TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

DIPLOMA IN AUTOMOTIVE ENGINEERING
DIPLOMA IN MECHANICAL ENGINEERING (POWER OPTION)
(DMPE 2 & DAE 2)

EEE 2102: ELECTRICAL ENGINEERING SCIENCE

END OF SEMESTER EXAMINATION
SERIES: APRIL 2014
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

All questions carry equal marks
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One

a) (i) Show that for four resistors connected in series:

$$R_T = R_1 + R_2 + R_3 + R_4$$

(5 marks)

(ii) Show that for four resistors connected in parallel:

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$$

(5 marks)

b) For the circuit of figure 1 below, calculate using superposition theorem:
(i) The current

(ii) Power dissipated by the 20Ω Resistors.

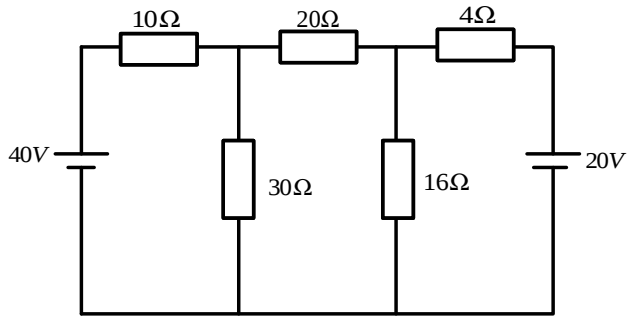

Fig. 1

(16 marks)

Question Two

A steel ring of mean circumference 400mm cross-sectional area 500mm^2 and a Relative Permeability of 1600 has a coil of 300 tums wound uniformly around it. Calculate the Reluctance of the ring and hence the current required to produce a flux of 600μWb in the ring. **(20 marks)**

Question Three

(a) When an alternating Emf is applied to a circuit the current produced laggs the emf by 75^o. Illustrate the above statement by means of wave and phasor diagram. **(4 marks)**

(b) A single phase A.C supply of 240V, 50Hz is applied to a series circuit consisting of a pure inductor of 0.06H and a non-inductive resistor of 50Ω. Calculate:

(i) The impedance of the circuit **(4 marks)**

(ii) The current in the circuit. **(4 marks)**
(iii) The potential difference (p.d) across inductor and resistor. **(4 marks)**
(iv) Draw the phasor diagram **(4 marks)**

Question Four

(a) Define the following magnetic Quantities:

(i) Magnetic field **(2 marks)**
(ii) Magnetic flux Q **(2 marks)**
(iii) Magnetic flux density (B) **(2 marks)**
(iv) Magnetomotive force (mmf) **(2 marks)**
(v) Reluctance (s) **(2 marks)**

(b) State the equivalent magnetic quantities of the following electric quantities:

(i) Current (I) **(2 marks)**
(ii) Resistance (R) **(2 marks)**
(iii) Electromotive force (Emf) **(2 marks)**
(iv) Absolute permittivity (ε) **(2 marks)**
(v) Relative permittivity (μr) **(2 marks)**

Question Five

a) Define capacitance. **(2 marks)**

b) (i) Show that for four capacitors connected in series, total capacitor is given by:

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \frac{1}{C_4} + \frac{1}{Cn} + etc$$

(4 marks)

(ii) Show that for four capacitor connected in parallel total capacitance C_T is given by:

$$C_T = C_1 + C_2 + C_3 + C_4 + C_n + etc$$

(4 marks)

c) (i) A network consists of a $8\mu F$, capacitor connected in parallel with a $4\mu F$ capacitor to a 15V d.c supply. Determine the charge taken from the source. **(5 marks)**

(ii) A network comprises three capacitors connected in series to give a total effective capacitance of $4\mu F$. If two of the capacitors have capacitance of $10\mu F$ and $20\mu F$, determine the value of the 3rd capacitor. **(5 marks)**