December 2023

B.Tech. 1st SEMESTER

Basic Electrical Technology (ESC-101-A)

Time : 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Assume data if missing.*

PART–A

1. (a) Differentiate independent and dependent sources. CO1 (1.5)

(b) What are the limitations of Ohm's law? CO1 (1.5)

(c) Define unilateral and bilateral circuits. CO1 (1.5)

(d) Define resonance in series RLC circuit. CO2 (1.5)

(e) Add $V_1 = (-10 + j\ 50)$ volts to $V_2 = (30 + j\ 20)$ volts and express the result in polar form. CO2 (1.5)

(f) What are the advantages of a three-phase AC system over single-phase? CO2 (1.5)

(g) What are the applications of auto-transformers? CO2 (1.5)

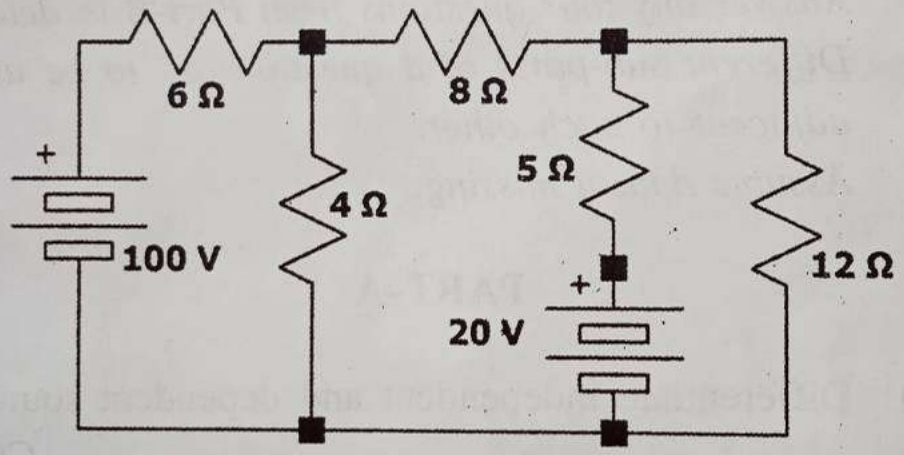
(h) Why brushes are made of carbon in a DC machine? CO3 (1.5)

(i) What is the function of a fuse in electrical installation? CO4 (1.5)

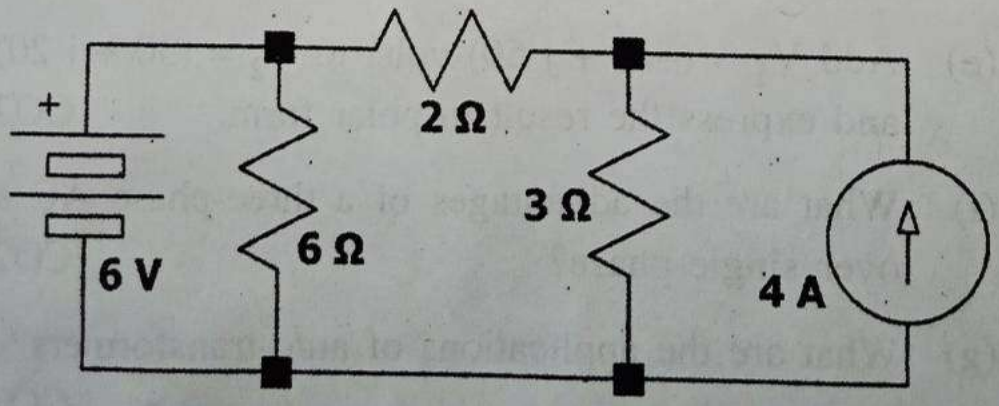
(j) Why earthing is necessary for electrical installations? CO3 (1.5)

PART–B

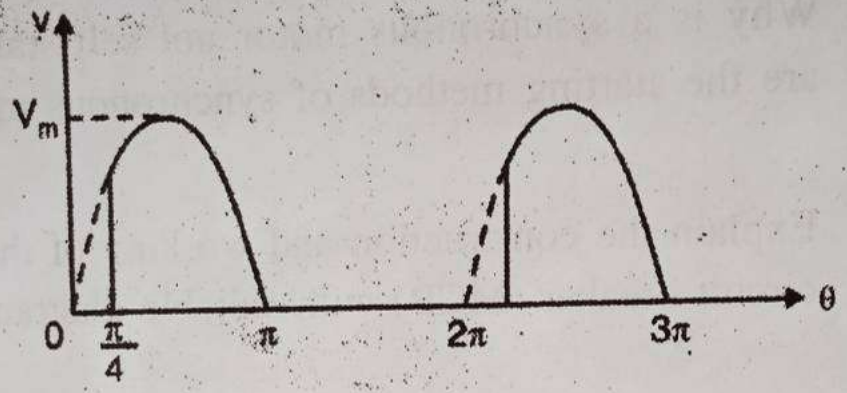
2. (a) Using node analysis determine the current in each resistor for the given circuit. CO1 (7.5)



(b) In the circuit shown in the figure, find the current in 2Ω resistor using the principle of superposition. CO1 (7.5)



3. (a) Find the average and effective values of the sinusoidal waveform shown in Figure. The maximum value is 100 V. CO2 (7.5)



(b) A 230V, 50 Hz a.c. supply is applied to a coil of 0.06 H inductance and 6-ohm resistance connected in series with a 6.8 μF capacitor. Calculate (i) impedance (ii) current (iii) phase angle between current and voltage (iv) power factor and (v) power consumed. CO2 (7.5)

4. (a) Derive the relationship between line and phase voltage and line and phase current for a star-connected three-phase system with suitable connection and phasor diagrams. CO2 (7.5)

(b) The power input to a 400 V, 3-phase, 50 Hz induction motor is measured by the two-wattmeter method. The readings of the two wattmeters are 40 kW and -10 kW. Calculate (i) the input power (ii) the power factor and (iii) line current. CO2 (7.5)

5. (a) Define the term magnetic circuit. What are the similarities and dissimilarities between magnetic and electric circuits? CO3 (7.5)

(b) Explain the working principle of a transformer. What are the properties of an ideal transformer? Draw and explain the phasor diagram of the single-phase transformer at no load condition. CO3 (7.5)

6. (a) Why is a synchronous motor not self-starting? What are the starting methods of synchronous motor? CO3 (7.5)

(b) Explain the construction and working of the miniature circuit breaker (MCB) with suitable diagram. CO4 (7.5)

7. (a) Define the term power factor. What are the effects of the low power factor? What are the methods of power factor improvement? CO4 (7.5)

(b) Define the maximum power transfer theorem. Derive the condition for maximum power transfer. CO1 (7.5)