



SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2014 SESSION

SUBJECT CODE : FTB 43202
SUBJECT TITLE : FAILURE ANALYSIS
LEVEL : BACHELOR
TIME / DURATION : 2.5 HOURS **9.00 am - 11.30 am**
DATE TIME : 30 MAY 2014

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) questions only.**
 - 6. Answer all questions in English.**
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SECTION A (Total 40 Marks)

INSTRUCTION: Answer All questions.

Please use answer booklet provided.

Question 1

- (a) Describe **FIVE (05)** causes of failure of a steel structure. (5 marks)
- (b) The fracture surfaces can lead to determine the type of fractures and mechanism of failures. Describe the features pertaining to fatigue and ductile failures. (5 marks)

Question 2

In Failure Analysis, the following are the methods commonly used. Discuss the methods;

- (a) Site visit
(b) Visual Examination
(c) Replication
(d) NDT
(e) Chemical Analysis (10 Marks)

Question 3

- a). Describe what is a fracture and how it occurs (5 Marks)
- b) In relation to fracture mechanics please describe the following;
- i. The **THREE (3)** modes of failures
ii. Stress Intensity (k) of material (5 marks)

Question 4

Identify and Explain **FOUR (4)** Tests used in determining mechanical properties of the failed components.

(10 marks)

SECTION B (Total 60 Marks)

INSTRUCTION: Answer any THREE (3) questions.

Please use answer booklet provided.

Question 1

Describe the objectives and procedures **THREE (3)** of the following;

- a). Structural Integrity Assessment
- b). Condition Monitoring
- c). Risk Based Inspection
- d). Fracture Mechanics

(20 marks)

Question 2

After completing Failure Analysis, an Investigation Reports must be prepared. What are the contents in the Reports and describe each of the items in the contents.

(20 marks)

Question 3

a). There are three distinct stages that occur during the fatigue life of a structure as listed below. Describe each of the stages.

- (1) crack initiation,
- (2) crack propagation, and
- (3) final rupture.

(10 Marks)

b). Calculate the maximum safe flaw size of a given structure with the following parameters;

A Maraging steel (350 grade) has a yield strength of approximately 2450 MPa (355 ksi) and a fracture toughness of 55 MPa m^{1/2} (50ksi in^{1/2}). A landing gear is to be fabricated from this material and the design stresses are 70% of the yield strength (1715 MPa, or 248.6 ksi). Assuming that the flaw must be 2.54mm (0.1in) to be detectable, can the part operate safely at this stress? Assume that edge cracks are present. The stress intensity factor for this crack geometry is $k=1.12\sigma(\pi a)^{1/2}$.

(10 marks)

Question 4

Welding defects could also contribute to the root cause of structural Failures. Identify **THREE (3)** type of weld defects and explain the causes of the defects and recommend solutions to prevent the defects.

(20 marks)

END OF QUESTIONS