Total No. of printed pages = 8

EE 181107

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

2019

B.Tech. 2nd Semester End-Term Examination

BASIC ELECTRICAL ENGINEERING

(New Regulation) (w.e.f. 2017-2018) and
New Syllabus (Group-B) (w.e.f. 2018-2019)

Full Marks – 70 Time – Three hours

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

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

$(10 \times 1 = 10)$

1. (i) The internal resistance of a battery which has an open circuit voltage of 12.0V and delivers 100A to a resistance of 0.10 Ω is

(a) 0.10 Ω

(b) 0.12 Ω

(c) 0.02 Ω

(d) None of the above

[Turn over

(ii) If the internal resistance of a voltage source is infinity then the internal resistance of the equivalent current source is

(a) zero

(b) infinity

(c) either (a) or (b)

(d) neither (a) nor (b)

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

(a) 50 Ω

(b) 10 Ω

(c) 100 Ω

(d) 1.0 Ω

(iv) A voltage since wave passes through zero at $t = 0$ and each 10 ms thereafter. At $t = 15\ ms$, the voltage is $(-10\sqrt{2})V$. The sinusoidal voltage waveform is

(a) $-10\sqrt{2}\sin 314t$

(b) $10 \sin 314\ t$

(c) $10\sqrt{2}\ \sin 314\ t$

(d) $10\sqrt{2}\ \sin\ 628\ t$

(v) A circuit element has a current $i = 2.5 \cos (2500t - 30°)$ when the applied voltage is $v = 5 \sin (2500t - 30°)$. The circuit element is a

(a) capacitor

(b) inductor

(c) resistor

(d) either resistor or inductor or capacitor

(vi) The admittance of a circuit is $\overline{Y} = 0.05 - j\ 0.087\ (s)$. The value of resistance of the circuit is

(a) 20 Ω

(b) 8.66 Ω

(c) 0.05 Ω

(d) 5 Ω

(vii) In a voltage signal, an AC voltmeter measures

(a) Peak value

(b) RMS value

(c) Average value

(d) All of the above

(viii) The pointer of an indicating instrument returns to its zero position on removing the source producing the deflecting torque. This happens due to

(a) controlling torque

(b) damping torque

(c) balancing torque

(d) mass of the pointer

(ix) When a DC machine is connected to the DC supply main it will produce

(a) emf in opposition to applied voltage

(b) unidirectional torque

(c) copper losses in the windings

(d) all of the above

(x) For an ideal transformer the winding should have

(a) maximum resistance on primary side and least on secondary side

(b) maximum resistance on secondary side and least on primary side

(c) equal resistance on both sides

(d) no ohmic resistance on either side

2. (a) Differentiate between

(i) active and passive circuit elements

(ii) linear and non-linear circuit elements. (2)

(b) Determine the current I_x in the $10\,\Omega$ resistor in Fig. 1 using superposition theorem. (4)

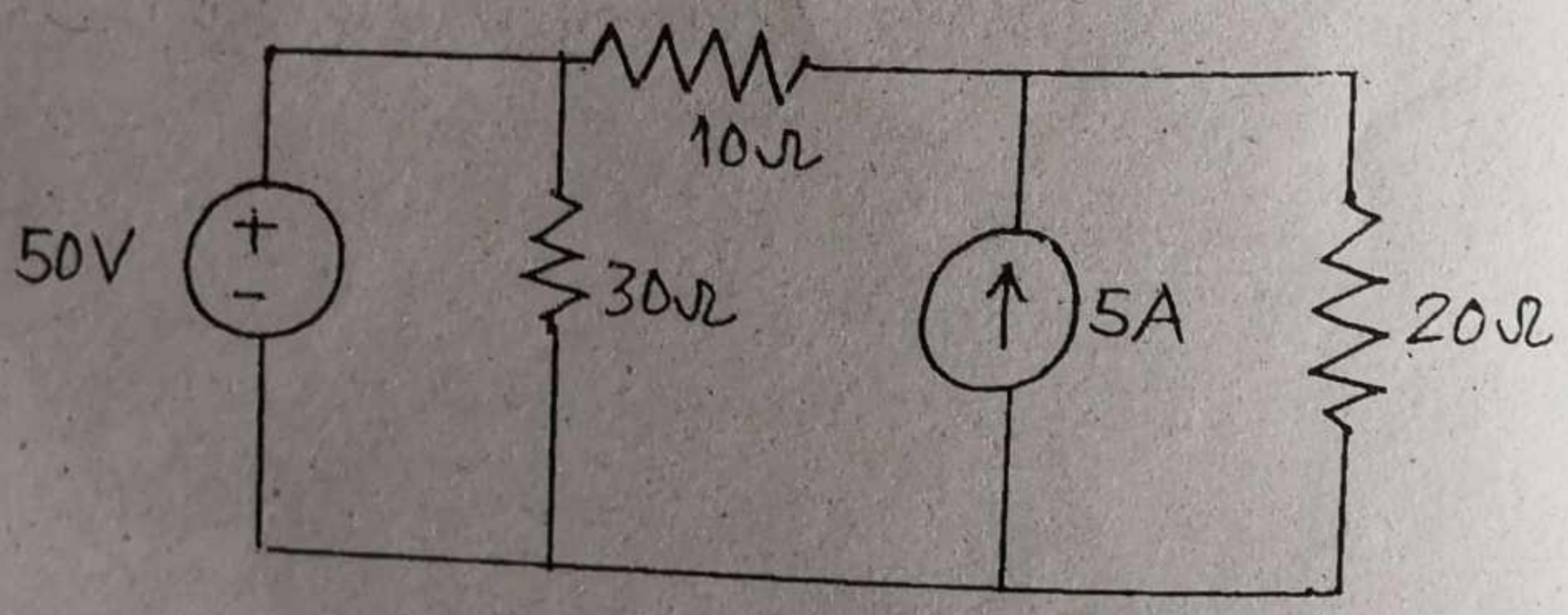

Fig. 1

(c) Determine the open circuit voltage across terminals A and B using node-voltage method in Fig. 2. Draw Thevenin's and Norton's equivalent circuits at terminals A and B. (4)

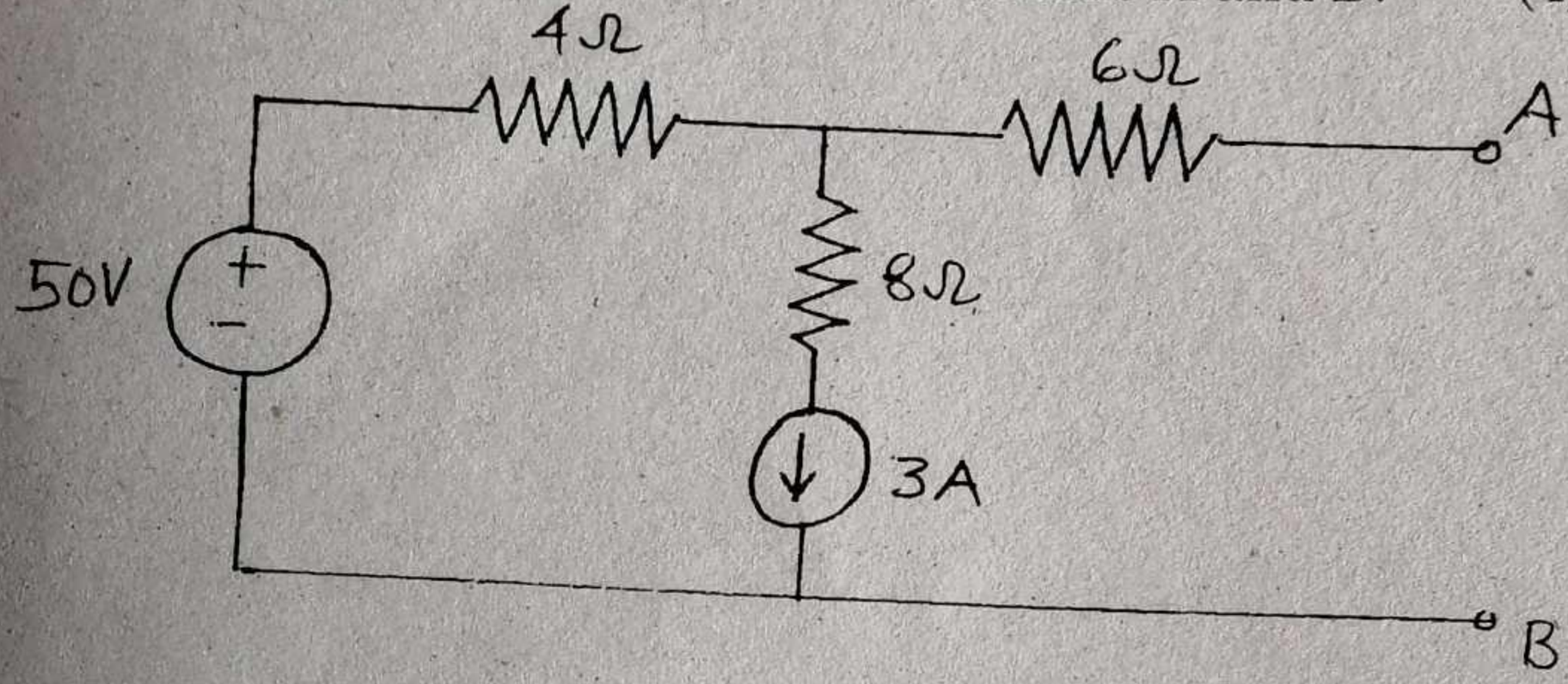

Fig. 2

(d) State and explain maximum power transfer theorem. (5)

3. (a) A period waveform is expressed as $v\,(t) = 14.14 \sin 31.4\,t$. Calculate (i) time period (in ms) (ii) frequency (mHz) (iii) angular frequency (in rad/s) (iv) peak value (v) average value (vi) RMS value. (3)

(b) A series RL circuit with $R = 5\Omega$ and $L = 2\,mH$ has an applied voltage, $v\,(t) = 150 \sin 5000\,t\ (v)$. Express the impedance $\bar{z}$ and current $\bar{I}$ in phasor notation. (4)

(c) Show that the power absorbed by a pure capacitive circuit is zero. (4)

(d) A series RC circuit with $R = 27.5\ \Omega$ and $C = 66.7\ \mu F$, has sinusoidal voltage and current, with angular frequency 1500 rad/s. Find the phase angle by which the current leads the voltage. (4)

4. (a) A voltage $v(t) = 150 \sin 1000t$ is applied across a series RLC circuit where $R = 40\,\Omega$, $L = 0.13\,H$ and $C = 10\,\mu F$.

(i) Compute the rms value of the steady state current

(ii) Compute power factor and active power of the circuit

(iii) Draw the complete phasor diagram showing all voltage components. (5)

(b) Determine $\bar{Z}_2$ in the parallel circuit of Fig. 3 if $\bar{V} = 50 < 30°\ V$ and $\bar{I} = 27.9 < 57.8°\ A$. (5)

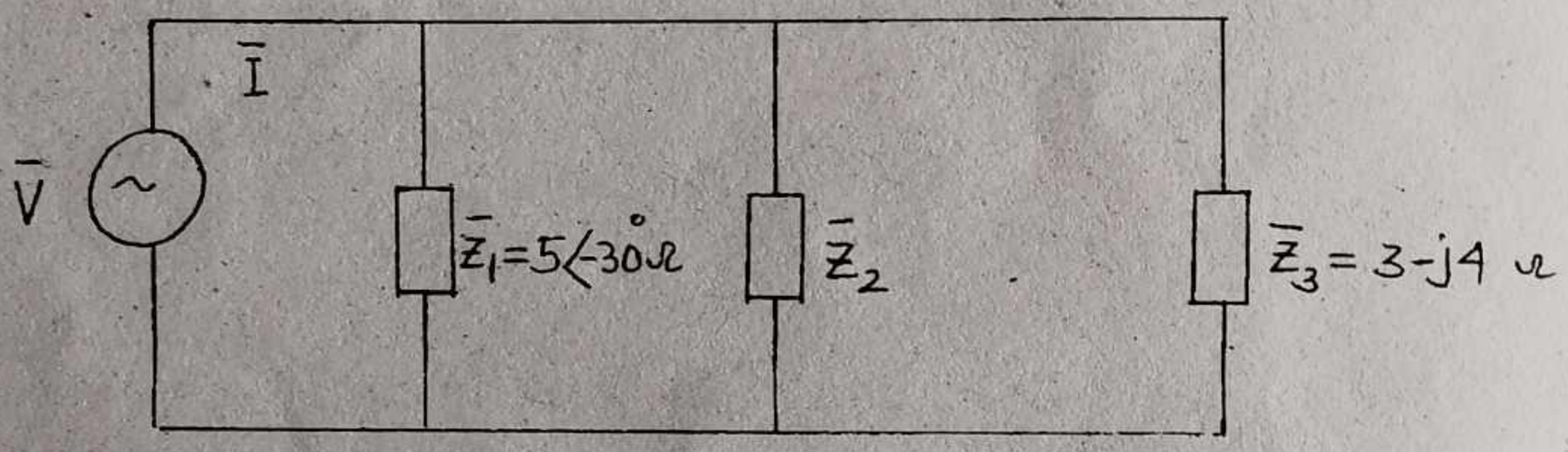

Fig. 3

(c) A 208V, three phase voltage supplies a total of 1800W at a line current of 10A when three identical impedances are arranged in star connection across the line terminals of the voltage source. Compute the resistive and reactive components of each phase impedance. (5)

5. (a) State the principle of operation of a transformer. (2)

(b) An ideal 25 KVA transformer has 500 turns on the primary winding and 40 turns on the secondary winding. The primary is connected to 3000V, 50Hz supply. Calculate (i) primary and secondary currents on full load (ii) secondary emf and (iii) the maximum core flux. (4)

(c) Give the classification of DC motors with the help of neat circuit diagram. (5)

(d) Explain the following characteristics of a DC shunt motor

(i) Torque-armature current characteristics.

(ii) Speed -armature current characteristics.

(4)

6. (a) What do you mean by synchronous speed of a three-phase induction motor? (2)

(b) Explain the principle of operation of a single phase induction motor. (3)

(c) How do you classify measuring instruments? Explain briefly. (3)

(d) Describe with neat sketches the construction and working principle of a moving-iron instrument. (7)

7. (a) Explain the importance of damping in an indicating instrument. How do you classify instruments on the basis of damping? (2)

(b) A PMMC instrument gives full scale deflection of 5mA when voltage across it is 100mV. Find the value of

(i) shunt resistance for full scale deflection corresponding to 10A.

(ii) series resistance for full scale deflection with 100V. (5)

(c) Answer the following questions:

(i) Name the various types of cables used in internal wiring.

(ii) State the function of fuse in electrical circuit.

(iii) State the importance of earthing in electrical installation (3)

(d) Draw wiring diagram of a circuit consists of three lamps and one socket outlet controlled by individual switches. (5)
