Document No : UniKL MFI_SD_AC41
Revision No: 02
Effective Date: 01 December 2008

CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FTB12103**
SUBJECT TITLE	:	**FUNDAMENTAL METALLURGY**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**9.00 AM- 11.00 AM (2 HOURS)**
DATE	:	**4 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. 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 **FOUR (4)** types of cast iron and its composition of alloying element such as carbon and silicon content.

(4 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 and benefits of a consideration of mechanical testing such as tensile test in engineering design.

(8 marks)

Question 2

(a) Differentiate between,

(i) Malleability and ductility,

(2 marks)

(ii) Toughness and hardness,

(2 marks)

(iii) Yield strength and tensile strength.

(2 marks)

(b) Discuss the role of solid impurities such as Manganese, Silicon, and Phosphorus which commonly found in steel and the impact of its quality.

(9 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.

(5 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer TWO (2) questions only.

Please use the answer booklet provided.

Question 1

(a) One of term in heat treatment process is annealing which usually applied to metals and alloys. Annealing processes for steels can be classified in several types of processes such as stress-relief annealing, spheroidising anneals and annealing of castings. Describe **ONE (1)** of the annealing process which is stress-relief annealing and its procedure.

(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 2

(a) Hardness is the property of a material that enables it to resist plastic deformation, usually by penetration. It also refers to resistance to bending, scratching, abrasion or cutting. There are three principal standard test methods for expressing the relationship between hardness and size of the impression, which are Brinell, Vickers and Rockwell. Compare at least **TWO (2)** methods in the range of its scales, combination of applied loads and indenter geometry.

(15 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 3

(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)

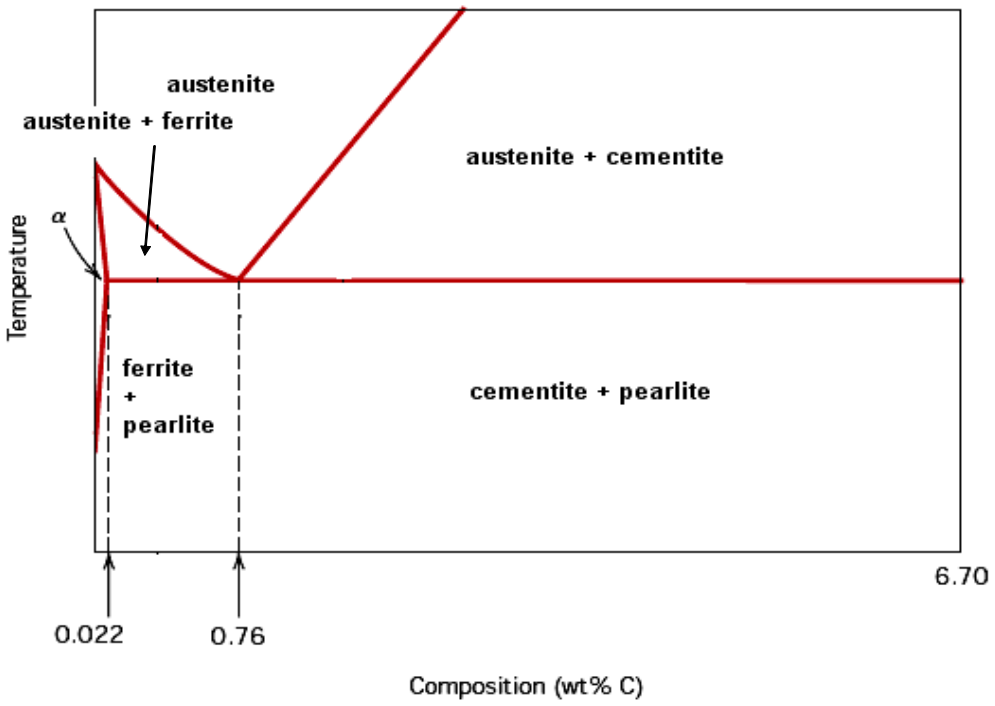

Figure 1: Iron-Carbon diagram

(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)

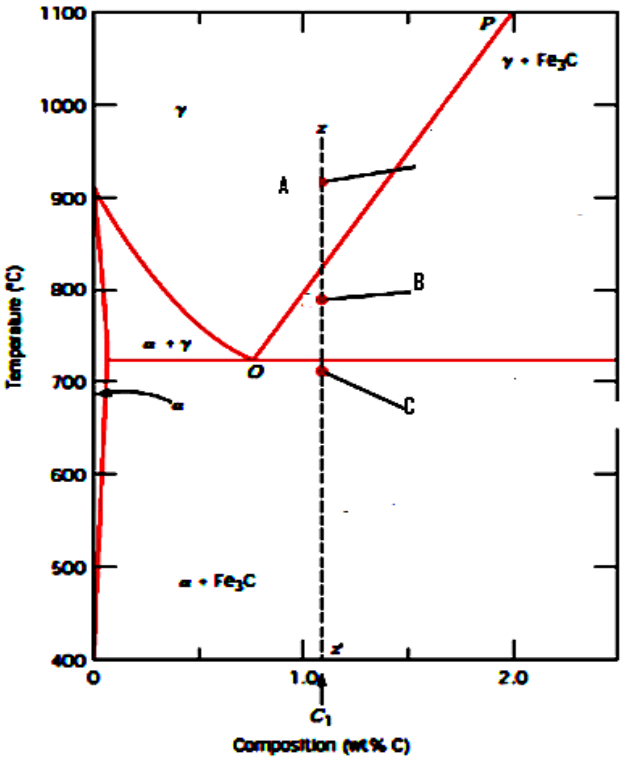

Figure 2: Iron-Carbon diagram

END OF QUESTION