TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF MEDICAL ENGINEERING

DIPLOMA IN MEDICAL ENGINEERING (Y1 S2)

EEP 2152: 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 question **ONE (compulsory)** and any other **TWO** questions

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

Question One (Compulsory)

a) Define the term "RMS current" **(1 marks)**

b) A series a.c. circuit consists of a 25 Ω resistor, 0.1H inductor, and a 50 μF capacitor. The circuit is powered from a 240V, 50Hz supply. Calculate:
- **(i)** The impedance of the circuit
- **(ii)** The current drawn from the power source
- **(iii)** The power-factor of the system
- **(iv)** The voltage across the resistor, inductor and capacitor. **(17 marks)**

c) Two identical coils are connected such that the total inductance is either 17.5H or 7.5H, depending on the mode of connection. Determine:
- **(i)** The value of inductance of each coil
- **(ii)** The mutual inductance between the coils **(10 marks)**

d) State the standard:
- **(i)** Single-phase voltage
- **(ii)** Power supply frequency in Kenya **(2 marks)**

Question Two

a) State "Ohm's law" **(1 mark)**

b) Describe:
- **(i)** Conductor
- **(ii)** Semi-conductor
- **(iii)** Insulator;

and give ONE example in each case **(9 marks)**

c) The equivalent resistance for two resistors connected in parallel is 6 Ω. The same resistors have an effective resistance of 25 Ω when connected in series. Calculate the ohmic value for each of the two resistors **(10 marks)**

Question Three

a) An alternating current is given by:

$i = 141.4 \sin 314t$

Find:
- (i) The maximum value
- (ii) Frequency
- (iii) Time period
- (iv) The instantaneous value when t is 3ms **(7 marks)**

b) Define the term "cycle" **(1 mark)**

c) A 318 μF capacitor is connected across a 230V, 50Hz system. Determine:

(i) The capacitive reactance
(ii) r.m.s value of current
(iii) equations for voltage and current **(12 marks)**

Question Four

a) Define the term "magnetic flux density" **(1 mark)**

b) State the difference between primary cells and secondary cells **(1 mark)**

c) A straight wire 0.5m long carries a current of 100A and lies at right-angles to a uniform field of 1.5T. Calculate the mechanical force on the conductor when:
(i) it lies in the given position
(ii) it lies in a position such that it is inclined at an angle of 30^o to the direction of field
(6 marks)

d) The resistances of the two coils of a wattmeter are 0.01 Ω and 1000 Ω respectively and both are non-inductive. The load is taking a current of 20A at 200v and 0.8 p.f. lagging. Show the two ways in which the voltage coil can be connected and find the error in the reading of the meter in each case.
(12 marks)

Question Five

a) A mica dielectric parallel-plate capacitor has 21 plates each having an effective area of $5cm^2$ and each separated by a gap of 0.005mm. Calculate the capacitance. Take the relative permittivity of mica as 6.
(3 marks)

b) With the aid of a labeled diagram, explain the principle of operation of a single-phase transformer.
(9 marks)

c) A 2000/200V, 20KVA transformer has 66 turns in the secondary. Calculate:
(i) Primary turns
(ii) Primary and secondary full-load currents. Neglect losses **(8 marks)**