrochemistry

Theory of metallic conduction, electrode potential, electrochemical cell, electrolysis and related issues, liquid junction potential electron transfer reactions, rate of charge transfer reaction, cell potential and thermodynamics, and Nernst equation, Voltammetry, fuel cells. Corrosion and its prevention. Ion in aqueous solution, ionic activity and Debye Huckel Theory.

Quantum Chemistry and Spectroscopy

Eigen functions and eigenvalues, Schrödinger wave equation and its applications, Hamiltonian operator, Simple harmonic oscillator. Rigid rator, vibrator, Quantum numbers.

Symmetry Elements

Introduction, Coordinate System, Symmetry operations and symmetry Elements, The Symmetry Point Groups.

CHM-506 Practicals

- Determination of molecular weight of a polymer by viscosity method
- Precipitation value of electrolytes
- Measurement of IR spectra of simple compound and their interpretation
- Measurement of cyclic voltammogram of an organic compound and its interpretation
- Determination of dipole moment of an organic liquid
- Determination of percentage composition of $KMnO_4$ / $K_2Cr_2O_7$ in a given solution by spectroscopy.
- Stoichiometry of a complex in solution by jobs method
- Evaluation of pKa value of indicator by spectrometric method

Books Recommended:

1. F. Cotton, Albert "Chemical Applications of Groups Theory", 1st Ed, Interscience Publishers (1963).
2. G. W. King, "Spectroscopy and Molecular Structure", 1st Ed, Rinehart and Winston (1964).
3. J. Albery, "Electrode Kinetics", 2nd Ed, Clarendon, Oxford, (1975).
4. O. M. J. Bockris, A. K. N. Reddy, "Modern Electrochemistry" 2nd Ed, Vol. I and 2, Plenum Press, New York, USA (1970).
5. D. F. Micheal, "Elements of Quantum Mechanics" 2nd Ed., Oxford University Press, USA (2005).
6. H. H. Lowell, "Group Theory and Symmetry in Chemistry" 1st Ed, McGraw Hill Book Company (1969).
7. D. H. Whiffen, "Spectroscopy" 1st Ed, Longmans Green and Co.: London, (1966).

CHM-508	Analytical Chemistry – II	4(3-1)

CHM-508 Analytical Chemistry-II4(3-1)

Spectroscopy, Theory and principals of Spectroscopy, Lambert-Beer's Law and its limitations, Single and double beam spectrophotometers, sources of light (lamp and lasers), monochromators, photomultiplier tubes, detectors, diode array and charged coupled devices, applications of UV-Vis spectrophotometer in natural product research, pharmaceutical industry, separation process, enzyme essay study, clinical studies, microbiology. Applications of IR, NMR and Mass spectrophotometer in research & development and quality control process.

Practicals

1. Qualitative and quantitative analysis by UV/Visible Spectroscopy
2. Identification of functional groups of organic compounds by IR spectroscopy
3. Identification of organic compounds using available and accessible spectroscopic techniques
4. Sample preparation for various molecular spectroscopic techniques; IR, FTIR, MS
5. Visit of Hi-Tech Lab and practical demonstration of molecular spectroscopic techniques; IR, FTIR, MS

Reference Books:

1. Christian, G.D. Analytical Chemistry, 6th ed., John-Wiley & Sons, New York, (2004).
2. Harris, D.C. Quantitative Chemical Analysis, 8th ed., W. H. Freeman and Company, New York, (2011).

3. Skoog, D. A., West, P.M., Holler, F.J. and Crouch, S. R., Fundamentals of Analytical Chemistry, 9th ed., Cengage Learning, (2013).
4. Braun, R.D. Introduction to instrumental Analysis, International student Edition, (1985).

CHM-510	Environmental Chemistry	3(3–0)

CHM-557 Environmental Chemistry 3(3-0)

Introduction, General principle and Techniques. Soil, sludge, sediment and dust analysis. Analysis of plant Material, Analysis of Atmospheric samples, Analysis of Water, determination of toxic organic Chemistry. Toxicity of heavy metals. Biological indicators, Green Chemistry, Echo toxicology.

Recommended Books:

1. B. B. Kebbekus, S. Mitra "Environmental Chemical Analysis", 1st Ed., Blackie Academic & Professional, New York, USA (1998).
2. D. Barcelo, "Environmental analysis: Techniques, Applications and Quality Assurance", Volume 13, Elsevier B.V., Netherland (1993).
3. P. Patnaik, "Handbook of Environmental Analysis", 2nd Ed, CRC Press, Taylor and Francis Group, UK (2010).

Semester 7

For All Specialization

ENG-611	English for Employment	3(3–0)

English for Employment 7th Semester (BS), 3rd Semester(MSc.)

Contents:

8. Forms of Communication:
- Verbal Communication
- Non-Verbal Communication
- Written Communication

9. Non-Verbal Communication
- What is Non-Verbal communication
- Characteristics of Non-Verbal Communication
- Classification of Non-Verbal Communication
- Advantages of learning Non-Verbal Communication
- Guidelines to develop Non-Verbal Communication

10. Verbal Communication
- Presentation Skills
  - What is presentation?
  - Qualities of a good presenter
  - Essential characteristics of a good presentation
  - Elements of a presentation
  - Designing of your presentation
- Interview Skills
  - Preparation of an interview
  - How to handle difficult questions
  - Most common mistakes to avoid during an interview
  - Tips of a successful interview
- Telephonic Conversations
  - How to enquire (job vacancy, scholarships, admissions)

- ❖ How to respond to an enquiry
- ❖ Effective use of Meta communication (Vocalization)

11. Written Communication

- Principles of effective writing
- Business writing- keys points to remember
- E-mail Writing
  - ❖ Advantages of e-mail writing
  - ❖ The most common complaints about e-mail in practice
  - ❖ How to create electronic rapport
  - ❖ Sample e-mail messages
  - ❖ Writing subject lines
  - ❖ Writing negative messages
  - ❖ Writing positive messages
  - ❖ Writing an enquiry e-mail
  - ❖ Writing a response to an enquiry
- CV Writing
  - ❖ How to read a job advertisement
  - ❖ Responding to Job advertisement
  - ❖ To identify individual strengths and skills to write CV
  - ❖ Writing an effective CV
- How to fill job application form
- How to write a Cover letter
- Report writing
- How to write a Research Proposal

12. Employability Skills

- Strategies to identify employment opportunities
- Business Etiquettes
  - ❖ Etiquette in the Workplace

- ❖ Etiquette in the Social settings
- Workplace Ethics
- Cultural Awareness
  - ❖ Intercultural sensitivities
  - ❖ Communicating effectively across cultures
- Positive thinking
  - ❖ Role of positive thinking in successful career
  - ❖ How to be positive in crucial situation

Recommended Readings:

- ❖ Tata McGraw-Hill Edition: Communication for business
- ❖ P.D.Chaturvedi&MukeshChaturvedi, Business Communication. Pearson
- ❖ Courtland Bovee&JohnThill , Business Communication Essentials. Pearson

Compiled by: Ms. Fareeha Saleem
Approved and recommended by: Chairman of English Department
Dr.Mazhar Hayat

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Semester 7

Specialization in Analytical Chemistry

Semester 7		
ENG-611	English for Employment (given above)	3(3–0)
CHM-601	Electroanalytical Techniques	3(3–0)
CHM-603	Advanced Separation Techniques	3(3–0)
CHM-605	Atomic Spectroscopy	3(3–0)
CHM-607	Analytical Chemistry Practicals – I	2(0 – 2)

CHM-601	Electroanalytical Techniques	3(3–0)

Introduction: Electrochemistry, Electrochemical cells, Standard cell potential, Indicator electrode, Reference electrodes, Classification of electro analytical methods, Bulk method, Interfacial methods, static methods, dynamic methods

Potentiometric method of analysis: Potentiometric measurements, Indicator electrodes, Metallic indicator electrode, Membrane indicator electrode, working of potentiometer and its application including pH measurements, ion selective electrode systems, ion exchange membrane electrode, solid state membrane electrodes and bio-membrane electrodes, potentiometric titrations.

Coulometry and Electrogravimetry: Basic electrochemistry, principle, instrumentation of coulometry, principle, instrumentation of electrogravimetry, consequences of electrogravimetry, Ohmic drop, activation over potential, concentration and gas polarization, basic difference and merits/demerits of coulometry and electrogravimetry.

Reference Books:

1. Christian, G.D. Analytical Chemistry, 6th ed., John-Wiley & Sons, New York, (2004).
2. Harris, D.C. Quantitative Chemical Analysis, 8th ed., W. H. Freeman and Company, New York, (2011).
3. Skoog, D. A., West, P.M., Holler, F.J. and Crouch, S. R., Fundamentals of Analytical Chemistry, 9th ed., Cengage Learning, (2013).
4. *Braun, R.D. Introduction to instrumental Analysis, International student Edition, (1985).*

CHM-603	Advanced Separation Techniques	3(3–0)

Chromatography:
Classification of chromatographic techniques, 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.

High Performance Liquid Chromatography:
General principle, sample preparation, separation process (normal phase and reverse phase separation), instrumentation, method development and applications.

Capillary Electrophoresis (CE):
Introduction to Electrophoresis, Theory and principle of CE, mobility, electro-osmotic flow separation by CE, instrumentation, modes of operation, applications.

Reference 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. *Braun, R.D. Introduction to Chemical Analysis, International student Edition, (1985).*

CHM-605	**Atomic Spectroscopy**	**3(3–0)**

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, wavelength selectors, 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 plasma, direct current plasma, microwave induced plasma, choice of argon as plasma gas, instrumentation for ICP-MS.

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 absorption spectrophotometry, interferences, merits and limitations.

Reference Books:

1. Christian, G.D. Analytical Chemistry, 6th ed., John-Wiley & Sons, New York, (2004).
2. Harris, D.C. Quantitative Chemical Analysis, 8th ed., W. H. Freeman and Company, New York, (2011).
3. Skoog, D. A., West, P.M., Holler, F.J. and Crouch, S. R., Fundamentals of Analytical Chemistry, 9th ed., Cengage Learning, (2013).

Braun, R.D. Introduction to instrumental Analysis, International student Edition, (1985).

CHM-607	Analytical Chemistry Practicals – I	2(0 – 2)

The experiments may be set making use of the following instruments depending upon their availability. The Instructor should consult the "Journal of Chemical Education" for the innovative designing of experiments. Special experiments may also be designed for which a specimen list of instruments/techniques is given below.

Conductometry, Potentiometry, Coulometry, Electrogravimetry, Column Chromatography

Gas Chromatography, HPLC, Capillary Electrophoresis. Atomic Absorption Spectroscopy and Atomic Emission Spectroscopy.

Experiments

Determination of iron in soil by spectrophotometry.
Spectrophotometric determination of molybdate ion.
Separation of dyes using column/paper/thin layer chromatography.
Separation of sugars using paper chromatography.
Separation of amino acids using paper/thin layer chromatography.
Separation of hydrocarbons using GC/HPLC.
Determination of iron in foods products spectrophotometrically.
Determination of phosphate content in commercial fertilizers by spectrophotometry.
Determination of nickel in vegetable ghee by spectrophotometry involving solvent extraction.
Identification and spectrophotometric determination of aspirin, phenacetine and caffeine in pharmaceutical samples.
IR analysis and identification of human body stones
Mass spectrometry of mineral oil samples.
To determine pKa values for the given samples of weak acids by potentiometric method.

To determine the quality parameters i.e. pH, conductance and concentration of anions cations.
To determine Ni (II) in steel using DMG reagent by spectrophotometric method.
To determine vitamin-C concentration in the given samples.
To determine calcium and zinc in milk by atomic absorption spectrophotometer.
To determine lead in sewage sludge by atomic absorption spectrophotometer.
To determine Mn and Cr in stainless steel spectrophotometrically.
To record and characterization of IR spectra of at least 1organic compounds.

Semester 7

Specialization in Inorganic chemistry

Semester 7 Specialization in Inorganic Chemistry		
ENG-611	English for Employment	3(3 – 0)
CHM-611	Main Group Organometallic and Organic Reagents	3(3 – 0)
CHM-613	Spectroscopic Methods of Analysis	3(3 – 0)
CHM-615	Organo-Transition Metal Compounds	3(3 – 0)
CHM-617	Inorganic Chemistry Practicals – I	2(0 – 2)

CHM-611	**Main Group Organometallic and Organic Reagents**	**3(3 – 0)**

Main Group Organometallic Reagents
Introduction, Preparation, classes of necleophilic organometallic reagents organo-Li**, S,** Sc, Si, B, Sn, Sb and Zn in organic synthesis, control side reaction (Enolization vs. nuelecophilic addition, substitution vs. elimination, selectively among functional griops via organometallic reagents
Organic reagents in inorganic Analysis
Type of reagents, their specific nature and methods of applications with specific examples, Complexometric and gravimetric methods involving various reagents, chelates and chelate effect.

Recommended Books:

1. C. R. Dillard, D. E. Goldberg, “Chemistry, Reactions, Structure and Properties” Colliers-Macmillan Limited, London, UK (1971).
2. E. S. Gould, “Inorganic Reactions and Structures” Holt, Rinehart and Winston, Inc. Revised Edition (1962).

3. A. K. Holliday,A. G. Massey, "Inorganic Chemistry in Non-Aqueous Solvents", 6th Ed., Pergamon Press. (1985).
4. J. E. Huheey, "Inorganic Chemistry Principles of Structure and Reactivity" 2nd Ed., Harper and Row Publishers (1978).

CHM-613	Spectroscopic Methods of Analysis	3(3 – 0)

Physical methods of analysis in Inorganic Chemistry, NMR, IR, UV Spectroscopy, Mass Spectrometry, Basic Principles, Instrumentation and Applications.

Recommended Books:

1. D. L. Pavia, G. M. Lampman, G. S. Kriz, Jr., "Introduction to Spectroscopy," 2nd Ed., W.B. Saunders, (1979).
2. D. W. Mathieson, "Nuclear Magnetic Resonance for organic Chemistry," Academic Press, London, UK (1967).
3. A. Douglas, F. Skoog, J. Holler, A. T. Neuman "Principles of Instrumental Analysis", 5th Ed, Saunders College Publishing, New York, USA (1997).
4. E. A. V. Ebsworth, D. W. H. Rankin, S. Cradock, "Structural Methods in Inorganic Chemistry," 2nd Ed., Blackwell, (1987).
5. E. D. Hoffmann, "Mass Spectrometry: Principles and Applications" 2nd Ed., V. Stroobant (Ed.,) John Wiley & Sons, USA (2001).
6. H. Budzikiewitz, C. Djerassi, D. H. Williams, J. R. Chapman, "Practical Organic Mass Spectrometry," John Wiley and Sons, USA (1985).

CHM-615	Organo-Transition Metal Compounds	3(3 – 0)

Introduction, Cluster Compounds: Nomenclature and Structural Patterns, Metal Carbonyl Type Clusters, Anionic, Hydrido, Larger and Superlarge Carbonyl Clusters, Non-Carbonyl Clusters, Heteroatom in Clusters, Electron Counting Rules (TEC, Wades, Capping). Metal to Carbon Single, Double and Triple bonds; Acyls, Alkylidene and Alkalidyne Complexes, Bonding to Olefins, Polyolefins, Allyl, Alkyne and Arene Complexes.

Recommended Books

F. A. Cotton, G. Wilkinson, C. A. Murillo, M. Bochmann, "Advanced Inorganic Chemistry", 6th Edition, John Wiley and Sons (2003).
G. L. Miessler and D.A. Tarr, Inorganic Chemistry", 3rd Edition, Pearson Education, Inc., (2004).
W. W. Porterfield, Inorganic Chemistry, A Unified Approach, 2nd Edition, Elsevier (1993).
B. Douglas, D. McDaniel, J. Alexander, Concepts and Models of Inorganic Chemistry, 3rd Edition, Johan Wiley and Sons (2006).

CHM-617	Inorganic Chemistry Practicals – I	2(0 – 2)

1. **Conductometry**

- Titration of strong acid and weak acid with a strong base.
- Precipitation titration involving $AgNO_3$ and KCI.

2. **Potentiometry**

- Determination of K1, K2 and K3 for H_3PO_4
- Determination of chloride in the presence of iodide and evaluation of AgI and AgCl

3. **Spectrophotometry**

- Micro determination of Cr(III) by Di-phenyllecarbazide.
- Determination of Fe (II) by 1-10Phenanthroline.
- Determination of nitrites. Determination of Fe (III) by 8-hydroxyquinoline.

4. **Use of some Organic Reagents for the estimation of various elements by gravimetric estimation.**

- 8-Hydroxyquinoline AI (III) and Fe (III)
- Salicylaldoxime: Ni (II) in the presence of Cu (II)
- Anthranilic acid: Co (II) and Zn (II)

5. **Inorganic Synthesis:**

Preparation of at least six inorganic compounds/complexes in a pure state and determination of their state of purity.

Semester 7

Specialization in Organic chemistry

Semester 7 Specialization in Organic Chemistry		
ENG-611	English for Employment	3(3 – 0)
CHM-621	Spectroscopic Organic Techniques	3(3 – 0)
CHM-623	Rearrangements and Pericyclic Reactions	3(3 – 0)
CHM-625	Pharmaceutical Chemistry	3(3 – 0)
CHM-627	Organic Chemistry Practicals – I	2(0 – 2)

CHM-621	Spectroscopic Organic Techniques	3(3 – 0)

(a) Introduction

Electromagnetic radiations. Wavelength, frequency, wave number and energy of electromagnetic radiations and their interconversion. Electromagnetic spectrum. Interaction transitions and spectral regions. Relaxation of the excited molecules.

(b) Ultraviolet/Visible Spectroscopy:

Introduction, Electronic transitions and absorption of electromagnetic radiations, Intensities of absorption, Beer-Lambert Law and its applications, Instrumentation and sample handling, The chromophore, Absorption by conjugated systems, Woodward fieser rules for conjugated dienes and unsaturated carbonyl systems, Absorption by aromatic compounds, Application of UV/Vis spectroscopy.

(c) Infrared Spectroscopy:

Introduction, Vibrational modes and absorption frequencies, Hooks Law, Instrumentation and sample handling, Interpretation of Infrared spectra, Characteristic absorptions frequencies of some common functional groups, Applications of Infrared spectroscopy.

(d) Nuclear Magnetic Resonance:

Introduction, Spin flipping Nuclear Precession and absorption of electromagnetic radiation, Spin relaxation, The Chemical shift and integration curve, Molecular structure and chemical shifts, Instrumentation and Sample handling, Spin splitting and coupling constants. Interpretation of NMR spectra.

(e) Mass spectrometry:

Introduction, Basic Principle, Instrumentation (theory and operation) The mass spectrum, Modes of Fragmentation of various organic molecules. Applications of mass spectrometry determination of molecular weight, molecular formula and molecular structure. Interpretation of mass spectra.

Recommended Books:

1. H. E Duckworth, R. C Barber, V.S Barber, V.S Venkatasubramanian "Mass Spectroscopy", 2nd Ed., Cambridge University Press, London, UK (1996).

2. E. D. Hoffmann, J. Charette, V. Stroobant, "Mass Spectrometry, Principes & Applications", John Wiley & Sons, USA (1996).
3. A. Frigerio "Essential Aspects of Mass Spectrometry", Spectrum Publication, Ine New York, USA (1974).
4. H. Friebolin "Basic one and two dimensional NMR Spectroscopy", 2nd Ed, VCH (1988).
5. G. E Martin, A. S Zektzer, "Two Dimensional NMR Methods for Establishing Molecular Connectivity" VCH (1988).
6. W. Voelter "Carbon-13 NMR Spectroscopy", 3rd Ed., VCH (1990).
7. Atta-ur-Rahman "Nuclear Manetic Resonsance Spectroscopy",UGC, Islamabad (1989).
8. H. Gunther, "NMR Spectroscopy", 3rd Ed., John Wiley and Sons, New York, USA (1972).
9. R. M. Silverstein, G. G. Bassler, "Spectrometric Identification of Organic Compounds" 5th Ed., John Wiley & Sons, New York, USA (1998).
10. W. Kemp, "Organic Spectroscopy", 3rd Ed., Macmillan, London, USA (1991).

CHM-623	Rearrangements and Pericyclic Reactions	3(3 – 0)

Classification of rearrangement, Pinacol Pinacolon rearrangement, Benzil benzilic acid rearrangement, R.A involving Diazomethane, Favorski R.A, Hofman R.A. Schmidt R.A, Lossen R.A, Bayer Villiger, R.A, benzidine R.A, Fries R.A. Sigma tropic R.A.
Migration of carbon, cope rearrangement, claisen rearrangement benzidine rearrangement. [1,3] H, [1,5], [1,7] H, [1,9] H migration.

Pericyclic Reactions

Conrotatory and Disrotatory motion of orbital, electrocyclic reactions, thermal cyclization, Photochemical cyclization, Hofman rule, Fukui Theory of Frontier orbitals.
Introduction to cycloaddition reactions. Supraficial and Antanafacial addition woodmard Hofman Rule. Frontier theory and mobius huckle theory for (2 + 2) and (2 + 4) thermal and photochemical cycloaddition reaction.

Recommended Books:

1. R. O .C. Norman "Principles of Organic Synthesis", Blackie Academic & Professional, 3rd Ed. (1993).
2. F. L. Ansari, R. Qureshi and M. L. Qureshi "Electrocyclic Reactions – from Fundamentals to Research", 1st Ed., John Wiley and Sons, (1999).
3. J. Clayden, N. Greeve, S. Warren, P. Wothers, "Organic Chemistry", 1st Ed., Oxford University Press, USA (2001).

CHM-625	Pharmaceutical Chemistry	3(3 – 0)

Alkolids
Introduction, occurrence, function of Alkolids in plants, Classification, Nomenclature, Pharmaceutical Applications, Isolation, Qualitative Test and General Properties, General Method of Structure Determination. Morphines, Nicotine, Quinine.
Drugs
Introduction, Sources, Route of administration, Metabolites and mechanism of drug action. Sulfonamide, Antipyretics, Analagasic, Barbiturates, Antibiotics, their general synthesis and structure activity relationship.

Recommended Books:

1. Koji Nakanishi et "Natural Products Chemistry", 1st Ed., Vol. I. (1974).
2. Mann, "Secondary Metabolism", Oxford Science Publication, 2nd Ed. (1987).
3. J. D. Bu Lock "The Biosynthesis of Natural Products", 1st Ed., McGraw-Hill, London, UK (1965).
4. S. V. Bhat, B. A. Nagasampagi, M. Sivakumar "Chemistry of Natural Product" 1st Ed., Narosa Publishing House (2005).

CHM-627	Organic Chemistry Practicals – I	2(0 – 2)

Synthesis of Organic Compounds:
Students must be informed of MSDS of all compounds used in experiments.
The experiments may be arranged as per choice/requirement of instructor but should be designed from following categories;
Various experiments involving the development of amide, ester and ether linkages.
Experiments involving oxidation and reduction of organic compounds.
Synthesis of various dyes.

Recommended Books:

1- J. Fuhrhop, G. Penzlin, "Organic Synthesis Concepts, Methods, Starting Materials", 2nd Ed., Weinheim Germany (1983).
2- A. L. Vogel, "Elementary Practical Organic Chemistry Part III: Quantitative Organic Analysis", 1st Ed., Longman Group Ltd (1958).
3- F. A. Carey, R. J. Sundberg, "Advanced Organic Chemistry (Part B: Reactions and Synthesis)", 3rd Ed, Plenum Press, New York, USA (1990).
4- B. S. Fumiss, A. J. IIannaford, P.W.G. Smith, A. R. Tatchell "Vogel's Practical Organic Chemistry", 5th Ed, Addition Wesley Longman, Harlow, England(1989).

Semester 7
Specialization in Physical Chemistry

Semester 7 Specialization in Physical Chemistry		
ENG-611	English for Employment	3(3 – 0)
CHM-631	Kinetics of Complex Reactions	3(3 – 0)
CHM-633	Advanced Spectroscopy	3(3 – 0)
CHM-635	Material Chemistry	3(3 – 0)
CHM-637	Physical Chemistry Practicals – I	2(0 – 2)

CHM-631	Kinetics of Complex Reactions	3(3 – 0)

Chemical Reactions
Advanced theories of unimolecular reactions, Chain and non chain complex reactions, Fast reactions, Experimental techniques for measurement of fast reaction kinetics, Kinetics of catalyzed reactions

Photochemical Reactions
Introduction, Photochemical reactions, photochemical reactions in gas phase and in solutions, quantum yields, flash photolysis, photochemical reaction kinetics

Interfacial Phenomena
Solid surfaces, Gas solid interfaces, thermodynamics of adsorption, adsorption at liquid surfaces, organized molecular assemblies, colloids and surfactants, liquid interfaces, surface tension and adsorption from solutions,

Recommended Books:

1. S. Asperger, "Chemical Kinetics and Inorganic Reaction Mechanisms" 2nd Ed., Springer Verlag (2003).
2. J. H. Espenson, "Chemical Kinetics and Reaction Mechanism "2nd Ed., McGraw Hill London, UK (2002).
3. D. C. Neckers, G. von, B. Unau, W. S. Jenks, "Advances in Photochemistry", Vol. 27, John Wiley & Sons, Inc. USA (2002).
4. P. W. Atkins, "Physical Chemistry" 6th Ed, W. H. Freeman and co. New York, (1998).
5. K. J. Laidler, "The World of Physical Chemistry" 1st Ed., Oxford University Press, pp. 488 (1993).

CHM-633	Advanced Spectroscopy	3(3 – 0)

Molecular Spectroscopy
Electromagnetic radiations, interactions of electromagnetic radiations with matter, microwave, infrared and Raman spectroscopy of polyatomic molecules, vibrational-rotational spectra,
Nuclear Magnetic Resonance
Principles of megnatic resonance. Nuclear magnetic resonance (NMR) spectroscopy. Coupling phenomenon in simple (AXn) and complex systems. Relaxation mechanisms and their applications. Dynamic NMR. Applications in structure elucidation.
Electron Spin Resonance
Electron spin resonance spectroscopy (ESR). Principles and applications to solids and solutions.

Recommended Books:

1. J. D. Graybal, "Molecular Spectroscopy," McGraw-Hill, New York, USA (1988).
2. G. M. Barrow, "Introduction to Molecular Spectroscopy," 2nd Ed, McGraw-Hill, New York, USA (1962).
3. C.N. Banwell, " Molecular Spectroscopy" 3rd edition Tata-Mc Grahill Publishing Company , New Delhi, India, 1983.

CHM-635	Material Chemistry	3(3 – 0)

Physical Chemistry of Macromolecules
Introduction, molecular forces and chemical bonding in macromolecules, configurations and conformation of polymer chains, theories of polymer solutions, spectroscopic analysis, thermal analysis, polymer reheology
Solid State
Introduction, attractive forces, properties of solids, crystal structure, crystal defects, crystallography, theories of bonding, packing of atoms in metals.

Modern Materials
Composite materials, superconductors, conducting polymers, biopolymers, Bullet proof polymers, edible plastics, smart materials, nano particles.

Recommended Books:

1. S. F. Sun, "Physical Chemistry of Macromolecules" 2nd Ed, John Wiley and Sons, INC. New York, USA (2004).
2. G. C. Bond, "Heterogeneous Catalysis" 2nd Ed., Clarendon Press. Oxford, USA (1987).
3. Anthony West "Basic Solid State Chemistry" John Wiley and sons, 1988, USA.

4. Robert J. Young, " Introduction to polymers" Capmann and Hall, 1981, USA.
5. Joel R. Fried " Polymer Science and Technology " Prentice Hall PTR. 1995. USA.
6. Fred W. Billmeyer "Text of Polymer Science" Wiley Interscience Publications, John Wiley and sons , 1984, USA.

CHM-637	Physical Chemistry Practicals – I	2(0 – 2)

Note: Any ten Experiments will be Conducted according to the Availability of Apparatus & Chemicals

1. Sugar analysis and inversion studies by polarimetry
2. Verify Beer's Lambert's Law for the given solution.
3. Investigate the kinetics of hydrolysis of ethyl acetate in the presence of hydrochloric acid at room temperature and determination of order of reaction.
4. Interpretation of IR and NMR spectra
5. Determination of molecular weight of given sample of polymer viscometrically
6. Thermal analysis of given polymer sample with the help of available established literature
7. Surface characteristics of given polymer sample with the help of available established literature
8. Waste water treatment using chemicals
9. Waste water treatment using advanced oxidation process
10. Study of isotherms and experiments of surface chemistry
11. Preparation of colloidal solution and determination of precipitation value of colloidal solution by using monovalent, bivalent and trivalent cations
12. Determination of apparent molar volume of different sample solutions
13. Calculation of partial molar volume by graphical method
14. Kinetic study of enzyme catalyzed reactions

Semester 8

For All Specializations

STA-321	Introduction to Statistical Theory	3(3 – 0)

Course Title: Introduction to Statistical Theory Credit Hours: 3(3-0)
Course Code: STA-595/321

Introduction and scope of statistics, Basic concepts of statistics, Different types of variables, types of data and methods of data collection, Scales of measurement, Data arrangement and presentation, formation of tables and charts, Measures of central tendency: mean, median and mode and quantiles from grouped and ungrouped data. Measures of dispersion: computation of range, variance, standard deviation, and coefficients of variation, Skewness and Kurtosis, Definition of probability, Different terminology used in probability, Different laws of probability, Discrete distributions (Binomial distribution, Poisson distribution, Negative Binomial distribution, geometric distribution, hyper geometric distribution with their properties and applications), Continuous distribution (Normal distribution with their properties and applications), Correlation and Regression, Survey sampling, Types of Sampling (probability and non probability sampling), Sampling Distribution of mean, Hypothesis testing: Z-test for single and difference between mean, Student's 't' test for single and difference between mean. Chi-square test of independence and goodness of fit, Analysis of variance and LSD.

Recommended Books

1. Ronald Walpole, Myers, Myers, Ye, "Probability & Statistics for Engineers & Scientists", 8th edition, 2008, Prentice Hall Publisher.
2. Sher M. Chaudhry, Shahid Kamal, "Introduction to Statistical Theory I and II".
3. Steel, R.G.D. and Torrie,J. H.,1980. Principles and procedures of statistics. McGraw Hill International Editions.
4. Zar, 1998. Biostatistics Analysis

Semester 8

Specialization in Analytical Chemistry

Semester 8 Specialization in Analytical Chemistry		
STA-321	Introduction to Statistical Theory	3(3 – 0)
CHM-602	Thermal Methods of Analysis	3(3 – 0)
CHM-604	Nuclear Analytical Techniques	3(3 – 0)
CHM-606	Food and Drug Chemistry	3(3 – 0)
CHM-608	Standard Methods & Quality Assurance	3(3 – 0)
CHM-610	Analytical Chemistry Practicals – II	2(0 – 2)

CHM-602	Thermal Methods of Analysis	3(3 – 0)

Thermal Analysis: Introduction, classification and principles of thermal analysis, thermograms, instrumentations, applications and limitations of thermal analysis.

Thermogravimetric Analysis (TGA) and Derivative Thermal analysis (DTA):
Introduction and principle of thermogravimetric analysis and derivative thermal analysis, its instrumentation, applications, data interpretations, limitations.

Differential Thermal Analysis (DTA): Introduction and principle of differential thermal analysis, its instrumentation, applications, data interpretations, limitations.

Differential Scanning Calorimetry (DSC):
Introduction and principle of differential scanning calorimetry, its instrumentation, applications, data interpretations, limitations.

Differential Photo-Calorimetry (DPC): Introduction and principle of evolved gas analysis, its instrumentation, data interpretations, applications.

Evolved Gas Analysis (EGA): Introduction and principle of evolved gas analysis, its instrumentation, data interpretations, applications.

Thermo-mechanical Analysis (TMA): Introduction and principle of thermo-mechanical analysis, its instrumentation, applications, data interpretations, limitations.

Dynamic Mechanical Analysis (DMA): Introduction and principle of dynamic mechanical analysis, its instrumentation, data interpretations, applications.

Di-electric Thermal Analysis (DETA): Introduction and principle of di-electric thermal analysis, its instrumentation, data interpretations, applications.

Reference Books:

1. Principles of Thermal Analysis and Calorimetry, by P. J. Haines Oakland Analytical Services, Farnhurn,Surrey, U K, Royal Chemical Society.
2. Braun, R.D. Introduction to Instrumental Analysis, International student Edition, (1985).
3. Haines. P. J., Whiltby, On Canada Mcgraw Hill Ltd., Thermal Methods of Analysis Principles, applications and problems, 1st ed. Springer, (1985).
4. Stephen Z.D. Cheng, Handbook of Thermal Analysis and Calorimetry, Vol. 3, Elsevier, (2002).

5. Brown, M. E. Introduction to Thermal Analysis: Techniques and Applications, 2nd ed., Kluwer Academic Publishers, (2001).
6. Gabbot, P., Principles & Applications of Thermal Analysis, Wiley-Blackwell, (2007).

CHM-604	Nuclear Analytical Techniques	3(3 – 0)

Introduction to Nuclear sciences, Radioactive decay, Production of nuclear radiation, Interaction of radiation with matter, Radio-analytical techniques, Radiation detection and measurement instruments,Role of radiotracers in development of modern nuclear analytical techniques, Applications of radio-tracers in medical, environment, agriculture and industries.

Reference Books:

1. V.S. Ramachandran, J.J. Beaudoin Handbook of Analytical Techniques in Concrete Science and Technology, Principle, Technique and Applications. William Andrew Publishing. Norwich, New Yourk, USA, 2001.
2. Brune, D.; Forkman, B.; Persson, B. Nuclear analytical chemistry, Chartwell-BrattLtd.,Bromley, England, United States, 1984.
3. R Cornelis, J Caruso, H Crews, K Heumann Handbook of elemental speciation II: species in the environment, food, medicine and occupational Health. Wiley

CHM-606	Food and Drug Chemistry	3(3 – 0)

Introduction to food analysis, food gradients and nutritional values, 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, test 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.

Reference Books:

1. Yolanda Picó, Chemical Analysis of Food: Techniques and Applications Academic Press, ELSEVIER, Spain, 2012.

2. Leo M. L. Nollet. Handbook of Food Analysis: Physical characterization and nutrient analysis.CRC Press, Technology & Engineering, New Yourk USA, 2004.
3. David E. Newton, Forensic Chemistry, United States of America, (2007).

CHM-608	Standard Methods & Quality Assurance	3(3 – 0)

CHM- 608 Standard Methods and Quality Assurance 3(3– 0)

Method development and validation: Selection of analytical methods for problem solving, Optimizing the experimental procedures, Single operator characteristics, Blind analysis of standard samples, Ruggedness testing, Equivalency testing, Sensitivity of instruments, Limits of detection and Signal-to-noise ratio.

Quality Control: Introduction and concept of quality control and quality assurance, Development of quality standards in industries, Quality control chart, Quality control in some industries, General safety practices, Good laboratory practices

Quality Assurance: Internal Methods of Quality Assessments, External Methods of Quality Assessments, Evaluation of quality assurance data, Prescriptive approach, Performance-based approach.

Automation in analytical methods; Automatic, automated and smart instruments and their applications with special emphasis on clinical, industrial and quality control aspects

Books Recommended:

1. Christian, G.D. 2003. Analytical Chemistry. Sixth edition, John Wiley and Sons, New York
2. Harvey, D. 2008. Modern Analytical Chemistry. The McGraw Hill Companies, Inc. USA.
3. Bender, G.T. 1987. “Principles of Chemical Instrumentation” W.B. Saunders Co., London
4. Hargis, L.G. 1988. “Analytical Chemistry: Printice Hall Publishers, London
5. Skoog, D.A. and J.J. Leary. 1992. “Principles of Instrumental Analysis. Saunders College
Publishing Co., London
6. FAO and WHO (2000). Codex Alimentarius General Requirement Vol. 14
7. Bender, G.T. 1987. “Principles of Chemical Instrumentation” W.B. Saunders Co., London.
8. Reilley, C. 1993. Laboratory Manual of Analytical Chemistry. Allyn& Bacon, London.

CHM- 610 Analytical Chemistry Practicals-II 2(0 - 2)

The experiments may be set making use of the following instruments depending upon their availability. The Instructor should consult the "Journal of Chemical Education" for the innovative designing of experiments. Special experiments may also be designed for which a specimen list of instruments/techniques is given below.

Thermogravimetry, Differential Thermal Analyzer, Differential Scanning Calorimetry, Differential Photo-Calorimetry, Evolved Gas Analyzer, Thermo-mechanical Analyzer

Experiments

Potentiometric determination of Fluoride in drinking water.
Spectrophotometric determination of Iron in soil.
Determination of pH of Hair Shampoos.
IR analysis and identification of human body stones
Ultraviolet Spectrophotometric determination of Aspirin and Caffeine in pharmaceutical samples.
Determination of iron in foods products spectrophotometrically.
Determination of Calcium by Atomic Absorption Spectrophotometry.
Determination of Mercury in Laboratory Air using Atomic Absorption Spectrophotometry.
Flame Emission Spectrometric determination of Sodium.
Qualitative and Quantitative Analysis of Fruit juices for Vitamin C using HPLC.
Enzymatic determination of Glucose in Blood.
Separation of dyes using column/paper/thin layer chromatography.
Separation of sugars using paper chromatography.
Separation of amino acids using paper/thin layer chromatography.
Identification of fingerprints by chemical test.
Analysis of Analgesics using HPLC.
Determination of phosphate content in commercial fertilizers by spectrophotometry.
Determination of nickel in vegetable ghee by spectrophotometry involving solvent extraction.
Mass spectrometry of mineral oil samples.
To determine calcium and zinc in milk by atomic absorption spectrophotometer.
Test for analysis of drugs.
To determine lead in sewage sludge by atomic absorption spectrophotometer.
Identification of fingerprints by powder test.
To record and characterization of IR spectra of at least 1organic compounds.
Gas Chromatographic analysis of drugs and poison.
Analysis of milk, beverages and meat.

Reference Books:

1. Yolanda Picó, Chemical Analysis of Food: Techniques and Applications Academic Press, ELSEVIER, Spain, 2012.
2. Leo M. L. Nollet. Handbook of Food Analysis: Physical characterization and nutrient analysis.CRC Press, Technology & Engineering, New York USA, 2004.
3. David E. Newton, Forensic Chemistry, United States of America, (2007).

Semester 8

Specialization in Organic Chemistry

Semester 8 Specialization in Organic Chemistry		
STA-321	Introduction to Statistical Theory	3(3 – 0)
CHM-622	Organic Polymers	3(3 – 0)
CHM-624	Reactive Intermediates and Photochemistry	3(3 – 0)
CHM-626	Disconnection Approach	3(3 – 0)
CHM-628	Organic Catalyst and Protective Group	3(3 – 0)
CHM-630	Advanced Organic Chemistry Practicals – II	2(0 – 2)

CHM-622	Organic Polymers	3(3 – 0)

Organic Polymers 3(3 – 0)

Introduction to polymer chemistry. Step-growth polymerization, free radical addition polymerization, ionic polymerization; stereochemistry polymers; polymerization using Ziegler-Ziegler-Niegler-Natta catalyst. Stereo-regulation and conformation of polymers. Moleculars weight determination. Structure property relation. Reactions of synthetic polymers; polymers degradation and stability with special emphasis on thermal and photo-degradation.

Recommended Books:

1. W. Fred, B. Meyer " Text Book of Polymer Science", 3rd Ed,. Johan Wiley & Sons, (1992).
2. Joel R. Fried "Polymer Science & Technology", Prentice Hall, Inc. (1995).
2. L.H Sperling "Introduction to Physical Polymer Sciences", 2nd Ed., John Wiley & Sons, USA (1990).
3. J. R. Fried "Polymer Science & Technology", Prentice Hall, Inc. (1995).

CHM-624	Reactive Intermediates and Photochemistry	3(3 – 0)

Reactive Intermediates and Photochemistry 3(3 –0)

Nomerclature, Preparation, Reaction of Carbene. Nintrene: Nomenclature, Preparation, Reactions, Preparation, Reaction. Arynes: Preparation, Reactions.

Photochemistry:

Introduction, Principles, Difference between thermal and photochemical reaction, laws of photochemistry, quantum yield, inter system crossing, jablonski diagram, Photofregmentation, Norish type I and II reaction. Photoreduction, Pateno Buchi Reaction. Reactivity of keton, photochemistry of olefins. Pinerization reaction.

Recommended Books:

1. N.S Isaacs "Reactive Intermediates in Organic Chemistry", John Wiley & Sons USA (1974).
2. H. Okabe "Photochemistry of small Molecules", John Wiley & Sons, New York, USA (1978).
3. C. W Rees, T.I. Gilehrist, "Carbenes, Nitrenes Arynes," Nelson, London, UK (1973).

CHM-626	Disconnection Approach	3(3 – 0)

Disconnection Approach 3(3 – 0)

The Disconnection Approach

Basic Principles: Synthesis of Aromatic Compounds, One Group: C – X Disconnections, Strategy II: Chemoselectivity, Two Group C – X Disconnections, Strategy V: Stereoselectivity A, One Group C – C Disconnections II: Carbonyl Compounds, Strategy VI: Regioselectivity, Two Group Disconnections II: 1,3-Difunctionalized Compounds and α,β-unsaturated Carbonyl Compounds, Two Group Disconnections III: 1,5-Difunctionalized Compounds, Michael Addition and Robinson Annelation, Two Group Disconnections IV: 1,2-Difunctionalized Compounds, Strategy XIII: Introduction to Ring Synthesis. Saturated Heterocycles, Three Membered Rings, Strategy XV: Use of Ketenes in Synthesis, Six-membered Rings

Recommended Books:

1. T. H. Lowry, K. S. Richardson, "Mechanism and Theory in Organic Chemistry", 3rd Ed, Harper and Row Publisher (1987).
2. G. M. Loudon "Organic Chemistry", 3rd Ed. Addison Wesley London Company (1995).
3. S. H. Pine, "Organic Chemistry", 5th Ed., McGraw Hill, New York, USA (1987).
4. G. M. Loudon, " Organic Chemistry", 2nd Ed., Addison Wesley, London (1998).
5. H.O. House "Modern Synthetic Reactions", 2nd Ed, Benjamin, California, USA (1972).

CHM-628	Organic Catalyst and Protective Group	3(3 – 0)

Homogeneous and heterogeneous catalysis, Acid Catalysis, Base Catalysis, Metal ion catalysis, Hydrogenation, Asymmetric hydrogenation, Hydroboration and Hydrocyanation of olefins, Transformation of alkenes and alkynes i.e. polymerization, metathesis, dimerization and oligomerization and olefin isomerization, oxidation of olefins using catalysts, Metal complexes and Quaternary ammonium compounds in organic synthesis. Protection of alcohols, amines, carboxyilic acids, aldehydes and ketones

Recommended Books:

1. T. H. Lowry, K. S. Richardson "Mechanism and Theory in Organic Chemistry", 3rd Ed, Harper and Row Publisher (1987).
2. S. H. Pine, "Organic Chemistry", 5th Ed., McGraw Hill, New York, USA (1987).
3. G. M. Loudon, "Organic Chemistry", 2nd Ed., Addison Wesley, London (1998).

CHM-630	Organic Chemistry Practicals – II	2(0 – 2)

CHM-630 Organic Chemistry Practicals -II 2(0-2)

The experiments may be arranged as per choice/requirement of instructor but should be designed from following categories;
Synthesis of the organic compounds involving multi step synthesis using various synthetic methods. Synthesis of five or six membered heterocyclic compounds. Synthesis of targeted molecules; Anthranilic Acid. Benzilic acid, p-nitro aniline, Phenacetin and Acridon.

Recommended Books:

1- J. Fuhrhop, G. Penzlin, "Organic Synthesis Concepts, Methods, Starting Materials", 2nd Ed., Weinheim Germany (1983).
2- A. L. Vogel, "Elementary Practical Organic Chemistry Part III: Quantitative Organic Analysis", 1st Ed., Longman Group Ltd (1958).
3- F. A. Carey, R. J. Sundberg, "Advanced Organic Chemistry (Part B: Reactions and Synthesis)", 3rd Ed, Plenum Press, New York, USA (1990).
4- B. S. Fumiss, A. J. IIannaford, P.W.G. Smith, A. R. Tatchell "Vogel's Practical Organic Chemistry", 5th Ed, Addition Wesley Longman, Harlow, England(1989).

Semester 8
Specialization in Inorganic Chemistry

Semester 8 Specialization in Inorganic Chemistry		
STA-321	Introduction to Statistical Theory	3(3 – 0)
CHM-612	X-ray Spectroscopy	3(3 – 0)
CHM-614	Homogeneous Catalysis	3(3 – 0)
CHM-616	Radio Nuclear Chemistry	3(3 – 0)
CHM-618	Magneto Chemistry	3(3 – 0)
CHM-620	Inorganic Chemistry Practicals– II	2(0 – 2)

CHM-612	X-ray Spectroscopy	3(3 – 0)

X-ray Spectroscopy 3(3-0)

Introduction, Lattice and unit cell , geometry of crystals, crystal systems, primitive and non primitive cells, Lattice direction and planes crystal shapes Dimensional relationship, Braggs equation, reciprocal lattice, experimental methods of single & multicrystal (power) analysis, diffraction and diffractrometer, identification and applications.

Recommended Books:

1. B. D. Cullity "Elements of X-ray diffraction" 2nd Ed, Addison-Wesley publishing company, California, (1977).
2. E. P. Bertin, "Principles and Practice of X-ray Spectrometric Analysis", Plenum Press (1975).
3. S. Prakash, G. D. Tuli, S. K. Basu, R. D. Madan, "Advanced Inorganic Chemistry" Vol.I (1997).

CHM-614	Homogeneous Catalysis	3(3 – 0)

Homogenous Catalysis 3(3-0)

Reaction of CO and hydrogenHydroformylation, reductive carbonylation, reduction of CO by hydrogen, synthesis of water gas and shift reactions. Carbonylation reactionSynthesis of methanol and methyl acetate, adipic ester, other carbonylation and decarbonylation reactions. Catalytic addition of molecules to C-C multiple bondsHomogeneous hydrogenation, and hydrocylation and hydrocynation.

Recommended Books:

1. P. Powell, "Principles of Organometallics Chemistry", 2nd Ed, London, Chapman and Hall, New York, USA (1988).
2. A. Yamamoto "Organotransition metal chemistry" John Wiley and Sons: New York, USA (1986).

3. M. Bochmann "Orgaometallics 2, complexes with transition metal carbon π-bonds" Oxford University Press, UK (1993).
4. G. L. Miessler, D. A. Tarr, "Inorganic chemistry" 2nd Ed., Prentice Hall International, USA (1998).
5. F. A. Cary, "Organic Chemistry" 7th Ed, The McGraw-Hill Company, USA (2008).

CHM-616	Radio Nuclear Chemistry	3(3 – 0)

Radio Nuclear Chemistry 3(3-0)

Fundamentals and applied aspects of Radio activity and nuclear chemistry. Trans-Uranium elements; Natural and artificial radioactivity, methods for isotope production, nuclear reactions; mass spectrograph, Astam mass spectrograph, The structure of the nucleus; nuclear stability and radioactive decay; Types, characteristics and detection of radio active Particles; laws of radioactive decay; the interaction of radiation with matter including radiological health hazards; Processing of the nuclear materials. Accelerators of charged particles Applications of radioisotopes.

Recommended Books:

1. F. Landler, Kennedy, Miller, "Nuclear and Radiochemistry", 2nd Ed, John Wiley and Sons, Inc. (1964).
2. G. R. Choppin, J. Rydber, "Theory and Applications", 1st Ed., Pergamon (1980).
3. H. J. Arnikan, "Essentials of Nuclear Chemistry", 4th Ed, (1990).
4. B. G. Harvey, "Nuclear Physics and Chemistry", Prentice-Hall Inc., (1990).
5. I. I. Naqvi, "Radiochemistry", McGraw Hill, USA (1990).

CHM-618	Magneto Chemistry	3(3 – 0)

Magneto Chemistry 3(3-0)

Theory of magnetism, diamagnetism, paramagnetism, ferro-, ferri- and antiferromagnetism, magnetic susceptibility, magnetic moments, Faraday's & Gouy's methods,orgital contribution to magnetic moment, Russell-Sanders coupling scheme, derivation of term symbols of for p^1 - p^6 and d^1 - d^{10} systems, pigeon holes diagram, effect of temperature on magnetic properties of complexes. Magnetic moment of lengthanise.

Recommended Books:

1. B. Douglas, D. McDaniel, J. Alexander, "Concepts of Models of Inorganic

Chemistry", 3rd Ed, John Wiley & Sons Inc., (.1994).
2. J. E. Huheey, E. A. Keiter, R. L. Keiter, "Inorganic Chemistry: Principles of Structure and Reactivity", 4th Ed., Harper & Row, New York, USA (2001).
3. K. M. Mackay, R. A. Mackay, W. Henderson, "Introduction to Modern Inorganic Chemistry", 5th Ed, Stanley Thomas Publisher Ltd. (1996).
4. G. L. Miessler, A. T. Donald, "Inorganic Chemistry", 2nd Ed., Prentice Hall International, 1991.

CHM-620	Inorganic Chemistry Practicals– II	2(0 – 2)

Advanced Inorganic Practicals 2(0-2)

Preparation of at least six compounds/organometallic compounds and characterization by IR and UV spectrophotometer to the subject of availability of facilities, Spectroscopic determination of some metal ions, Estimation of different metals in food, tap water and brass etc. By atomic absorption spectrometer/flame photometer/UV/Visible spectrophotometer, subject to the availability of facilities.

Recommended books:

1. Bassette, J., Denney, G.H. and Mendham, J., Vogel's Textbook of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis '' English Language Book Society, 4th Edition .1981.
2. Vogel, A. I., ''A Textbook of Micro and Semi-micro Qualitative Inorganic Analysis '' Longman Green & Co. 1995.
3. Fritz, J . S. and Schenk, G. H., ''Quantitative Analytical Chemistry'', Allyn and Bacon Inc., 4th Edition, 1979.
4. Pass. G and Sutcliffe .H., ''Practical Inorganic Chemistry ''. Van Nostrand Reinhold Company. 1972.

Semester 8
Specialization in Physical Chemistry

Semester 8 Specialization in Physical Chemistry		
STA-321	Introduction to Statistical Theory	3(3 – 0)
CHM-632	Applications of Symmetry & Group Theory	3(3 – 0)
CHM-634	Quantum Mechanics	3(3 – 0)
CHM-636	Nuclear and Radiation Chemistry	3(3 – 0)
CHM-638	Electrochemical Aspects of Solutions	3(3 – 0)
CHM-640	Physical Chemistry Practicals – II	2(0 – 2)

CHM-632	Applications of Symmetry & Group Theory	3(3 – 0)

Group Theory and Solutions 3(3-0)

Advanced Group Theory
Group Algebra. Point groups. Classes Symmetry, The character table and representation, Group theory application in chemistry

Solution chemistry
Physicochemical characteristics of solvents. Solute-solvent interaction, salvation of ions, preferential salvation. Thermodynamic methods for study of solutions

Biophysical Chemistry
Principles of biophysical chemistry; thermodynamic aspect of simple molecules, macro molecules, lipids and biological membranes; nucleic acids and proteins; enzyme kinetics and catalysis; experimental techniques.

Recommended Books:

1. F. A. Cotton, "Chemical Applications of Groups Theory", Interscience Publishers (1963).
2. A. Mohammad, "Application of Symmetry and Group Theory in Chemistry" University Grants Commission, Islamabad, (1984).
3. Alan Vincent "Molecular Symmetry and Group Theory" John Wiley & sons , 1976, USA.
4. Alberty, R. A., Robert J. S. and Moungi G. B. "Physical Chemistry". 4th Edition , John Wiley and Sons, (2004).
5. Smith, E. Brian, "Basic Chemical Thermodynamics" 5th Edition. Imperial College Press,. (2004).
6. Stephen B. R., Rice S. A., and Ross J., "Physical Chemistry" 2nd Ed., Oxford University Press, (2000).
7. Jurg, W., "Basic Chemical Thermodynamics" W. A. Benjamin (1969).

8. Robert G. Mortimer. "Physical Chemistry" 3rd Edition, Elsevier Academic Press, UK (2008).

CHM-636	Nuclear and Radiation Chemistry	3(3 – 0)

Nuclear and Radiation Chemistry 3(3-0)

Nuclear Chemistry
Introduction to Nuclear chemistry, Nuclear systematic, sources of nuclear instability, nuclear energetics , nuclear fission and fusion

Nuclear Techniques
Principles, sources of nuclear radiation. Nuclear track detectors. Etchings. Kinetics and mechanism of track etching. Nuclear materials. Nuclear techniques.

Radiation Chemistry
Tracers. Radiation Chemistry, theoretical aspects. Various models. Kinetic studies of radiolytic processes. Dosimetry (physical and chemical). Radiation chemical yields. Dose and dose rate effects on primary and secondary products. Steady atate and pulse radiolysis techniques. Radiolytic studies of gaseous, water, aqueous and organic systems. Radiology.

Recommended Books:

1. G. Friedlander, J. W. Kennedy, "Nuclear and Radiochemistry", 3rd Ed. John Wiley & Sons, New York, USA (1981).
2. G. R. Choppin, J. Rayberg "Nuclear Chemistry Theory and Applications", 1st Ed., Pergaman Press, Oxford, USA (1998).
3. F. Aziz, M. A. J. Rodgers, "Radiation Chemistry Principles and Application" Ed., VCH Publishers, Inc, (1987).
4. R. Gregory, Choppin, J. Rayberg "Nuclear Chemistry Theory and Applications", 1st Ed., Pergaman Press, Oxford, USA (1998).

CHM-638	Electrochemical Aspects of Solutions	3(3 – 0)

Electrochemical Aspects of Solutions 3(3-0)

Electrochemistry of Solution
Introduction to solution and its units, Conductance and resistance, Fugacity, activity, activity coefficient, colligative properties of electrolytes, ionic mobility, cell constant, ionic strength

Kinetics of Electrode Process

Theories of electrolytes, interfacial phenomena, electrode kinetics, mechanism of electrode reactions, Butlar Volmer equation, cyclic voltametry and its applications

Electrochemistry of Colloidal Solution

Colloids, classification, preparation of colloidal solution, peptisation, coagulation, flocculation, peptisation, Dialysis, Electrophoresis, Zeta potential, Solutions of Surfactants.

Recommended Books:

1. J. Albert, "Electrode Kinetics" Clarendon, Oxford, USA (1975).
2. B. R. Stephen, S. A. Rice, J. Ross, "Physical Chemistry" 2nd Ed., Oxford University Press, USA (2000).
3. W. Jurg, "Basic Chemical Thermodynamics" W. A. Benjamin (1969).
4. Smith, E. Brian, "Basic Chemical Thermodynamics" 5th Ed, Imperial College Press. (2004).
5. R. A. Alberty, J. S. Robert, G. B. Moungi, "Physical Chemistry". 4th Ed, John Wiley and Sons, (2004).
6. D. W. Ball, "Physical Chemistry" 1st Ed., Brooks/Cole Co. Inc., (2003).

CHM-640	Physical Chemistry Practicals – II	2(0 – 2)

Physical Chemistry Practicals-II 2(0-2)

NB: ***At least eight experiments should be performed from following list subjected to availability of apparatus and chemicals.***

1. Determination of Equivalent and molar conductance of aqueous and non-aqueous solutions of different electrolytes.
2. Determination of partial molar volumes and excess molar volumes for binary and ternary systems.
3. Purification of the given commercial solvent using pertinent methods of separation (distillation, fractional distillation, reflux).
4. Verification of Ostwald's Dilution law.
5. Verification of Debyle-Huckel Limiting law.
6. Determination of heat of solutions of selected compounds by solubility methods in aqueous and non-aqueous media.
7. Determination of critical micelle concentration of selected surfactants in aqueous and non-aqueous media by surface tension and conductivity.
8. Determination of free energy of micellization of selected surfactants in aqueous and non-aqueous media by surface tension and conductivity.
9. Determination of equivalence point of acid-base titration by electrical conductivity.
10. Determination of degree of dissociation of weak electrolytes.
11. Determination of pKa values of acids.
12. Determination of pKa values of indicators.
13. Preparation of buffers of required pH values.

Books recommended:

1. C.W. Garland, J.W. Nibler and DP Shoemaker, Experiments in Physiacl Chemistry, Mc Grawhill, 7th edition (1996).
2. James, A. M., Prichard, F. E., *Practical Physical Chemistry,* 3rd ed., Longman Group Limited, New York, (1974).
3. A. Findly's Practical Physical Chemistry, Longmann, London(1972).
4. LP Gold, L. Gold, Physical Chemistry Laboratory, Primis Publishers (1997) ISB: 0072902698.