Total No. of Questions : 8]

P9070

SEAT No. :

[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) Attempt0.1 or 0.2, 0.3 or 0.4, 0.5 or 0.6, 0.7 or 0.8
 - 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 $v = Vm \sin \omega t$ 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 24 Ω has a reactance of 32 Ω 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:
 - i) A purely resistive circuit
 - i) 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 $v = Vm \operatorname{sinwt}$. [6]
 - c) A series R-L-C circuit consists of $R = 10 \Omega$, L = 0.318 H and $C = 63.6 \mu$ 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

Q3) a) Define the following in the context of three phase AC systems: [3]

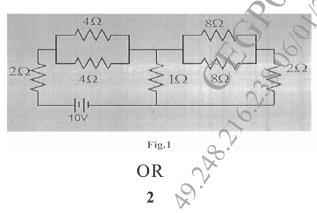
- i) Symmetrical AC supply
- ii) Phase Sequence
- iii) Balanced Load
- b) Derive the emf equation of a single phase transformer. Hence obtain the transformation ratio. [6]
- c) Three impedances each of (3- j4) Ω are connected in delta across a 3-phase. 230 V supply. Calculate: [8]
 - i) Phase and line currents
 - ii) Power factor of the load

iii) 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]
 - i) secondary induced ent
 - ii) number of turns in the primary
 - iii) cross sectional area of the core if the maximum value of flux density is 0.1 T
 - iv) 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]

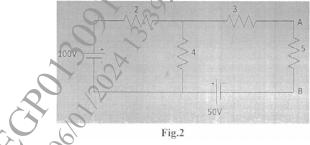
c) Find the current through 1Ω resistance of the circuit shown in Fig. 1 below using Thevenin's Theorem. [8]



[6178]-5

Q6) a) Define the following terms:

- i) Active Network and Passive Network
- ii) Lumped Network and Distributed Network
- b) Find the current through branch AB of the circuit shown in Fig.2 below by applying Kirchhoff's Laws. [6]



- 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.J/kg. K and 1 liter of water as equivalent to a mass of 1kg. [8]

<u></u>∽OR

Q8) a) Write your choice of either a lead acid battery or a lithium ion battery for the following applications:

i) Mobile phone

- ii) Electric bike
- iii) 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]

3 . 24.16.2

[6178]-5

[4]