



UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
JANUARY 2016 SEMESTER

COURSE CODE : LGB 21203
COURSE NAME : SHIP MATERIALS
PROGRAMME NAME : BACHELOR OF SHIPBUILDING AND NAVAL ARCHITECTURE
(FOR MPU: PROGRAMME LEVEL)
DATE : 28 MAY 2016
TIME : 09.00 AM – 12.00 PM
DURATION : 3 HOURS

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 ONE (1) section ONLY with SIX (6) questions. Answer FOUR (4) questions ONLY.
 6. Answer all questions in English.
 7. Graph paper is appended.
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THERE ARE 7 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 100 marks)

INSTRUCTION: Answer only FOUR questions.

Please use the answer booklet provided.

Question 1

- (a) Explain the mechanism that provides graphite its lubricating properties. Use an illustration of graphite structure in relation to atomic bonding to explain your answer. (6 marks)
- (b) Define a crystal structure and elaborate the **THREE (3)** examples of common metal crystal structures. (8 marks)
- (c) Figure 1 shows an iron unit cell relationship between the lattices constant a and the atomic radius R . Iron at 20 °C is have a BCC crystal structure with atomic radius of 0.124 nm. By referring to Figure 1, determine

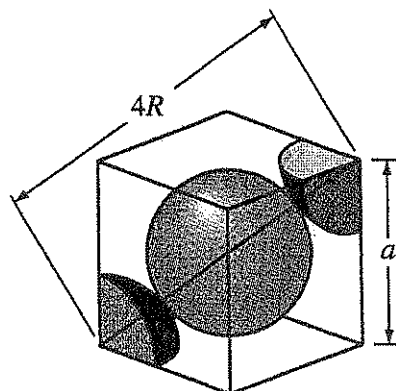


Figure 1

- i. show that the relation of lattice constant and the atomic radius R of a BCC unit cell is $a = \frac{4R}{\sqrt{3}}$
- ii. the volume of Iron unit cell.
- iii. the volume of Iron sphere in BCC unit cell.

(11 marks)

Question 2

- (a) A titanium alloy was performed a creep test at 345 MPa and 400 °C. The creep data were listed in Table 1.

Table 1

Strain (mm/mm)	Time , h
0.00254	2
0.00762	18
0.0127	40
0.01905	80
0.02286	120
0.02794	160

- i. Plot the creep strain vs. time (hours). (5 marks)
- ii. Determine the steady state creep rate for these test conditions. (4 marks)
- iii. Briefly explain the **THREE (3)** stages in the ductile fracture of a metal. (6 marks)

- (b) By referring to Figure 2, explain about the fatigue behavior of ferrous and nonferrous metal.

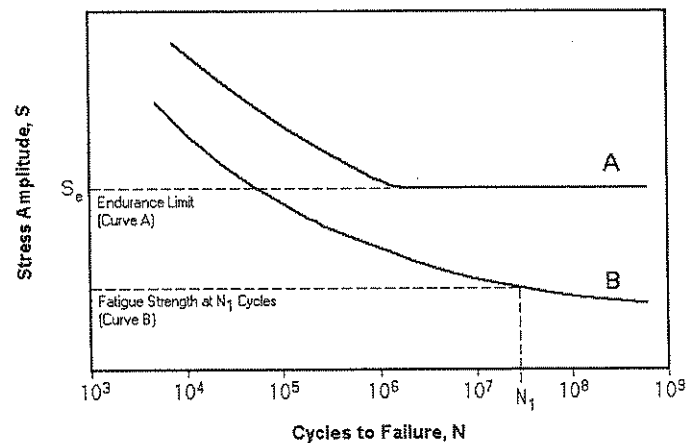


Figure 2

(10 marks)

Question 3

- (a) Sketch and describe the microstructures for eutectoid, hypoeutectoid and hypereutectoid (with labelling) during slow cooling in iron carbide phase diagram.

(15 marks)

- (b) 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)

Question 4

- (a) Discuss the important of materials testing in materials engineering and differentiate between destructive and non-destructive testing.

(8 marks)

- (b) Briefly explain the radiographic test for examination the engineering components. With diagram illustrate the cracks, pore, channel and hole defects.

(11 marks)

- (c) Magnetic particle testing is one of important non-destructive testing. Discuss the important of demagnetized the component or specimen at the end of the magnetic particle testing.

(6 marks)

Question 5

- (a) Figure 3 shows the schematic of force-displacement curve for a monolithic ceramic and ceramic matrix composite. By referring to Figure 3,

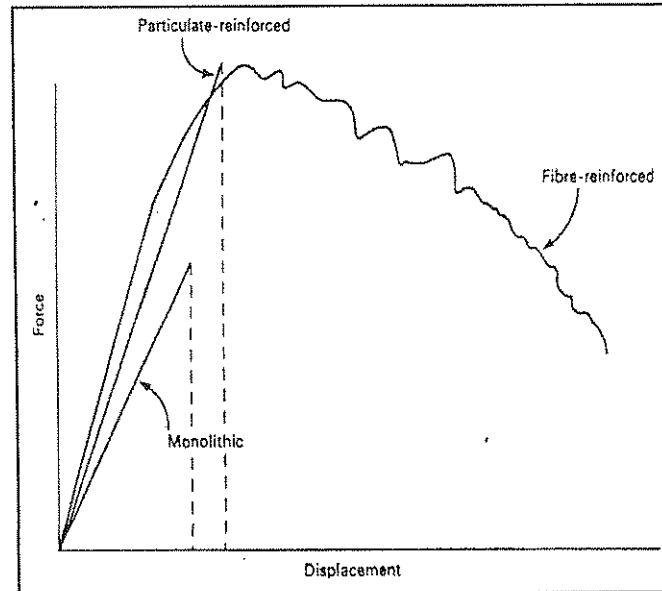


Figure 3

- i. Explained the failure behavior for each monolithic ceramic and its reinforcement.
- ii. Discuss the reason why the ceramic matrix composite development has lagged behind compared to polymer matrix composite and metal matrix composite.

(12 marks)

- (b) In fiberglass boat manufacturing, one of the techniques that used to produce fiber-reinforced plastic composite is spray-up process.

- i. Describe about the types of polymer used in fiberglass boat manufacturing.
- ii. Sketch and explain the production process of spray up and list **ONE (1)** advantage and **ONE (1)** disadvantage of this method.

(13 marks)

Question 6

(a) Hot-dip Galvanizing process is used for many shipbuilding applications where ferrous metals are used such as piping, fabricated components, rails and many other applications.

i. Explain the important and mechanism of hot-dip galvanizing process in corrosion protection of shipbuilding structure.

(12 marks)

ii. Briefly describe in point form the methods of the hot-dip galvanizing process.

(5 marks)

(b) Discuss **FOUR (4)** engineering design rules that may be important to prevent corrosion.

(8 marks)

END OF EXAMINATION PAPER

