UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	MATERIALS SCIENCE
COURSE CODE	:	BNJ 10602/ BNR 10102
PROGRAMME CODE	:	BNM/ BNF
EXAMINATION DATE	:	DECEMBER 2019/ JANUARY 2020
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

Q1   (a)   List **THREE (3)** component in an 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   (a)   Based on **Figure Q2(a)** for a Pb-30% Sn, determine the phases present, their amounts and the compositions at the following temperatures:
(i)   300 °C
(ii) 200 °C
(iii) 184 °C
(iv) 182 °C
(iv) 0 °C

(15 marks)

(b)   Sketch a flowchart of an austenite transformation.

(6 marks)

(c)   Discuss the tempering process in heat treatment

(4 marks)

Q3   (a)   Demonstrate between ductile and brittle fracture of materials by giving an appropriate plot of stress and strain that exposed uniaxial tensile load and state.

(4 marks)

(b)   A 3780 N force is applied to a 0.375 cm diameter nickel wire having a yield strength of 310 MPa and tensile strength of 379 MPa. Calculate;

(i)   whether the wire will plastically deform, and

(5 marks)

(ii)   whether the wire will experience necking

(2 marks)

(c)   Discuss **FOUR (4)** most effective methods of improving fatigue performance related to the improvements in design.

(8 marks)

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

(6 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 the condition:
   (i) isostrain
   (ii) isostress
   Given : $E_{polyester} = 6.9$ GPa and $E_{E-glass} = 72.4$ GPa

(8 marks)

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

(6 marks)

-END OF QUESTIONS –

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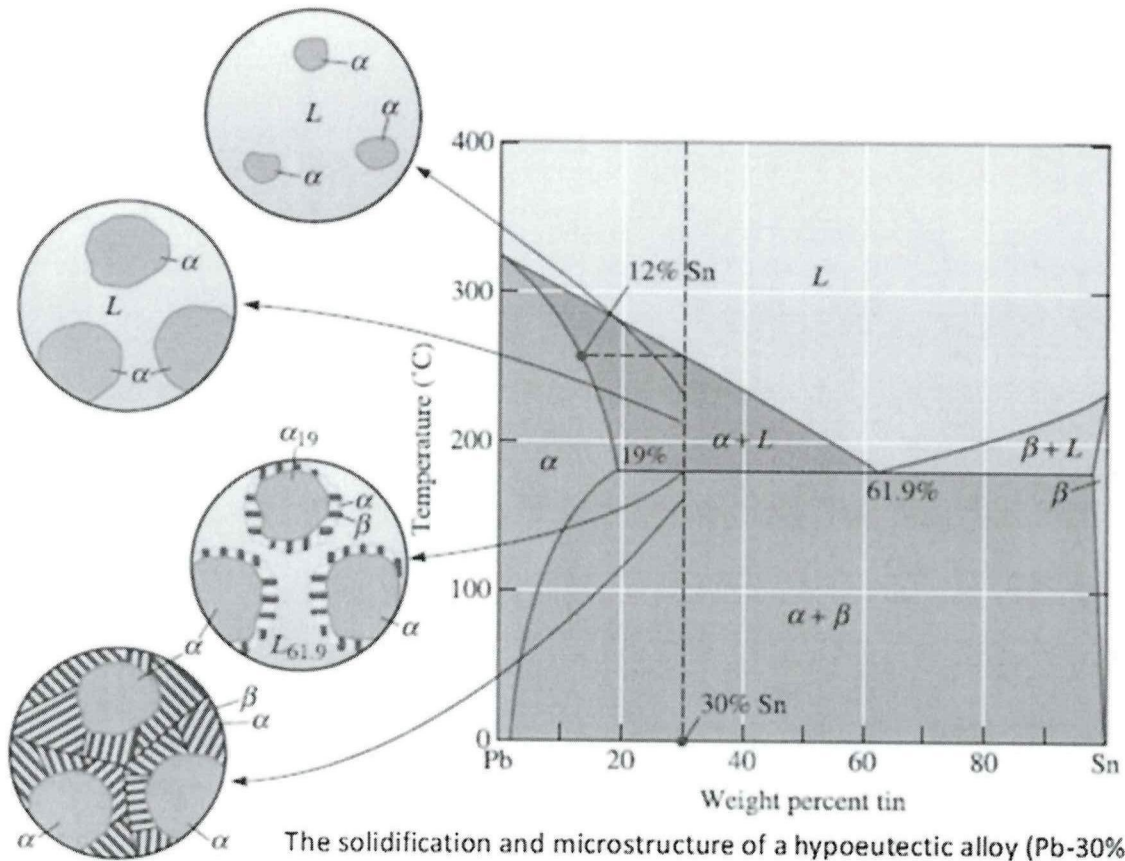COURSE CODE   : BNJ10602/
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The solidification and microstructure of a hypoeutectic alloy (Pb-30% Sn).

Figure Q2(a)

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