TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology in Conjunction with Kenya Institute of Highways and Building & Technology (KIHBT)

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

HIGHER DIPLOMA IN TECHNOLOGY

EEP 3107: ELECTRICAL TECHNOLOGY I

END OF SEMESTER EXAMINATION
SERIES: MAY 2015
TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions. Answer any **THREE** questions
This paper consists of **FOUR** printed pages

Question One

a) Explain the main advantages of connecting the secondary windings of a three-phase distribution transformers in star **(6 marks)**

b) A three phase system supplies a balanced load of 25KW at a p.f. of 0.8, the line voltage being 440V. Calculate:
   (i) The line current
   (ii) The phase current, when the load is connected either in star or in delta **(8 marks)**

c) With the aid of a diagram, show the connection of three waltmeters for 2-phase balanced star connected load and derive the formula for total power **(6 marks)**

Question Two

a) State:
   (i) TWO causes of Harmonics
   (ii) TWO methods of minimizing Harmonics **(4 marks)**

b A complex voltage wave form is made of two sinusoidal wave forms as follows:

- A fundamental wave of peak value 10V and frequency 50Hz
- A second harmonic wave of peak value A volts and frequency 100Hz all waves starting at the same time as the fundamental wave

   (i) Draw a scale on the same axis the two waves with only one cycle of the fundamental **(10 marks)**
   (ii) Derive the complex waveform form the two waves **(4 marks)**
   (iii) State the maximum or peak value of the complex wave **(2 marks)**

Question Three

a) (i) Give the expression for the R.M.S value of a complex wave with the fundamental and 2^{nd}, 3^{rd} and 5^{th} harmonics **(5 marks)**
   (ii) Also show graphically how the R.M.S value of the complex wave in a(i) above with 50% 2^{nd} and 3^{rd} Harmonics and 25% 5^{th} harmonic **(7 marks)**

b) A coil has a reactance of 15Ω and a resistance of 10Ω when connected across a 200V, 50Hz a.c. supply. Calculate:
   (i) The current
   (ii) The average power consumed
   (iii) The phase angle between the voltage and the current
   (iv) Draw both the circuit and the phasor diagram for this connection **(8 marks)**

Question Four

a) State:

(i) Norton's theorem
(ii) Theremin's theorem

Find the current flowing in the 5Ω resistor of the network shown in figure 4(a) above **(8 marks)**

Using THEVENI theorem, calculate the current and power (W) across the 1KΩ load resistor RL in figure 4(b)

Question Five

a) A capacitor of 100μF is connected in series with a pure resistor of 50Ω across a 15V, 50Hz supply:
(i) Capacitive reactance
(ii) Total impedance of the circuit
(iii) The current in the circuit
(iv) The phase angle
(v) The voltage across the capacitor
(vi) The KVA power in the circuit **(10 marks)**

b) If a resistance of 100Ω an inductance of 0.2H and a capacitor of 20μF are connected in parallel across a 240V supply, calculate:
(i) The current through each component

(ii) Total circuit current
(iii) Power factor of circuit, state whether leading of lagging
(iv) The power absorbed by the circuit **(10 marks)**