Total No. of Questions : 5]

SEAT No. :

PD-4038

[Total No. of Pages : 3

[6401]-2405

F.E.

ESC-102-ELE : BASIC ELECTRICAL ENGINEERING

(2024 Pattern) (Semester - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Attempt any one from each sub question.***
3) ***Figures to the right indicate full marks.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Assume suitable additional data, if necessary.***
6) ***Use of non-programmable calculator is allowed.***

Q1) a) Attempt any One : **[6]**

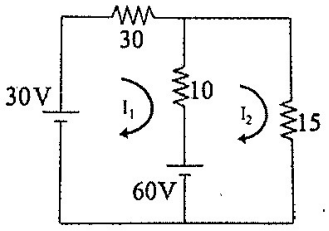
i) Derive the expressions for conversion of a delta connected resistive network into an equivalent star connected resistive network.

ii) Define the following terms related with DC network

1) Active Network
2) Passive network
3) Linear Network
4) Non-Linear network
5) Unilateral Network
6) Bilateral network

b) Attempt any One : **[8]**

i) State Kirchhoff's laws and find current flowing through l5Ω using loop current analysis method



ii) State Superposition theorem and find current flowing through 15Ω resistance in above network, using Superposition theorem.

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Q2) a) Attempt any One : **[6]**

i) Compare Magnetic and Electric Circuit clearly mentioning similarities and dissimilarities.

ii) Derive the expression for dynamically induced emf with suitable diagram.

b) Attempt any One : **[8]**

i) Define MMF and Reluctance, An iron ring with mean circumference of 80 cm, cross sectional area of 15 cm^2 and relative permeability of 2000 wound with 160 turns coil. If the coil carries a current of 2.5 amp, then calculate MMF, magnetic field strength, reluctance, flux and flux density.

ii) State Flemings right hand rule. Two coils with 1250 and 1600 turns are placed side by side such that 60 % of the flux produced by first coil links with second coil. A magnetic flux of 60 μWb and 80 μWb is produced by each coil, when a current of 5A flows through them separately. Calculate self-inductance of each coil, mutual inductance and 'coefficient of coupling.

Q3) a) Attempt any One : **[6]**

i) Define average value and derive the expression for average value of sinusoidal current in terms of its maximum value.

ii) Obtain the expression for instantaneous power in case of purely inductive circuit and by using this expression, prove that this circuit never consumes power.

b) Attempt any One : **[8]**

i) Define RMS value. A sinusoidal voltage with frequency of 50 Hz has RMS value of 200 V. Write the expression for its instantaneous value and find its instantaneous value at t = 1.78 mSec and time required to reach 100 V for first time from t = 0.

ii) Define inductive and capacitive reactance. A voltage of 230 volt is applied across inductance of 350mH and capacitance of 25μF independently. Calculate RMS and maximum value of current flowing through each element.

Q4) a) Attempt any One : **[6]**

i) Derive the expression for average power in case of R-C series circuit. Draw voltage, current and power waveforms.

ii) Derive the relation between line current and phase current for three phase delta connected balanced R-L load.

b) Attempt any One : **[8]**

i) Draw impedance triangle for R-L and R-C series circuit. Resistance of 15Ω, inductance of 200mH and capacitance of 150 μF are connected in series across 230V, 50 Hz single phase supply. Calculate impedance, current, power factor and power consumed.

ii) Define phase sequence and balanced load. Three phase star connected balanced load with impedance of 9+j12 Ω per phase is connected across 440V, 50 Hz three phase supply. Calculate phase voltage, phase current, line current, active power and reactive power.

Q5) a) Attempt any One : **[6]**

i) Draw torque-armature current, speed-armature current characteristics for DC Shunt and series motor. Give two applications of each motor.

ii) Explain the working principle of three phase Induction motor with suitable diagram. State two applications of squirrel cage and slip ring induction motor.

b) Attempt any One : **[8]**

i) Define kVA rating of transformer. A 25 kVA, 50 Hz single phase transformer has 500 turns on primary side and 50 turns on secondary side. A voltage of 3000 volt is applied across primary winding. Calculate primary and secondary full load currents and cross-sectional area of core, if maximum flux density is 1.8 tesla.

ii) State, how eddy current and hysteresis loss can be minimized in case of single- phase transformer. 150kVA, 11000V/230V, 50 Hz single phase transformer has iron losses of 1400 watt and full load copper losses of 1600 watt. Calculate the efficiency of transformer for full load at 0.707 power factor and for half of full load at 0.8 power factor.

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