



UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2014 SESSION

SUBJECT CODE : FTB 12103
SUBJECT TITLE : FUNDAMENTAL METALLURGY
LEVEL : BACHELOR
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. For Section B, answer **TWO (2)** question only.
6. Answer all questions in English.

THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)**INSTRUCTION: Answer ALL questions.****Please use the answer booklet provided.****Question 1**

- (a) Describe **THREE (3)** types of iron ore with their percentage of iron.
(6 marks)
- (b) Steelmaking from scrap metal involves melting scrap metal, removing impurities and casting it into the desired shape. This process does not require the three step refinement as needed to produce steel from ore. Sketch and describe the furnace process in the presence of pure oxygen.
(8 marks)
- (c) Discuss the importance of a consideration of fatigue in engineering design.
(6 marks)

Question 2

- (a) Differentiate between,
(i) Malleability and ductility,
(3 marks)
(ii) Toughness and hardness,
(3 marks)
(iii) Yield strength and tensile strength.
(3 marks)
- (b) Determine the role of gaseous impurities such as Oxygen, Nitrogen, and Hydrogen which commonly found in steel and the impact of its quality.
(5 marks)
- (c) An engineer is designing a high speed dental drill. Identify the properties that would be important for the materials to be used for the dental drill and suggest the type of alloy should the engineer consider for this application.
(6 marks)

SECTION B (Total: 60 marks)**INSTRUCTION: Answer TWO (2) questions only.****Please use the answer booklet provided.****Question 3**

- (a) One of the major use of cast iron is in structural purposes. However, it is not suitable for purposes where a sharp edge or flexibility is required. Elaborate the advantages and disadvantages of using cast iron in industrial application.

(10 marks)

- (b) Despite of grey cast iron graphite in malleable cast iron separates out much more slowly and has time to form spheroidal particles rather than flakes.

- (i) illustrate and elaborate the related microstructure

(10 marks)

- (ii) Conclude the advantages and disadvantages of using malleable cast iron in industrial application.

(10 marks)

Question 4

- (a) A part of metal has been heated to a high temperature and then has been cooled.

- (i) Suggest the most suitable cooling process to produce the softest part of metal.

(5 marks)

- (ii) Explain briefly the process involved.

(10 marks)

- (b) Cast iron is a cheap, easily produced engineering material, but ordinary grey cast iron has relatively poor mechanical properties. Discuss in general terms how to overcome these limitations.

(15 marks)

Question 5

- (a) Describe hypereutectoid alloy.

(6 marks)

(b) For a 99.55 wt% Fe–0.45 wt% C alloy at a temperature just below the eutectoid, determine the following. Refer Figure 1 below.

(i) The fractions of total ferrite and cementite phases.

(5 marks)

(ii) The fractions of the proeutectoid ferrite and pearlite.

(5 marks)

(iii) The fraction of eutectoid ferrite.

(5 marks)

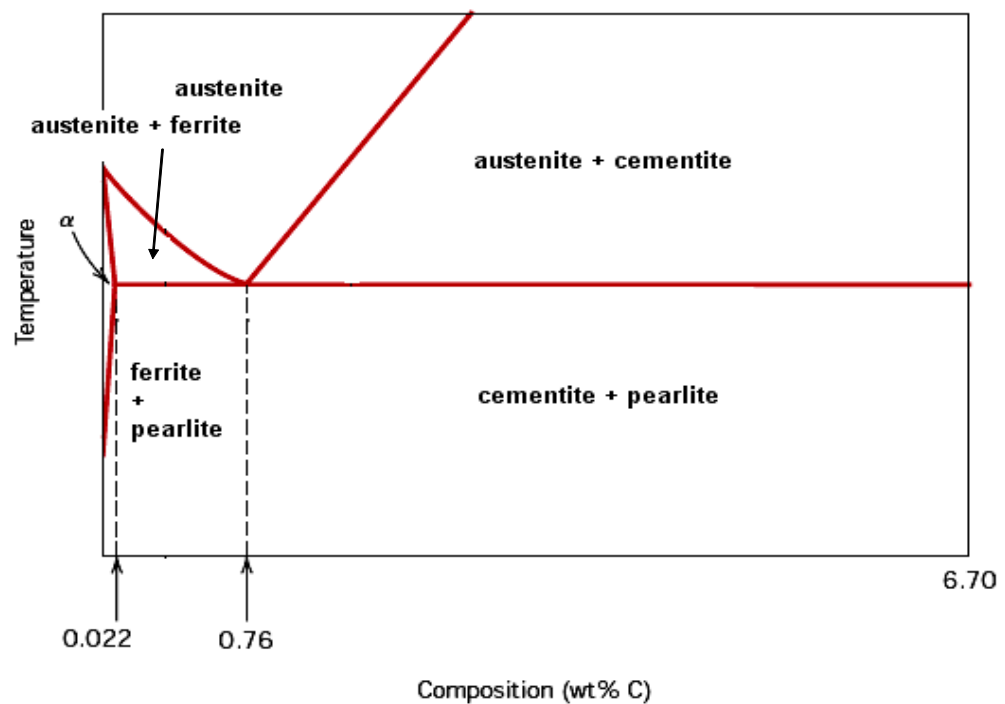


Figure 1 Iron-Carbon diagram

(c) Sketch the microstructure at A, B and C points of an iron-carbon alloy of hypereutectoid composition C1 (containing between 0.76 and 2.14 wt% C), as it is cooled from within the austenite phase region to below the eutectoid temperature. Refer Figure 2.

(9 marks)

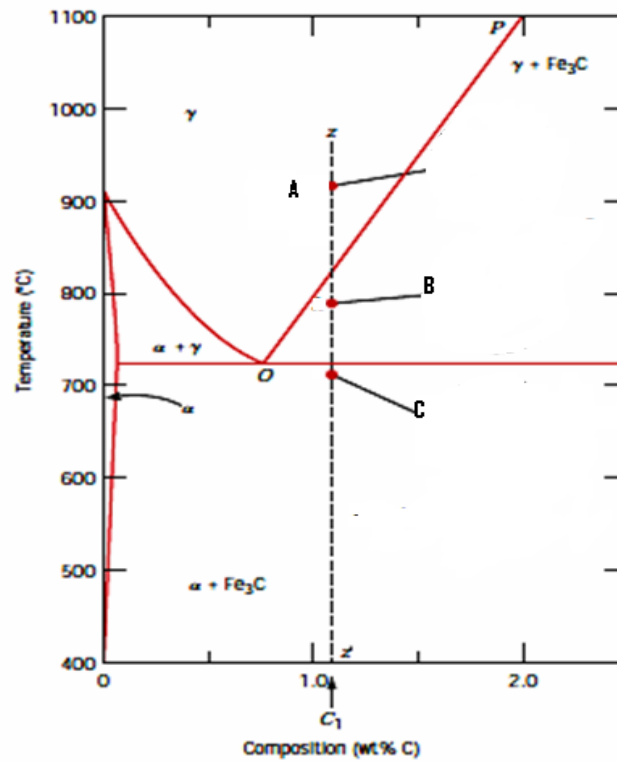


Figure 2 Iron-Carbon diagram

END OF QUESTION