ASSOCIATE DEGREE IN SCIENCE
Chemistry- II

(Outlines of Tests)	
Paper-A: Organic Chemistry (Written) :	40 Marks
Paper-B: Applied Chemistry (Written) :	40 Marks
Paper-C: Organic Chemistry & Applied Chemistry (Practical-II)	10+10=20 Marks

(Syllabi and Courses of Reading)

Paper A: Organic Chemistry **Marks: 40**

It is compulsory to attempt at least TWO questions from each section.

Section- I

1. Basic Concepts

Weightage of marks 3

Atomic, molecular and hybrid orbitals; multiple localized and delocalized bonds; properties of bonds, inductive effect (-I, +I), dipole moment. The concept of resonance, rules for resonance; resonance energy; steric inhibition of resonance; hyperconjugation; resonance effect (-R, +R); hydrogen bonding; tautomerism (keto-enol).

2. Hydrocarbons

Weightage of marks 4

Classification of hydrocarbons. Nomenclature, methods of preparations, physical characteristics and chemical reactions of alkanes, cycloalkanes, alkenes and alkynes. Source of aromatic hydrocarbons. Structure of benzene and the concept of aromaticity. Aromatic electrophilic substitution reactions.

3. Stereoisomerism

Weightage of marks 5

Conformational analysis of ethane (C_2H_6) and butane (C_4H_{10}). Optical isomerism: optical activity, chiral carbon atom and optical isomerism. Geometrical (*cis/trans*) isomerism. Relative (*D/L*) and absolute (*R/S*) configuration. Creation of chiral carbon and racemization; resolution of racemic mixture. Elements of symmetry; optical isomerism in compounds containing one or two asymmetric carbon atoms (concept of enatiomerism & diasteroisomerism); designation of absolute configuration (CIP rule).

4. Alkyl Halides

Weightage of marks 4

Nomenclature, methods of preparation and chemical reactions with special reference to nucleophilic substitution (S_N2 & S_N1) and elimination reactions (E_2 & E_1) of alkyl halides. Preparations, structure and synthetic applications of Grignard's reagents.

5. The Hydroxyl group and Ethers

Weightage of marks 4

Nature of hydroxyl group in alcohols and phenols.
Alcohols: Classification and nomenclature of alcohols; methods of preparation and chemical reactions of alcohols; distinction between 1°, 2° and 3° alcohols; Polyhydric alcohols.
Phenols: Methods of preparation & chemical reactions of phenols; acidity of phenols;
Ethers: Methods of preparation (Williamson's synthesis) and reactions of ethers.

Section- II

6. The Carbonyl Group

Weightage of marks 5

Nature of carbonyl group and its reactivity; nomenclature, methods of preparation & chemical reactions of aldehydes and ketones; distinction between aldehydes and ketones; Aldol reactions (self & cross).

7. Carboxylic Acids and their Derivatives

Weightage of marks 6

Nomenclature, methods of preparation and chemical reactions of carboxylic acids; strength (*p*Ka) of carboxylic acids and the factors affecting it. Formation and hydrolysis of acid anhydrides, acid amides, acid halides and esters including glycerides. Introduction to amino acids.

8. Nitrogen Compounds: Amines:

Weightage of marks 5

Classification, nomenclature, methods of preparation and chemical reactions of amines; distinction between 1°, 2° and 3° amines. Preparation and reactions of aniline. Basicity of aliphatic and aromatic amines and factors affecting it. Diazzonium salts and their synthetic applications.

9. **Bio-molecules and Simple Heterocycels**

Weightage of marks 4

Importance, nomenclature, properties, synthesis and reactions of simple heterocycles (carbohydrates, proteins, lipids, nucleic acids).

Recommended Books (Organic Chemistry)

1. Younas, M., "Text Book of Organic Chemistry" Ilmi Kutab Khana, Lahore (2006).
2. Rehman, A., "Text Book of Organic Chemistry" Caravan Book House, Lahore (2006).
3. March, J., "Advanced Organic Chemistry" Wiley, New York (1992).
4. Pine, S. H., "Organic Chemistry" McGraw-Hill, New York (1987).
5. Sykes, P., A "Guide Book to Mechanism in Organic Chemistry" Prentice Hall (1999).
6. Younas, M., "Organic Spectroscopy" A. H. Publisher, Lahore (2006).
7. Solomons, T. W. G., "Fundamentals of Organic Chemistry" Wiley, New York (1999).
8. Kemp, W., "Organic Spectroscopy" Macmillan, London (1990).
9. Chughtai, F. A., "Organic Reactions" Majid Book Depot, Lahore/Faisalabad (1995).
10. Vogel, A. I., "A Text Book of Practical Organic Chemistry" Prentice Hall (1996).
11. Clarke, H. T. and D. Haynes. "A Hand Book of Organic Analysis" Edward Arnold, London (1947).

12. Mann, F. G and B. C. Saunders. "Practical Organic Chemistry" Longman, London (1978).
13. Shriner, R. L., D.Y. Curtin, R.C. Fuson, and T.C. Morrill, "The Systematic Identification of Organic Compounds" Wiley, New York (1997).
14. Rehman, A., "Experimental Organic Chemistry" The Caravan Book House, Lahore (2006).
15. Morrison R. T. and R.N. Boyd, "Organic Chemistry" Allyn and Bacon, London (1987).

Paper B: Applied Chemistry **40 Marks**

It is compulsory to attempt at least TWO questions from each section.

Section-I

1. **Introduction to Spectroscopy**
   Weightage of marks 5
   Electromagnetic radiations (EMR); spectral bands; principle, instrumentation, sample handling and applications of IR & UV/Vis spectroscopy.

2. **Nuclear Chemistry**
   Weightage of marks 5
   Radioactivity; stability of nuclei, nuclear transformation, measurement of nuclear radiation, nuclear reactions, fission and fusion, nuclear reactor, uses of radioisotopes, nuclear hazards and safety measures.

3. **Separation Techniques**
   Weightage of marks 4
   General introduction and applications of solvent-extraction and chromatographic techniques, such as, paper, ion-exchange and column-chromatography.

4. **Modern Materials**
   Weightage of marks 6
   Introduction to liquid crystals, inorganic polymers, ceramics, fiber glass, thin films, semiconductors and composite materials.

Section-II

5. **Environmental Chemistry**
   Weightage of marks 8
   Introduction to environment and its segments, Green House effect and global warming; acid rain and its impact on environment. Sources of pollution (soil, air and water), heavy metal pollution in water bodies; toxicity of pollutants.

6. **Evaluation of analytical data**
   Weightage of marks 6
   Concepts of mean, mode, median, accuracy & precision; determinate and indeterminate errors, significant figures, rounding off, standard deviation, relative standard deviation. Application of mean, median, mode, rounding off significant figures and standard deviation in chemistry.

7. **Chemical Industries**

Weightage of marks 6

Metallurgies of Cu, Fe and Al; fertilizers (urea & phosphate); industries (paper and sugar).

Recommended Books

1. Voet, D. R and Voet, J. G. "Biochemistry" John Wiley & Sons, NY (2001).
2. Kent, J.A. Riegal's "Handbook of Industrial Chemistry" CBS Publishers and Distributors, New Delhi (1997).
3. Arnikar, H.J. "Nuclear Chemistry. Krishna Prakashan Media (P) Ltd. (1998).
4. Gurdeep R. "Advanced Physical Chemistry", Krishna Prakashan Media (P) Ltd. Delhi (2002).
5. Maeder, M. and Neuhold, Y-M. "Practical Data Analysis in Chemistry" Elsevier UK (2007).
6. Younas, M., "Organic Spectroscopy" A. H. Publisher, Lahore (2005).

Paper C: Applied Chemistry & Organic Chemistry (Practical-II) **Marks: 20 (10+10)**

Organic Chemistry **Marks 10**

1. Qualitative organic analysis: systematic identification of organic compounds containing groups like COOH and its derivatives, OH, NH_2 and C=O.
2. Purification techniques (solvent extraction, distillation and recrystallization etc.)
3. Preparation of simple organic compounds (benzoic acid, ethyl benzoate, tribromophenol, aspirin and nitrobenzene).

Recommended Books (Organic Chemistry)

1. Vogel, A.I. "A Text Book of Practical Organic Chemistry" Longman, London (2005).
2. Shaheen, M. A., Paracha, R. N, Jilani, "Manual of Practical Chemistry" Vol.III, Jilani Notes, Sargodha, (2016).
3. Mann, F.G and Saunders B.C. "Practical Organic Chemistry" Longman, London (2007).
4. Shriner, R.L., Curtin, D.Y. Fuson, R.C. and Morrill, T.C. "The Systematic Identification of Organic Compounds" Wiley, NY (2003).

Applied Chemistry **Marks 10**

1. Percentage determination of Ba^{2+} in $Ba(NO_3)_2$ by gravimetric method.
2. Gravimetric determination of Ni^{2+}.
3. Estimation the glucose content in a sample by titration method.
4. Determination of adsorption parameters using Langmuir adsorption isotherm of AcOH on charcoal.
5. To determine the wavelength of maximum absorption (λ_{max}) of compounds using spectrophotometer.
6. To determine the concentration of Cr^{3+} in water sample by using spectrophotometer.
7. To determine the concentration of Mn^{2+} in water sample by using spectrophotometer.

8. To determine the concentration of the sucrose, glucose and dextrose in samples by using polarimeter.
9. To determine the Iodine value of the oil and fat.
10. Identification Al^{3+}, Cr^{3+} and Fe^{3+} in samples by TLC.
11. Determine the partition coefficient of I_2 between water and CCl_4.
12. Qualitative analysis of lipids, proteins and carbohydrates.