



ED-608

M.Sc. 3rd Semester
Examination, March-April 2021

CHEMISTRY

Paper - I

Resonance Spectroscopy, Photochemistry
and Organocatalysis

Time : Three Hours] [*Maximum Marks* : 80
 [*Minimum Pass Marks* : 16

Note : Answer any **one** question from each Unit. The figures in the right-hand margin indicate marks.

Unit-I

1. (a) What is meant by g-tensor? Discuss significance of g-tensor by taking suitable example. 12
- (b) The ESR spectrum of a radical with a single magnetic nucleus is split into four lines of equal intensity. What is the spin of the nucleus? 8

DRG_15_(3)

(Turn Over)

(2)

2. (a) Discuss the basic theory of NQR spectroscopy. Explain splitting pattern in NQR. 12
- (b) Discuss advantages and disadvantages in the use of NQR to obtain quadrupole coupling constants. 8

Unit-II

3. (a) What is Photoelectron spectroscopy (PES)? Discuss identification of an element based on its PES spectrum. 12
- (b) The analysis of an unknown but homogeneous sample is carried out with photoelectrons collected at some off normal takeoff angle. On rotating the sample around its normal axis, reproducible periodic spikes are noted in various core-level photoelectron signals. Explain the following : 8
- (i) What are these variations indicative of?
- (ii) How may they be useful?
4. (a) Discuss the basic theory of Photoacoustic spectroscopy (PAS). Explain also modulated and pulsed PAS. 12
- (b) Write notes on PES spectrum of lithium. 8

(3)

Unit-III

5. (a) Explain photochemical quenching. Discuss the coalitional quenching using Stern-Volmer equation. 12
- (b) Give the mechanism of Photo-Fries rearrangement with example. 8
6. (a) What is Quantum yield? Discuss the kinetic scheme for a simple system with a photoreactive singlet state. 12
- (b) Explain photochemical formation of smog. 8

Unit-IV

7. (a) Discuss on Wacker process for oxidation of alkene. 10
- (b) Explain insertion and de-insertion reactions with suitable example. 10
8. (a) Discuss on heterogeneous catalysis synthesis. Give advantages of heterogeneous catalysis by giving examples. 10
- (b) Explain hydrogenation of alkene giving its catalytic cycle. 10



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Paper - II

Chemistry of Biomolecules

Time : Three Hours]

[*Maximum Marks* : 80

[*Minimum Pass Marks* : 16

Note : Answer **all** questions. All questions carry equal marks.

Unit-I

1. (a) Define Free energy. What are exergonic and endergonic reactions? Explain with suitable example.
- (b) Explain the biological function of haeme in haemoglobin and myoglobin.

OR

- (a) Describe the detailed structure and functions of cytochrome and iron-sulphur proteins.
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DRG_66_(3)

(Turn Over)

(2)

- (b) Write short notes on the following :
- (i) Rubredoxin (Rd) (1 Fe – 0S) protein
 - (i) Ferredoxin (FD) (2 Fe – 2S) protein

Unit-II

2. (a) How cytochrome 450 converts a hydrocarbon into an alcohol ?
- (b) Write notes on the structural behaviour and enzymatic activity of:
- (i) Xanthine oxidase
 - (ii) Carboxy peptidase

OR

- (a) Describe the crown ethers and cytodextrin based enzyme model.
- (b) Discuss the structural behaviour and enzymatic activity of:
- (i) Superoxide dismutase
 - (ii) Catalase

Unit-III

3. (a) Discuss the structure and biological functions of FMN and FAD.
- (b) Explain the following :
- (i) Effect of immobilisation of enzymes
 - (ii) Application of immobilisation of enzymes in medicinal and industrial chemistry

OR

(3)

- (a) Discuss the structure and biological functions of co-enzyme-A and NADP^+ .
- (b) Explain the following :
 - (i) Classification of enzymes by IUB report
 - (ii) Concept and identification of active sites by the use of inhibitors

Unit-IV

4. (a) What is biopolymer interaction ? Describe various types of binding process in biological cell.
- (b) Explain the following :
 - (i) Functions of nerve conduction
 - (ii) Hydrogen ion titration curve

OR

- (a) Write notes on irreversible thermodynamic treatment of membrane transport
- (b) Describe the following terms :
 - (i) Osmotic pressure in membrane equilibrium
 - (ii) Donnan membrane equilibrium

(2)

- (d) Derive Michaelis-Menten equation for studying the kinetics of enzyme catalysed reactions. 8

OR

- (a) Discuss the catalytic role of acid and base in the mutarotation of glucose. 6
- (b) What is nucleophilicity scale? 2
- (c) Explain Bronsted catalytic law. 4
- (d) find out the expression for acid-base dissociations. 4
- (e) What are enzyme catalysed reactions? Give any two enzyme catalysed reactions. 4

Unit-II

2. (a) What is surface active agents? Classify the surfactants with example of each. 10
- (b) What is CMC? Discuss the thermodynamics of micellization. 6
- (c) Write down Laplace equation and Kelvin equation. 4

OR

- (a) Explain the following in very brief: 3×5
- (i) Micelles
- (ii) Reverse micelles
- (iii) Micro emulsion

(3)

- (iv) Hydrophobic interaction
(v) Mass action model
(b) What is Surface energy ? Explain surface tension capillary action. 5

Unit-III

3. (a) Explain point defect, line and plane defects. 6
(b) Write any four difference between Schottky defect and Frenkel defect. 4
(c) Explain Band theory of semiconductors. 10

OR

- (a) Explain Non stoichiometry defects. 8
(b) Discuss the thermodynamics of Schottky and Frenkel defect. 6
(c) What are direct and indirect gap in semiconductors ? 6

Unit-IV

4. (a) Write notes on the following : 8
(i) Fire resistant polymers
(ii) Liquid crystal polymers
(b) Discuss the viscosity method for determining the molar mass of polymer. Why this method is called relative method ? 8

(4)

- (c) Equal masses of polymer molecules with $M_1 = 10,000$ and $M_2 = 1,00,000$ are mixed. Calculate \overline{M}_n and \overline{M}_w ? 4

OR

- (a) Write note on electrically conducting polymers. 6
- (b) Find out the expressions related to calculation of average dimension of various chain structure. 8
- (c) What is osmometer? Explain any one osmometer used for determination of molar mass of polymer. 6
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(2)

- (b) What is significant figure? Give the significant figure of the following data : 7
- (i) 0.800
 - (ii) 1.00
 - (iii) 1.05×10^{-6}
 - (iv) 0.051
 - (v) 43.00
- (c) Discuss the Propagation of Error. 3

Unit-II

2. (a) What is chromatography technique? Write in detail its classification and applications. 5
- (b) Discuss the solvent extraction factor and its importance. 5
- (c) Discuss the principle and methodology of Gas chromatography. 10

OR

- (a) Define the term : synergic extraction and distribution co-efficient, countercurrent extraction and retardation factor. 10
- (b) Discuss the principle and methodology and application of thin layer chromatography. 10

Unit-III

3. (a) Discuss the principle and methodology of flow injection analysis. 10

(3)

- (b) Discuss the factors affecting and application of TGA. 6
- (c) Explain the terms residence time and detector. 4

OR

- (a) What is automated method? Give the advantages of automated method. 8
- (b) What is gas diffusion method? Discuss the analysis of ammonium ions by the FIA method. 6
- (c) Discuss the principle and methodology of DTA technique. 6

Unit-IV

4. (a) Write short notes on the following : 10
- (i) Amperometric titration
- (ii) Ilkovic equation
- (b) Discuss the principle and instrumentation of the coulometry. 10

OR

- (a) Discuss the principle, instrumentation and application of the cyclic voltammetry. 10
- (b) Explain the term : Diffusion current, square wave polarography and equivalent conductance. 6
- (c) Discuss about polarized electrode and micro electrode. 4