

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:

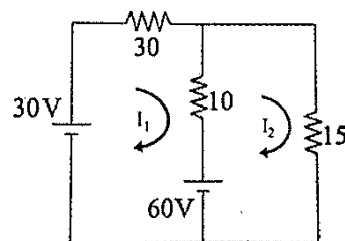
- 1) All questions are compulsory.
- 2) Attempt any one from each sub question.
- 3) Figures to the right indicate full marks.
- 4) Neat diagrams must be drawn wherever necessary.
- 5) Assume suitable additional data, if necessary.
- 6) Use of non-programmable calculator is allowed.

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 15Ω using loop current analysis method



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

P.T.O.

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 $60 \mu\text{Wb}$ and $80 \mu\text{Wb}$ 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 $t = 1.78 \text{ mSec}$ 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 $25\mu\text{F}$ 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 $150\ \mu\text{F}$ 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 $9+j12\ \Omega$ 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 , $11000\text{V}/230\text{V}$, 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.

