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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019**

COURSE NAME : MATERIALS SCIENCE
COURSE CODE : BNJ 10602/BNR 10102
PROGRAMME CODE : BNM/BNL/BNG/BNE/BNF/BND
EXAMINATION DATE : JUNE / JULY 2019
DURATION : 2 HOURS
INSTRUCTION : ANSWERS ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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- Q1** (a) List **THREE (3)** component in automobile. For each component, determine the class of materials used in its structure. (6 marks)
- (b) Show that the atomic packing factor for BCC is 0.68. (5 marks)
- (c) Calculate the planar atomic density for the following crystal planes in FCC gold, which has a lattice constant of 0.28846 nm.
(i) (100)
(ii) (111) (14 marks)
- Q2** **Figure Q2** shows a phase diagram containing 70 wt% Ni and 30 wt% Cu.
- (a) When the temp at 1350 °C,
(i) identify the phases present. (4 marks)
(ii) describe the chemical composition of the phases. (4 marks)
(iii) calculate the amount of each phases. (8 marks)
- (b) Propose the possible phases at 1500 °C. (3 marks)
- (c) Illustrate the microstructure of the alloy at 1350 °C and 1500 °C by using circular microscopic field. (6 marks)
- Q3** (a) Strain and stress behavior consist of two deformation mechanisms which are elastic deformation and plastic deformation. Illustrate both mechanisms using plot of stress and strain curve by providing some illustration on the material changes and condition at each critical points of this plot. (9 marks)
- (b) Discuss **FOUR (4)** most effective methods of improving fatigue performance which is related to the improvements in design. (8 marks)

- (c) Illustrate briefly **TWO (2)** of the metal forming as follows;
- (i) Extrusion
 - (ii) Rolling
 - (iii) Drawing

(8 marks)

- Q4** (a) Compare between thermoplastic and thermoset and give **ONE (1)** example of each type of the polymer.

(6 marks)

- (b) Describe **FIVE (5)** properties of ceramic materials.

(5 marks)

- (c) Calculate the composite modulus of elasticity for polyester reinforced with 60% volume of E-glass particles if under condition:

(i) isostrain

(ii) isostress

Given : $E_{\text{polyester}} = 6.9 \text{ GPa}$ and $E_{\text{E-glass}} = 72.4 \text{ GPa}$

(8 marks)

- (d) Identify the importance usage of composites in aircraft and airframe.

(6 marks)

-END OF QUESTIONS -

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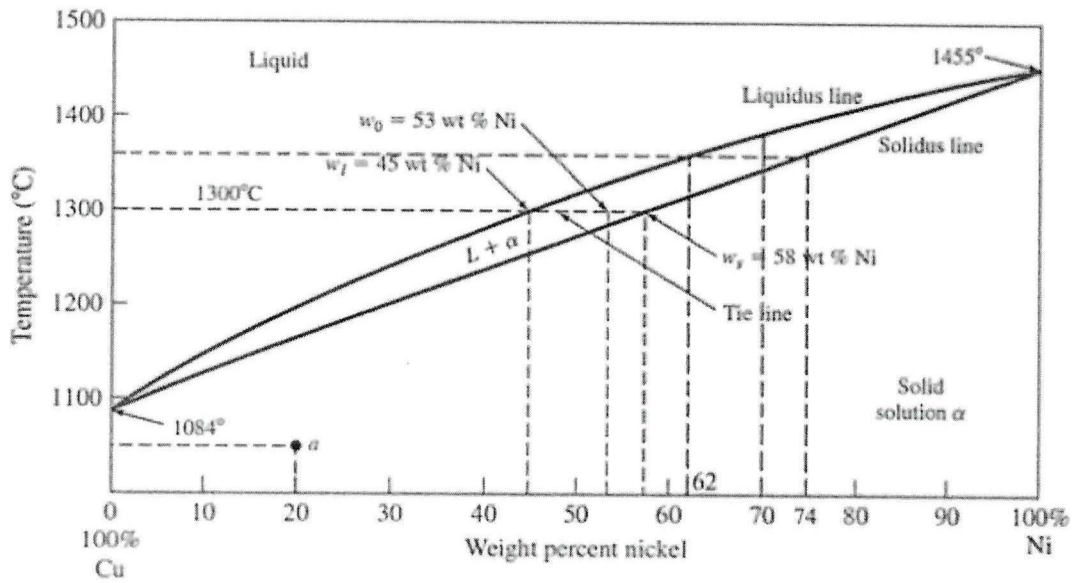


Figure Q2