UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE & ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

MAIN EXAMINATION - MAY 2015

TITLE OF PAPER:	FUNDAMENTALS OF **ELECTRICAL POWER ENGINEERING**
COURSE CODE:	**EE351**
TIME ALLOWED:	**THREE HOURS**

INSTRUCTIONS:

1. Answer all 5 questions
2. Marks for different sections are shown in the right-hand margin.

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This paper has 3 pages including this page.

Question 1

a) Write down four conditions which must be met before connecting a finite synchronous machine to a large grid network. (4 marks)

b) A three-phase, 50 Hz overhead transmission line is supplying a 0.8 power factor lagging load with both the sending and receiving end voltages held 110 kV and the former leads by 15^0. The line constants are $A = 0.96\angle 1^0$, $B = 100\angle 83^0\ \Omega$.
Calculate
(i) the active power and reactive power demanded by the load, and (9 marks)
(ii) the active power and reactive power at the sending end. (12 marks)
[Hint: receiving end current $I_R = \frac{V_S}{B} - \frac{AV_R}{B}$***; sending end current*** $I_S = \frac{AV_S}{B} - \frac{V_R}{B}$***;]***

Question 2

A single phase two winding transformer is rated 20kVA, 480/240V, 50Hz. A source connected to 480V winding supplies an impedance load connected to the 240V winding. The load absorbs 12kVA at 0.8 power factor lagging when the voltage is 220V. Assume that the transformer is ideal.
Calculate
(a) the voltage across the 480V winding, (3 marks)
(b) the load current (4 marks)
(c) the load impedance, (3 marks)
(d) the impedance referred to the 480V winding, (3 marks)
(e) the current supplied by the source, and (3 marks)
(f) the reactive power supplied to the 480V winding. (3 marks)

Question 3

A load shown in Figure 3 is connected to a balanced 549V, 60Hz, three phase source having a sequence a *abc*. The impedances (in ohms) are $\hat{Z}_a = 25 + j15$, $\hat{Z}_b = 15 - j15$, and $\hat{Z}_c = 20 + j20$. With $\hat{V}_{ab} = 549\angle 0^0$ determine
a) the phase voltages, (6 marks)
b) the line currents, (9 marks)
c) the apparent power supplied by the source, and (9 marks)
d) the real power supplied to the load. (3 marks)

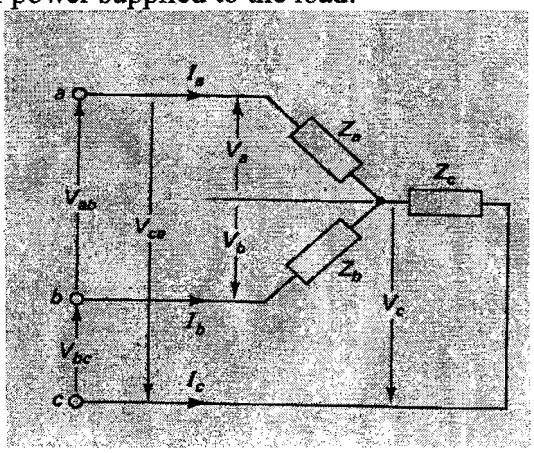

Figure 3

Question 4

a) Sketch the Radial type and Ring type of secondary distribution power system arrangement. (10 marks)

b) Why is the ring type of secondary power distribution system arrangement better than radial arrangement. (4 marks)

Question 5

A 480V, 60Hz, three phase induction motor is drawing 63A at 0.86 power factor lagging. The stator copper losses are 2 kW and the rotor losses are 600W. The friction and windage losses are 400W, the core losses are 1044W, and the stray losses are negligible.

Determine

a) the airgap power P_{AG}, (6 marks)

b) the power converted P_{CONV}, (3 marks)

c) the output power P_{OUT}, and (4 marks)

d) the efficiency of the induction motor. (2 marks)