TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

Department of Mechanical and Automotive engineering

UNIVERSITY EXAMINATION FOR:

EEE1221: PRINCIPLES OF ELECTRICAL TECHNOLOGY

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: SEPTEMBER 2018

TIME: 2 HOURS

DATE: SEPTEMBER 2018

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of **five** Questions; Question ONE is compulsory. In addition attempt any Other TWO
Questions.
Do not write on the question paper.

Question ONE (Compulsory 30 marks)

Question1

(a) (i) State the difference between work, energy and power

   (ii) An electric heater consumes $3.6mJ$ when connected to 250V supply for 40minutes. Find the power of the heater and current taken from the supply

   (iii) A coil of resistance R ohms and inductance L henrys is connected in series with a $50\mu F$ capacitor. If the voltage is 225V at 50Hz and the current flowing in the circuit is $1.5/-30A$.Determine the value of R and L. Determine also the voltage across the coil and capacitor   **(10mks)**

(b) (i) Two parallel plates having a P.d of 200V, between them are spaced 0.8mm apart. What is the dielectric field strength? Find the flux density when the dielectric between the plates is

       (I) air

       (II) Polythene of relative permeability 2.3 (take $\xi = 8.85 \times 10^{-12} F/M$)

(ii) Define a capacitor and state two of its applications

(iii) A capacitor is charged with $10mC$, if the energy stored is 1.2J find the voltage and its capacitance

(13mks)

(d)   A silicon iron- ring is wound with 800turns, the ring having a mean diameter of 120mm and a cross-sectional area of $400mms^2$.If when carrying current of 0.5A the relative permeability is found to be 3000, calculate

(i) The self inductance of the coil

(ii) The induced e.m.f if the current is induced in 80ms   **(7mks)**

Question TWO

(a)   (i) State ohms law

(ii)With aid of circuit diagrams show that $R_T = R_1 + R_2 + R_3$ in parallel connected resistors

(iii) For the circuit shown in figure Q2a Find

       (l) Supply current

       (ll) Current flowing in each resistor

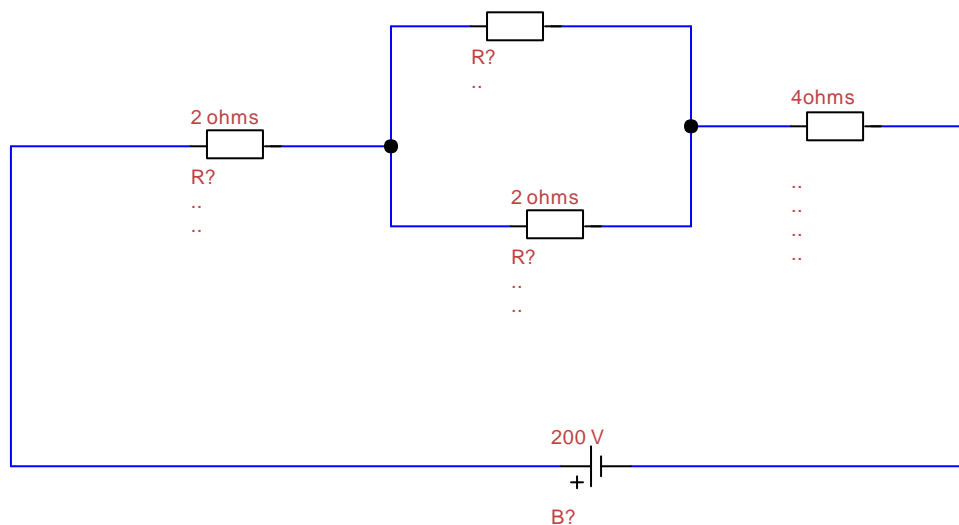   (lll) P.d across each resistor

Figure Q2a

B   (i) State kirchoffs current and voltge laws

(ii) Use kirchoffs laws to determine the currents flowing in each branch of the network of figure Q2b
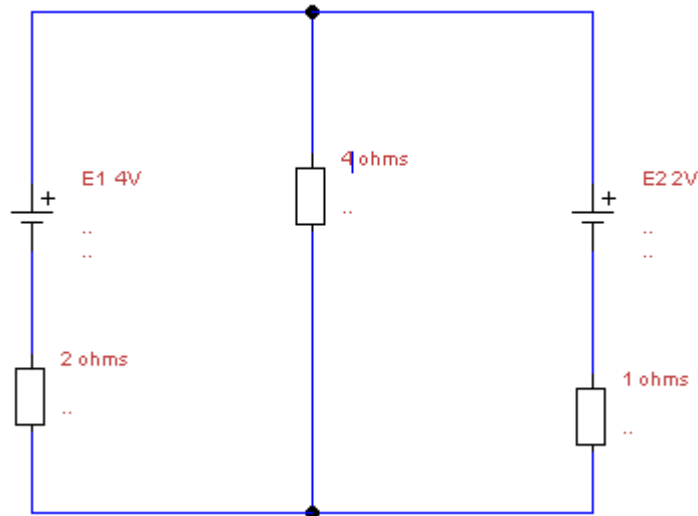
(12mks)

Figure Q2b

(b) (i)   Explain the phenomena of electromagnetic induction

     (ii) Define an inductor and state THREE factors which affects the inductance of an inductor

     (iii) A rectangular coil of sides 12cm by 8cm is rotated in a magnetic field of flux density 1.4T, the longer side of the coil actually cutting this flux. The coil is made up of 80 turns and rotates at $1200 rev / \min$

           (l)   Calculate the maximum generated e,m,f

           (II) If the coil generates 90V at what speed will the coil rotate   (**10mks**)

Question THREE

(a) (i)   Describe with aid of sketches power in AC circuits

     (ii) With aid of a sketch describe the power triangle and power factor

     (iii) A circuit consisting of a series resistor in series with a capacitor takes 100 watts at power factor of 0.5 from a 100V, 60Hz supply. Find the current flowing, the phase angle, the resistance, the impedance and the capacitance

                                                                            (**10mks**)

(c) (i)   Describe series impedance as used in AC circuits

     (ii) The following impedances are connected in series across a 40V, 20 kHz supply, a resistance of 8 ohms, a coil of inductance 130µH and 5Ω resistance, a 10Ω resistance in series with 25µ Capacitor. Calculate, the circuit current, the circuit phase angle, the voltage drop across each impedance .

(iii)   A series circuit of resistance 60Ω and inductance 75mH is connected to a 110V, 60Hz supply, calculate the power dissipated.   **(10mks)**

Question FOUR

(a)   (i)   Define the following terms as used in sinusoidal stead state analysis

(I) Peak value

(ll) Average value

(ii)   Define the root mean square of an A.C waveform and explain its significance

{iii)   The current in an AC circuit is given by $i = 120\sin(100\pi t + 0.36)$

(I)   find the peak value, the periodic time, the frequency and the phase angle in relation to $120\sin 100\pi t$

(II)   The value of the current when t=0

(III)   The value of the current when t=8ms

(IV)   The time when the current first reaches 60A   **(10mks)**

(b)   (i)   Explain the importance of test and measurement

(ii)   Describe THREE devices found in analog instrument s and with aid of a sketch describe the construction of a repulsion type moving coil instrument

(iii)   A moving coil instrument gives a f.s.d when current is 40mA and its resistance is 25Ω. Calculate the value of the shunt to be connected in parallel with the meter to enable it to be used as an ammeter for measuring current up to 50A   **(10mks)**

Question FIVE

(a)   (i)   Describe the generation of three phase supply

(ii)   With aid describe the two voltage distribution in 3 phase star system.

(iii)   A star connected load consists of three identical coils each of resistance 30Ω and inductance 127.3mH. If the line current is 5.08A, calculate the line voltage if the supply frequency is 50Hz   **(10mks)**

(b)   (i)   With aid of a sketch describe three phase connection of a delta load

(ii)   Three coils each having resistance 3Ω and inductive reactance 4Ω are connected in star and in delta to 415V, 3phase supply. Calculate for each the line and the phase line currents

(iii)   With aid of circuit diagrams describe the one wattmeter and two wattmeter methods of measurement of power

(c)   A 400V, 3phase star connected alternator supplies a delta connected load each phase of which has resistance of 30Ω and inductive reactance 40Ω.Calculate the current supplied by the alternator and the output power and the kVA of the alternator.   **(10mks)**