MASTER OF CHEMICAL ENGG 2ND SEMESTER EXAMINATION-2017

SUBJECT: HIGH POLYMER ENGINEERING

FM-100

TIME-3HRS

Answer All Questions (Assume any missing data)

1. (a) 0.10 gm of a polymer sample has been dissolved in 100 ml of solvent. The respective flow time at RT is mentioned below:

Flow time $_{solvent}$ = 100 sec

Flow time $_{Polymer\ solution}$ = 150 sec

Given: K= 3*10^{-2} and a = 0.6

Determine the molecular weight of a Polymer sample. (10)

(b) It is desired to prepare a polymer with Mn of 10000 via unimolar reaction between a diol and diacid. (Given: Mo = 100)

I. Calculate the extent of reaction.

II. Assume 2 mol% diol is lost during the course of reaction. What would be the value of Mn in that scenario?

III. suppose 2 mol of adipic acid contains 1% of monoacid as impurity. What would be the value of extent of reaction to achieve the desired product? (15)

2. (a) State two differences between bulk and solution polymerization. Write down typical recipe of Emulsion polymerization. What are the conditions (in terms of monomer reactivity ratio) for ideal, alternating and Aezotropic co polymerization? (2+3+5)

(b) Write short notes on (any three): (i) Aezotropic copolymerization, (ii) Inhibition; (iii) Kinetic Chain Length; (iv) Stoitiometric imbalance; (v) Polydispersity index (15)

3. (a) Nylon 6,6 is made on every 8 hour shift. In each batch, euimolar reactants are used and conversion is 95%. In final stage, the bulk product is extruded and chopped into pellets. (Given: $M_0=113$)

   I.   Calculate the number average molecular weight.

   II.   In afternoon shift, the operator added 1.0 moles of excess adipic acid. If the batch went to the usual conversion, what will be the number average molecular weight?

   III.   The night shift operator went for a long walk and in the meantime the reaction went too long. What will be the number average molecular weight of this batch?

   IV.   How should the engineer mix these batches to obtain the number average molecular weight of the usual product? Calculate the weight average molecular weight? (18)

(b) Write down the reaction mechanism of a cationic polymerization involving a vinyl chloride and a lewis acid. (7)

4. (a) Draw the schematic of a Plastic Extruder and henceforth describe the working principle of the extrusion process. State the roles of different screws used during Extrusion process? How do you control the heat build up inside the barrel? Write down the mechanism of Electro-spinning towards polymer membrane fabrication. (10+4+3+8)