MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2018/2019 ACADEMIC YEAR

THIRD YEAR **SECOND** SEMESTER EXAMINATION FOR, DIPLOMA ELECTRICAL AND ELECTRONICS ENGINEERING

SEE 1324 - POWER SYSTEM II

DURATION: 2 HOURS

DATE: 10/12/2018

TIME: 9 – 11 A.M.

Instructions to candidates:

1. Answer question One and Any Other Two questions
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a. i. Outline the main types of transformers applied to regulate the supply of electrical energy (3 Marks)

ii. A 1-Φ transformer 400/600v draws a no-load current of 4A at a power factor of 0.2 lagging. If the secondary supplies a load of 280A at a power factor of 0.8 lagging, determine the current and power factor of the primary circuit (5 Marks)

b. Explain any TWO basic standard parameters that exist in power systems under no-load conditions (2 Marks)

c. Discuss the significance of symmetrical components when analyzing power system conditions (3 Marks)

d. Explain the following terms as applied to power system stability;

i. Stability limit

ii. Dynamic stability (4 Marks)

e. With the aid of network sketches, illustrate the configurations applied to determine transmission lines parameters (3 Marks)

f. State THREE causes of voltage surges in overhead transmission lines (3 Marks)

g. Outline the factors that affect the transient stability of a power system (3 Marks)

h. Derive an expression for surge impedance of a loss-free overhead transmission line (4 Marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

a. State any THREE advantages of Zinc Oxide surge diverters over silicon surge dividers (3 Marks)

b. Derive an expression for the reflected voltage when a transmission line is terminated by a pure resistor whose value is greater than the characteristic impedance of the line (5 Marks)

c. With reference to line performance, state the difference between a medium and a long transmission line (2 Marks)

ii. A three phase, 50Hz, 132kv, 150km line supplies a load of 30mw at 0.9 power factor lagging. Each conductor has a resistance, inductance and capacitance of 0.15Ω, 1.2mH and 0.0096Ω per km per phase respectively. Using π configuration, determine the send end;

i. Line voltage

ii. Current (10 Marks)

QUESTION THREE (20 MARKS)

a. Outline advantages and disadvantages of auto-transformers (4 Marks)

b. A 100kVAS transformer has 200 turns on the primary and 1000 turns on the secondary winding. The primary and secondary resistances are 1.25Ω and 0.04Ω respectively. The supply voltage is 240V. Calculate;

   i. The equivalent impedance referred to the primary

   ii. The full load primary current

   iii. Voltage regulation of the transformers

   iv. Secondary terminal voltage for full load at a power factor of 0.8 lagging (13 Marks)

c. Discuss any THREE construction features of a transformer (3 Marks)

QUESTION FOUR (20 MARKS)

a. State THREE types of unsymmetrical faults that may occur on a three-phase power system (3 Marks)

b. With the aid of phaser diagrams, show that the expression for zero sequence current (I_O) of a three-phase unbalanced system is given by;

   $I_O = \frac{1}{3}(I_R + I_Y + I_B)$, where I_R, I_Y and I_B are phase currents in the red, yellow and blue phases respectively. (8 Marks)

c. In a three-phase, four wire system, currents in the red, yellow and blue phases under fault conditions are $I_R = (10 + j20)$ A, $I_Y = (12 – j10)$ A and $I_B = (-3 – j5)$ A respectively. Determine the;

   i. Zero

   ii. Positive

   iii. Negative

   Sequence component of currents in the red phase (9 Marks)