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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FTD22103**
SUBJECT TITLE	:	**METALLURGY**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**12.45 PM – 3.45 PM (3 HOURS)**
DATE	:	**8 JANUARY 2015**

INSTRUCTIONS TO CANDIDATES

1. **Please read the instructions given in the question paper CAREFULLY.**
2. **This question paper is printed on both sides of the paper.**
3. **Please write your answers on the answer booklet provided.**
4. **Answer should be written in blue or black ink except for sketching, graphic and illustration.**
5. **This question paper consists of TWO (2) sections. Section A and B. Answer ALL questions in section A and TWO (2) questions in section B.**
6. **Answer all questions in English.**

THERE ARE 4 PAGES OF QUESTIONS AND 1 PAGE OF APPENDIX, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL Questions.

Please use the answer booklet provided.

Question 1

a) List **TWO (2)** effects of nitrogen in carbon steel.

(4 marks)

b) Describe annealing process in term of the purpose, properties, and types of this process.

(6 marks)

c) Hardness is refers to the ability of a material to resist abrasion or penetration. Discuss the procedures of measuring materials' hardness by using hardness testing machine.

(10 marks)

Question 2

a) What is the function of Chromium (Cr) elements in Stainless steel?

(4 marks)

b) State **THREE (3)** advantages of Austenitic Stainless Steel.

(6 marks)

c) Carbon Steels are low alloys steel and they can be classified according to the carbon composition.

i. List the **THREE (3)** classifications of these alloys.

ii. For each classification of steel, briefly describe the properties and its typical applications.

(10 marks)

Question 3

a) Sketch the microstructure of ductile cast iron and list **TWO (2)** advantages of this steel.

(4 marks)

b) Brinell hardness measurement, using a 1 cm diameter indenter and 5000 N load, produce an indentation of 4.5 mm on a copper plate. Calculate the Brinell hardness number (BHN) of this metal.

(6 marks)

c) Quenching is a rapid cooling process in heat treatment. Describe the stages of this process.

(10 marks)

SECTION B (Total: 40 marks)

INSTRUCTION:Answer TWO (2) questions only

Please use the answer booklet provided.

Question 1

a) List **FOUR (4)** types of liquid use during the quenching process.

(4 marks)

b) Discuss the normalizing process. Your discussion should be included;

i. The purposes, and

ii. The process.

(6 marks)

c) Tempering is a process of heat treatment that improve the mechanical poperties of the weldment. Describe this process in terms purposes, cooling rate, cooling medium, and the microstructure of this heat treatments.

(10 marks)

Question 2

a) State **FOUR (4)** types of penetration hardness testing.

(4 marks)

b) Strength is a measurement on mechanical properties of ferrous metal that obtained by a response or deformation due to load or force.

i. List down **TWO (2)** types of strength.

ii. With aid of graph state **FOUR (4)** typical regions that can be observed in a stress-strain curve of carbon steel.

(6 marks)

c) Describe the process involved in obtaining the ferrite – pearlite microscopic structure.

(10 marks)

Question 3

a) By referring to the Fe – C phase diagram in Figure 1, answer the following:

i. State the lines **A** and **B**.

ii. Calculate the relative amount of microstructure for hyper-eutectoid composition at structure C.

iii. Draw the microstructure changes of hypoeutectoid 1.2 wt% C during a slow cooling process at temperatures: T1 = 900 °C, T2 = 800 °C, and T3 = 700 °C.

iv. List **TWO (2)** characteristics of austenite phase.

(20 marks)

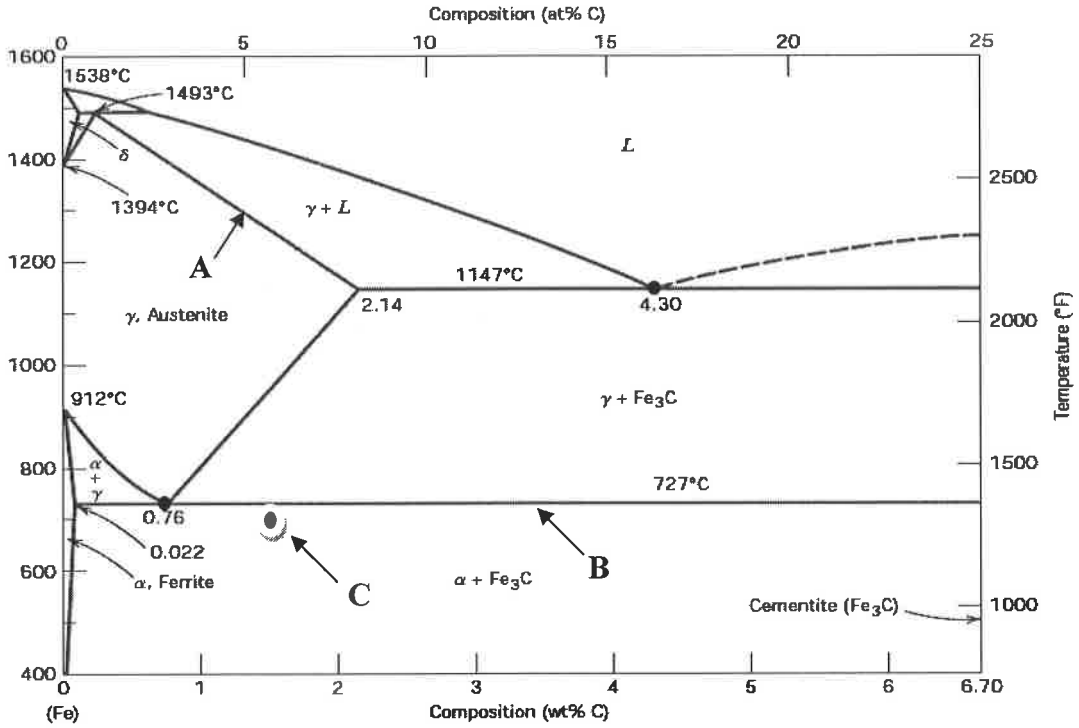

Figure 1. Fe – C Phase Diagram

END OF QUESTION

APPENDIX

$$APF = (n)(\frac{4\pi r^3}{3})(\frac{1}{a^3})$$

$$\rho = \frac{nA}{V_c N_A}$$

$$N = \frac{N_A \rho}{A}$$

$$N_v = N \exp(\frac{-Q}{kT})$$

$$a_{fcc} = \frac{4r}{\sqrt{2}}$$

$$a_{bcc} = \frac{4r}{\sqrt{3}}$$

$$a_{sc} = 2r$$

$$D = D_o \exp(\frac{-Q_d}{RT})$$

$$m_\alpha phase = \frac{m_\beta - m_x}{m_\beta - m_\alpha} x Total\ Mass$$

$$m_\beta phase = \frac{m_x - m_\alpha}{m_\beta - m_\alpha} x Total\ Mass$$

$$m_L phase\% = \frac{m_s\% - m_x\%}{m_s\% - m_{L\%}} x100$$

$$m_s phase\% = \frac{m_x\% - m_L\%}{m_s\% - m_{L\%}} x100$$

$$\rho_\alpha = \frac{100}{\frac{C_{A(\alpha)}}{\rho_A} + \frac{C_{B(\alpha)}}{\rho_B}}$$

$$\rho_\beta = \frac{100}{\frac{C_{A(\beta)}}{\rho_A} + \frac{C_{B(\beta)}}{\rho_B}}$$

$$V_\alpha = \frac{\frac{m_\alpha}{\rho_\alpha}}{\frac{m_\alpha}{\rho_\alpha} + \frac{m_\beta}{\rho_\beta}}$$

$$V_\beta = \frac{\frac{m_\beta}{\rho_\beta}}{\frac{m_\alpha}{\rho_\alpha} + \frac{m_\beta}{\rho_\beta}}$$

$$\sigma = \frac{F}{A_o}$$

$$\varepsilon = \frac{\Delta l}{l_o}$$

$$E = \frac{\sigma}{\varepsilon}$$

$$\%elongation = \frac{\Delta l}{l_o} x100\%$$

$$\%\ area\ reduction = \frac{\Delta A}{A_o} x100\%$$

$$BHN = \frac{F}{\frac{\pi D}{2}(D - \sqrt{D^2 - d^2})}$$

$$VHN = \frac{1.85F}{d^2}$$