



UNIVERSITI KUALA LUMPUR
MALAYSIA FRANCE INSTITUTE

FINAL EXAMINATION
JULY 2010 SEMESTER

SUBJECT CODE : FTB43202
SUBJECT TITLE : FAILURE ANALYSIS
LEVEL : BACHELOR
DURATION : 12.30pm – 3.30pm
(3 HOURS)
DATE / TIME : 20 NOVEMBER 2010

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 three (3) question only.
 6. Answer all questions in English.
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THERE ARE 4 PRINTED PAGES OF QUESTIONS.

SECTION A (Total: 40 marks)

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

Question 1

- (a) Explain five metallurgical causes of failure in the metal components?
(5 marks)
- (b) The features present on the fracture surface can be used to explain the mechanism of the failure. Describe the features as the result of the fatigue and ductile failures.
(5 marks)

Question 2

Discuss the following methods in the failure analysis

- (a) Site Visit
- (b) Visual Examination
- (c) Macroscopic and Microscopic Analysis
- (d) Chemical Analysis
- (e) Report Writing

(10 marks)

Question 3

- (a) What is a fracture?
(5 marks)
- (b) What are the differences between ductile and brittle fracture?
(5 marks)

Question 4

Explain the following tests used in determine the mechanical properties of the failed components:

- (a) Tensile test
- (b) Impact test
- (c) Hardness test
- (d) Fracture toughness test

(10 marks)

SECTION B (Total: 60 marks)**INSTRUCTION: Answer THREE (3) questions only.****Please use the answer booklet provided.****Question 1**

- (a) An axle for rear wheel of a car was broken in an accident, the axle may be failed by fatigue or impact as a consequence of the accident. What features on the axle and the fracture surface would you look for in attempt to settle this problem of failure?
(10 marks)
- (b) A cast iron lever is used to tighten ropes that a heavy load on a truck. After several years of use, the lever breaks during routine tightening operation. What types of fracture mechanisms would be possible for such a case? What features of the fractures level would you look for to determine the cause of the fracture?
(10 marks)

Question 2

- (a) What is stress corrosion cracking (SCC)? Describe the mechanism of SCC and to avoid or minimize the SCC.
(10 marks)
- (b) A brass fitting used in marine application is joined by soldering with lead-tin solder. Will the brass or solder corrode?
(10 marks)

Question 3

- (a) A steel pipeline carrying liquid fertilizer crosses a small creek. A large tree fell down and wedged against the pipeline. After some time, a hole is produced on the pipe at the point at the tree touches, with diameter of hole on the outside pipe larger than on the inside pipe. The pipe then leak fertilizer into the creek. Give the explanation of why the pipe corroded.

(10 marks)

- (b) Explain **TWO (2)** causes of the welding failure.

(10 marks)

- (c) The crack propagated through the heat affected area, right the next to the actual fusion zone of two thick steel plates joined for a pressure vessel. Suggest possible causes of the failures, including the role of welding process and microstructure that welding process may have produced in the heat-affected zone.

(10 marks)

Question 4

The boiler tubes in a petrochemical furnace need to be inspected after two years of operation during shut-down program, explain **TWO (2)** metallurgical methods used to inspect the condition of the tubes without removing them from the furnace.

(20 marks)

END OF QUESTION