NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF TEXTILE TECHNOLOGY

END OF SECOND SEMESTER EXAMINATIONS - AUGUST 2009

TXT 1204 - POLMER SCIENCE

TIME: 3 HOURS

INSTRUCTIONS

Answer **Question 1** and **ANY OTHER FOUR** questions. Each question carries **20 marks.**

QUESTION 1

(a) Giving examples, list four classes of polymers.   **(4)**

(b) Differentiate between "polymer" and "macromolecule"   **(4)**

(c) What properties differentiate a thermoplastic polymer from a thermosetting polymer?
Give one example of each class.   **(4)**

(d) What do you understand by T_g and T_m ? Explain how knowledge of these is
helpful in understanding polymer properties relating to textile applications.

                                                                                                                  (4)

(e) Draw the structures of the following polymers; urea formaldehyde, nylon 6,6,
poly(ethyleneterephthalate) known as polyester.   **(4)**

QUESTION 2

 (a) With the aid of appropriate structures define the terms isotactic, syndiotactic,
atactic.   **(6)**

(b) Differentiate between step-growth polymerization and addition polymerization. Give
one example of each.   **(6)**

(c) Taking styrene as an example, write chemical equations for the initiation,
propagation, and termination steps involved in anionic polymerization of this
monomer.   **(8)**

QUESTION 3

(a) Explain the terms : block polymer, branched polymer, graft polymer, random
     polymer.   **(8)**

(b) Hand and aesthetic properties of textiles can be enhanced during finishing using
    some polymers. Discuss, clearly stating relevant examples.   **(12)**

QUESTION 4

(a) Outline some common methods used in the characterization of polymers in
    solution.   **(15)**

(b) What differentiates elastomers from other polymers?   **(5)**

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QUESTION 5

 (a) Define or explain what you understand by the terms M_n and M_w. **(6)**

(b) Given that in a polymer sample there are 100 polymer molecules of molecular mass
10^3, 200 molecules of molar mass of 10^4 and 200 molecules of molecular mass of 10^5.
Calculate: M_n, and M_w.   **(14)**

QUESTION 6

(a) What do you understand by the term degree of polymerization?   **(2)**

(b) Given that: a polymer has a repeat unit of mass 104 and molar mass of
    100000 g/ mol. Calculate the degree of polymerization.   **(8)**

(c) Termination reactions of polymerization reactions can take place in several ways. List
    four such ways, for two (2) of these, illustrate with reaction equations. **(10)**

END OF QUESTION PAPER