

UNIVERSITY OF SWAZILAND  
FACULTY OF SCIENCE & ENGINEERING  
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

SUPPLEMENTARY EXAMINATION JULY 2014

TITLE OF PAPER: FUNDAMENTAL OF ELECTRICAL POWER  
ENGINEERING

COURSE CODE: EE351

TIME ALLOWED: THREE HOURS

INSTRUCTIONS:

1. Answer **all five** questions
2. Marks for different sections are shown in the right-hand margin.

This paper has 3 pages including this page.

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BY THE INVIGILATOR.

**Question 1**

For the circuit shown in Figure 1, calculate the following:

- a) The load impedance when referred to the primary side of transformer T2, (3 marks)
- b) The voltage on the secondary side of transformer T1, (3 marks)
- c) The current labelled I, (6 marks)
- d) The voltage on the load, and (8 marks)
- e) The real power supplied by the source. (4 marks)

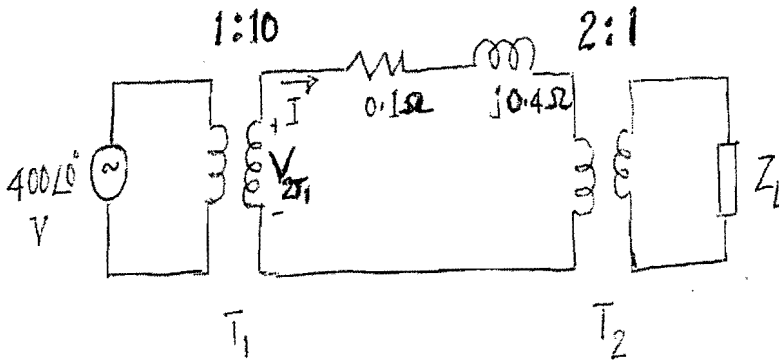


Figure 1.

**Question 2**

An **unbalanced** wye-connected load is connected to a balanced 400-V three phase source, sequence *abc*. The impedances (in ohms) of load are

$$\widehat{Z}_a = 5 + j8.66; \quad \widehat{Z}_b = 5 - j8.66; \quad \widehat{Z}_c = 5.5 + j8.66$$

Using voltage  $\widehat{V}_{ab}$  as reference determine the phase voltages. (25 marks)

**Question 3**

A balanced delta load shown in Figure 3 is connected to a balanced 480-V three phase source, sequence *abc*, The impedances (in ohms) are  $\widehat{Z}_{ab} = \widehat{Z}_{bc} = \widehat{Z}_{ca} = 4 + j3$

Using voltage  $\widehat{V}_{ab}$  as reference determine

- a) the phase currents, (9 marks)
- b) line currents, and (9 marks)
- c) the total power dissipated in the load. (4 marks)

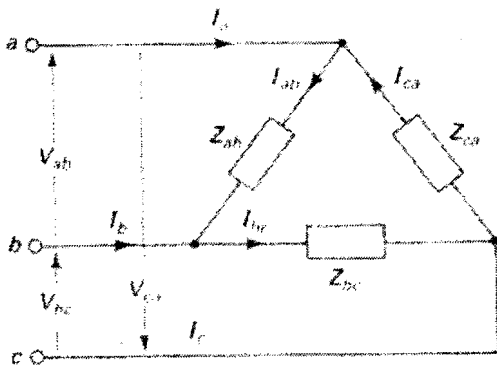


Figure 3

#### Question 4

Figure 4 shows a single-line diagram of a 13.8kV primary feeder supplying power to a load at the end of the feeder. A shunt capacitor bank is located at the load bus. The load is wye-connected with  $R_{\text{load}} = 3 \Omega$  per phase in parallel with load  $jX_{\text{load}} = j20 \Omega$  per phase. With the shunt capacitor bank out of service. Calculate the following:

- a) the phase currents, (11 marks )  
b) the load power factor. (8 marks)

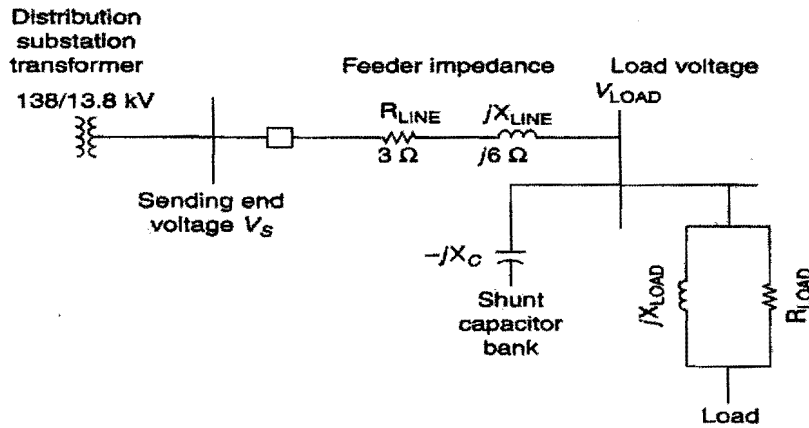


Figure 4

#### Question 5

A three-phase, 400-V, 50-Hz, ten-pole, wye-connected, cylindrical rotor synchronous motor has a synchronous reactance of  $2 \Omega$  per phase and negligible armature resistance. If the power input is 50 kW at 0.8 leading power factor when connected to a 400-V source, determine

- a) the armature current, and (5 marks)  
b) the excitation voltage. (5 marks)