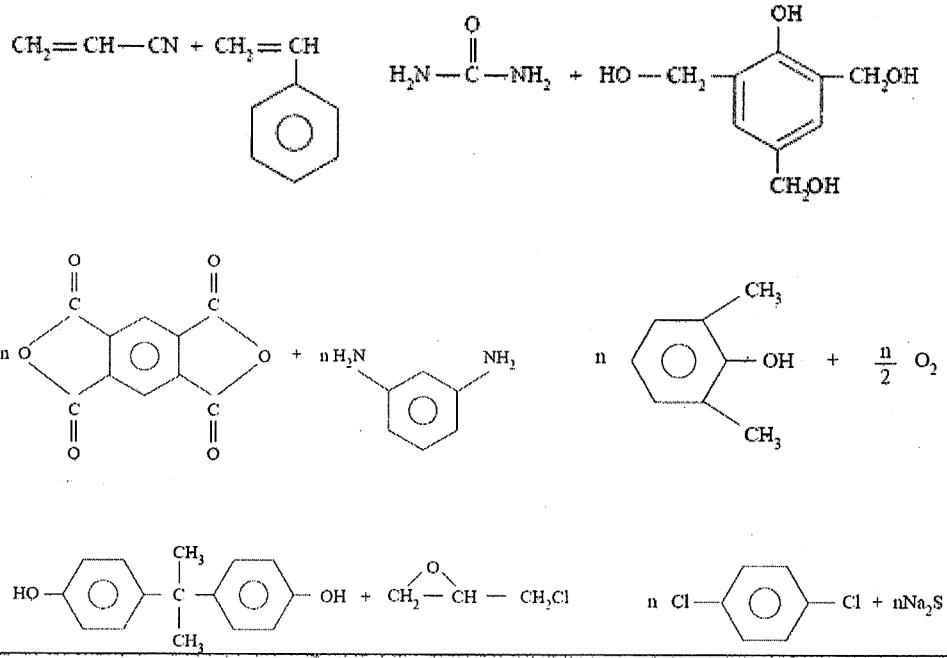
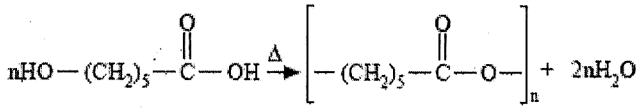
B.E. CHEMICAL ENGINEERING FOURTH YEAR
SECOND SEMESTER EXAM 2025

HIGH POLYMER TECHNOLOGY

FM-100 Time-3hrs

Question No	CO No.	Question	Marks
1	CO-1	(i) Show the branch point formation considering the reaction between diamine and epoxy. (ii) How polydispersity index is related with average functionality for branched step growth polymers? (iii) Write down the structure of the repeat unit of the following (any 5): 	6+4+10=20
2	CO-2	(i) a. Polyester fibers can be produced from ω = hydroxycaproic acid.  If the initial 100 moles of the hydroxyl acid are reduced to 4 moles after 10 hours reaction time, calculate: i. The number average molecular weight M_n ii. The weight average molecular weight M_w b. As a result of extraneous reactions of the hydroxyl groups, a 2% excess of the carboxylic acid is present in the reaction mixture. Calculate the number-average molecular weight for the same extent of reaction in a. c. If 5 mol% of monoacid is present as impurity. What will be the maximum degree of polymerization? (ii) Write short notes on: (a) Zeigler Natta polymerization (b) Electroviscous effect (c) Inhibition	15+10=25

<table>
<tr><td>3</td><td>CO-3</td><td>(i) Discuss glass-rubber transition behaviour of polymer.
(ii) Estimate the feed and copolymer compositions for the azeotropic copolymerization of Metahyl methacrylate and styrene at 60°C.
<table><tr><th>Monomer 1</th><th>Monomer 2</th><th>r_1</th><th>r_2</th><th>T (°C)</th></tr><tr><td>Acrylonitrile</td><td>1,3-Butadiene</td><td>0.02</td><td>0.30</td><td>40</td></tr><tr><td></td><td>Methyl methacrylate</td><td>0.15</td><td>1.22</td><td>80</td></tr><tr><td></td><td>Styrene</td><td>0.04</td><td>0.40</td><td>60</td></tr><tr><td></td><td>Vinyl acetate</td><td>4.2</td><td>0.05</td><td>50</td></tr><tr><td></td><td>Vinyl chloride</td><td>2.7</td><td>0.04</td><td>60</td></tr><tr><td>1,3-Butadiene</td><td>Methyl methacrylate</td><td>0.75</td><td>0.25</td><td>90</td></tr><tr><td></td><td>Styrene</td><td>1.35</td><td>0.58</td><td>50</td></tr><tr><td></td><td>Vinyl chloride</td><td>8.8</td><td>0.035</td><td>50</td></tr><tr><td>Methyl methacrylate</td><td>Styrene</td><td>0.46</td><td>0.52</td><td>60</td></tr><tr><td></td><td>Vinyl acetate</td><td>20</td><td>0.015</td><td>60</td></tr><tr><td></td><td>Vinyl chloride</td><td>10</td><td>0.1</td><td>68</td></tr><tr><td>Styrene</td><td>Vinyl acetate</td><td>55</td><td>0.01</td><td>60</td></tr><tr><td></td><td>Vinyl chloride</td><td>17</td><td>0.02</td><td>60</td></tr></table>(iii) 0.2 gm of polystyrene (PS) sample is dissolved in 250 ml of butanone. Flow time of are measured employing ubbelhode capillary viscometer. Determine the molecular weight of PS.
Given: Flow time of butanone = 140 sec and that of PS solution is 160 sec. $K = 40*10^{-3}$ and $a = 0.6$
(iv) Calculate the time required for 25% polymerization of pure styrene at 60°C with benzoyl peroxide as the initiator in a batch reactor. Assume that the initiator concentration remains (a) constant and (b) first order decay.
Data:
$f = 1$
$K_p^2/K_t = 2 *10^{-3}$ l/mol-s
$[I] = 5.0 *10^{-3}$ mol/l
$K_d = 1.5*10^{-6}\ s^{-1}$</td><td>5+5+5+10=25</td></tr>
<tr><td>4</td><td>CO-4</td><td>Write short note on: Extrusion, Dipping
Or
Discuss the different steps associated with injection molding process?</td><td>10</td></tr>
<tr><td>5</td><td>CO-5</td><td>Write the manufacturing method of Nylon 6,6 with PFD.</td><td>15</td></tr>
<tr><td colspan="2"></td><td>Total</td><td>100</td></tr>
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