3[illegible]

RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General/Special) Degree in Applied Science
Third Year – Semester I Examination – October/November 2015

CHE 3203- CHEMISTRY OF POLYMERS

Time: Two hours

Answer question **No. 1** (compulsory) and any other **three (3)** questions.
Non programmable calculator will be provided.

1. (i) According to the number of repeating units define monomer, oligomer and polymer.

(ii) Write down the structure of the monomer and the polymer of the following;

a. PVC
b. Nylon 6,6

(iii) Give three reasons, why polymers differ from simple compounds.

(iv) Explain the term DRC (Dry Rubber Content) of Natural rubber (NR) latex. Write down the structure of Natural Rubber. Give one difference between Cis and Trance structure of Natural Rubber.

(v) Give the structure of the ingredients used in the production of malty purpose adhesives (Multybond).

(vi) Write down four main classes of polymers.

(vii) Explain why Rubber can be used in tires using stress and strain.

(viii) Briefly describe thermoplastics and give one example for thermoplastic polymer.

[25 marks]

2. (a) Describe the four main molecular structures of polymers. Give one example with structure of each type. [08 marks]

(b) Write down the structures of the following polymers.

i. Polyvinyl Acetate (PVA)

ii. Poly Acrylonitrile (PAN)

iii. Poly Tetra Fluoro Ethylene (PTFE) [08 marks]

(c) Give the three steps involved in radical polymerization. Explain with suitable examples of these three steps in radical polymerization. [09 marks]

3. (a) What are the chemical ingredients used in Rubber processing? Explain each in detail. [15 marks]

(b) Write down the structure of the resin form Epichloro hydrine (CH_2-(O)CH-CH_2Cl), Bisphenol (HO-C_6H_6-$(CH_3)C(CH_3)$-C_6H_6-OH) monomers. Name two catalysts used to cross link the above resin. [10 marks]

4. (a) Explain the Osmometry method with relevant graphs, equations and give the disadvantages in determining Number average molar mass. [10 marks]

(b) How can the End Group analysis be used to determine the number average molar mass. Give three disadvantages of this method. [10 marks]

(c) A polymer sample contains three molecules with molar masses $1.00x10^3$ g/mol, $2.00x10^3$ g/mol and $3.00x10^3$ g/mol. Calculate the number average and weight average molar mass of the polymer sample. [05 marks]

5. (a) Explain the kinetics of step growth polymerization. [08 marks]

(b) Deduce the "Carothers Equation" using the relevant parameters and give the conditions of the equation. [12 marks]

(c) What will happen to the degree of polymerization if the temperature changes. Explain our answer. [05 marks]

[Hint: $\bar{X}n$ = Kp/Kt [M] where, Kp- rate of propagation, Kt-rate of termination, M concentration of monomer]

6. (a) Explain the steps involving in powder coating process [08 marks]

(b) Give the reactions of the following;

(i) Di-cyandi-amide and its derivatives that cross-link at 180 ^{0}C by reaction of the amino and imino (=NH) groups with the epoxy ring

(ii) Anhydrides cross-link with epoxy resins [10 marks]

(c) What is meant by Emulsion and Enamel paints. Give one example of each paint. [07 marks]