END SEMESTER/RETEST EXAMINATION
NOVEMBER – 2019

Semester : 3rd (New)

Subject Code : EI-304

ELEMENTS OF ELECTRICAL ENGINEERING

Full Marks – 70

Time – Three hours

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

Instruction :

All questions of PART–A are compulsory.

PART – A

Marks – 25

1. Fill in the blanks :   1×10=10

   (a) A _____ network is one which contains one or more sources of emf.

   (b) Unit of power is _____.

(c) If two resistances R_1 and R_2 are connected in series, then their equivalent resistance is _____.

(d) Unit of inductive reactance is _____.

(e) _____ is a mechanical rectifier which converts AC to DC.

(f) If a DC generator consists of 40 coils and each coil has 20 turns, then the number of conductors in the DC generator are _____.

(g) One complete set of positive and negative values of alternating quantity is known as _____.

(h) The time taken by an alternating quantity to complete one cycle is called _____.

(i) An alternating sinusoidal voltage $v = 150 \sin 100\pi t$ volt is applied to a circuit. The maximum value of the voltage is _____ volt.

(j) _____ is a static device which can change the magnitude of alternating voltage or current from one value to another value.

2. Write true or false : $1 \times 10 = 10$

(a) The rate of flow of charge is known as voltage.

(b) A node is a junction in a circuit where two or more circuit elements are connected together.

(c) A DC motor is a machine which converts mechanical energy into electrical energy.

(d) The direction of force in a DC motor is given by Fleming's left hand rule.

(e) If the speed of a DC motor is high, then the back emf is high.

(f) If temperature increases, the resistance of conductor increases.

(g) If a transformer has N_1 turns in the primary and N_2 turns in the secondary, then the voltage transformation ratio of the transformer is $\frac{N_2}{N_1}$.

(h) Unit of inductance is Farad.

(i) The relationship between frequency, f and time period, T is given by, $f = \dfrac{1}{T}$.

(j) If the angle between current and voltage in an AC circuit is 45°, then the power factor of the circuit is sin 45°.

3. Choose the correct answer : 1×5=5

(a) Unit of electrical energy is _____ .

  (i) Newton   (ii) Watt

  (iii) Kilo Watt hour   (iv) None of these

(b) The equation of power, P is given by _____

  (i) VI   (ii) I²R

  (iii) $\dfrac{V^2}{R}$ (iv) All of these

  (Where V, I and R are the Voltage, Current and Resistance respectively)

(c) The emf equation of a DC generator is given by _____ .

  (i) $E_g = \dfrac{P\phi ZN}{60A}$

  (ii) $E_g = \dfrac{\phi ZN}{60PA}$

  (iii) $E_g = \dfrac{P\phi ZN}{120A}$

  (iv) None of the above

  (Where, E_g, P, Z, N, A are the generated emf, number of pole, number of conductor, speed and number of parallel path of a DC generator respectively.)

(d) If $e_1 = A\,\sin\omega t$ and $e_2 = B\,\sin(\omega t - \Phi)$, then

  (i) e_1 lags e_2 by Φ

  (ii) e_2 lags e_1 by Φ

  (iii) e_2 leads e_1 by Φ

  (iv) e_1 is in phase with e_2

(e) The equation of synchronous speed, N_s is given by _____ .

(i) $N_s = \dfrac{120f}{P}$ (ii) $N_s = \dfrac{120P}{f}$

(iii) $N_s = \dfrac{60f}{P}$ (iv) None of these

(Where f and P are the frequency and number of pole of induction motor respectively).

PART – B

Marks – 45

Answer any *three* questions from question nos. 4 to 7 :

4. (a) Define Conductor and insulator. Give examples of each.   3

   (b) Find the equivalent resistance when three resistances R_1, R_2 and R_3 are connected in parallel.   4

   (c) Define Ohm's law, Kirchhoff's current law and Kirchhoff's voltage law.   5

5. (a) Define the two laws of Faraday of electro-magnetic induction.   3
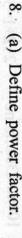
   (b) What are the different types of DC generator ? Draw the symbolic diagram of each.   4

   (c) A 250 V shunt motor takes a total current of 20 A. The shunt field and armature resistance are 200 Ω and 0.3 Ω respectively. Determine the value of back emf.   5

6. (a) Define work, power and energy.   3

   (b) Derive the emf equation of a transformer.   4

   (c) An alternating current is represented by $i = 100 \sin 100\pi t$. Determine   2+2+1=5

   (i) RMS value

   (ii) Frequency

   (iii) Time period

7. (a) An RLC series circuit has R = 10 Ω, L = 0.1 H and C = 8 μF. Calculate the resonant frequency.   3

(b) The heating element of an electric heater made of nichrome wire has value of resistivity of 1×10^{-6} Ωm. The diameter of the wire is 0.4 mm. What length of this Nicrome wire will make a resistance of 100 Ω. 4

(c) A 6 pole, lap connected DC generator has a total of 650 conductors. The flux per pole is 0.05 Weber. Calculate the voltage generated in the armature when driven at 400 rpm. 5

Answer any *one* question from question nos. 8 to 9

8. (a) Define power factor. 2

(b) Write the multiplication and division of two phasor quantities. 2

9. (a) Write about Fleming's left hand rule. 2

$$v_1 = a_1 + jb_1, \quad v_2 = a_2 + jb_2$$

(b) Find the relationship between kWh and Joule. 2

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Answer any *one* question from question nos. 10 to 12 :

10. Write the working principle of transformer. 5

11. An RLC series circuit has R = 10Ω, L = 0.1 H and C = 8 μF. Calculate the inductive reactance, capacitive reactance and total impedance. 5

12. Write short notes on Resonance in series RLC circuit. 5

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