UNIVERSITY
— OF —
JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA *METALLURGICAL ENGINEERING*
SUBJECT	:	**MECHANICAL METALLURGY**
CODE	:	**TMP 31-1**
DATE	:	SUMMER SSA EXAMINATION 2015 8 DECEMBER 2015
DURATION	:	(SESSION 3) 15:00 - 18:00
TIME	:	15:00 - 18:00
WEIGHT	:	40 : 60
TOTAL MARKS	:	100

EXAMINER	:	MR JW VAN DER MERWE	082003406
MODERATOR	:	MR JM PROZZI	5103
NUMBER OF PAGES	:	4 PAGES	

INSTRUCTIONS	:	CALCULATORS ARE PERMITTED

INSTRUCTIONS TO STUDENTS:

    1.   ANSWER ALL QUESTIONS.
    2.   MAKE ASSUMPTIONS WHERE NECESSARY AND JUSTIFY THEM CLEARLY.

QUESTION 1

1.1. Describe the two kinds of stress and strain.   (6)

1.2. How can components fail?   (6)

    [12]

QUESTION 2

2.1. Show the Mohr circle of stress for the following condition: stress in the x-direction = 50 MPa; stress in the y-direction = -80 MPa and a shear stress of 35 MPa.   (6)

2.2. Compare the two yielding criteria for ductile metals.   (4)

    [10]

QUESTION 3

3.1. Discuss the difference between slip in a perfect lattice and slip by dislocation movement. Why is it necessary to have dislocations?   (6)

3.2. Why would one rather use true strain than engineering strain?   (4)

    [10]

QUESTION 4

4.1. Name a sessile dislocations.   (2)

4.2. What is meant by the critical resolved shear stress?   (4)

    [6]

QUESTION 5

5.1. How do dislocations interact with precipitates? Show two ways.   (7)

5.2. How would dislocations multiply? (4)

[11]

QUESTION 6

6.1. Show the elastic stresses at a notch for plane strain conditions. (6)

6.2. Explain microvoid coalescence. (4)

[10]

QUESTION 7

7.1. Explain how to test for a valid fracture toughness value when using a notched bend specimen (8)

7.2. What can be done to determine if a pressure vessel is safe for operation when it contains a crack of known length? (5)

[13]

QUESTION 8

8.1. What is the relationship between hardness and fatigue? (4)

8.2. Discuss the difference between striations and beach marks. (6)

[10]

QUESTION 9

9.1.Show the stress rupture curve and how it can be used to predict fatigue life. (6)

9.2.Discuss two creep deformation mechanisms in short. (4)

[10]

QUESTION 10

10.1. Give two material-environment combinations that will cause SCC when stressed
   appropriately.   (2)

10.2. Explain the Robertson crack arrest test.   (6)

                                                                                 [8]

TOTAL : 100