UNIVERSITY OF JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA ENGINEERING: ELECTRICAL
SUBJECT	:	**ELECTRICAL DISTRIBUTION III**
CODE	:	**ELD 3221**
DATE	:	SUMMER EXAMINATION 2017 21 NOVEMBER 2017
DURATION	:	(SESSION 2) 12:30 - 15:30
WEIGHT	:	40: 60
TOTAL MARKS	:	106
FULL MARKS	:	100

ASSESSOR	:	MR EM MALATJI
MODERATOR	:	PROF AA YUSUFF 2309
NUMBER OF PAGES	:	3 PAGES (INCLUDING THE COVER PAGE)

INSTRUCTIONS TO STUDENTS

WORK IN PENCIL WILL NOT BE MARKED.
ALL WORK WITH THE EXCEPTION OF DIAGRAMS MUST BE IN BLUE OR BLACK INK.
NO UNITS NO MARKS.
QUESTIONS MAY BE ANSWERED IN ANY ORDER.
DO NOT SPLIT QUESTIONS.
PLEASE ANSWER ALL QUESTIONS.
USE THREE DECIMAL PLACES.
ONLY ONE POCKET CALCULATOR PER CANDIDATE MAY BE USED.

QUESTION 1

1.1 There are factors to consider when designing an electrical energy system. List five of those factors. (5)

1.2 With the aid of a table compare the coal fired power station and solar plant in terms of suitability for baseload, cost of energy and initial cost (6)

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QUESTION 2

A biogas station has a maximum demand of 10 000 kW and a load factor of 40%. The name plate om the Gas engine indicates that their Alternator efficiency and Engine mechanical. efficiency are 85% and 90% respectively. The slugde consumption of the plant is 0.9 kg/kWh. The company that runs the station buys 1 ton of sludge for R300.

Determine :

2.1 Thermal efficiency of the biogas station and (3)

2.2 Sludge bill per annum. (7)

The plant capacity factor of this station is 50% and a plant use factor of 70%. Calculate

2.3 the reserve capacity of the plant (5)

2.4 the daily energy produced (3)

Because of the aging of the station long retention time (The time it take for the gas form from sludge) increased. The station started to delivers 10000 kW for 2 hours, 5000 kW for 6 hours and is shut down for the rest of each day. The plant is normally shut down for 40 days each year for maintenance.

2.5 Calculate its new annual load factor under this conditions (6)

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QUESTION 3

The city of Cape Town has decided to build a desalination plant to solve her water crisis. As an engineer you saw an opportunity to couple this plant with a hydro electric station. The plant will require 1 978 350 kWh. At the hydro-electric station the penstock, turbine and generation efficiencies are 90%, 90% and 90% respectively.

3.1 Calculate the overall efficiency of the hydro-electric station (2)

3.2 If effective head of water can only be 150 m calculate the volume of water needed to generate the required energy. Assume the flow rate is Q=1 m^3/s (8)

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[10]

QUESTION 4

A single phase transmission line 100 km long has the following constants:

Resistance/km = 0·25Ω ; Reactance/km = 0·8Ω
Susceptance/km = 14×10^{-6} Siemen; Receiving end line voltage = 66 kV. The line is delivering 15 00kW at 0.8 power factor lagging.
Determine:

4.1 The A, B, C and D constants of the line using a nominal π method (6)
4.2 Receiving end voltage (2)
4.3 Receiving end current (4)

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QUESTION 5

5.1 The improvement of power factor is very important for both consumers and generating stations, briefly explain the importance to:

5.1.1 Consumers (3)
5.1.2 Generating stations (3)

5.2 A consumer has an average demand of 400 kW at a p.f. of 0·8 lagging and annual load factor of 50%. The tariff is R50 per kVA of maximum demand per annum plus R0,05c per kWh. If the power factor is improved to the most economical power factor by installing phase advancing equipment,
Explain briefly the term the "most economic power factor " (3)

5.3 The phase advancing equipment costs R100 per kVAR and the annual interest and depreciation together amount to 10%. Calculate:

5.3.1 The capacity of the phase advancing equipment (8)
5.3.2 The payback period of the investment (10)

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Question 6

Each line of a 3-phase system is suspended by a string of 3 similar insulators. If the line to neutral voltage is 44.25kV . Assume that the shunt capacitance between each insulator and earth is 1/8th of the capacitance of the insulator itself.

6.1 Calculate :

6.1.1 The voltage across the line unit (7)
6.1.2 String efficiency. (4)
6.2 Explain what is meant by Corona (3)

6.3 A 132 kV line with 1.956cm diameter and conductor spacing of 341 cm diameter conductors is built so that corona takes place if the line voltage exceeds 210 kV (r.m.s.), find the dielectric strength of air g_o. Assume smooth conductors (i.e., irregularity factor mo = 1) and standard pressure and temperature for which air density factor = 1 (8)

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TOTAL = 100