

Total No. of Questions : 8]

SEAT No. :

P9070

[Total No. of Pages : 3

[6178]-5

F.E. (All Branches)

BASIC ELECTRICAL ENGINEERING

(2019 Pattern) (Credit System) (Semester - I/II) (103004)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Use of non-programmable electronic pocket calculator is permitted.

- Q1)** a) Derive the expression for resonant frequency in an RLC series circuit. [4]
b) A sinusoidal AC voltage given by $v = V_m \sin \omega t$ is applied across a pure inductor. Obtain the following for this circuit: [6]
i) Expression for the instantaneous current
ii) Phasor diagram. waveforms of instantaneous voltage and current
iii) Expression for the instantaneous power
c) A coil of resistance 24Ω has a reactance of 32Ω when connected across a single phase voltage given by $v = 566 \sin 314t$. Find: [8]
i) Frequency
ii) Rms value of current
iii) Power factor
iv) Equation of the resultant current

OR

- Q2)** a) State the power factor in case of following circuits: [4]
i) A purely resistive circuit
ii) A purely inductive circuit
iii) A purely capacitive circuit
iv) An RLC series circuit under resonance
b) Obtain the expression for power in an R-C series circuit when supplied with $v = V_m \sin \omega t$. [6]
c) A series R-L-C circuit consists of $R = 10 \Omega$, $L = 0.318 \text{ H}$ and $C = 63.6 \mu\text{F}$. This circuit is supplied by source of emf given by $e(t) = 100 \sin 314t$. Find: [8]
i) Expression for $i(t)$
ii) Phase angle between voltage and current
iii) Power factor of circuit
iv) Active power consumed

P.T.O.

- Q3) a)** Define the following in the context of three phase AC systems: [3]
- Symmetrical AC supply
 - Phase Sequence
 - Balanced Load
- b) Derive the emf equation of a single phase transformer. Hence obtain the transformation ratio. [6]
- c) Three impedances each of $(3 - j4) \Omega$ are connected in delta across a 3-phase, 230 V supply. Calculate: [8]
- Phase and line currents
 - Power factor of the load
 - Power delivered to the load

OR

- Q4) a)** Compare an autotransformer with a conventional two-winding transformer by mentioning any three differences. [3]
- b) Prove that the three phase delta connected balanced load consumes thrice the power consumed by that of the star connected load. [6]
- c) The primary winding of a single phase transformer is connected to a 230 V, 50 Hz supply. The secondary winding has 1500 turns. If the maximum value of the core flux is 0.00215 Wb, determine [8]
- secondary induced emf
 - number of turns in the primary
 - cross sectional area of the core if the maximum value of flux density is 0.1 T
 - whether it is a step up or a step down transformer?

- Q5) a)** State and briefly explain Kirchhoff's Laws for DC circuits. [4]
- b) Obtain the relations for converting delta connected resistances into equivalent star connection. [6]
- c) Find the current through 1Ω resistance of the circuit shown in Fig. 1 below using Thevenin's Theorem. [8]

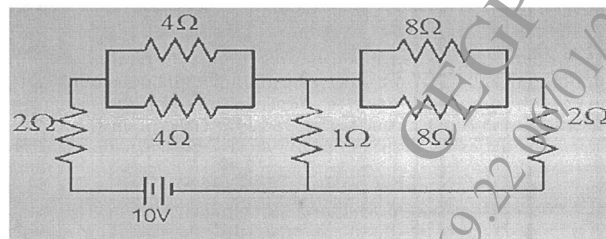


Fig.1

OR

- Q6) a)** Define the following terms: [4]
- Active Network and Passive Network
 - Lumped Network and Distributed Network
- b) Find the current through branch AB of the circuit shown in Fig.2 below by applying Kirchoff's Laws. [6]

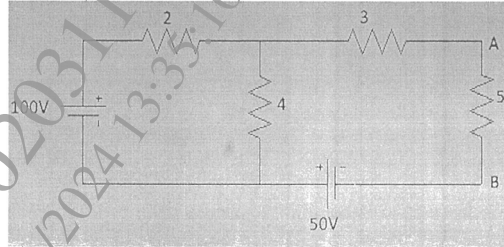


Fig.2

- c) State Superposition Theorem. Find the current through branch AB of the circuit shown in Fig.2 above by applying Superposition Theorem. [8]
- Q7) a)** Define the temperature coefficient of resistance of a material and state its unit. [3]
- b) Explain the construction and working of a Lead Acid Battery with the help of suitable diagram and chemical equations. [6]
- c) An electric kettle is required to heat 5 liters of water from 15°C to 96°C in 30 minutes. Find the input power of the kettle assuming the efficiency of 80 %. If the kettle operates on 230 V mains, find the resistance of the heating element. Assume the specific heat capacity of water to be $4200.\text{J/kg. K}$ and 1 liter of water as equivalent to a mass of 1kg. [8]

OR

- Q8) a)** Write your choice of either a lead acid battery or a lithium ion battery for the following applications: [3]
- Mobile phone
 - Electric bike
 - Conventional petroleum vehicle
- b) An electric motor runs at 500 rpm while producing torque of 20 Nm. The motor operates at efficiency of 85%. Find motor input power and current drawn when the motor is fed from 230V DC supply. [6]
- c) Define insulation resistance and derive the expression for insulation resistance of a single core cable. [8]

