INTI International University & Colleges

FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**January 2021**
Programme	:	Diploma in Electrical & Electronic Engineering (DEEI)
Course	:	**EGM1182: Structures and Properties of Materials**
Date of Examination	:	11 March 2021 (Thursday)
Time	:	2.00pm – 5.00pm Reading Time : Nil
Duration	:	3 Hours

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions.

Material permitted :
Non-Programmable Scientific Calculator

Materials provided :
Periodic Table

Examiner(s)	:	**Johnny Wong Kee Hui**
Chief Moderator	:	Dr Aaron Edward Teo

*This paper consists of **6** printed pages, including the cover page*

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING PROGRAMME (DEEI)
EGM1182: STRUCTURES AND PROPERTIES OF MATERIALS
FINAL ALTERNATIVE ASSESSMENT: JANUARY 2021 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions.

Question 1

a) Aluminum foil used for storing food weighs about 0.3 grams per square inch. Compute the number of aluminum atoms that are contained in one cm^2 of foil? (Note: 1 inch = 2.54 cm, $N_A = 6.022\times10^{23}$ atoms/mol)

(6 marks)

b) Determine Miller indices for the planes in the cubic unit cell shown in Figure Q1b.

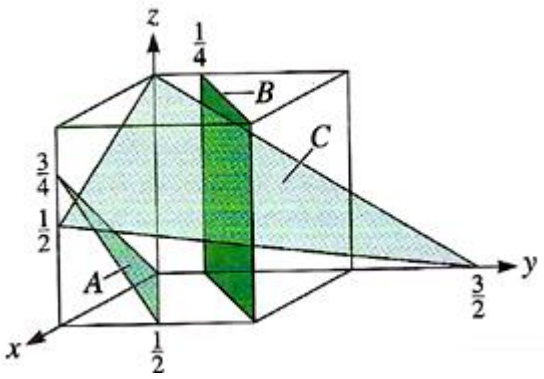

Figure Q1b

(9 marks)

c) Briefly describe the following terms that related to mechanical test.

i. Ductility

(2 marks)

ii. Modulus of elasticity

(2 marks)

iii. Impact test and name an impact test.

(2 marks)

d) State the electronic configuration of Sc and Ni^{2+}.

(4 marks)

Question 2

(a) Tin substitutional atoms are introduced into a FCC copper crystal, producing an alloy with a lattice parameter of 3.7589×10^{-8} cm and a density of 8.772 g/cm^3. Calculate the atomic percentage of tin present in the alloy ($N_A = 6.022 \times 10^{23}$ atoms/mol).

(7 marks)

(b) Briefly describe the following terms that related to fatigue test of materials.

i. Endurance limit

(3 marks)

ii. Fracture surface of fatigue failure

(3 marks)

(c) Calculate the linear atomic density in atoms per millimeter for the following direction in FCC iridium, which has a lattice constant of 0.38389 nm:

i. [100]
ii. [110]

(6 marks)

(d) A cylindrical rod of copper (E = 110 GPa) having a yield strength of 240 MPa is to be subjected to a load of 6660 N. Calculate the diameter required if the length of the rod is 380 mm and an allowable elongation of 0.50 mm?

(6 marks)

Question 3

a) Referring to Figure Q3a, if 500 g of a 40 wt % Ag–60 wt % Cu alloy is slowly cooled from 1000°C to just below 780°C, calculate:

i. how many grams of liquid and proeutectic alpha are present at 850°C?

(5 marks)

ii. how many grams of liquid and proeutectic alpha are present at 780°C + ΔT?

(5 marks)

iii. how many grams of alpha are present in the eutectic structure at 780°C - ΔT?

(4 marks)

iv. how many grams of beta are present in the eutectic structure at 780°C - ΔT?

(4 marks)

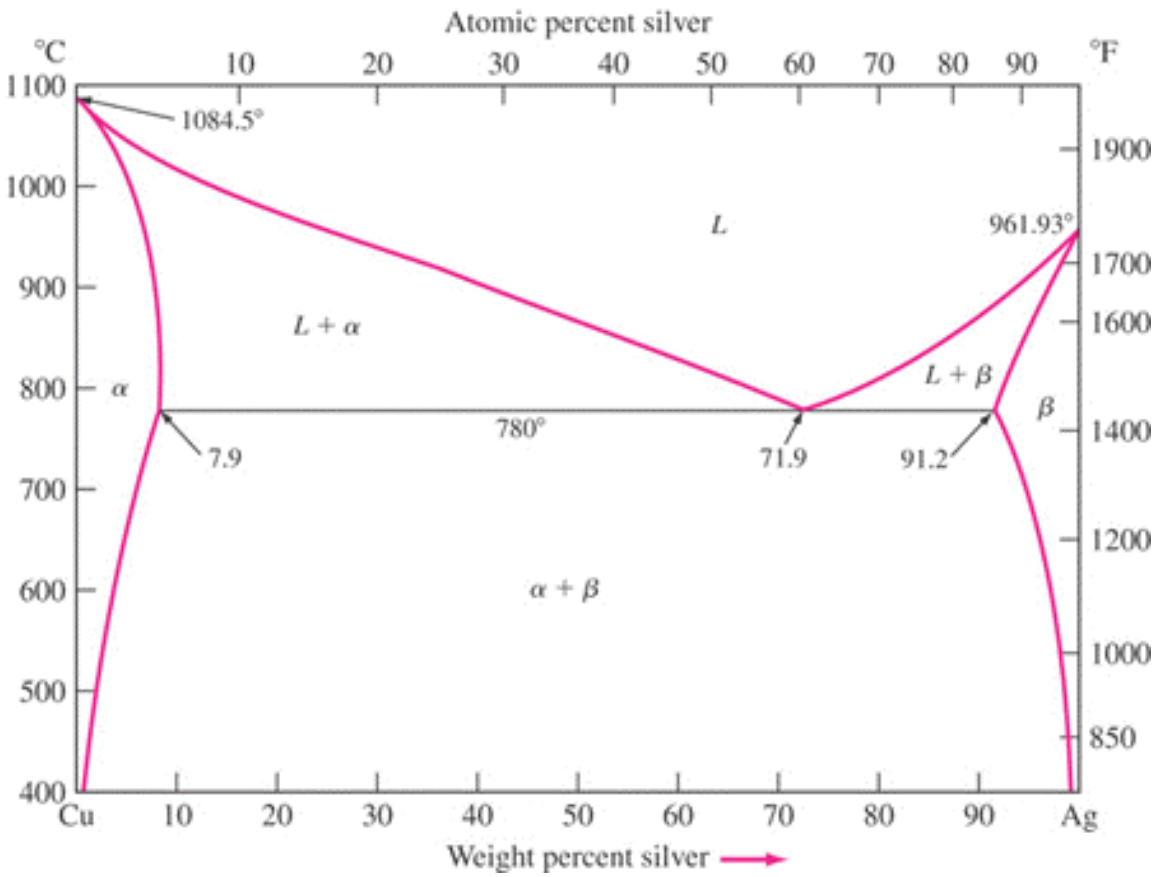

Figure for Q3a

b) Briefly explain the definition of the following polymeric materials and give one (1) example of an item made from it:

i. Plastics.

(3 marks)

ii. Elastomers.

(4 marks)

Question 4

a) The degree of polymerization of polytetrafluoroethylene –[C2F4]n– is 7500. If all of the polymer chains are the same length, calculate the molecular weight of the chains.

(3 marks)

b) Briefly describe the following terms that related to electrical properties of materials.

i. Energy gap

(3 marks)

ii. Valence band

(2 marks)

iii. Hole

(2 marks)

c) If we wish to double the electrical conductivity of cobalt from the electrical conductivity at 0 °C. Calculate to what temperature must we cool the metal?(Given the coefficient of resistivity α is 0.006 Ω/ºC)

(5 marks)

d) Describe two characteristics of the component ions that determine the crystal structure for ceramic compound.

(4 marks)

e) Describe and illustrate with sketches the solidification process of a pure metal in terms of the nucleation and growth of crystals.

(6 marks)

~THE END~

PERIODIC TABLE OF ELEMENTS