UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE & ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

MAIN EXAMINATION MAY 2018

TITLE OF PAPER: **FUNDAMENTALS OF POWER ENGINERRING**

COURSE CODE: **EE351**

TIME ALLOWED: **THREE** HOURS

INSTRUCTIONS:

1. Answer all four (**4**) questions
2. Each question carries 25 marks.
3. Marks for different sections are shown in the right-hand margin.

This paper has 3 pages including this page.

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QUESTION 1

A) State the first rule of personal safety which applies to all industrial workers as well as electrical workers, and then state any three rules for safe practice and to avoid electric shocks. [4 marks]

B) It is important that voltage drop be minimized by marking the resistance of the transmission line wires as low as practical. State two ways of lowering the resistance of a power transmission line. [4 marks]

C) A 20 Km transmission line having a total resistance of 40 Ω connects a power source, supplying 33 kV, to a 320 Ω switchable load. Calculate the following:

(i) The power supplied by the source, [4 marks]

(ii) The voltage drop on the line, [4 marks]

(iii) The power lost in the line, and [4 marks]

(iv) The percentage line voltage regulation [5 marks]

QUESTION 2

A) Three single phase transformers P, Q, and R are to be connected in delta-delta to a balanced three - phase load. Assuming that the transformers have polarity marks, H1, H2, X1, X2, make a schematic drawing, and mark the incoming transmission line A, B, C and the outgoing transmission line 1, 2, 3. [9 marks]

B) Three single-phase step-up transformers rated at 40 MVA, 13.2kV/80kV are connected in delta-wye on a 13.2kV transmission line. If the transformers feed a 120 MVA load. Calculate the following:

(i) The line voltage on the secondary side of transformer, [3 marks]

(ii) The phase currents in the primary side of the transformer, [4 marks]

(iii) The phase currents in the secondary side of the transformer, [3 marks]

(iv) The current in each incoming line A, B, C. (See Figure Q2 below) [3 marks]

(v) The current in each outgoing line 1, 2, 3 [3 marks]

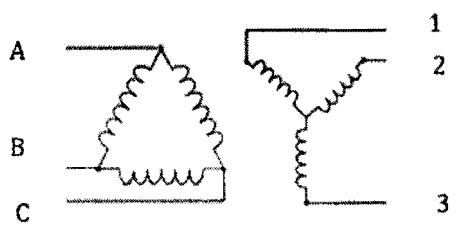

Figure Q2

QUESTION 3

A) Why are nuclear power stations not suitable to supply peak loads? [2 marks]

B) A hydroelectric power station has a head of 115 m, an average flow of 500 m^3/s, and a the capacity is 3200 $x10^6$ m^3 Calculate the following:

(i) The available hydraulic power, and [5 marks]

(ii) The number of days that can sustain a 100 m level drop the impounded water. (Assume no precipitation or evaporation and neglect water brought in by rivers and streams). [7marks]

C) Three identical impedances of (3 + j4) Ω per phase are connected in wye to a 550 V line voltage balanced three phase source. Using abc sequence Calculate the following:

(i) The phase voltages [4 marks]

(ii) The line currents, and [4marks]

(iii)The real power. [3 marks]

QUESTION 4

A) Briefly explain each of the following major components of a medium - voltage substation: circuit breakers, disconnect switches, grounding switches, surge arresters, current-limiting reactors, grounding transformers. [12 marks]

B) Why are induction motors most frequently used in industry. [2 marks]

C) State one difference between a linear induction motor and a standard induction motor. [2mark]

D) A 40 horse-power, 1750 r/min, 400 V, three phase squirrel cage induction motor is to be used as an asynchronous generator. The rated current of the motor is 30 A, and the full-load power factor is 86 %. Calculate the following:

(i) The apparent power drawn by the engine, [3 marks]

(ii) The active power absorbed by load, and [3 marks]

(iii)The reactive power absorbed by the motor. [3 marks]