PH 541.4 Reg. No. : | | | | | | | |

St Aloysius College (Autonomous)

Mangaluru

Semester IV – P.G. Examination – M.Sc. Analytical Chemistry

April - 2025

ORGANIC SYNTHETIC METHODS

Time: 3 Hours **Max. Marks: 70**

PART - A

1. **Answer any FIVE questions of the following:** **(5x2=10)**

a) How do transition metal catalysts participate in homogenous catalysis reactions?

b) What types of organic functional groups can be reduced using lithium aluminium hydride?

c) Describe Shapiro reaction with example.

d) Explain the mechanism of the reaction of peracid with keto compound.

e) Give carbon - carbon double bond forming reactions.

f) Write a note on Ene reaction.

g) Perform retrosynthetic analysis of phenacetin.

h) Avoid chemoselectivity issues while disconnection. Explain.

PART - B

Answer any FIVE of the following choosing at least one full question from each unit: **(5x12=60)**

UNIT – I

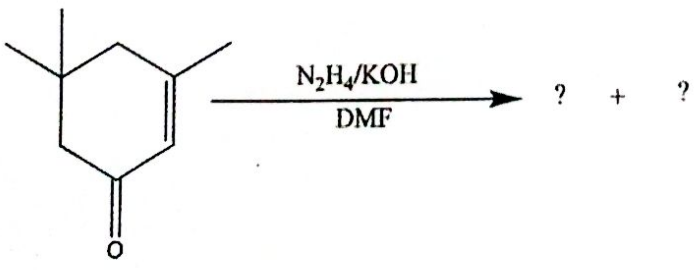
2.a) Explain the role of sodium borohydride as a reducing agent in organic chemistry. **(4)**

b) Give the synthetic utility of sodium metal in liquid ammonia. How this is used to synthesize unconjugated dihdroderivatives. **(4)**

c) Outline the bimolecular reduction of esters. **(4)**

3.a) What is heterogeneous catalysis? Discuss its mechanism with suitable examples. **(4)**

b) Predict the product with the mechanism for the following and also mention the name of the reaction:



(4)

c) Write a note on reduction using diimide. **(4)**

Contd...2

UNIT – II

4.a) Discuss the mechanism of Neber rearrangement. (4)

b) Explain the mechanism of oxidation of aldehydes by SeO_2. (4)

c) Discuss the oxidation of allylic alcohols utilising MnO_2. (4)

5.a) Explain Demaynov rearrangement. (4)

b) Describe Benzil-Benzilic acid rearrangement. (4)

c) Write a note on applications of lead tetraacetate in organic synthesis. (4)

UNIT - III

6.a) Write a note on 1, 3-dipolar addition reaction. (4)

b) Outline the mechanism of Robinson annulation. (4)

c) Discuss the mechanism of Sonagashira reaction. (4)

7.a) Outline the synthesis of Penicillin-V. (4)

b) Outline the synthesis of 7-methoxy-1-tetralone. (4)

c) Write a note on Thorpe condensation. (4)

UNIT – IV

8.a) What is FGI? What is its importance in synthesis? Explain with examples. (4)

b) Provide the synthetic scheme for lemonene. (4)

c) Give one group and two group C-C disconnections with suitable examples. (4)

9.a) Perform retrosynthetic analysis of benzocaine and paracetamol. (4)

b) Suggest retrosynthetic schemes for 2, 4-dichloro phenoxy acetic acid and chlorobenzide. (4)

c) Suggest any two protecting reagents for the amino group. Write the corresponding protection and deprotection reactions. (4)

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SPECTROSCOPIC METHODS OF ANALYSIS

Time: 3 Hours **Max. Marks: 70**

PART - A

1. **Answer any FIVE questions of the following:** **(5x2=10)**

a) Define hyperfine couplings in the context of electron paramagnetic resonance (EPR) spectroscopy.

b) What type of nuclei are typically studied using NQR spectroscopy?

c) Define absorption spectroscopy in one sentence.

d) What are two key factors that influence the precision of AAS measurements for trace element analysis?

e) What is a typical application of phosphorimetric analysis in forensic science?

f) Discuss the potential consequences of using an inappropriate excitation wavelength in fluorescence analysis.

g) What is the effect of wavelength on scattering?

h) Give the different crystal systems.

PART - B

Answer any FIVE of the following choosing at least one full question from each unit: **(5x12=60)**

UNIT – I

2.a) What is Auger Spectroscopy and how does it complement Photoelectron Spectroscopy? **(4)**

b) Discuss the principle of photoelectron spectroscopy and its significance in analyzing the binding energy of atoms and molecules. **(4)**

c) Discuss the measurement techniques of ESR spectroscopy. **(4)**

3.a) Draw the energy level diagram and calculate NQR transition frequencies for a nucleus with $I=3/2$, assuming $\eta=0$. **(4)**

b) Give an account of the experimental technique involved in Mössbauer Spectroscopy. **(4)**

c) Write a short note on applications of ESR in the study of inorganic complexes. **(4)**

Contd...2

UNIT – II

4.a) Discuss the advantages and limitations of atomic absorption spectroscopy, in terms of the instrumental design and analytical performance. (4)

b) Evaluate the role of atomizers in atomic absorption spectroscopy and highlighting their importance in sample introduction and vapor generation. (4)

c) Discuss the various laws governing the photochemistry. (4)

5.a) Explain the principle of operation and key components of plasma excitation sources in atomic spectroscopy. (4)

b) Give the principle and describe the procedure for the determination of sodium in water samples by flame photometry. (4)

c) Describe the principle of photo acoustic spectroscopy. (4)

UNIT - III

6.a) How do the pH and dissolved oxygen affect fluorescence and phosphoresce. (4)

b) Analyze the significance of fluorescence and phosphorescence in analytical chemistry and materials science. (4)

c) Given an account of the principle of chemiluminescence. (4)

7.a) Explain de-excitation of molecules by intersystem crossing. Justify that it leads to phosphorescence. (4)

b) What is the role of filters in fluorimetors? (4)

c) Explain the importance of quantum yield for luminescence analysis. (4)

UNIT – IV

8.a) What is the influence of X-rays on matter? (4)

b) Explain the principle and applications of turbidimetric titrations. (4)

c) Define specific rotation and explain how is it calculated. (4)

9.a) Describe the principle and applications of X-ray absorption. (4)

b) Explain the principle and applications of circular dichroism. (4)

c) How is nephelometry different from turbidimetry? Explain. (4)

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Semester IV – P.G. Examination – M.Sc. Analytical Chemistry

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CHEMISTRY OF POLYMERS AND NATURAL PRODUCTS

Time: 3 Hours **Max. Marks: 70**

PART - A

1. **Answer any FIVE questions of the following:** **(5x2=10)**

a) Give the structure of monomers and the repeating units in the following polymers

i) Polyvinyl chloride ii) Nylon 6,6

b) Write any two differences between step-growth and chain-growth polymerisation.

c) How is LDP different from HDP at glass transition temperature?

d) What makes elastomers different from plastics?

e) List the few specific amino acids which form the pre-cursors for all alkaloids.

f) What is 1, 3 dipolar reaction?

g) Outline synthesis of quinine from quiniclidine.

h) Explain Hoffman's degradation method.

PART – B

Answer any FIVE of the following choosing at least one full question from each unit: **(5x12=60)**

UNIT- I

2. a) Describe the mechanism of cationic polymerization. **(4)**
   b) How does partial dissolution help in isolation of polymers? Explain. **(4)**
   c) Explain the weight-average and number-average molecular weight concept of polymers. **(4)**

3. a) Describe the mechanism of ROMP. **(4)**
   b) Explain gradient elution technique in purification of polymers? **(4)**
   c) Which among the linear and network polymers have highest crystallinity? Explain the effects of crystallinity on the properties of polymers. **(4)**

UNIT - II

4. a) Describe osmometry method of determination of molecular weight of polymers. **(4)**
   b) What makes DSC analysis different from TGA? Discuss. **(4)**
   c) Which technique is better for making plastic bottle? Explain the technique. **(4)**

Contd...2

5. a) Differentiate between thermosetting and thermoplastic polymers. Explain briefly the temperature effect on them. (4)

b) Differentiate between Tg and Tm of polymers. (4)

c) Explain the principle of end-growth analysis in the determination of molecular weight of polymer. (4)

UNIT – III

6. a) Account for the presence of phenanthrene nucleus and ether linkage in Morphine. (4)

b) Write the routes for synthesis of Reserpine. (4)

c) Illustrate the total synthesis Papaverine. (4)

7. a) Schematically demonstrate the synthesis of Menthol. (4)

b) Explain the structural elucidation of Abietic acid. (4)

c) i) ii)

(4)

UNIT – IV

8. a) How FMO can be used to study Diels-Alder reaction? (4)

b) Describe using suitable examples: suprafacial and antarafacial rearrangement in H? (4)

c) Explain the stereochemistry and regio-chemistry involved in Cope and Claisen rearrangement? (4)

9. a) With suitable examples for rearrangement reaction, predict the most favorable product of allyl vinyl ether. (4)

b) Explain with examples:

i) Ene reactions

ii) Fluxional tautomerism (4)

c) Sketch and explain the correlation diagram of electro cyclic reaction when polyene has 4n electrons. (4)

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Semester IV – P.G. Examination - M.Sc. Analytical Chemistry

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APPLIED ANALYSIS AND AUTOMATION

Time: 3 Hours **Max. Marks: 70**

PART – A

1. **Answer any SEVEN questions of the following:** **(7x2=14)**

a) Define the order of a chemical reaction and explain why it is important in understanding reaction kinetics.

b) Define reaction stoichiometry and provide an example illustrating its significance in chemical reactions.

c) Write the significance of flow injection analysis.

d) Mention two differences between automated and automatic systems

e) Explain the difference between quality control and quality assurance in the context of pharmaceutical production.

f) Explain why quality control is crucial at each stage of the manufacturing process, from raw materials to finished products.

g) Explain how potentiometric methods can be used to determine reaction rates.

h) Write the procedure for determination of ash content in food sample.

i) What are the different methods to determine order of a reaction?

PART – B

Answer any FOUR of the following choosing at least one full question from each unit: **(4x14=56)**

UNIT – I

2.a) How do you determine sGPT in human samples? **(4)**

b) Explain at least two kinetic methods to analyse chemical reactions. **(5)**

c) Analyze the principle behind catalysis and its significance in chemical reactions, elaborating on how catalysts alter the reaction pathway and reaction rates. **(5)**

3.a) Discuss about enzyme specificity, effects of pH and Temperature. **(4)**

b) Explain any two methods to determine order of a reaction. **(5)**

c) Derive the integrated rate law for first-order reactions. **(5)**

Contd...2

UNIT – II

4.a) Discuss BUN analyser. (4)

b) Explain the analysis of fat content in milk. (5)

c) Discuss the mode of action of cyanide on human beings. (5)

5.a) Give an account of determination of any two adulterants in milk sample. (4)

b) Explain centrifugal fast analyzer with a schematic representation. (5)

c) Discuss the mode of action of organophosphates and snake venom. (5)

UNIT – III

6.a) Discuss the recent trends in quality control. (4)

b) What are the various cost aspects of quality decisions? (5)

c) Discuss about QA and QC and highlight how they affect a pharma company in terms of costs. (5)

7.a) Compare and contrast ISO 14001 and ISO/IEC 17025 with ISO 9001 in terms of their focus and application. (4)

b) Provide an overview of acts such as the Drugs and Cosmetics Act, 1940, and the Pharmacy Act, 1948, highlighting their key provisions and objectives. (5)

c) Explain how specification limits are determined based on factors such as product functionality, regulatory requirements, and customer expectations. (5)

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