**53 (EE 201) BEEN**

**2014**

# BASIC ELECTRICAL ENGINEERING

**Paper : EE 201**

*Full Marks : 100*

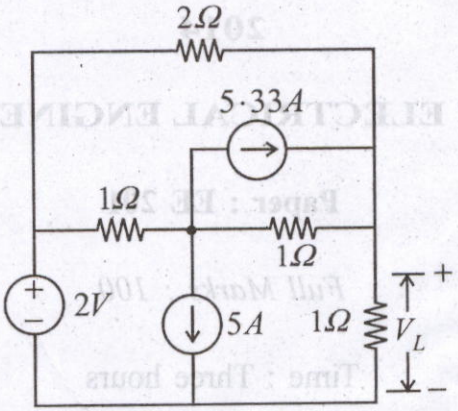
Time : Three hours

***The figures in the margin indicate full marks for the questions.***

*Answer **any five** questions.*

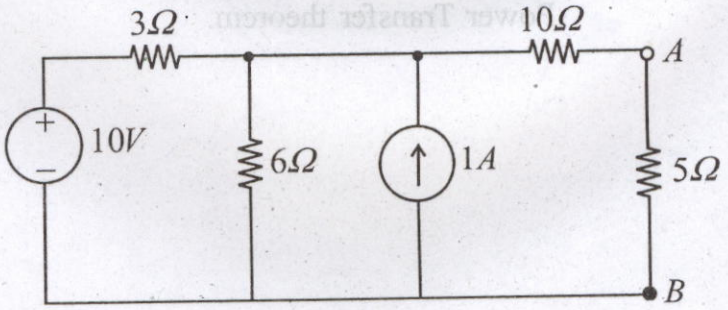
1. *(a)* State Superposition theorem and Maximum Power Transfer theorem. 5

(b) Find $V_L$ in the following circuit using superposition theorem 9

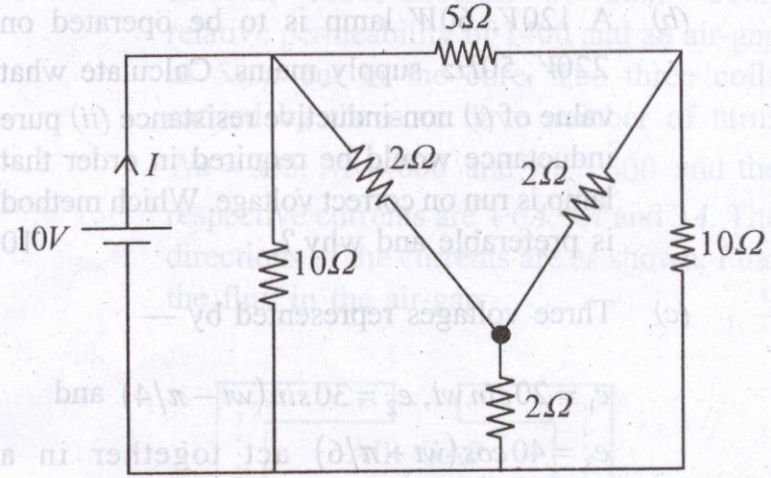



(c) What do you mean by active and passive circuits and linear and non-linear elements ? 6

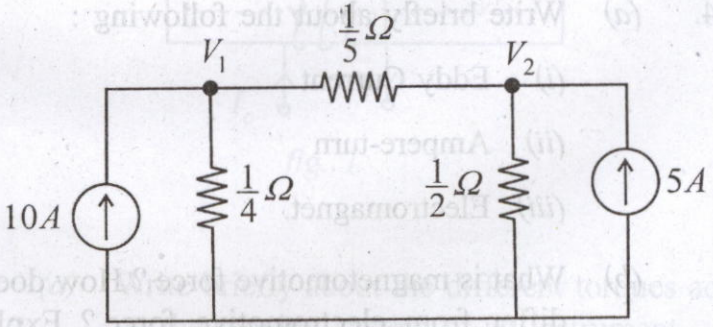
2. (a) Find the current in 5Ω resistor using Norton's theorem 6



(b) Calculate Current $I$ in the following circuit 8




(c) Find $V_1$ and $V_2$ using nodal analysis. 6



3. *(a)* Define Power factor. What do you mean by lagging and leading power factor ? 1+2=3

*(b)* A $120V$, $60W$ lamp is to be operated on $220V$, $50Hz$ supply mains. Calculate what value of *(i)* non-inductive resistance *(ii)* pure inductance would be required in order that lamp is run on correct voltage. Which method is preferable and why ? 10

*(c)* Three voltages represented by —

$e_1 = 20 \sin wt$, $e_2 = 30 \sin(wt - \pi/4)$ and $e_3 = 40 \cos(wt + \pi/6)$ act together in a circuit. Find an expression for the resultant voltage. Represent them by appropriate vectors. 7

4. *(a)* Write briefly about the following : 6

*(i)* Eddy Current

*(ii)* Ampere-turn

*(iii)* Electromagnet.

*(b)* What is magnetomotive force ? How does it differ from electromotive force ? Explain with examples, if necessary. 5

(c) A rectangular iron core is shown in *fig. 1*. It has a mean length of magnetic path of $100cm$, cross-section of $2cm \times 2cm$, relative permeability of 1400 and an air-gap of $5mm$ cut in the core. The three coils carried by the core have number of turns $Na = 335$, $Nb = 600$ and $Nc = 600$ and the respective currents are $1{\cdot}6A$, $4A$ and $3A$. The directions of the currents are as shown. Find the flux in the air-gap 9

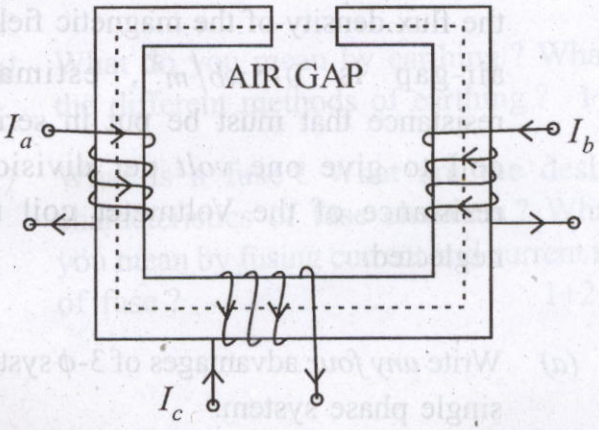



*fig. 1*

5. (a) Write briefly about the different torques act on the moving system of an instrument. 9

(b) A moving-coil instrument has a resistance of $10\Omega$ and gives full-scale deflection when carrying a current of $50mA$. Show how it can be adopted to measure voltage upto $750V$ and currents upto $1000A$. 5

(c) The coil of a moving coil permanent magnet Voltmeter is $40mm$ long and $30mm$ wide and has 100 turns on it. The control spring exerts a torque of $120\times10^{-6}\ N\text{-}m$ when the deflection is 100 divisions on full-scale. If the flux density of the magnetic field in the air-gap is $0{\cdot}5\,wb/m^2$, estimate the resistance that must be put in series with coil to give one *volt* per division. The resistance of the Voltmeter coil may be neglected. 6

6. (a) Write *any four* advantages of 3-$\phi$ system over single phase system. 4

(b) Derive a relation between line current and phase current in a balance delta connected system. 6

(c) A balanced star-connected load of $(8+j6)\Omega$ per phase is connected to a balanced 3-$\phi$, $400V$ supply. Find the line current, power factor, power and total *volt-amperes.* 10

7. (a) What are the different types of internal wiring usually employed in industries and house ? With the help of a neat diagram show, how a single phase energy meter, main switch and a distribution box (with 4 sub-circuits) are connected in a domestic wiring system. 4+7=11

(b) What do you mean by earthing ? What are the different methods of earthing ? 1+3=4

(c) What is a fuse ? What are the desirable characteristics of fuse elements ? What do you mean by fusing current and current rating of fuse ? 1+2+2=5