# ELEMENTS OF ELECTRICAL ENGINEERING

Full Marks – 70

Pass Marks – 28

Time – Three hours

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

Answer question No.1 and any *five*
from the rest.

1. Fill in the blanks :                    1×10=10

   (i)   Current flows from ———— to ———— .

   (ii)  The power consumed by a purely inductive
         circuit is ———— .

   (iii) In a purely resistive circuit, the angle
         between current vector and voltage vector
         is ———— .

   (iv)  The voltage of a cell when fully charged is
         ———— .

   (v)   Kirchhoff's voltage law can be applied in
         ———— circuit only.

(vi) An ideal transformer is one which has ——————.

(vii) At series resonance, circuit current is ——————.

(viii) One kilowatt-hour of electrical energy is —————— Joule.

(ix) The value of crest factor is —————— .

(x) The conductor has —————— temperature co-efficient of resistance.

2. (a) Define conductor and insulator.  4

(b) Write down the industrial use of conductor and insulator.  4

(c) The following are details of load on a circuit connected through a supply meter :

   (i) 8 lamps of 60 watt each working for 8 hours per day.

   (ii) 5 fluorescent tubes of 40 watt each working for 5 hours per day.

   If each unit of energy cost is Rs. 6.00, what will be the monthly electricity bill ?  4

3. (a) Define Kirchhoff's current law. 2

   (b) Determine the algebraic sign of voltage drop in applying Kirchhoff's voltage law. 2

   (c) A Wheatstone bridge ABCD is arranged as follows :

   AB = 15Ω, BC = 20Ω, CD = 10Ω, and DA = 15Ω.

   A galvanometer of resistance 5Ω is connected between B and D. A 100 volt supply of negligible internal resistance is connected between A and C with A positive. Applying Kirchhoff's laws find the magnitude and direction of galvanometer current. 8

4. (a) Deduce the equation of alternating voltage. 4

   (b) Define r.m.s value and form factor. 2

   (c) An alternating current is given by $i = 20 \sin 314t$. Determine the maximum value, r.m.s value, frequency and time period. 6

5. (a) A coil having a resistance of $7\Omega$ and an inductance of 31.8 mH is connected to 230V, 50 Hz supply. Calculate inductive reactance, impedance, circuit current, power factor and power consumed. 7

(b) Define series resonance. 2

(c) An R-L-C series circuit consists of a resistance of $1000\Omega$, an inductance of 100 mH and a capacitance of 10 microfarad. If a voltage of 200V is applied across the combination, find the resonance frequency. 3

6. (a) Deduce the e.m.f equation of transformer. 5

(b) Describe the short circuit test of a transformer. 4

(c) A single phase 2200 / 250V, 50 Hz transformer has a net core area of 36 cm$^2$ and a maximum flux density of 6 wb/m$^2$. Calculate the number of turns of primary and secondary winding. 3

7.  (a)  Deduce the e.m.f equation of a DC generator.
4

(b)  What are the types of DC motor and draw the circuit diagram of these.
4

(c)  Write down the working principle of DC motor.
4