Total No. of printed pages = 8

EE 181107

Roll No. of candidate

2019

B.Tech. 1st Semester End-Term Examination

BASIC ELECTRICAL ENGINEERING

(New Regulation and New Syllabus)

(Group A)

(w.e.f of 2017 – 2018 and 2018 – 2019)

Full Marks – 70   Time – Three hours

Answer Question No.1 and any Four from the rest.

Choose the correct answer : $(10 \times 1 = 10)$

1. (i) The condition for the validity of Ohm's law is that the
    (a) temperature should remain constant
    (b) current should be proportional to voltage
    (c) resistance must be wire wound type
    (d) all of the above

   (ii) Two wires A and B of the same material and length L and 2L have radius R and 2R respectively. The ratio of their resistance will be
    (a) 1:1
    (b) 1:2
    (c) 2:1
    (d) 4:1

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(iii) The elements which are not capable of delivering energy are known as

    (a)   unilateral elements

    (b)   non-linear elements

    (c)   active elements

    (d)   passive elements

(iv) A practical current source is represented by

    (a)   a resistance in series with an ideal current source

    (b)   a resistance in parallel with an ideal current source

    (c)   a resistance in parallel with an ideal voltage source

    (d)   none of the above

(v) When a sinusoidal voltage is applied across R-L series circuit having $R = X_L$, the phase angle will be

    (a)   90°

    (b)   45° lag

    (c)   45° lead

    (d)   0°

(vi) In an ac circuit if voltage $V = a+jb$ and current $I = c+jd$, then the active power is given by

    (a)   ac+ad

    (b)   ac+bd

    (c)   bc-ad

    (d)   bc+ad

(vii) A three-phase delta connected load consumes P watts of power from a balanced supply. If the same load is connected in star to the same supply, then the power consumption is

(a) P

(b) 3P

(c) $\sqrt{3}P$

(d) $\dfrac{P}{3}$

(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) The core of a transformer is laminated to

(a) make the transformer mechanically strong

(b) make it safe to handle

(c) reduce reluctance of the magnetic circuit

(d) reduce core losses

(x) The back emf in a dc motor

(a) oppose the applied voltage

(b) aids the applied voltage

(c) aids the armature current

(d) none of the above

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2. (a) Define the following: (2)

    (i) ideal voltage source and

    (ii) ideal current source.

(b) State and explain Kirchoff's voltage law. (2)

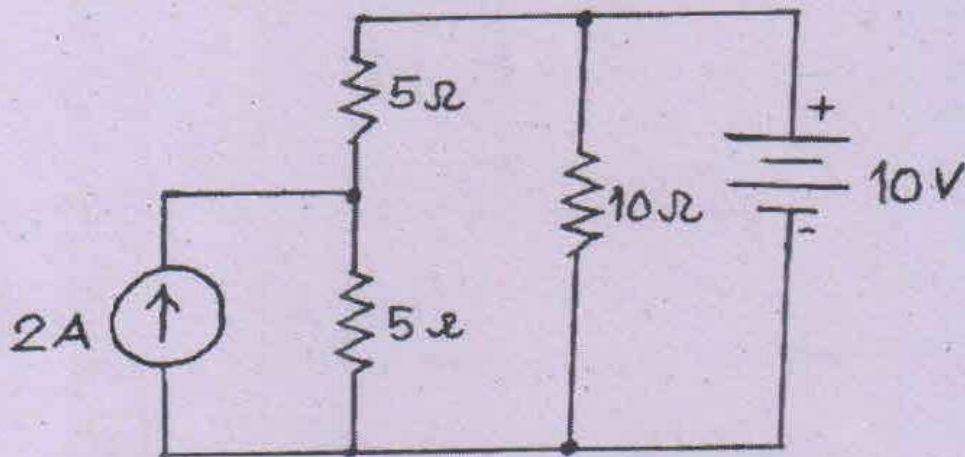(c) Determine current in 10 ohm resistor using superposition theorem in the circuit shown in fig.1 (5)

Fig. 1

(d) Apply Thevenin's theorem and maximum power transfer theorem to determine maximum power delivered to the load resistance R_L in the circuit shown in Fig.2 (6)
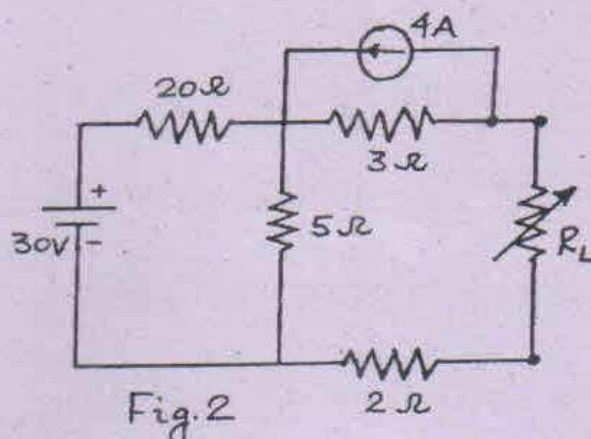

Fig. 2

3. (a) An alternating current is given by $i = 20 \sin 600t$. Determine the

   (i) frequency

   (ii) peak value and rms value of current and

   (iii) the time taken from $t = 0$ for the current to reach a value of 10 A. (4)

   (b) Three phasors are $A = 10 + j10$, $B = 50 < 120°$ and $C = 8 - j6$. Evaluate $\dfrac{AB}{C}$ and express it in rectangular and polar form. (3)

   (c) A series R-L circuit with R = 35 ohm and L = 0.1 H has an applied voltage V = 220 < 30° with 50 Hz frequency. Determine (4)

   (i) current through the circuit

   (ii) power factor

   (iii) impedance in polar form.

   (d) A coil of resistance 10 ohm and inductance 0.1 H is connected in series with a condenser of capacitance 150 microfarad across a 200 V, 50 Hz supply. Determine

   (i) voltage across the coil and

   (ii) voltage across the condenser. (4)

4. (a) An inductive circuit, in parallel with a resistive circuit of 20 ohm is connected across 50 Hz supply. The inductive current is 4.3 A and the resistive current is 2.7 A. The total current is 5.8 A. Draw the phasor diagram and from the phasor diagram determine

   (i) power factor of the inductive branch

   (ii) power factor of the combined circuit and

   (iii) resistance and inductance of the inductive circuit. (6)

   (b) Define active power, reactive power and apparent power. A single phase motor with 0.8 power factor draws a current of 5 A from a 230V, 50 Hz line. Determine

   (i) the apparent power drawn by the motor

   (ii) the active power absorbed by the motor and

   (iii) the reactive power supplied by the line. (3)

   (c) State the relationship between line and phase quantities (voltage & currents) of three phase star and delta connected system. (3)

   (d) A three-phase balanced load draws 10 kW power from a 400 V, 3-phase, 50 Hz, 4-wire supply at 0.8 lagging power factor. Determine the line current. (3)

5. (a) State the characteristics of an ideal transformer. Derive voltage transformation ratio of an ideal transformer. (6)

(b) What are the various losses occurred in a transformer? How do you classify constant losses and variable losses in a transformer? (4)

(c) Explain the electromechanical energy conversion principle of a DC motor. Draw equivalent circuit diagram of a DC motor and derive voltage equation. (5)

6. (a) State the relations between the torque and armature current of DC shunt and series motor. The armature of a DC motor takes a current of 40 A at certain load. The load is reduced to make it 20 A. What is the percentage change in torque if the motor is a

(i) DC shunt motor

(ii) DC series motor? (5)

(b) Define synchronous speed and slip of three phase induction motor. A 4-pole, 50 Hz, single phase induction motor is running with a slip of 3.4%. Calculate the speed of the motor. (5)

(c) What is the basis of classification of single phase induction motor? Name various types of single phase induction motor and its field of applications. (5)

7. (a) Describe the importance of the following torques in a measuring instrument:

   (i) Deflecting torque

   (ii) Controlling torque

   (iii) Damping torque (3)

   (b) Describe with neat sketches the construction and working principle of PMMC type instrument. (7)

   (c) A moving coil instrument has a resistance of 5 ohm and gives a full-scale deflection of 100 mV. Show how this instrument may be used to measure

   (i) voltages up to 50V

   (ii) currents up to 10A. (5)

8. (a) Name the types of internal wiring usually employed in India. (3)

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

   (c) Explain the role of distribution board in electrical installation and wiring. (2)

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

   (e) Draw wiring diagram of a circuit consists of two lamps, two fans and two socket outlets which are controlled by individual switches. (6)

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