Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017

COURSE NAME	:	MATERIAL SCIENCE
COURSE CODE	:	BNR10102
PROGRAMME CODE	:	1 BND / 1 BNE / 1 BNF
EXAMINATION DATE	:	DECEMBER 2016 / JANUARY 2017
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **THREE (3)** PAGES

Q1 (a) FCC is a closed-packed structure. Explain.

(8 marks)

(b) A copper (Cu) cube has a dimension of 1 mm × 1 mm × 1 mm. If Cu atom has a diameter of 0.2556 nm, how many Cu atoms exist inside the cube? Atomic mass of Cu = 64 g/mol. Avogadro Number = 6.023×10^{23} atom/mol. Crystal structure of Cu is FCC. Density of Cu is 8.96 g/cm^3.

(12 marks)

(c) Which one is denser in a BCC unit cell, (1 1 0) or (1 0 1)?

(5 marks)

Q2 (a) How to construct a binary phase diagram? Explain in detail.

(8 marks)

(b) (i) Sketch a limited solid solubility phase diagram and label all existing axis, lines, phases, and melting points completely.

(8 marks)

(ii) Based on diagram sketched in **Q2(b)(i)**, do a microstructural analysis on the eutectic composition upon solidification.

(4 marks)

(c) Two eutectoid steels, X and Y, were subjected to different heat treatment. X was heated at 600°C and followed by water quenching, whereas Y was heated at 800°C and then undergone slow cooling inside the furnace. Compare the final microstructure of both steels.

(5 marks)

Q3 (a) There are TWO (2) types of polymerization processes known as Addition Polymerization and Condensation Polymerization. Discuss ONE (1) of the processes with a sketch.

(6 marks)

(b) Give FOUR (4) types of non-ferrous metal.

(4 marks)

(c) Compare between thermoplastic and thermoset and give ONE (1) example of each type of polymer.

(9 marks)

(d) Cement can be classified under ceramic material. Give the characteristic of this material.

(6 marks)

Q4 (a) Give THREE (3) types of composites with example.

(6 marks)

(b) The composites properties may influence by the various geometrical and spatial characteristic of particles of the dispersed phase. Illustrate the schematic representations of the geometrical and spatial characteristic.

(10 marks)

(c) State and explain the composite according to the types of reinforcement.

(9 marks)

Q5 (a) A 20 cm long rod with a diameter of 0.250 cm is loaded with a 7000 N weight. If the diameter decreases to 0.210 cm, determine:

(i) Engineering stress and strain at this load

(ii) True stress and strain at this load

(12 marks)

(b) Give FOUR (4) common hardness tests.

(4 marks)

(c) Mr. Aiman has done the tensile testing at material laboratory. A bar of steel alloy that exhibits the stress-strain behavior, the specimen length is 375 mm and the square cross section of dimension is 5.5 mm x 5.5 mm. After the test, the specimen recovered to original dimension.

(i) Compute the magnitude of the load necessary to produce an elongation of 2.25 mm

(6 marks)

(ii) Predict either the deformation will occur after the load has been released.

(3 marks)

~ END OF QUESTIONS ~