SLIATE

SRI LANKA INSTITUTE OF ADVANCED TECHNOLOGICAL EDUCATION

(Established in the Ministry of Higher Education, vide in Act No. 29 of 1995)

Higher National Diploma in Engineering (Electrical and Electronic)

First Year, First Semester Examination – 2017

EE1107- ELECTRICAL PRINCIPLES - A

Instructions for Candidates:
Answer **any FIVE (5)** questions.
All question carry **equal** marks.

No. of questions : 06
No. of pages : 04
Time : **Three (03) hours**

Q1.

i. The short circuit current through the resistance R_2 is 6A. While network is functioning as normal the current passing through the resistance R_2 is 4A. Calculate the value of E_1 and R_2 of the network given in figure 1. **(8 Marks)**

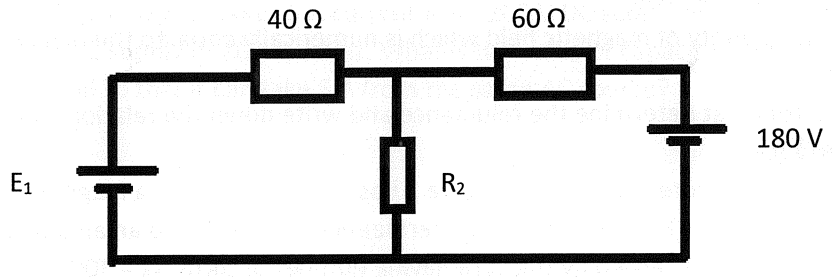


Figure 1

ii. By using superposition theorem and Kirchhoff's laws, find the current through 40 Ω resister and R_2 of the network given in figure 1. **(8 Marks)**

iii. Three 1.5 V, 0.5 A bulbs are connected in parallel. A resister R is connected in series with the parallel bulb arrangement. This series resistance with 3 parallel bulbs are connected across a 12 V battery having zero internal resistance. Find the value of R in order to light the bulbs with their normal light intensity. **(4 Marks)**

[Total 20 marks]

Q2.

i. Write the names of 3 types of capacitors. **(3 Marks)**

ii. Draw the graph for the voltage across the capacitance during charging and roughly mark the time constant on the curve. **(4 Marks)**

iii. Three capacitors of capacitance 8 μF, 8 μF and 4 μF are connected in series and a 12 V volt is applied between the two ends of this combination. Calculate,

   a. The charges in the 4 μF Capacitor. **(3 Marks)**

   b. The total energy stored in the combination. **(3 Marks)**

iv. Two dielectrics having relative permittivity of k_1 and k_2, and their thicknesses are t_1 and t_2. A parallel plate capacitor is completely filled by these two dielectrics. Charge on the plates of the capacitor is Q and the permittivity of air is ξ_0. Find the potential difference between two parallel plates. **(7 Marks)**

[Total 20 marks]

Q3.

i. State the purpose of magnetic shielding and how the permeability should be of selected material for the shielding. **(3 Marks)**

ii. What is the quantity of magnetic field which is numerically equal to the magnetic potential gradient? **(1 Marks)**

iii. State 3 factors that determine the reluctance and write down the relationship between them and reluctance. **(3 Marks)**

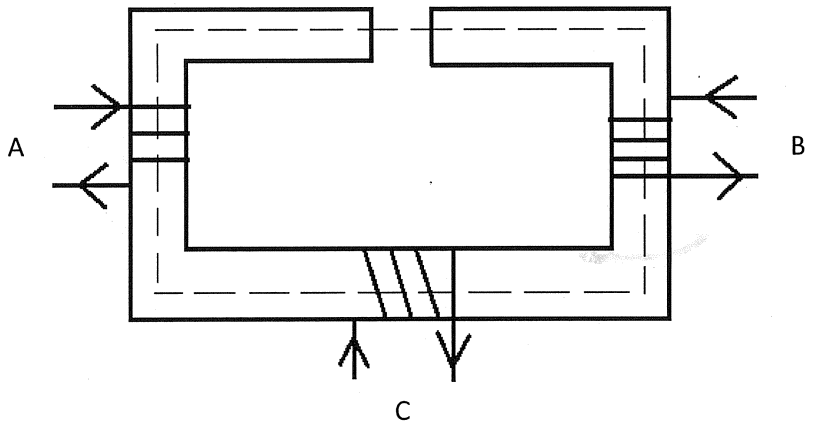
iv. A rectangular iron core shown in the figure 2 has a mean length of a magnetic path of 100 cm, cross section of 2 cm X 2 cm and relative permeability of 1000 and an air gap of 5 mm cut in the core. The three coils carried by the core having number of turns $N_A = 300$, $N_B = 500$ and $N_C = 600$ and the respective currents flowing through the coils are 2 A, 4 A and 3 A. The directions of currents flowing in the coils are shown in the figure. Neglecting the fringing of flux, find,

   a. Total m.m.f in the circuit

   b. Total reluctance in the circuit

   c. Total flux in the circuit

   d. Flux density in the air gap. **(8 Marks)**



v. An iron toroid of 10 cm in diameter and 8 cm^2 in cross section is wound with 300 turns. An exciting current of 2 A is necessary to produce a flux density of 1.2 Wb/m^2. Calculate the energy stored in the magnetic field. **(5 Marks)**

[Total 20 marks]

Q4

i. Why does the average power absorbed by a R-L- C circuit is equal to I^2R? **(2 Marks)**

ii. What do you mean by lagging power factor? **(1 Mark)**

iii. If the supply frequency is increased, state with reasons whether the reactance of a circuit is increased or decreased when the circuit consists of,
   a. Choking coil
   b. Capacitor **(4 Marks)**

iv. Derive an equation for the resonant frequency f_c of a R-L-C series circuit, having an inductance L, capacitance C, and Resistance R **(3 Marks)**

v. Write a relationship between the peak value and the rms value of an alternating sinusoidal current or voltage. **(2 Mark)**

vi. The coil of an electromagnet takes 5 A current from 200 V DC supply but it takes only 2.5 A current from an AC supply of 200 V, 50 Hz. What is the value of capacitor to be connected in series with the coil so that it can take 5 A from the same AC source? **(8 Marks)**

[Total 20 marks]

Q5.

Two impedances are given by Z_1= (10 Ω - j5 Ω) and Z_2 = (8 Ω + j6Ω) are connected in parallel and connected across a voltage of 200 V.

i. What is the total current taken by the circuit **(4 Marks)**

Ii. What is the current taken by each branch **(4 Marks)**

Iii. Find the average power delivered to the circuit **(3 Marks)**

iv What is the power taken by each branch ? **(3 Marks)**

v. Calculate the power factor of individual circuit and of combination. **(3 Marks)**

vi Draw the vector diagram **(3 Marks)**

[Total 20 marks]

Q6.

i. Re-draw the diagram shown in figure 3 and mark the voltages and currents without changing its properties. **(2 Marks)**

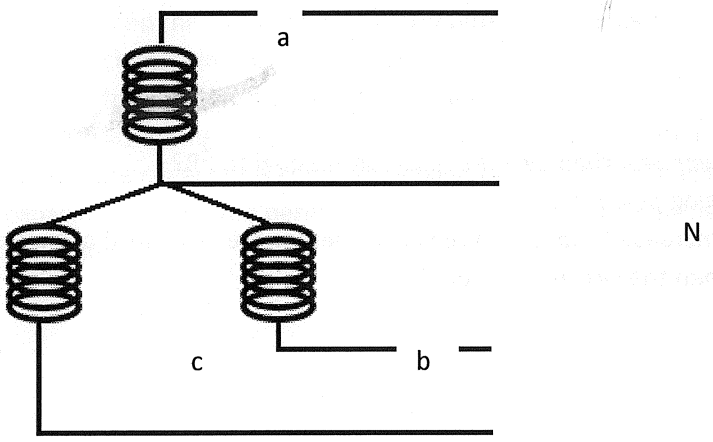


Figure 3

ii. Draw the complete phasor diagram of three phase star connection to indicate the phase
iii. voltages and line voltages. Use the double subscript notation. **(3 marks)**

iv. Why is the delta system is more suitable to transmit electrical power than a star system **(2 Marks)**

v. Non inductive non capacitive balanced delta connected to 3 phase load consumes 12 kW power. The phase current drawn by the load is 10 A. Find the line voltage and magnitude of load in a phase. **(5 Marks)**

vi. Three similar single phase circuits each consisting of a fluorescent lamp of 0.04 H of negligible resistance are connected **in star** to a 3 phase, 50 Hz AC supply 400 V between lines. Calculate the line current. If they are now connected in delta, calculate the line current and the current taken by each lamp. Prove that the power absorbed by 3 phases when connected in mesh is 3 times the power absorbed by 3 phases when connected in star through this Answer.
[Hint : Fluorescent lamp is purely resistive, each phase consist of a resistance and an inductance in series.] **(8 Marks)**

[Total 20 marks]

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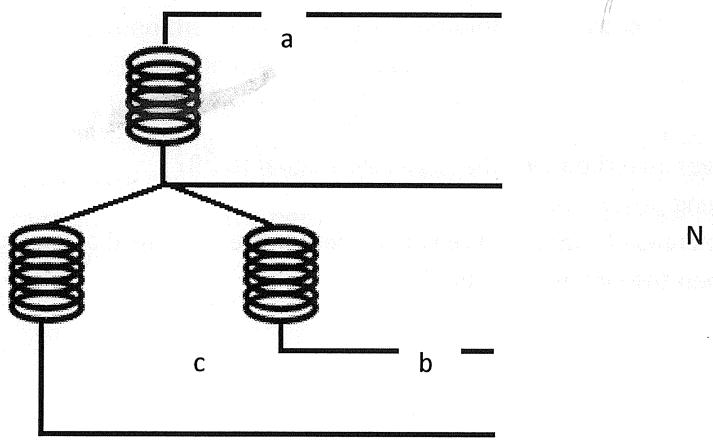

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