Total No. of printed pages = 7

END SEMESTER EXAMINATION – 2022

Semester : 3rd (Old/Retest)

Subject Code : El-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 and PART–B are compulsory.

PART – A

Marks – 25

1. Fill in the blanks : $1 \times 10 = 10$

   (a) The unit of resistance, inductive reactance, capacitive reactance and impedance is _____.

   (b) The resistance offered by a conductor is directly proportional to its _____.

[Turn over

(c) Power factor of a pure inductor is _____.

(d) _____ point starter is used for starting a DC series motor.

(e) 1 kWh is equal to _____ Joule.

(f) The capacity of a cell is measured in _____.

(g) The number of parallel path in wave winding is _____.

(h) Form factor is defined as the ratio of rms value to _____ value.

(i) In R-L series circuit V_L leads V_R by _____.

(j) A transformer has no _____ parts.

2. Choose the correct answers : 1×5=5

(i) The flow of electric current in a conductor due to flow of

(a) electrons

(b) protons

(c) electrons and ions

(d) charged particles

(ii) The active material of a lead-acid cell are

(a) lead peroxide

(b) sponge lead

(c) dilute sulphuric acid

(d) All of the above

(iii) Which of the following material has negative temperature co-efficient of resistance ?

(a) Brass (b) Copper

(c) Aluminium (d) Carbon

(iv) In a series R-L-C circuit, resonance occurs when

(a) $R = X_L - X_C$ (b) $X_L = X_C$

(c) $X_L > X_C$ (d) $X_L < X_C$

(v) In an ordinary transformer which of the following does not change ?

(a) voltage (b) current

(c) frequency (d) All of these

3. Write true or false : 1×10=10

(i) A transformer can be connected to DC.

(ii) DC generator converts mechanical energy into electrical energy.

(iii) According to Kirchhoff's voltage law, at any junction of an electrical network, the sum of incoming currents is equal to sum of outgoing currents.

(iv) During charging of a lead acid cell, the specific gravity of a cell decreases.

(v) The unit of back emf and generated emf is not same.

(vi) An iron takes 5 A from 250 volt. Its power rating is 1.25 kW.

(vii) At half-power points of a series resonance, the current is half of current at resonance.

(viii) Capacitive reactance increases with the increase in capacitance.

(ix) The basic unit of electric charge is coulomb.

(x) In an AC circuit, the ratio of kW/kVA represents phase angle.

PART – B

Marks – 45

4. Define conductor and insulator. Mention two properties of good conductor and good insulator. 3

5. (a) Define power and energy. 2

   (b) State and explain Kirchhoff's Laws. 4

   Or

   A Wheat stone Bridge ABCD is arranged as follows : AB = 1 Ohm, BC = 2 Ohm, CD = 3 Ohm, DA = 4 Ohm. A resistance of 5 Ohm is connected between B and D.

   A 10 volt battery is connected between A and C. Calculate the magnitude and direction of current in 5 Ohm resistor. 6

6. (a) What are the types of DC motors ? Draw the circuit diagram of different types of DC motors. 4

   (b) A four pole lap wound armature has 500 conductors and a flux per pole of 25 mwb. Calculate the emf generated when running at 500 rpm. 3

Or

(a) Define back emf of DC motor. 2

(b) Deduce the emf equation of a DC generator. 5

7. Explain the indications of a fully charged lead acid cell. 5

8. (a) Define rms value and average value of an AC quantity. 2

(b) The instantaneous current is given by the equation i = 120 sin314t. Calculate frequency, maximum current, rms value of current and average value of current. 3

9. (a) Define power factor. What are the types of power factor ? 3

(b) A resistance of 20 Ohm is connected in series with an inductor of inductance 0.1 Henry. An AC supply of 200 Volt, 50 Hz is connected across the series combination. Calculate inductive reactance, impedance, current flowing through the circuit, power factor and power consumed by the circuit. Draw also the phasor diagram. 7

Or

(b) A resistance of 20 Ohm is connected in series with a capacitor of capacitance 150 μF. An AC supply of 200 Volt, 50 Hz is connected across the series combination. Calculate capacitive reactance, impedance, current flowing through the circuit, power factor and power consumed by the circuit. Draw also the phasor diagram. 7

10. (a) Deduce the emf equation of a transformer. 5

(b) Write short notes on current transformer and potential transformer. 4