



PROGRAM: NATIONAL DIPLOMA
ENGINEERING METALLURGY / EXTRACTIVE METALLURGY

SUBJECT: MATERIAL TESTING: METALLURGY

CODE: MTM 3111

DATE: SUPPLEMENTARY EXAMINATION
JUNE 2019

DURATION: 3 hours

WEIGHT: 40: 60

TOTAL MARKS: 100

FULL MARKS: 100

EXAMINERS: DR. OE FALODUN/MISS TS TSHEPHE

MODERATOR: MR ELVIS GONYA

NUMBER OF PAGES: 3 PAGES IN TOTAL

INSTRUCTIONS: ALL THE ANSWERS MUST BE COMPLETED IN
THE EXAM SCRIPTS AND HANDED IN

REQUIREMENTS: 1 POCKET CALCULATOR
NO CORRECTION FLUID SHALL BE USED
ALL WORK SHALL BE HANDED IN.

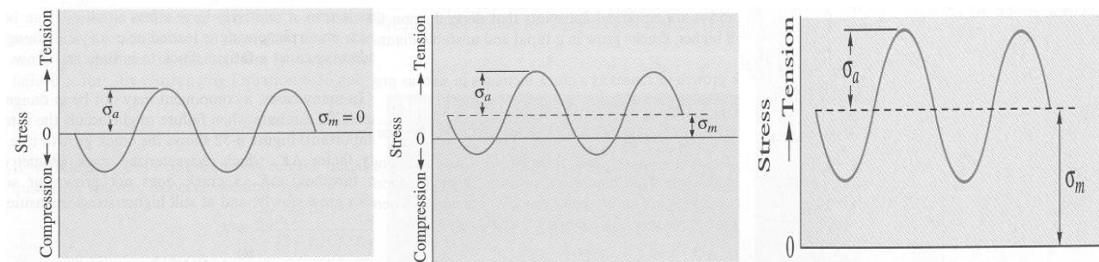
INSTRUCTIONS TO CANDIDATES:
PLEASE ANSWER ALL THE QUESTIONS

QUESTION 1

- 1.1. Why are metals tested? (2)
- 1.2. Mention and explain two forms of materials testing (2)
- 1.3. List and discuss the three basic assumptions of strength of material (4)
- 1.4. What are the three general ways that cause failure in structural members and machine elements (3)
- 1.5. Define the following
 - (a) Engineering stress (2)
 - (b) Engineering strain (2)
 - (c) Modulus of elasticity (2)

QUESTION 2

- 2.1. What is Fatigue (2)
 - (a) State and discuss the stages of fatigue failure (3)
 - (b) Briefly explain the stress cycles of the diagram below (3)



- (c) Explain the causes of stress corrosion failure with two examples (5)
- 2.2. Explain the word fatigue limit (3)
- 2.3. Mention three types of stresses for fatigue test (3)
- 2.4. Generated the following, mean stress, stress amplitude, stress range, stress ratio (2)

QUESTION 3

- 3.1. Discuss the word “creep” (2)
- 3.2. As a material scientist, how can you determine the temperature at which creep will occur in materials? (6)
- 3.3. List the five problems that occur in materials at high temperatures (5)
- 3.4. Draw a typical creep curve showing the three stages of creep and briefly explain the stages (8)
- 3.5. State and explain the principal deformation processes at elevated temperatures (6)

3.6. What does creep and rupture test measures? (2)

QUESTION 4

4.1. Mention four major usage of Non-destructive testing (4)

4.2. Discuss the following Non-destructive testing:

(a) Magnetic particle test (4)

(b) Dye penetrant test (4)

(c) Ultrasonic test (4)

(d) Radiography (X-ray) test (4)

QUESTION 5

5.1. The following data was obtained from a tensile test on a specimen of 10 mm diameter and gauge length of 60 mm. Draw the graph for this tensile test? (5)

Load (kN)	16	32	56	72	95	110	132	142	140	135
Extension (mm)	0.2	0.4	0.7	0.9	1.5	2.5	5.0	8.5	10	12

Assume that the select point on elastic region of the diagram is (32 kN, and 0.4 mm).

Calculate the young modulus of the material (5)

5.2. What are the three factors that contribute to a brittle cleavage fracture? (3)

TOTAL [100]