Nov - Dec 2008

Total No. of Questions : 12] [Total No. of Printed Pages : 7

[3461]-103

F. E. (2008 Course) Examination - 2008

BASIC ELECTRICAL ENGINEERING

Time : 3 Hours] [Max. Marks : 100

Instructions :

(1) *Answer 3 questions from Section I and 3 questions from Section II.*

(2) *Answers to the* ***two sections*** *should be written in* ***separate books.***

(3) *Black figures to the right indicate full marks.*

(4) *Neat diagrams must be drawn wherever necessary.*

(5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

(6) *Assume suitable data, if necessary.*

SECTION - I

Q.1) (A) Compare Nickel Metal Hydride Battery with Nickel Cadmium Battery. **[04]**

(B) The insulation resistance per km of a single core cable having a conductor diameter of 1.2 cm and insulation thickness of 1.5 cm is 550 MΩ. Find percent increase in insulation resistance if insulation thickness is increased by 50%. **[06]**

(C) A heater coil, after running several hours from switched on, draws a current of 2A from constant voltage 400V. If the temperature rise is 70° C, find the change in voltage required to maintain same current at the time of starting the heater coil. Assume the heater is started at 20° C and RTC for the heater coil at 0° C is 0.0038 per °C. **[08]**

OR

Q.2) (A) Write down the changes taking place during the charging of lead acid cell. **[05]**

(B) The filament of 240V of metal filament lamp is to be constructed from a wire having a diameter of 0.03 mm and a resistivity of 4.3 μΩ - cm. If the RTC of the filament material is 0.005°C at 20°C, what length of the filament is necessary for the lamp to dissipitate 60 W at a filament temperature of 2420°C. Assume room temperature as 20°C. **[06]**

(C) A three blade wind mill is used to lift underground water and store it at ground level using a pump. For average wind speeds, the value of torque developed is 20 Nm and speed of this wind mill is 150 r.p.m. Actual head of water is 9 m and pipe friction is 1 m head loss. The wind mill mechanical efficiency and water pump efficiency are 40% and 75% respectively. Calculate the speed of this wind mill to store water quantity of 20 kiloliters at the ground level. **[07]**

Q.3) (A) Explain the classification of Electrical Networks. **[04]**

(B) Use Superposition Theorem to find current in 4Ω resistance as shown in fig. A. Hence verify your result by Thevenin's Theorem. All the resistances are in ohm. **[7+5]**

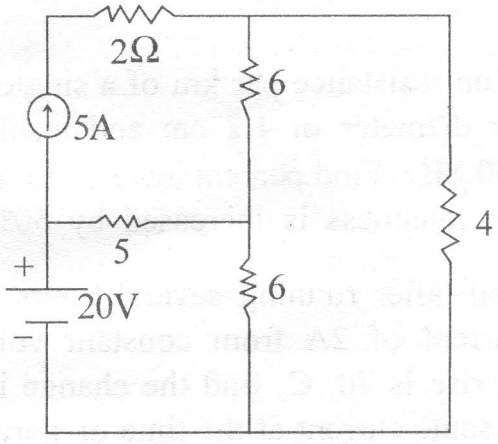
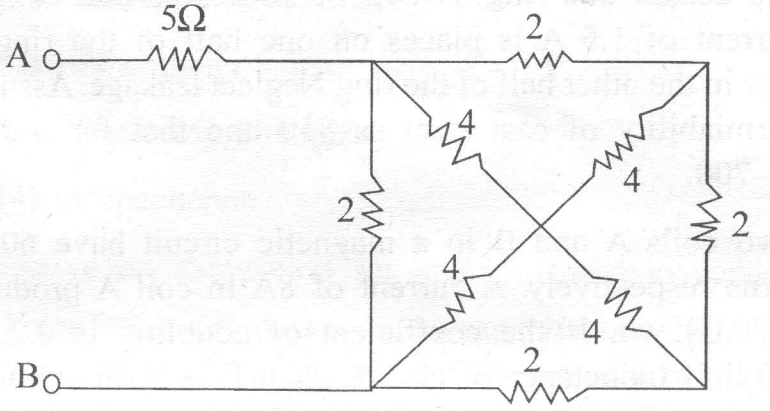


Fig. A

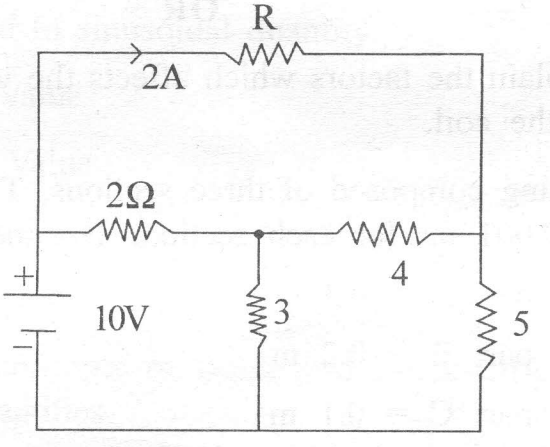
OR

Q.4) (A) State and explain Maximum Power Transfer Theorem. **[04]**

(B) Find the equivalent resistance across the terminals A-B for the network as shown in fig. B. All resistances are in ohm. **[06]**



(C) Use Kirchoff's Laws to find the value of unknown resistance R such that 2A current flow's through it. The direction of the current is shown in fig. C. All the resistances are in Ohm's. **[07]**



Q.5) (A) With usual notations show that the magnitude of the dynamically inducced emf is

$e = BlV$

Where V → Velocity component perpendicular to the magnetic field. **[04]**

(B) A ring of cast steel has on external diameter of 25 cm and a square cross-section of 4 cm side. An ordinary steel bar 17 cm × 4 cm × 0.5 cm is fitted with negligible gap inside and across this ring. A coil of 500 turns and carrying a DC current of 1.5 A is places on one half of the ring. Find the flux in the other half of the ring Neglect leakage. Assume relative permiability of cast steel as 850 and that for ordinary steel as 700. **[07]**

(C) Two coils A and B in a magnetic circuit have 600 and 500 turns respectively. A current of 8A in coil A produces a flux of 0.04 wb. If the coefficient of coupling is 0.2. Calculate (1) Self Inductance of coil A when B is open circuit. (2) Flux linkage with Coil B. (3) Mutual Inductance. (4) Emf induced in B when flux changes from zero to full value in 0.02 seconds. **[05]**

OR

Q.6) (A) Explain the factors which affects the value of self inductance of the coil. **[04]**

(B) A ring composed of three sections. The cross sectional area is 0.001 m^2 for each section. The mean arc lengths are

For part A = 0.3 m

For part B = 0.2 m

For part C = 0.1 m

An air-gap length of 0.1 mm is cut in the ring. The relative permiabilities for the sections A, B, C are 5000, 1000 and 10000 respectively. Flux in the air-gap is 7.5×10^{-4} wb. Find (1) mmf (2) Exciting current if the coil has 100 turns (3) Reluctances of the sections. **[06]**

(C) A coil of 100 turns having a mean diameter of 5 cm is placed coaxially at the centre of a Solenoid 50 cm long, wound with 2500 turns and carrying a current of 3A. Determine the mutual inductance of the arrangement. **[06]**

SECTION - II

Q.7) (A) Define as related to electrostatics : **[04]**

(1) Electric Aux Density

(2) Permittivity

(3) Dielectric Strength

(4) Capacitance

(B) Derive an expression for energy stored in capacitor. **[04]**

(C) Three capacitor A,B,C have capacitances 20, 50 and 25 μF respectively. Calculate (1) Charge on each when connected to parallel to a 250 V supply. (2) Total capacitance and (3) Potential difference across each when connected in series. **[06]**

OR

Q.8) (A) Define related to sinusoidal quantity

(1) R.M.S. Value

(2) Average Value

(3) Form Factor

(4) Peak Factor **[04]**

(B) Explain the concepts of phase and phase difference in an alternating quantities. **[04]**

(C) Three voltages represented by

$e_1 = 20 \sin wt.$

$e_2 = 30 \sin (wt - \pi/4)$

$e_3 = 40 \cos (wt + \pi/6)$

act together in a circuit. Find an expression for the resultant voltage. Represent them by appropriatate vectors. **[08]**

Q.9) (A) Define the following terms with their units :

(1) Admittance

(2) Susceptance

(3) Power

(4) Power Factor **[04]**

(B) Derive an expression for instantaneous current and power consumed when voltage of V = Vm sinwt is applied through pure inductance alone. **[06]**

(C) A 50 μf capacitor is connected across a 230 V, 50 Hz supply. Calculate (1) the reactance offered by the capacitor (2) the maximum current and (3) the r.m.s. value of the current drawn by the capacitor. **[06]**

OR

Q.10) (A) An A.C. circuit connected across 200 V, 50 Hz, supply has two parallel branches A and B. Branch A draws a current of 4 Amp at 0.8 lagging power factor, while the total current drawn by the parallel combination is 5 Amp at unity power factor. Find (1) Current and Power Factor of branch B and (2) Admittances of branch A, B and its parallel combination, both in polar and rectangular form. **[10]**

(B) The load taken from a supply consists of a (1) lamp load 10 KW at unity power factor (2) motor load of 80 KVA at 0.8 power factor lagging and (3) motor load of 40 KVA at 0.7 Power Factor lagging. Calculate the total load taken from the supply in KW and in KVA and the Power Factor of the combined load. **[06]**

Q.11) (A) Derive the relationship between the line current and phase current, line voltage and phase voltage, for a balanced three phase star-connected load connected across three phase supply. Derive also power consumed by load. **[08]**

(B) Thee 100Ω non-inductive resistances are connected in (1) star (2) delta across a 400 V, 50 Hz, 3 Phase Supply. Calculate power taken from supply system in each case. In the event of one of the three resistances getting open - circuited, what would be the value of total power taken from the mains in each of the two cases ? **[10]**

OR

Q.12) (A) Derive the expression for emf induced in the transformer. **[06]**

(B) State and explain different losses taking place in the transformer. **[06]**

(C) A 10 KVA, 3300/240V, Single Phase, 50Hz, transformer has a core area of 300 sq. cm. The flux density is 1.3 telsa. Calculate (1) Number of Primary Turns. (2) Number of Secondary Turns. (3) Primary Full Load Current. **[06]**
