NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF APPLIED CHEMISTRY

POLYMER SCIENCE I

SCH 2107

First Semester Examination Paper

December 2014

This examination paper consists of 3 pages

Time Allowed: **3 hours**

Total Marks: 100

Special Requirements:

Examiner's Name: DR C T PAREKH

INSTRUCTIONS

1. **Answer all questions in Section A and any three questions from Section B. Section A carries 40 marks and each question in Section B carries 20 marks.**

2. **Start each question on a new page.**

MARK ALLOCATION

QUESTION	**MARKS**
1.	**40**
2.	**20**
3.	**20**
4.	**20**
TOTAL	**100**

SECTION A:

1. (a) What is the degree of polymerization of each of the following?

(i) PVC with molecular weight 15625
(ii) PE with molecular weight 17500
(iii) PMA with molecular weight 5504
(iv) PS with molecular weight 5200

(2x4 Marks)

(b) One of the classification of polymers is chemical nature. List four of them with one example each.

(2x4 Marks)

(c) What are the properties of thermoplastic and thermosetting polymers?

(6 Marks)

(d) Differentiate between "polymer" and "macromolecule".

(2 Marks)

(e) Draw the structure of a living polymer.

(2 Marks)

(f) Give the repeating unit of the following polymers.

(i) polypropylene
(ii) polymethylmethacrylate
(iii) polytetrafluoroethene

(1x3 Marks)

(g) You are given five different polymers that are mixed together. Rewrite the polymers with their correct nomenclatures.

(i)	natural polymers	(i) poly butadiene
(ii)	addition polymers	(ii) wool
(iii)	crossed link polymers	(iii) rayon
(iv)	condensation polymer	(iv) UF
(v)	regenerated fibres	(v) terylene

(1x5 Marks)

(h) Draw the structures of the following polymers.

(i) spandex
(ii) poly(ethyleneterphtalate) known as polyester

(2x3 marks)

SECTION B:

2. (a) Using vinyl chloride as an example draw (i) isotactic (ii) syndiotactic and (iii) atactic structures. Indicate the characteristics of these stereoisomers.

(4x3 Marks)

(b) Given the following pairs:

Compound	Q	E
Acrylonitrile	0.06	1.20
Butadiene	2.39	-1.05

Calculate r_1 and r_2 and suggest the type of polymer that will be produced.

(8 Marks)

3. (a) Describe the art of latex tapping.

(6 Marks)

(b) Why is vulcanisation of rubber necessary? Write a chemical equation for the process.

(8 Marks)

(c) Explain, with the aid of chemical equations, why polyvinyl alcohol cannot be synthesised from vinyl alcohol but it can be synthesised from polyvinyl acetate.

(6 Marks)

4. (a) Differentiate between step-growth polymerization and addition polymerization. Give one example of each.

(6 Marks)

(b) Taking propene as an example, write chemical equations for the initiation, propagation and termination steps in cationic polymerisation.

(10 Marks)

(c) Draw a possible structure of ABS if it is described as "…Graft of styrene and acrylonitrile on butadiene backbone"

(4 Marks)

5. (a) Draw a labelled schematic diagram to show emulsion polymerisation.

(6 Marks)

(b) How are Tencel (lyocell) fibres produced?

(4 marks)

(c) Draw the structure of Nomex and suggest the characteristics of Nomex.

(4 Marks)

(d) Write chemical equations, with conditions, for the formation of carbon fibre from acrylonitrile.

(6 Marks)

END OF QUESTION PAPER