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) ***AttemptQ.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7or 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 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: **[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 $v = V_m \sin wt$. **[6]**

c) A series R-L-C circuit consists of R = 10 Ω, L = 0.318 H and C = 63.6 μF. 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

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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 emf

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]**

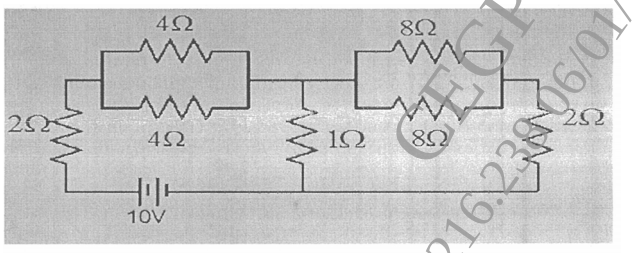

Fig.1

OR

Q6) a) Define the following terms: **[4]**

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]**

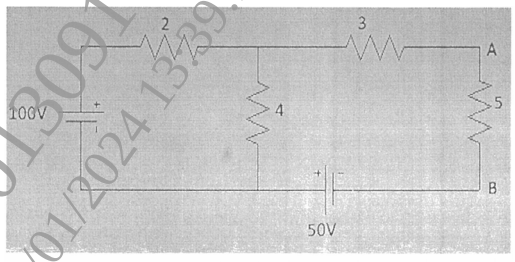

Fig.2

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.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]**

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]**

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