BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B.TECH **SEMESTER :IV**
BRANCH: CHEMICAL ENGG **SESSION : SP/2023**

SUBJECT: CL229 MACROMOLECULAR SCIENCE

TIME: 3 hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Explain the reason behind the trend in the variation of storage modulus of thermoplastic polymers with temperature. Show the position of Tg and Tm in this curve.	[5]	1	Explain
Q.1(b)	What is the difference between internal and external plasticization? Give examples of both types of plasticizers. Compare phenolic resin and phenoxy resin in respect of chemical structure of the repeat units.	[3+2]	4	Compare
Q.2(a)	Derive the expression of average degree of polymerization of PET in absence of external catalyst. What are the demerits of Condensation polymerization?	[3+2]	3	Derive
Q.2(b)	Calculate the average degree of polymerization after 100 minutes if the initial monomer concentration was $4.0x10^{-3}$mol/lt in a self- catalyzed polycondensation reaction system. Given that after 15minutes and 60 minutes the reaction was 45% and 65% complete respectively.	[5]	3	Calculate
Q.3(a)	Compare the expressions of Rp of methyl methacrylate through free radical and anionic polymerization. Derive the expression of copolymer composition for a random copolymer.	[2+3=5]	3	Derive, Compare
Q.3(b)	How can we overcome the limitations of free radical polymerization? Calculate the rate of polymerization of styrene in benzene from following data when BPO is 70 % efficient: $[M]=2.5x10^3 Mol/m^3$, $[I]=4.0mol/m^3$, $kp/kt^{1/2}=0.09x10^{-3}\ m^{1.5}/(mol\text{-}s)^{0.5}$ If the spontaneous decomposition rate of BPO is $3.2x10^{-6}s^{-1}$ calculate the rate of polymerization. If the efficiency was 100% how much increase in Rp could be found?	[1+4]	2	Calculate
Q.4(a)	Write down Flory Huggin's equation. Define each parameter in it. What are the factors controlling solubility of polymers? Why does PE dissolve in xylene at an elevated temperature but not at room temperature?	[1+2+1+1]	1	define
Q.4(b)	Describe the process of heterogeneous bulk polymerization of a vinyl monomer. Explain the function of various ingredients used in emulsion polymerization.	[3+2]	4	describe
Q.5(a)	Explain the reason behind the crystallinity of the following polymers: PP, PET, NYLON 6 Draw the graph of rate of crystallization Vs. time. Explain the trend seen here.	[3+2]	5	Explain
Q.5(b)	Calculate the percent crystallinity of polyethylene sample after 300 seconds during DSC experiment based on following data: ΔH_f=109J/g after 180sec,92 J/g after 80 sec $\Delta H_{100\%}$=253J/gm Why does PP show very good hinge property but PE does not?	[3+2]	5	Calculate

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