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St Aloysius College (Autonomous)
Mangaluru
Semester III – P.G. Examination – M.Sc. Chemistry
February - 2022

**ORGANOMETALLIC, BIOINORGANIC AND COORDINATION
 CHEMISTRY**

Time: 3 Hours

ST. ALOYSIUS COLLEGE
 PG Library Max. Marks: 70
 MANGALORE-575 004

PART - A

1. Answer any **FIVE** sub divisions of the following: (5x2=10)
- Give two examples each for di and tetra hapto ligands.
 - Citing an example, explain 18-electron rule.
 - Distinguish between homogeneous and heterogeneous catalysis with suitable examples.
 - Illustrate the industrial importance of oxo process.
 - Explain the roles of Zinc and Manganese in biological system.
 - Give the biological functions of myoglobin.
 - Distinguish between complementary and non-complementary reactions.
 - Illustrate the terms: inert and labile complexes with examples.

PART - B

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

UNIT – I

- Discuss the methods of synthesis, structure and bonding in Lithium alkyls. (4)
 - Explain the bonding in metal complexes of butadiene. (4)
 - Explain the synthesis and bonding in ferrocene. (4)
- Discuss the structure and bonding in metal cyclopentadiene complexes. (4)
 - Explain the bonding in metal alkene complexes. (4)
 - Write a brief account of structure and bonding in transition metal complexes with π – ligands with special reference to arenes and CO. (4)

UNIT – II

- Write a note on Fischer-Tropsch reaction. (4)
 - What is water-gas shift reaction? Explain the catalytic cycle for water gas shift reaction. (4)
 - Discuss the mechanism of hydrogenation of olefins. (4)

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PH 582.3

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St Aloysius College (Autonomous)
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Semester III- P.G. Examination - M.Sc. Chemistry

February - 2022

ELECTROCHEMISTRY AND THERMO-ANALYTICAL METHODS

Max. Marks: 70

Time: 3 Hours

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PART - A

MANGALORE - 575 004

(5x2=10)

1. Answer any **FIVE** sub-divisions of the following:
- Give the fundamental principle of the solvation process.
 - List the limitations of the Gouy-Chapman Stern Model.
 - What is the principle of Coulometry?
 - Differentiate between Polarography and Voltammetry.
 - Write the reaction mechanism involved at the cathode and anode of a proton exchange membrane fuel cell.
 - Mention the advantages and reaction mechanism of Kolbes synthesis by electrochemistry over organic synthesis.
 - List the factors that affect the rate of corrosion.
 - Sketch the thermogram and mention the degradation reactions at different temperature ranges for $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

PART - B

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

UNIT- I

- Discuss Helmholtz - Perrin Model interface and explain its limitation. (4)
 - Explain the theory of formation of double layer at Semiconductor - Electrolyte interface. (4)
 - Explain the spectroscopic evidence towards ion-solvent interaction. (4)
- What is Solvation number? Explain any one method for its determination. (4)
 - Briefly describe the thermodynamics of electrified interfaces. (4)
 - Explain the influence and competition of water and organic molecules at the electrified interface. (4)

UNIT- II

- With a neat schematics, illustrate the construction and working of Dropping Mercury Electrode. (4)
 - Briefly explain the principle and working of different types of coulometric techniques. (4)

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PH 582.3

- c) Enumerate the advantages and applications of electrochemical stripping analysis. (4)
5. a) What is the function of a reference electrode? Classify and give suitable example. (4)
- b) Sketch and explain the nature of different types of amperometric titration curves (4)
- c) Write a short note on: (4)
- i) Cyclic Voltammetry ii) Ilkovic equation.

UNIT- III

6. a) What are the disadvantages of primary batteries?. Discuss the working of a Laclanche dry cell. (4)
- b) Illustrate the principle and procedure with the help of reaction mechanism, the electro-inorganic synthesis of fluorine. (4)
- c) Explain the principle and applications of photoelectrochemical cells. (4)
7. a) With the suitable examples, discuss the mechanism involved in the reduction of nitro compounds by electro-organic synthesis. (4)
- b) What are reserve batteries? List their advantages and important applications. (4)
- c) Describe the construction and working of bio-fuel cells. (4)

UNIT- IV

8. a) With the schematics, explain the instrumentation and working principle of DTA. (4)
- b) With suitable examples, explain the effect of temperature on hydrated organic and inorganic compounds. (4)
- c) Write a short note on: (4)
- i) Microbial corrosion ii) Galvanic corrosion
9. a) Discuss the principle and applications of thermometric titrations in acid -base and complexometric titrations. (4)
- b) Differentiate between TGA and DTA with respect to principle, working and applications. (4)
- c) Explain the working principle and application of DSC in the determination of glass transition temperature of polymers. (4)

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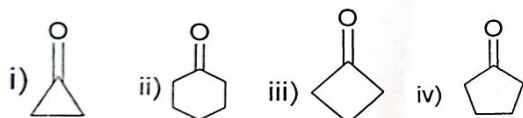
St Aloysius College (Autonomous)
Mangaluru
Semester III – P.G. Examination – M.Sc. Chemistry
February - 2022
MOLECULAR SPECTROSCOPY

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 MANGALURU - 575 003
 Max. Marks: 70

Time: 3 Hours

PART - A

1. Answer any **SEVEN** sub divisions of the following: (7x2=14)
- Why is splitting observed in 2-methylpropene but not in neopentyl chloride.
 - How would you distinguish cyclohexanol from chlorocyclohexane on the basis of PMR spectroscopy?
 - Calculate the chemical shift of benzene when proton chemical shift of TMS and benzene is 505 Hz at magnetic field of 1.5 T.
 - ^{13}C is NMR active while ^{12}C is not why?
 - UV absorption curves appears as a band rather than peaks – Give reason.
 - What are metastable ions? How its m/z value is calculated?
 - What are overtones and hot bands?
 - Assign the following frequency to their structure and rewrite in the increasing order of the same: 1745 cm^{-1} , 1850 cm^{-1} , 1780 cm^{-1} .



- i) Give the fingerprint region of IR Spectrum. Comment on its significance.

PART - B

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

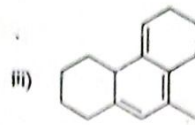
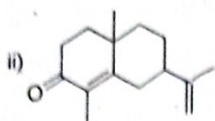
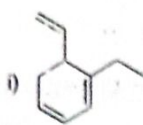
UNIT - I

- Write a note on
 - Double resonance techniques
 - Nuclear Overhauser effect
 - What internal standards are used in recording the NMR spectrum and write its unique features.
 - Write a note on the use of NMR in medical diagnostics.
- What is anisotropic effect? How it affects the chemical shift of protons in alkenes, benzene and carbonyl compounds.
 - Discuss the spin-spin coupling of magnetic nuclei.
 - How are intra and inter-molecular hydrogen bonding differentiated by ^1H NMR spectroscopy?

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UNIT - II

4. a) Calculate λ_{\max} for following compounds using Woodward Fieser's rules. (6)

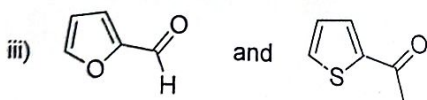
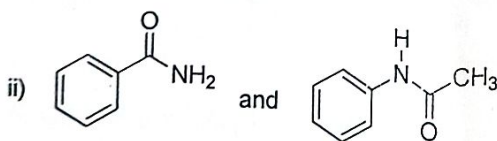
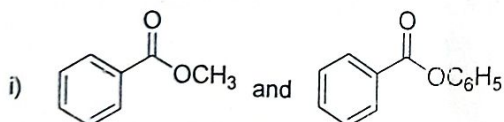


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- b) Predict the relative intensities of molecular ion and isotope peak for the following (4)
- i) $C_5H_9Br_3$ ii) p-chlorobenzene
- c) Describe with an example, the simultaneous determination of chromium and manganese by spectrometric method. (4)
5. a) Write notes on
- i) Solvent effects on UV absorption
- ii) Off resonance proton decoupling (6)
- b) Discuss the factors influencing fragmentation in mass spectrometry. (4)
- c) Compound with a molecular formula $C_9H_{10}O_2$ shows the following spectral data (4)
- NMR: $\delta=1.96(3H,s)$, $\delta=5.00(2H,s)$, $\delta=7.22(5H,s)$
 IR: 1745 cm^{-1} , 1125 cm^{-1} , 749 cm^{-1} , 697 cm^{-1}
 Mass: $m/z=150,135,91,65$. Deduce the structure of the compound.

UNIT - III

6. a) How do you distinguish the following pairs of compounds by IR spectroscopy? (6)



- b) Discuss the application of IR spectroscopy in the identification and study of aldehydes, amides and phenols with suitable examples. (6)
- c) Predict the important stretching frequencies in the IR spectrum of 3-methyl-2-butanone. (2)
7. a) Discuss the application of IR spectroscopy in the identification and study of hydrocarbons, alcohols and amines with suitable example. (6)
- b) Write note on NIR and FIR spectroscopy. (5)
- c) How IR spectroscopy is helpful in distinguishing intermolecular and intramolecular hydrogen bonding. (3)
