M.Sc. POLYMER SCIENCE AND TECHNOLOGY (IIIrd SEMESTER) EXAMINATION
POLYMER MATERIALS-I
AC-3711

Maximum Marks: 70
Credits: 04
Duration: 2Hrs 30Min.

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

Q.No.  Question                                      CO  M.M.
1(a)   Describe the manufacture, properties and uses of any ONE of the following polymers:
       i. Polyvinyl acetate
       ii. Polyvinyl alcohol
1(b)   Why is PTFE highly crystalline and linear? Explain.
1(c)   What are the limitations of polystyrene and how can these defects be overcome?
2(a)   What are polyimides? Discuss their general structure and properties.
2(b)   Write notes on any TWO of the followings:
       i. Kevlar
       ii. Unsaturated polyesters
       iii. Polyurethane coatings
3(a)   Give an account of the manufacture of SBR by both emulsion and solution polymerization techniques.
3(b)   Write down the important characteristics that are imparted by Cl atom to Neoprene rubber.

OR

3(b')  Why Silicone rubbers are good elastomers?
3(c)   Write notes on any TWO of the followings:
       i. Hylaprons
       ii. EPDM
       iii. Fluorocarbon

4(a)   What are epoxy resins? Explain their advantages over other adhesives.
4(b)   Write the properties and applications of Chitin OR Starch.
4(c)   Explain, why is curing essential for epoxy resins? Discuss the curing process and show the structure of cured product. Also, highlight the requirements of curing agents.
2018-19
M.Sc. POLYMER SCIENCE AND TECHNOLOGY (IIIrd SEMESTER) EXAMINATION
Special Topics in Polymer Chemistry & Technology
AC-3712

Maximum Marks: 70 Credits: 04 Duration: 2Hrs 30Min.

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

Q.No. Question CO M.M. 
1(a) What structural features make a polymer to conduct electricity? Describe the 4-in-line-probe method of measurement of electrical conductivity of materials with the help of a labeled circuit diagram. (CO1) [6] 
1(b) Compare the band theory and percolation theory of electrical conduction in materials with the help of suitable diagrams. (CO1) [6] 
1(c) What is doping? Describe the electrochemical method of doping of conducting polymers with the help of a labeled diagram. (CO1) [6] 

OR

1(c') Explain the preparation of polyaniline by oxidative polymerization. (CO1)

2(a) Write short notes on ANY TWO of the followings: (CO2) [8]
(i) Anode materials
(ii) Hole injection materials
(iii) Light emitting materials

2(b) Explain the working of single layer organic light emitting device. (CO2) [5]
2(c) What is delayed fluorescence? How is it different from phosphorescence? (CO2) [4]

3(a) What do you mean by biocompatibility of polymers? Discuss the in vitro and in vivo biocompatibility tests. (CO3) [5]
3(b) What are different drug delivery routes? Explain any one of them in detail by highlighting its advantages and disadvantages over other routes. (CO3) [6]
3(c) What are the required properties of polymers to be used in orthopaedic applications? Give examples of three polymers with their specific uses in orthopaedics. (CO3) [6]

OR

3(c') Write note on applications of polymers in ‘dentistry’ or ‘surgery’ (CO3)

4(a) Write notes on ANY THREE of the followings: (CO4) [18]
(i) Similar and dissimilar characteristics of adhesives and sealants
(ii) Joint failure
(iii) Mechanical theory of adhesion
(iv) Advantages and disadvantages of adhesive bonding
Maximum Marks: 70  
Credits: 04  
Duration: 2Hrs 30Min.

**Answer all questions.**

**Assume suitable data if missing.**

**Notations and symbols used have their usual meaning.**

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>CO</th>
<th>M.M.</th>
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</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>What do you mean by ideal elastic response of polymers? Describe the parameters used to determine elasticity of materials.</td>
<td>(CO1)</td>
<td>9</td>
</tr>
<tr>
<td>1(a')</td>
<td>What is viscoelasticity? How the linear combination of springs and dashpots connected in a series is helpful to describe the viscoelastic response of polymeric solids?</td>
<td>(CO1)</td>
<td>9</td>
</tr>
<tr>
<td>1(b)</td>
<td>Explain Kelvin-Voigt and four parameter models for linear viscoelastic response of polymers.</td>
<td>(CO1)</td>
<td>8</td>
</tr>
<tr>
<td>2(a)</td>
<td>Explain any two of the followings:</td>
<td>(CO2)</td>
<td>5x2</td>
</tr>
<tr>
<td></td>
<td>(i) Impact testing of polymers</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(ii) Crazing and cold drawing</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(iii) Principles of fracture mechanics</td>
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<tr>
<td>2(b)</td>
<td>What are oriented polymers? Give a detailed account of the desirable and undesirable orientations of polymers.</td>
<td>(CO2)</td>
<td>8</td>
</tr>
<tr>
<td>3(a)</td>
<td>Explain shear-thinning behaviour of non-Newtonian fluids.</td>
<td>(CO3)</td>
<td>6</td>
</tr>
<tr>
<td>3(a')</td>
<td>Define Melt Flow Index (MFI) and explain the procedure of its determination.</td>
<td>(CO3)</td>
<td>6</td>
</tr>
<tr>
<td>3(b)</td>
<td>Discuss the role of molecular weight in influencing the flow behaviour of polymers.</td>
<td>(CO3)</td>
<td>6</td>
</tr>
<tr>
<td>3(c)</td>
<td>What is Bagley correction? Discuss the procedure for its estimation.</td>
<td>(CO3)</td>
<td>6</td>
</tr>
<tr>
<td>4(a)</td>
<td>How the breakdown of thixotropic structures is measured using CR-rheometer?</td>
<td>(CO4)</td>
<td>6</td>
</tr>
<tr>
<td>4(a')</td>
<td>Explain the hysteresis curve of thixotropic structures when measured by CS-rheometer.</td>
<td>(CO4)</td>
<td>6</td>
</tr>
<tr>
<td>4(b)</td>
<td>What is yield point in thixotropic fluid? How is it measured?</td>
<td>(CO4)</td>
<td>6</td>
</tr>
<tr>
<td>4(c)</td>
<td>Explain any one method for measuring the recovery time of gel.</td>
<td>(CO4)</td>
<td>5</td>
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</tbody>
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2018-19
M.SC. (POLYMER SCIENCE AND TECHNOLOGY)
(III SEMESTER) EXAMINATION
ENVIRONMENTAL CHEMISTRY
(OPN ELECTIVE)
AC-3714

Maximum Marks: 70
Credits: 04
Duration: 2Hrs 30Min.

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

Q.No. Question CO M.M. 
1 What are the major chemical species present in different atmospheric (CO1) [18] regions? Explain the significance of troposphere and stratosphere with the help of temperature – altitude profile.

OR

1'(a) Describe the photochemical reactions in the atmosphere involving organic (CO1) [08] compounds.

1'(b) Describe the atmospheric conditions responsible for the formation of (CO1) [08] photochemical smog. Discuss the formation of oxidizing and reducing smog.

2(a) Discuss the sources and significance of CO and NOx in the atmosphere. (CO2) [08]

2(b) Classify particulate matter according to their physical, chemical and biological characteristics. How human body defends itself against the invasion of particulate matter?

3(a) What are water pollutants? How are they classified? Discuss the (CO3) [17] significance of various water pollutants.

OR

3'(a) Write short notes on the followings: (CO3) [3x3]
i) Biodegradable and non-biodegradable pollutants

ii) Biological Oxygen Demand (BOD) and chemical Oxygen Demand

contd...2.
iii) Radioactive wastes

3(b) Enumerate the sources and adverse effects of toxic heavy metals. (CO3) [8]

4(a) Describe the characterization of wastewater on the basis of physical, chemical and biological properties. (CO3) [9]

4(b) What are various types of pond processes used for the treatment of sewage? (CO4) [9]

OR

4(b') What are the various stages of wastewater treatment? Discuss the aerobic suspended growth system in detail. (CO4) [9]
Maximum Marks: 70  
Credits: 04  
Duration: 2Hrs 30Min

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

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<tr>
<td>1(a)</td>
<td>Explain the following organic transformations in the light of IR spectral changes observed during the process.</td>
<td>(CO1)</td>
<td>[07]</td>
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<tr>
<td></td>
<td><img src="image1" alt="Chemical Structure" /></td>
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<tr>
<td>1(b)</td>
<td>Using suitable example, discuss the effect of hydrogen-bonding on IR bands.</td>
<td>(CO1)</td>
<td>[04]</td>
</tr>
<tr>
<td>1(c)</td>
<td>Describe the variation of stretching frequency of carbonyl in the compounds given under.</td>
<td>(CO1)</td>
<td>[06]</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th><img src="image2" alt="Chemical Structure" /></th>
<th><img src="image3" alt="Chemical Structure" /></th>
</tr>
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<tbody>
<tr>
<td>$1710 \text{ cm}^{-1}$</td>
<td>$1750 \text{ cm}^{-1}$</td>
</tr>
</tbody>
</table>

2(a) Write the principle of mass spectrometry and draw a labelled block diagram of mass spectrometer. (CO2) [06]

2(b) Discuss McLafferty rearrangement with the help of suitable examples. (CO2) [05]

2(c) Give the fragmentation patterns of the given molecule. (CO2) [06]

3(a) Discuss the principle of Electron Spin Resonance spectroscopy. Give the block diagram of a typical ESR spectrometer. (CO3) [06]
3(b) Define Kramer degeneracy? Discuss the splitting of triplet state in presence of magnetic field and exhibiting zero field splitting.

3(c) Describe the McConnell’s relation for electron delocalization. The hyperfine constant in the EPR spectrum of (naphthalene)\textsuperscript{1} at α and β positions are 0.499 mT and 0.195 mT respectively. Map the unpaired electron spin density around the ring.

OR

3(c') What is the reason of hyperfine structure (HFS) in ESR spectrum? Discuss the HFS in case of methyl radical.

4(a) With the help of examples, explain the uses of Mössbauer spectroscopy in corrosion study.

OR

4(a') Why does the experimental Mössbauer spectrum of a nucleus having nuclear spin \( \frac{1}{2} \) in the ground state and 3/2 in the first excited state exhibit two lines?

4(b) What is electric field gradient (EFG)? Define asymmetry parameter of quadrupole nucleus.

4(c) The NQR frequency for a nucleus with \( l=3/2 \) in an axially symmetric EFG (\( \eta=0 \)) is 120 MHz. Calculate the nuclear quadrupole coupling constant.

4(d) NQR spectroscopy can be used for bulk explosive detection. Give plausible explanation.
**M.Sc. POLYMER SCIENCE AND TECHNOLOGY**  
**(III<sup>rd</sup> SEMESTER) EXAMINATION**  
**SUPRAMOLECULAR CHEMISTRY**  
**AC-3717**

Maximum Marks: 70  
Credits: 04  
Duration: 2Hrs 30Min.

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<tr>
<td>1(a)</td>
<td>What are supramolecular interactions and how are they classified? Discuss the application of supramolecular chemistry.</td>
<td>(CO1)</td>
<td>8</td>
</tr>
<tr>
<td>1(b)</td>
<td>Write the importance of supramolecular catalysis.</td>
<td>(CO1)</td>
<td>6</td>
</tr>
<tr>
<td>1(c)</td>
<td>Briefly explain the biological applications of host–guest compounds.</td>
<td>(CO1)</td>
<td>4</td>
</tr>
<tr>
<td>1(c')</td>
<td>Explain molecular recognition and its uses.</td>
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<tr>
<td>2(a)</td>
<td>Discuss any two of the followings:</td>
<td>(CO2)</td>
<td>(5 x2)</td>
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<tr>
<td></td>
<td>(i) Cyclodextrins</td>
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<td></td>
<td>(ii) Calixarenes</td>
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<td></td>
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<td></td>
<td>(iii) Cryptands</td>
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<td>2(b)</td>
<td>Discuss the structure and synthesis of cucurbiturils.</td>
<td>(CO2)</td>
<td>7</td>
</tr>
<tr>
<td>2(b')</td>
<td>What are ionophores? Explain the action of valinomycin.</td>
<td>(CO2)</td>
<td></td>
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<tr>
<td>3(a)</td>
<td>Write short notes on any two of the followings:</td>
<td>(CO3)</td>
<td>(6x2)</td>
</tr>
<tr>
<td></td>
<td>(i) Nucleation theory</td>
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<td></td>
<td>(ii) Polymorphism</td>
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<td>(iii) Supramolecular synthons</td>
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<td>3(b)</td>
<td>What are molecular logic gates? Discuss AND and NOT logic gates.</td>
<td>(CO3)</td>
<td>6</td>
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<td>3(b')</td>
<td>What are molecular machines, write their characteristic features. Explain optical twizzers or molecular fan.</td>
<td>(CO3)</td>
<td></td>
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<tr>
<td>4(a)</td>
<td>With the help of well labelled diagrams, discuss the dimensionality in metal organic frameworks (MOFs).</td>
<td>(CO4)</td>
<td>7</td>
</tr>
<tr>
<td>4(b)</td>
<td>Write short notes on any two of the followings:</td>
<td>(CO4)</td>
<td>(5 x 2)</td>
</tr>
<tr>
<td></td>
<td>(i) MOFs in gas storage</td>
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<tr>
<td></td>
<td>(ii) MOFs in drug delivery</td>
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<td>(iii) Polymer electrolyte membrane</td>
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