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SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2014 SESSION

SUBJECT CODE	:	**FTD 22103 / FTD 12102**
SUBJECT TITLE	:	**METALLURGY**
LEVEL	:	**DIPLOMA**
TIME DURATION	:	**2 HOURS**
DATE	:	

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 3 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) Define 'Alloy Steels' and give **TWO (2)** examples.

(4 marks)

b) List **THREE (3)** the advantages of Stainless Steels.

(6 marks)

c) Compare between high carbon steel and low carbon steel in terms of the carbon composition, properties and applications.

(10 marks)

Question 2

a) State **TWO (2)** effects of Manganese in carbon steel.

(4 marks)

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

(6 marks)

c) Describe the process of penetration hardness test.

(10 marks)

Question 3

a) List **TWO (2)** advantages of the malleable cast iron and sketch the microstructure.

(4 marks)

b) A hardness measurement using a 10 mm diameter indenter and 5000 N load produces an indentation of 1.80 mm on a 12 mm HSLA carbon steel. Calculate Brinell Hardness Number (BHN) of this material.

(6 marks)

c) Explain briefly the procedures in obtaining the microstructure of AISI 1021 carbon steel plate.

(10 marks)

SECTION B (Total: 40 marks)

INSTRUCTION:Answer TWO (2) questions only

Please use the answer booklet provided.

Question 1

a) List **TWO (2)** method in applying etching solution on a specimen.

(4 marks)

b) Cast iron and steel can be classified as ferrous metals. Discuss these classification of ferrous alloys. In your discussion include;

i. the composition of carbon,
ii. the mechanical properties, and
iii. the microstructure.

(6 marks)

c) Normalizing and full annealing are two processes of heat treatment that improve the mechanical poperties of the weldment. Compare between normalizing and full annealing in terms purposes, cooling rate, cooling medium, and the microstructure of those heat treatments.

(10 marks)

Question 2

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

i. Name and state the definition of lines **A** and **B**.
ii. Calculate the relative amount of microstructure for eutectic composition at temperatures which are slightly below 1147 °C and 727 °C.
iii. Draw the microstructure changes of hypoeutectoid 0.5 wt% C during a slow cooling process at temperatures: T1 = 850 °C, T2 = 750 °C, and T3 = 700 °C.
iv. List **TWO (2)** characteristics of ferrite phase.

(20 marks)

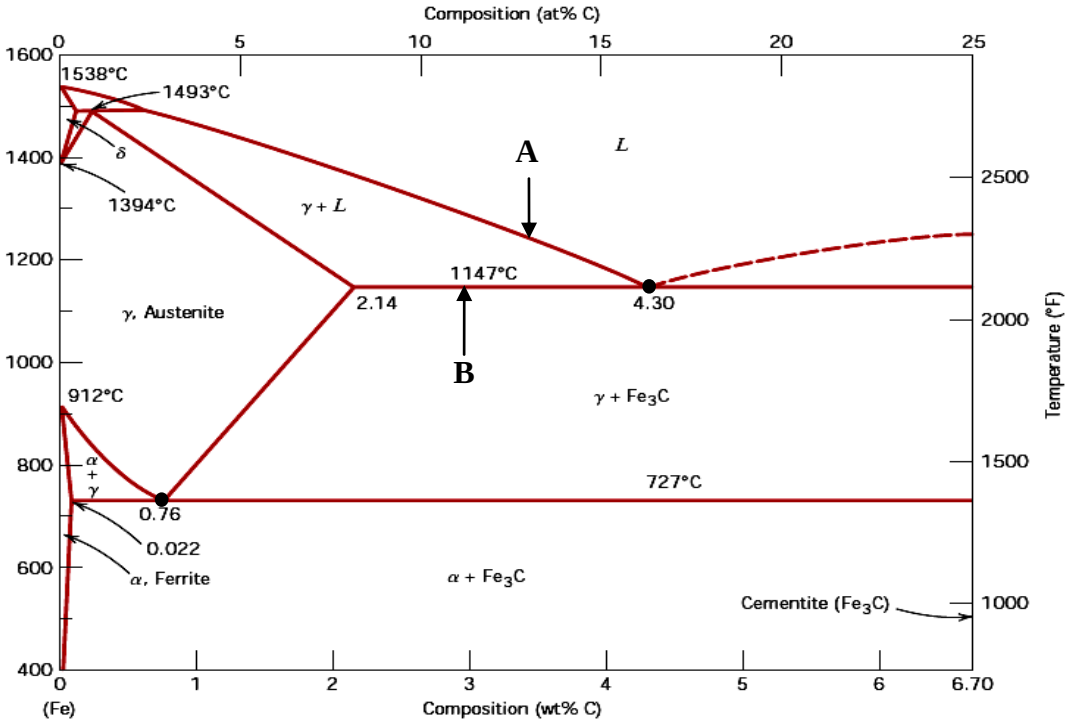

Figure 1. Fe – C Phase Diagram

Question 3

a) Classify the impurities in Carbon Steel.

(4 marks)

b) Tensile test is performed in order to measure the mechanical properties of ferrous steel.

i. With the aid of schematic graph, list down the informations that can be obtained by performing Tensile Test on carbon steel.

ii. List **TWO (2)** methods in determining the ductility.

(6 marks)

c) Quenching process involving four (4) stages. Explain briefly this process.

(10 marks)

END OF QUESTIONS

APPENDIX

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

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

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

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

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

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

$$a_{sc} = 2r$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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