UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLGY

FINAL EXAMINATION
SEPTEMBER 2016 SEMESTER

COURSE CODE	: LGB 21203
COURSE NAME	: SHIP MATERIALS
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	: BACHELOR OF SHIPBUILDING AND NAVAL ARCHITECTURE, BACHELOR OF MARINE ENGINEERING
DATE	: 24 JANUARY 2017
TIME	: 02.00 PM – 05.00 PM
DURATION	: 3 HOURS

INSTRUCTIONS TO CANDIDATES

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

THERE ARE 6 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

Discuss the important of understanding the materials engineering in shipbuilding industry. Explain the different between materials science and materials engineering.

(8 marks)

Question 2

Differentiate between destructive and non-destructive testing. Explain the important of materials testing in shipbuilding industry.

(8 marks)

Question 3

Sketch the iron carbon phase diagram with the heat treatment process temperature range (normalizing, annealing, hardening, tempering). Describe the relation between phase diagram and heat treatment.

(8 marks)

Question 4

Define composite. Summarize the types of composite in term of its properties.

(8 marks)

Question 5

Discuss the types of corrosion that may occur in shipbuilding industry.

(8 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE questions only.
Please use the answer booklet provided.

Question 6

(a) Discuss the mechanism that provides graphite its lubricating properties. Use an illustration of graphite structure in relation to atomic bonding to explain your answer.

(5 marks)

(b) Figure 1 shows Copper unit cell relationship between the lattices constant a and the atomic radius R. Copper at 20 °C is having a FCC crystal structure with atomic radius of 0.128 nm and atomic weight of 63.5 g/mol. By referring to Figure 1,

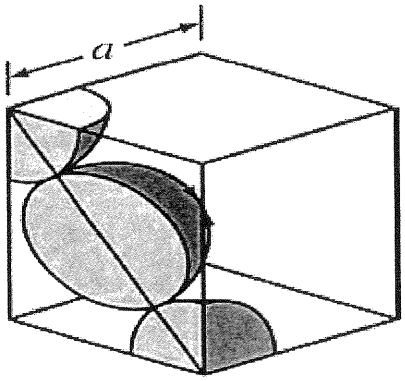

Figure 1

i. Prove that the relation of lattice constant and the atomic radius R of a BCC unit cell is

$$a = \frac{4R}{\sqrt{2}}$$

ii. Determine the volume of Copper sphere in the FCC unit cell.

iii. Calculate the density of Copper. Given 1nm = 10^{-7} cm

(15 marks)

Question 7

(a) By referring to Figure 2, discuss the fatigue behavior of ferrous and nonferrous metal.

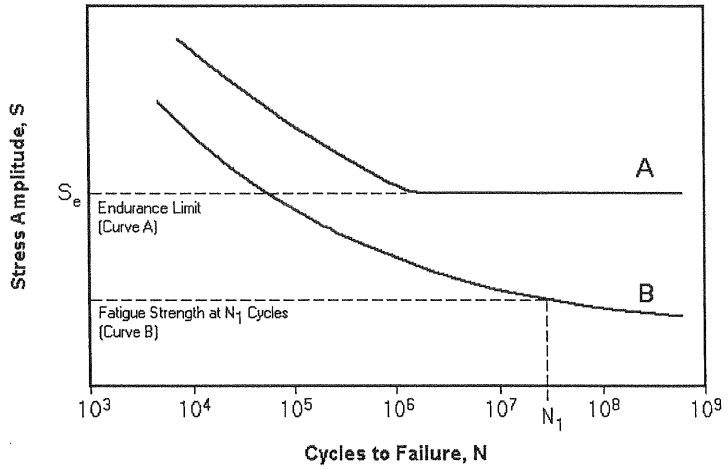

Figure 2

(10 marks)

(b) Nondestructive testing is conducted to inspect shipbuilding component frequently during manufacture or for maintenance. Magnetic particle inspection is one of common nondestructive testing in shipbuilding industry. Plan the procedure of conducting magnetic particle inspection and describe the possible defect that may occur. Choose only one specimen either Figure 3(a) or Figure 3(b)

(10 marks)

Figure 3(a)

Figure 3(b)

Question 8

(a) Explain about steel and cast iron with the help of iron carbon phase diagram. Discuss the suitable application in shipbuilding for both types of ferrous alloy.

(10 marks)

(b) Figure 4 shows the iron-carbon phase diagram. Make phase analyses of 99.5 wt% Fe -0.5 wt% C alloy at temperature slightly higher than 727 °C.

i. Evaluate the amount of each phase

ii. Skecth of microstructure occur using 2cm diameter circular fields.

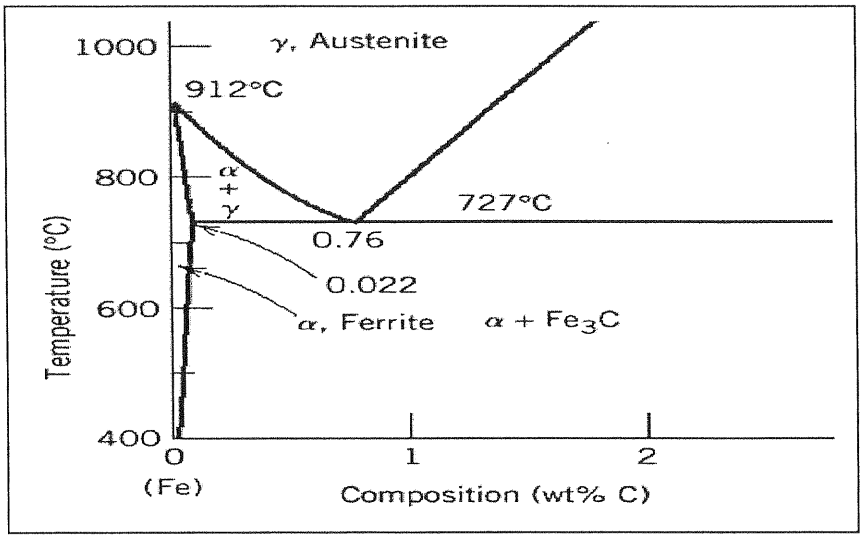

Figure 4

(10 marks)

Question 9

(a) Ceramic materials are important for many engineering designs and have a wide range of properties of applications in many technical areas or industries. Suggest the properties of ceramic applicable in marine related industries.

(5 marks)

(a) As a local fiberglass boat manufacturer, your company are well known in the small fiberglass boat manufacturing and maintenance. Elaborate about the manufacturing process of your fiberglass boat. Explain also about the types of polymer, reinforcement material and the advantages of the mechanism you choose.

(15 marks)

Question 10

A piece of corroded steel plate was found in a submerged ocean vessel. It was estimated that the original area of the plate was $10in^2$ and that approximately 2.6kg had corroded away during the submersion.

(a) Assuming a corrosion penetrate rate of 200mpy for this alloy in seawater, estimate the time of submersion in years. The density of steel is $7.9g/cm^3$.

(5 marks)

(b) Suggest the corrosion minimization method that can be implement for the submerged ocean vessel.

(15 marks)

END OF EXAMINATION PAPER