Total No. of printed pages = 8

EI-304/EEE/3rd Sem/2018/M

ELEMENTS OF ELECTRICAL ENGINEERING

Full Marks – 70

Time – Three hours

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

All the questions are compulsory.

Part-A consists of 25 marks and Part-B consists of 45 marks

PART – A

1. Answer the following Multiple Choice Questions : 1×10=10

(a) A kilowatt hour is the unit of :

(i) Energy (ii) Power

(iii) Electric charge (iv) Electric current

(b) If potential difference across a conductor of a material of resistivity ρ remains constant, then heat produced in the conductor is proportional to

(i) ρ (ii) ρ^2

(iii) $1/\sqrt{\rho}$ (iv) $1/\rho$

(c) A multi-plate construction is used in a lead-acid cell to

(i) increase the capacity of the cell

(ii) increase the emf of the cell

(iii) increase the internal resistance of the cell

(iv) facilitate cell connection

(d) A sinusoidal current wave has a maximum value of 20V. Its value at 135° is :

(i) 10V (ii) 14.14 V

(iii) 15V (iv) 5V

(e) The inductive reactance of a circuit is :

(i) directly proportional to frequency

(ii) indirectly proportional to frequency

(iii) independent of frequency

(iv) None of the above.

(f) The armature of a DC machine is laminated in order to reduce :

(i) eddy current loss

(ii) hysteresis loss

(iii) copper loss

(iv) frictional loss.

(g) In a lap winding, the number of brushes required is equal to :

(i) number of poles

(ii) number of pair of poles

(iii) commutator pitch

(iv) None of the above.

(h) The value of back emf in a DC motor is maximum at :

(i) no - load

(ii) full - load

(iii) half- full load

(iv) None of the above.

(i) The primary and secondary of a transformer are coupled :

(i) electrically

(ii) magnetically

(iii) both electrically and magnetically

(iv) None of the above.

(j) The all day efficiency of a transformer is also called its :

(i) energy efficiency

(ii) power efficiency

(iii) current efficiency

(iv) None of the above.

2. Fill in the following blanks : 1×5=5

(a) The motor equation is given by ———.

(b) During recharging in a lead acid cell, the anode is converted into ——— and the cathode into ———.

(c) The yoke of a DC machine is made of ———.

(d) The ratio of rms value to the average value of an alternating quantity is called ———.

(e) Kirchoffs current law is also called ———.

3. State whether the following are true or false : 1×5=5

(a) In an R-L series circuit, line current leads the applied voltage.

(b) The emf of a fully charged lead acid cell is about 2V.

(c) In conductor, the conduction band and the valence band overlaps each other such that the forbidden gap is almost negligible.

(d) In a wave winding, there are two parallel paths irrespective of number of poles.

(e) Transformers are rated in kW.

4. Answer the following objective type questions : $1 \times 5 = 5$

(a) What happens to the armature current, when the speed of a DC motor increases ?

(b) An alternating voltage is given by $v = 20$ Sin 157t. What is the frequency of the alternating voltage ?

(c) What is the power across an ideal inductor ?

(d) What is the unit in which the capacity of a secondary cell is expressed ?

(e) Name the winding in which the emf is induced.

PART – B

5. Answer the following questions briefly : $2 \times 5 = 10$

(a) State the kcl and kVL.

(b) Define the terms :

(i) One cycle of an alternating voltage.

(ii) Average value of an alternating current.

(c) Define capacitive reactance.

(d) What is back emf in a DC Motor ?

(e) Why transformer is rated in kVA ?

6. Answer the following questions : 3×5=15

(a) Define conductors and write some of its properties.

(b) Define electrical work, energy and power.

(c) Write the chemical reactions that takes place in a lead-acid battery during discharging.

(d) An alternating voltage v, is given by v = 220 Sin 314t. Find its maximum value, frequency, time period and instantaneous value when t is 3ms.

(e) A 2000/200 V, 20 kVA transformer has 66 turns in the secondary. Calculate the primary turns, primary full load current and secondary full load current.

7. Answer the following questions in details : 5×4=20

(a) What are the types of DC Generator ? Draw their respective circuit diagrams.

(b) Derive the voltage and power equation of a DC Motor.

(c) Explain the principle and working of an ideal transformer.

(d) Explain the working principle of a three phase induction motor.