FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
DEPARTMENT OF POLYMER AND TEXTILE ENGINEERING

2014/2015 HARMATTAN SEMESTER EXAMINATION

PTE 301: POLYMER CHEMISTRY

TIME: 2½ HRS DATE: 21st APRIL, 2015.

INSTRUCTION: ANSWER ANY FIVE QUESTIONS

1(a) Define step growth polymerization and list the two classes of step growth polymerization with the reactions involved.

(b) With the aid of mathematical expressions, show that the number distribution function for a linear step growth polymerization in terms of initial amount of monomer and extent of reaction is given as: $N_x = N_0 (1-P)^2 P^{x-1}$.

(c) Mention the methods of producing step growth polymers and state the chemical reactions involved in each case.

2(a) State the general guidelines for polymerization of monomers in a chain growth polymerization and define chain growth polymerization.

(b) Explain briefly 'chain transfer' in a chain growth polymerization.

(c) Using mathematical equations show how the number average degree of polymerization (X_n), rate of polymerization (R_p) and the rate of termination (R_t) relate in a free radical polymerization.

3(a) Illustrate the mechanism of cationic polymerization of styrene using BF_3 catalyst.

(b) Calculate the molecular weight of the following polymers if each of them has the average degree of polymerization of 5000. (i) Polypropylene (ii) Poly (vinyl alcohol) (iii) Polystyrene.

4(a) With the aid of equation(s), show four ways in which free radicals can be generated for the polymerization of monomers.

(b) Explain the following terms (i) auto-acceleration (ii) Living polymers.

5(a) Differentiate between solution and suspension polymerization processes.

(b) Identify the polymerization technique(s) for polyethylene synthesis.

(c) List two merits of bulk polymerization.

(d) What are the two components of anions formed from emulsifier?

(e) Briefly explain the following terms (i) Critical Micelle Concentration (CMC) (ii) Hot spots and runaways.

6(a) Describe the manufacturing processes of viscose rayon from cellulose.

(b)Give one physical, thermal and chemical properties of the fibre.

(c) What is Polymer Characterization?

(d) Describe the manufacturing process of Acetate fibre, stating how the process differs from that of Triacetate fibre.