Total No. of printed pages = 4

EE 181107

Roll No. of candidate | | | | | | | | | | |

23/37

2022

B.Tech. 1st Semester End-Term Examination

BASIC ELECTRICAL ENGINEERING

(New Regulations (w.e.f 2017–18) & New syllabus (Group – A) (w.e.f 2018 – 19))

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Choose the correct answers from the following : (10 × 1 = 10)

(i) The resistivity of a wire depends on

(a) length (b) cross sectional area

(c) material (d) all of the above

(ii) Two resistances of equal value, when connected in series give an equivalent resistance of R. If these resistors are connected in parallel, the equivalent resistance will be

(a) R ohm (b) 2R ohm

(c) R/4 ohm (d) R/2 ohm

(iii) The internal resistances of a current and voltage source are

(a) infinity and zero respectively

(b) zero and infinity respectively

(c) both zero

(d) both infinity.

(iv) The open circuit voltage and short circuit current of a two port network are 100 V and 10 A respectively. What would be the load resistance across which the maximum power will be dissipated?

(a) 5 ohm (b) 10 ohm

(c) 100 ohm (d) 1 ohm.

[Turn over

(v) When a sinusoidal voltage is applied across R-L-C series circuit having $X_C > X_L$, the current in the circuit will

(a) lead the voltage

(b) in phase with the voltage

(c) lagging behind the voltage

(d) lead the voltage by 90 degree

(vi) A sinusoidal voltage of $v(t) = 200 \sin(314t - 45^\circ)$ is applied to a pure resistive circuit of 100 ohm. The current in the circuit will be

(a) $i(t) = 2 \cos(314t - 45^\circ)$

(b) $i(t) = 2\sqrt{2} \sin(314t - 45^\circ)$

(c) $i(t) = 2 \sin(314t - 45^\circ)$

(d) None of the above

(vii) In a three-phase circuit neutral to phase voltage is V_{ph}. The line to line voltage of the circuit is

(a) $V_L = V_{ph}$

(b) $V_L = 3V_{ph}$

(c) $V_L = \sqrt{3}\, V_{ph}$

(d) $V_L = \sqrt{2}\, V_{ph}$

(viii) A moving coil galvanometer can be converted into a DC ammeter by connecting

(a) a high resistance in series with the meter

(b) a low resistance in series with the meter

(c) a low resistance across the meter

(d) a high resistance across the meter

(ix) In a transformer, laminated core is used to

(a) reduce the eddy current loss

(b) reduce the hysteresis loss

(c) both (a) and (b)

(d) none of the above.

(x) The back emf in a DC motor

(a) opposes the applied voltage

(b) aids the applied voltage

(c) aids the armature current

(d) none of the above

2. (a) State and explain Thevenin's theorem. (4)

(b) Determine the current flowing through 8 ohm resistance in the circuit shown in Fig. 1 using (i) superposition theorem and (ii) Thevenin's theorem. (5+6 = 11)

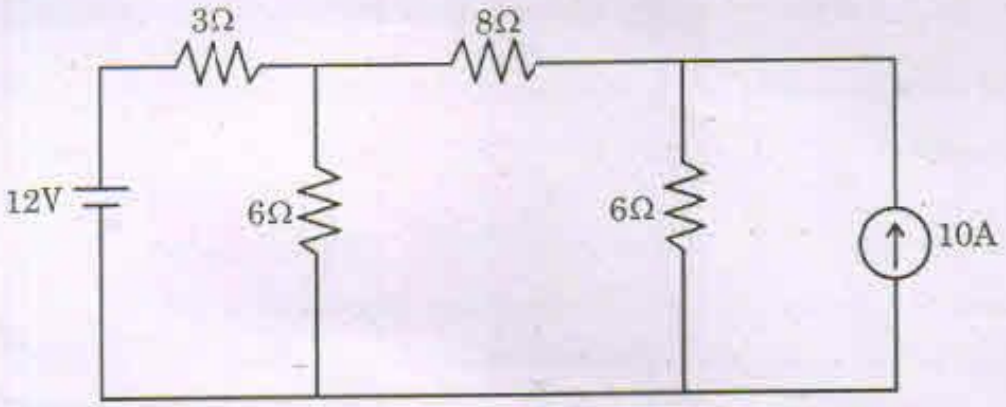

Fig 1.

3. (a) Find the amplitude, phase, period and frequency of the sinusoid: $v(t) = 12\cos(50t - 10^{\circ})$ (4)

(b) Calculate the phase angle between the following sinusoids. State which sinusoid is leading? $v(t) = -10\cos(wt + 50^{\circ})$ and $g(t) = 12\sin(wt - 10^{\circ})$ (4)

(c) A series R-L-C circuit is composed of 10 ohm resistance, one 0.1 H inductance and one 50 microfarad capacitance. A voltage $v(t) = 141.4\cos(100\pi t)$v is impressed upon the circuit.

(i) Calculate the current in the circuit and express it in phasor form

(ii) Find the expression of instantaneous current

(iii) Calculate voltage drop across resistor, inductor awnd capacitor and express it in phasor form and

(iv) Draw the phasor diagram showing the voltage relations. (7)

4. (a) Two impedances Z_1= 10+j15 ohm and Z_2 = 6-j8 ohm are in parallel in an electrical circuit. If the total current supplied to the circuit is 15<0 A, determine each branch current and their phase angle with respect to the total current. (5)

(b) Derive power equation of a single phase AC circuit. Calculate active, reactive and apparent power of a circuit when an electrical load of power factor 0.8 draws a current of 5 A from a 230 V, 50 Hz supply. (6)

(c) A balanced delta-connected load of impedance 40+j30 ohm/phase is connected to a three-phase 400 V supply. Calculate the phase current, line current and total power drawn from the source (4)

5. (a) Explain the working principle of a single-phase transformer. What is meant by an ideal transformer? A 2000/200 V, 20 kVA transformer has 66 turns in the secondary. Calculate (i) primary turns (ii) primary and secondary full load currents. Neglect the losses. (10)

(b) What is iron loss in a transformer? How this loss has occurred? (3)

(c) Define efficiency of a transformer. State the condition of maximum efficiency. (2)

6. (a) Explain how torque is produced in a DC motor. (4)

(b) What is synchronous speed of a three phase induction motor? A 500 hp, 3-phase, 440 V, 50 Hz induction motor has a speed of 950 rpm on full load. The machine has 6 poles. Calculate the full load slip. (4)

(c) Explain with neat sketches the construction and working principle of a moving iron instrument? How it is different from moving coil instrument?(7)

7. (a) A PMMC type instrument gives full scale deflection at 60 mV when current is 20 mA. Calculate the value of shunt resistance required to convert the instrument into an ammeter of 0—20A range. (4)

(b) What is a fuse? State the functions of fuse in an electrical circuit. (2)

(c) Why earthing is needed in electrical installation? (2)

(d) Why PVC cables are most widely used in internal wiring? (2)

(e) Draw wiring diagram of a circuit consists of one lamp and one socket outlet which are controlled by individual switches. (5)
