UNIVERSITY OF JOHANNESBURG

PROGRAM	NATIONAL DIPLOMA *CHEMICAL ENGINEERING*
SUBJECT	**CHEMICAL PLANT 3A**
CODE	**ACPA 321**
DATE	: WINTER SSA EXAMINATION 2016 27 JULY 2016
DURATION	: (SESSION 1) 08:00 - 11:00
TOTAL MARKS	163
FULL MARKS	163

EXAMINER	PROFESSOR PETER OLUBAMBI
MODERATOR	Dr H. RUTTO
NUMBER OF PAGES	3

INSTRUCTIONS	NON-PROGRAMMABLE CALCULATORS PERMITTED (ONLY ONE PER CANDIDATE) SHOW ALL UNITS IN CALCULATIONS!!! ANSWER ALL THE QUESTIONS.

QUESTION ONE

1.1 List the four types of special metals and alloys. (4)

1.2 With the aid of a well-labeled diagram, describe Charpy impact test (12)

1.3 A circular wire has a tensile force of 60.0 N applied to it and this force produces a stress of 3.06 MPa in the wire. Determine the diameter of the wire. (20)

[36]

QUESTION TWO

2.1 Identify the type of corrosion in the following cases: (14)

i. General rusting of steel and iron when the entire surface is exposed to air;
ii. Domestic water heater where copper and steel tubing are joined;
iii. Corrosion in firearms, in the bore of the barrel when corrosive ammunition is used and the barrel is not cleaned soon afterward;
iv. Flanges, Washers, O-rings on metal plates immersed in seawater;
v. Weld decay in stainless steel;
vi. Stainless steel parts in a combustion engine operated at temperatures between 500 and 800oC for long time;
vii. Elbow fitting in a steam condensate line;

2.2 Differentiate between wet and dry corrosion (4)

2.3 Explain four Damage and Cost associated with Corrosion (12)

[30]

QUESTION THREE

3.1 Explain atmospheric water generation as a source of water. (5)

3.2 You have been appointed to design an ammonia production plant. What impacts will this plant have on the environment? (5)

[10]

QUESTION FOUR

A conveyor is 750 m long and 1.0 m wide, and conveyors coal of bulk density 0.9 t/m^3 up a gradient of 1 in 60 at the rate of 250 t/h. Determine the suitable values of speed and total power for the installation. The average section of material on the belt can be considered to be W2/11 and the mass of the moving part per meter is taken to be 70 W. The idler friction coefficients are μe=0.03 and μm= 0.04 respectively. (20)

[20]

QUESTION FIVE

5.1 What are the differences between Gyratory and jaw crushers? (6)

5.2 A material consisting originally of 25 mm particles is crushed to an average size of 7 mm and requires 20 kJ/kg for this size reduction. Determine the energy required to crush the material from 25 mm to 3.5 mm assuming

(a) Rittinger's theory (5)

(b) Kick's theory (5)

(c) Bond's theory (5)

[21]

QUESTION SIX

6.1 What role does coagulation play in water treatment? Use a diagram and explain. (10)

6.2 Explain how fossil fuels are a source of pollution. (10)

[20]

QUESTION SEVEN

7.1 Describe the three main types of carbon steels and give two applications of each class (12)

7.2 A pipe has an outside diameter of 25 mm, an inside diameter of 15 mm and a length 0.40 m and it supports a compressive load of 40 kN. The pipe shortens by 0.5 mm when the load is applied. Determine

(a) the compressive stress; (7)

(b) the compressive strain in the pipe when supporting the load. (7)

[26]