

FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
DEPARTMENT OF MATERIALS AND METALLURGICAL ENGINEERING
SESSION: 2019/2020 RAIN SEMESTER EXAMINATIONS DATE: 2/07/2021
COURSE: MME 306 (PRINCIPLES AND PROCESSING OF POLYMERS) TIME ALLOWED: 3 HOURS
INSTRUCTION: ATTEMPT FIVE (5) QUESTIONS

- 1(a) According to spatial arrangement, sketch the portions of the polyvinyl chloride molecules that are (i) atactic (ii) isotactic (iii) syndiotactic. [3 marks]
- (b)(i) How many monomers would polymerize to give a 6, 6 – nylon molecule having weight average molecular weight of 180800? [8 marks]
- (ii) If the polydispersity index of the 6, 6 – nylon in No. 1(b)(i) is 5, calculate the number-average molecular weight. [3 marks]
- 2(a) Using appropriate examples, give at least four differences between chain and step-wise polymerization reactions. [12 marks]
- (b) Which of the polymerization processes in No. 2(a) is slower and why? [2 marks]
- 3(a) Define wetting of adhesive and identify three (3) conditions that impair its occurrence [4 marks]
- (b) Distinguish between structural and non-structural adhesives and give at least two (2) examples each [5 marks]
- (c) Identify 5 advantages of adhesive joints over metallurgical joints and 5 disadvantages of adhesives. [5 marks]
- 4(a) Explain, with the aid of a diagram, the concept of hysteresis. [4 marks]
- (b) Draw the structural formulae of (i) natural rubber (cis-1,4 polyisoprene) and (ii) styrene-butadiene synthetic rubber. [4 marks]
- (c) One monomer of styrene is polymerized with 6 monomers of polybutadiene to produce butadiene-styrene rubber. Determine the weight percent of sulphur required to cross-link 15% of the sites assuming 100g of the copolymer is involved. [6 marks]
5. Discuss Dashpot and Spring models as displacement models. Sketches are essential [14marks]
- 6 (a) Show that viscoelastic modulus is temperature dependent. [4 marks]
- (b) A polymeric substance has a relaxation time of 90 days at 25⁰ C when a stress of 5.5MPa is applied. Calculate: (i) in how many days the stress reduces to 3MPa (ii) the relaxation time at 35⁰C if the activation energy is 18kJ/mole. [10 marks]

Good Luck