Maximum Marks: 60  
Credits: 04  
Duration: Two Hours

Answer all the questions.

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Questions</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>What do you understand by primary and secondary structures of polymers? Discuss the polarity of monomers.</td>
<td>[5]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Write notes on any TWO of the following:</td>
<td>[2×5]</td>
</tr>
<tr>
<td></td>
<td>(a) Morphology of crystalline polymers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) Cohesive energy density</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(c) Determination of degree of crystallinity by density measurement</td>
<td></td>
</tr>
<tr>
<td>2(a)</td>
<td>Explain the ‘free volume theory’ of glass transition temperature.</td>
<td>[5]</td>
</tr>
<tr>
<td>2(b)</td>
<td>Giving suitable examples explain the role of ‘geometrical factors’ or ‘copolymerisation’ on the glass transition temperature.</td>
<td>[5]</td>
</tr>
<tr>
<td>2(c)</td>
<td>List the factors affecting the crystalline melting point of polymers and discuss one of them in detail.</td>
<td>[5]</td>
</tr>
<tr>
<td>3</td>
<td>Write notes on any TWO of the following:</td>
<td>[2×7.5]</td>
</tr>
<tr>
<td></td>
<td>(a) Membrane osmometry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) Conformations of polymer in solution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(c) Solubility of polymers</td>
<td></td>
</tr>
<tr>
<td>4(a)</td>
<td>Calculate number of microstates associated with following macrostates:</td>
<td>[7.5]</td>
</tr>
<tr>
<td></td>
<td>![Diagram of microstates]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4(b) What is partition function? Prove that it is store house of information of a system.</td>
<td>[7.5]</td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>4(b')</td>
<td>Establish relationship between equilibrium constant and partition function.</td>
<td></td>
</tr>
</tbody>
</table>
2017-2018
IIrd SEMESTER EXAMINATION
M.Sc. (Polymer Science and Technology)
ORGANIC CHEMISTRY-II
AC-2612

Maximum Marks: 60
Credit: 04
Duration: Two Hours

Q.No. Question M.M.
1(a) Describe the CIP rules of the nomenclature of stereoisomers and suggest the R and S configurations of the following molecules in the light of CIP rules. [5+2.5]

1(b) Explain the term 'prochiral' with the help of suitable example. [2.5]

1(c) Describe the stereochemical features of hexane and decalin with the help of suitable figures. [5]

OR

1(c') What are regioselective and stereoselective chemical reactions? Discuss them with the help of the elimination reaction by E2 mechanism.

2(a) Discuss the preparation, properties and applications of ANY TWO of the following reagents used in organic synthesis. [5+5]
   (i) Dicyclohexylcarbodiimide (DCC)
   (ii) N-bromosuccinimide (NBS)
   (iii) 1,3-Dithiane

2(b) Write the reaction mechanism of ANY ONE of the following reactions. [5]
   (i) Wittig reaction
   (ii) Prevost hydroxylation

3(a) Write explanatory notes on ANY TWO of the following topics. [5+5]
   (i) Chelotropic Reaction
   (ii) Swern Oxidation
   (iii) Electroyclic Reaction

3(b) What is sigmatropic rearrangement? Discuss Claisen rearrangement with the help of suitable example. [5]

OR

3(b') What is cycloaddition reaction? With the help of correlation diagram and FMO method, show that the Diels-Alder reaction is a thermally allowed process.

4 Discuss the mechanisms of ANY TWO of the following rearrangement reactions with the help of suitable examples. [15]
   (i) Beckmann Rearrangement
   (ii) Stevens Rearrangement
   (iii) Pinacol-Pinacolon Rearrangement

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2017-18  
M.Sc. POLYMER SCIENCE & TECHNOLOGY  
II SEMESTER EXAMINATION  
POLYMER CHEMISTRY  
AC-2613

Maximum Marks: 60  
Credits: 04  
Duration: Two Hours

Answer all the questions. 
Assume suitable data if missing. 
Notations used have their usual meaning.

<table>
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<tr>
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<tr>
<td>1(a)</td>
<td>What do you understand by chain growth and step growth polymers? Discuss the general mechanism involved in chain growth polymer synthesis.</td>
<td>[7.5]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Describe the number average and the weight average molecular masses of a polymer? A sample of polymer contains 300 molecules of molecular mass $10^3$ each, 400 molecules of molecular mass $10^4$ each and 500 molecules each having $10^5$ as molecular mass. Calculate number average and weight average molecular masses for the sample.</td>
<td>[7.5]</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1(b)'</td>
<td>Using an appropriate sketch, explain the difference between atactic, syndiotactic and isotactic side chains in a polyalkene. Draw the structures of syndiotactic and atactic forms of polypropylene.</td>
<td></td>
</tr>
<tr>
<td>2(a)</td>
<td>Explain the statistic of linear step-reaction and molecular weight control in step-growth polymerization.</td>
<td>[7.5]</td>
</tr>
<tr>
<td>2(b)</td>
<td>Write short notes on any three of the followings:                                                                                                                                                    [2.5×3]</td>
<td></td>
</tr>
<tr>
<td>(i)</td>
<td>Coordination polymerization (ii) Bulk Polymerization</td>
<td></td>
</tr>
<tr>
<td>(iii)</td>
<td>Emulsion Polymerization (iv) Interfacial polymerization</td>
<td></td>
</tr>
<tr>
<td>3(a)</td>
<td>Describe the gel permeation chromatography method used for the determination of the molecular weight of the polymers.</td>
<td>[7.5]</td>
</tr>
<tr>
<td>3(b)</td>
<td>Write short notes on any three of the followings:                                                                                                                                                       [2.5×3]</td>
<td></td>
</tr>
<tr>
<td>(i)</td>
<td>Polydispersity index (ii) The importance of characterization of polymers</td>
<td></td>
</tr>
<tr>
<td>(iii)</td>
<td>Osmometry (iv) The significance of molecular weight distribution</td>
<td></td>
</tr>
<tr>
<td>4(a)</td>
<td>What is degradation of polymers? Give the types of degradation.</td>
<td>[4]</td>
</tr>
<tr>
<td>4(b)</td>
<td>Discuss general mechanism of thermal oxidative degradation of polymers.</td>
<td>[7]</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4(b)'</td>
<td>Discuss the mechanism of rubber oxidation.</td>
<td>[2×2]</td>
</tr>
<tr>
<td>4(c)</td>
<td>Write short notes on the followings:</td>
<td></td>
</tr>
<tr>
<td>(i)</td>
<td>Antioxidant</td>
<td></td>
</tr>
<tr>
<td>(ii)</td>
<td>Photostabilizers</td>
<td></td>
</tr>
</tbody>
</table>
2017-18  
M.Sc (POLYMER SCIENCE AND TECHNOLOGY)  
(II SEMESTER) EXAMINATION  
GENERAL SPECTROSCOPY  
(AC-2614)  
Credits: 04  

Maximum Marks: 60  
Answer all the questions  
*Marks are allotted against each question*  

<table>
<thead>
<tr>
<th>Q. No.</th>
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<tbody>
<tr>
<td>1.(a)</td>
<td>Describe different types of electronic transitions in a molecule. Explain the transition responsible for a band at $\lambda_{\text{max}}=280$ nm in absorption spectrum of acetone.</td>
<td>5</td>
</tr>
<tr>
<td>1.(b)</td>
<td>Which of the following molecule absorbs at the longest wavelength? Justify with proper arguments.</td>
<td>2</td>
</tr>
<tr>
<td>1.(c)</td>
<td>Give an account of the solvent effect on $\pi\rightarrow\pi^<em>$ and $n\rightarrow\pi^</em>$ transitions.</td>
<td>4</td>
</tr>
<tr>
<td>1.(d)</td>
<td>A mixture of natural cholesterol and its enantiomer has a specific rotation of $-27^\circ$ at 20°C. Calculate % enantiomeric excess (ee) of this mixture. What % of this mixture is natural cholesterol? (Given [a] pure natural cholesterol $= -31.5^\circ$)</td>
<td>4</td>
</tr>
<tr>
<td>2.(a)</td>
<td>The normal modes of vibration of CO$_2$ molecule are $\nu_1=1310$ cm$^{-1}$, $\nu_2=660$ cm$^{-1}$ and $\nu_3=2350$ cm$^{-1}$. Evaluate zero-point energy of CO$_2$ molecule.</td>
<td>4</td>
</tr>
<tr>
<td>2.(b)</td>
<td>The transition of $J=0 \rightarrow J=1$ in rotational spectrum is often not the most intense. Why?</td>
<td>3</td>
</tr>
<tr>
<td>2.(c)</td>
<td>Why anti-stokes lines are less intense than Stokes lines?</td>
<td>2</td>
</tr>
</tbody>
</table>
| 2.(d)  | Answer any two of the followings:  
(i) Classical theory of Raman scattering  
(ii) Normal modes of CO$_2$ molecule  
(iii) Fundamental, overtone and hot band absorptions | 3x2 |
| 3.(a)  | What is the chemical shift in NMR spectroscopy? Calculate the chemical shift of a peak that occurs at 754.6 Hz downfield of TMS on a spectrum recorded using a 60 MHz spectrometer? | 7 |
| 3.(b)  | What will be the multiplicity of each kind of proton in the following molecules?  
(i) $\text{(CH}_3\text{)}_2\text{C CH}_2\text{Br}$  
(ii) CICH=CHI | 2 |

contd...
3.(c) **Draw the** structures of the given compounds that meet following descriptions:
- $\text{C}_2\text{H}_4\text{O}$; one singlet and $\text{C}_3\text{H}_7\text{Cl}$; one doublet and one septet.

3.(d) Describe the shielding and de-shielding in NMR.

**OR**

3.(d') What is the difference between geminal and vicinal couplings?

4.(a) What is $V'$ progression? Draw a neat and labeled vibrational coarse-electronic absorption spectrum.

4.(b) Explain the vibrational electronic spectra of the given diatomic molecule undergoing transition from $E_v$ to $E'_v$. Briefly discuss the intensity of lines also.

4.(c) Describe the meaning of the state $^1\Sigma_g^+$.

4.(d) Answer any two of the followings.
   (i) Born-Oppenhiemer approximation
   (ii) Principle and working of Auger spectroscopy
   (iii) Band origin and Band head
2017-18
M.Sc. (Polym. Sc. & Tech.) II Semester Examination
Colloids and Surfactants
(AC-2615)

Maximum Marks: 60
Time: 2 hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. | Question | M.M.
--- | --- | ---
1 | Answer any THREE of the followings:
(a) Give in details the methods of preparation of colloidal dispersions.
(b) Explain the distinctive physical properties of colloids.
(c) Discuss the origin of charge on colloidal particles and its role on its stability.
(d) Write note on the structure of colloids.
2(a) | What are surfactants? Describe the structure, properties and uses of Gemini surfactants. | 5
2(b) | Give the physical significance of critical micelle concentration (CMC). List various factors which influence the CMC values. Discuss any one technique for the determination of CMC value. | 6
2(c) | Define HLB numbers. Give an account of HLB ranges for different practical applications. OR |
2(c)' | Explain the structure of micelles in polar and non-polar solvents. |
3 | Discuss any THREE of the followings with suitable examples: | 3x5
(a) Polymer-Surfactant Interactions
(b) Kraft Temperature
(c) Adsorption of polymer at surfaces.
(d) Cloud Point
4(a) | Define hydrogels and give their applications in pharmaceuticals and modern technology. | 5
4(b) | Discuss any TWO of the followings: | 2x5
a) Chemical and Physical hydrogels
b) Polymer grafting
c) Synthesis of hydrogels by solution polymerisation

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2017-2018
M.Sc. (POLYMER SCIENCE & TECHNOLOGY)
II-Semester Examination
Green Chemistry (open elective)
AC-2616
Maximum Marks: 60
Credit: 04
Duration: Two Hours
Answer all the questions.

Q.No. | Questions | M.M. |
---|---|---|
1.(a) | Calculate the % atom economy of any two of the following reactions: | (2.5x2) |
   i) | ![Reaction 1](image1) | |
   ii) | ![Reaction 2](image2) | |
   iii) | ![Reaction 3](image3) | |

1.(b) | Explain any two of the following principles of green chemistry: | (2.5x2) |
   i. | Use of Renewable Feedstocks |
   ii. | Safer Solvents and Auxiliaries |
   iii. | Design for Degradation |

1.(c) | Discuss the favorable interactions among economy, environment and |

contd... 2.
society to achieve sustainable development.

2.(a) The adsorption of a gas is described by Langmuir adsorption isotherm. Calculate the pressure at which the fractional coverage is 0.1. Given \( K = 0.9 \text{kPa}^{-1} \) at 27 °C.

OR

Calculate how long a hydrogen atom will remain on the surface of a solid at 298K if its desorption activation energy is 15kJ/mol. Assume that \( \tau_0 = 10^{-13} \text{s} \).

2.(b) Differentiate between chemisorption and physisorption.

2.(c) At 0 °C and 1 atm pressure, the volume of nitrogen gas required to cover a sample of silica gel, assuming Langmuir monolayer adsorption, is found to be 130 cm\(^3\)/gm of the gel. Calculate the surface area per gram of the silica gel. Given that the area occupied by a nitrogen molecule is 0.162 \( \text{(nm)}^2 \).

3.(a) What are supercritical fluids? Discuss about supercritical carbon dioxide.

OR

What do you understand by ionic liquids? Discuss their importance as green solvents.

3.(b) Discuss any three solvent free organic synthesis reactions and their preferences over classical methods.

4.(a) Discuss biocatalysed Baeyer-Villiger reactions in terms of chemoselectivity, site selectivity and functional group selectivity.

4.(b) Discuss the importance of zeolite catalysed reactions over conventional organic synthesis.