TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR

BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY

ACH 4404 : POLYMER TECHNOLOGY

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: 11TH MAY 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Attempt Question ONE and any other TWO.

Do not write on the question paper.

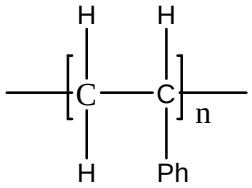
Question ONE

a) Suggest reasons for the following observations
   i) Polydisperse polymers have average molecular weights
   ii) For a substance to act as a condensation monomer it must have at least two reactive sites. (4marks)

b) Explain the following terms
   i) Amorphous polymer
   ii) Atacticity
   iii) Copolymer

   (6marks)

c) Poly (styrene) is represented by the formula



i) Draw molecular structures for tetramers (n=4) of the atactic, isotactic, and syndiotactic forms of polystyrene.

(6marks)

ii) Draw the structure and name the monomer that forms polystyrene

(2 marks)

d) High-density polyethylene (HDPE) has a higher melting point and more rigid than low- density polyethylene (LDPE). Explain.

. (4marks)

e) Describe the kinetics of the termination process by coupling in free radical polymerization.

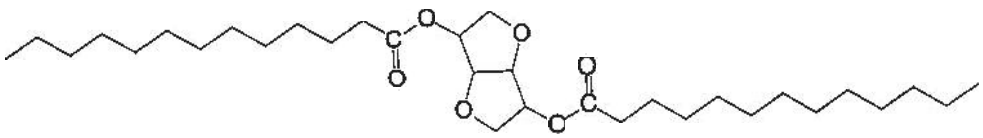
(4marks)

f) List any four types of components in rubber compounding

(4marks)

Question TWO

a) Use isosorbide diester, whose structure is given below to answer questions that follow



Volume of molecule (V) = 355.80 cm^3
ρ (density) = 1.51 g/cm^3
Assume the following molar attraction constants (G) ($J^{1/2}\ cm^{3/2}\ mol^{-1}$)

$-CH_3$	420
$-CH_2-$	280
-COO-	511
-CH-	140
-O-	137

i) Estimate the solubility parameter of isosorbide diester (6 marks)

ii) Suggest the derived units of solubility parameter δ. (2 marks)

b) i) Explain the differential scanning calorimetric (DSC) method for determination of Tg of polymers. (3 marks)

ii) Sketch a DSC plot for an amorphous polymer and label Tg on this curve. (3 marks)

c) i) Calculate the weight average molecular weight of a polymer containing 9 moles of molecular weight 30,000 and 5 moles of molecular weight 50,000. (3 marks)

iii) work out the polydispersity index for the polymer in (i) above (3 marks)

Question THREE

a) Describe the determination of polymer molecular weight distribution by gel permeation chromatography. (6 marks)

b) i) What is theta state? (2 marks)

ii) Give two parameters that constitute a theta state.

(2 marks)

c) Discuss the thermodynamics of dissolution of a polymer (5 marks)

d) Give three advantages and two disadvantages of emulsion polymerisation method

(5marks)

Question FOUR

a) i) Explain the term birefringence

(2 marks)

ii) What is the significance of birefringence in fibre characterisation?

(3marks)

b) Describe melt spinning of polymeric fibres

(6marks)

c) With the help of a tree diagram show the classification of natural and man made fibres (6 marks)

d) Give three applications of polyester fibres

(3marks)

Question FIVE

a) i) Derive the expression for overall rate of polymerization as a function of conversion in step growth polymerization. 6marks)

ii) Sate two ways of controlling molecular weight in step growth polymerisation reactions (2marks)

b) i) Explain injection molding process. (5 marks)

ii) Enlist any three industrially important products prepared by this process. (3 marks)

c) i) Differentiate between extenders and blowing agents in rubber compounding.

ii) Explain their role in the production cost of moulded goods.

(4 marks)