Total No. of Questions : 12] **[Total No. of Printed Pages : 4**

[3761]-103

F. E. (Semester - I) Examination - 2010

BASIC ELECTRICAL ENGINEERING

(June 2008 Pattern)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

(1) In section I, attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6. In section II, attempt Q. 7 or Q. 8, Q. 9 or Q. 10, Q. 11 or Q. 12.

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

(3) Figures to the right indicate full marks.

(4) Neat diagrams must be drawn wherever necessary.

(5) Use of non-programmable electronic pocket calculator is allowed.

(6) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) How materials are classified as Conductor, Insulator and Semiconductor. Give two examples of each. **[06]**

(B) An electric pump lifts 60 m^3 of water per hour to a height of 25 meter. The pump efficiency is 86% and motor efficiency is 78%. The pump is used for three hours daily. Find energy consumed per week, if one m^3 of water is 1000 kg. **[06]**

(C) Explain the charging of Lead Acid Battery with chemical reaction. What are the changes taking place during charging ? **[06]**

OR

Q.2) (A) Obtain the expression for $\alpha_2 = \alpha_1/1 + \alpha_1 (t_2 - t_1)$. **[06]**

(B) An electric furnace is used to melt aluminum. Initial temperature of the solid aluminum is 32°C and its melting point is 680°C. Specific heat capacity of aluminum is 0.95 kJ/kg°K and the heat required to melt 1 kg of aluminum at its melting point is 450 kJ. If the input power drawn by the furnace is 20 kW and its overall efficiency is 60%. Find the mass of aluminum melted per hour. **[06]**

(C) What is Insulation Resistance ? What are the factors on which insulation resistance of a single core cable depends ? **[06]**

Q.3) (A) State and explain Superposition Theorem. **[08]**

(B) Using Kirchhoff's Laws, find the current delivered by 12V battery as shown in the Fig. 1. **[08]**

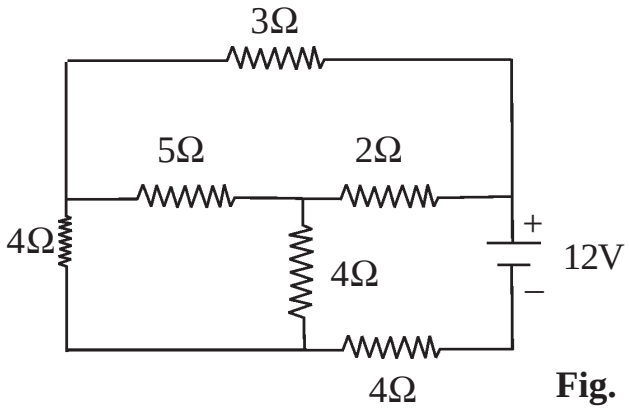

Fig. 1

OR

Q.4) (A) Derive an expression to convert Star Connected Network into its Equivalent Delta Network. **[08]**

(B) Using Thevenin's Theorem find the current flowing through 1 ohm resistance connected between A-B, as shown in the Fig. 2. **[08]**

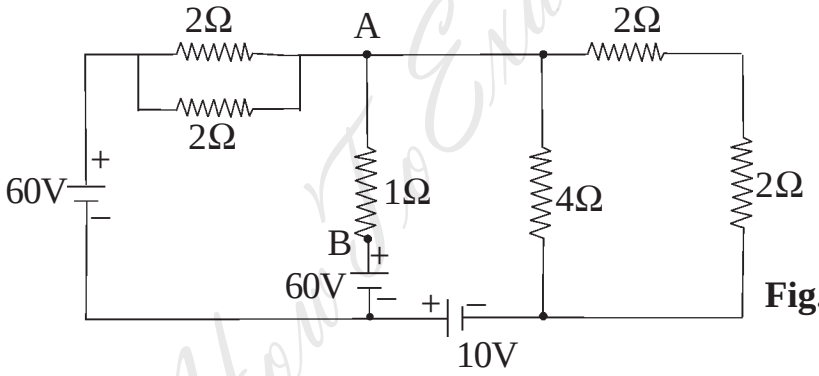

Fig. 2

Q.5) (A) Explain the following terms : **[08]**

(1) MMF

(2) Reluctance

(3) Pearmeance

(4) Flux Density

(B) A coil M is wound around a magnetic circuit. Explain the phenomenon of self induced emf in it. Define its self inductance and state its unit. Another coil N is wound around the same magnetic circuit. Explain the phenomenon of mutual inductance between the coils and define 'coefficient of coupling' between them. **[08]**

OR

Q.6) (A) An iron ring wound with 550 turn's solenoid produces a flux density of 0.94 tesla in the ring carrying a current of 2.4 Amp. The mean length of iron path is 80 cm and that of air gap is 1 mm. Determine :

(1) The relative permeability of iron

(2) Self-inductance

(3) Energy stored in the above arrangement, if the cross sectional area of ring is 25 cms^2. **[08]**

(B) Derive the expression for the energy stored in the magnetic field in terms of energy stored per unit volume. **[08]**

SECTION - II

Q.7) (A) At instant t = 0, the instantaneous value of 50Hz sinusoidal current is +5 Amp and increases in magnitude further. Its r.m.s. value is 10 Amp :

(1) Write expression for its instantaneous value.

(2) Find the current at t = 0.01 and t = 0.015 second.

Sketch the waveform indicating these values. **[08]**

(B) Derive Mathematical Expression for capacitor voltage and current at any instant during charging of capacitor through resistance. Also sketch the graph of capacitor voltage and current with respect to time. **[08]**

OR

Q.8) (A) A sinusoidal voltage of $V = V_m \sin(\ t)$ is applied across a series R-L circuit. Derive the expression for current and average power consumed by the circuit. **[08]**

(B) A parallel plate capacitor has plates, each area of $100cm^2$, separated by a distance of 3cms. The dielectric between the plates has relative permittivity of 2.2. The potential difference between the plates is 10kV. Find (1) Capacitance of the Capacitor (2) The Electric Flux Density, (3) The Electric Field strength, (4) Energy Stored. **[08]**

Q.9) (A) Sketch and explain Phasor diagram of an RLC series circuit when (1) $X_C > X_L$ (2) $X_C = X_L$ (3) $X_C < X_L$. **[08]**

(B) A series circuit consisting of a 12Ω resistance, 0.3 henry inductance and a variable capacitor is connected across 100V, 50Hz A.C. Supply. The capacitance value is adjusted to obtain maximum current. Find this capacitance value and the power drawn by the circuit under this condition. Now supply frequency is raised to 60Hz, the voltage remaining same at 100V. Find the value of inductive and capacitive reactance. **[08]**

OR

Q.10) (A) What is admittance of an AC Circuit ? What are its two components ? State the units of these quantities. How is admittance expressed in rectangular and polar form ? **[06]**

(B) Two circuits the impedances of which are given by Z_1 = (12 + j16) Ohm and Z_2 = (8 – j4) Ohm are connected in parallel across the potential difference of (23 + j0) volts. Calculate : (1) The Total Current Drawn (2) Total Power and Branch Power consumed and (3) Overall Power Factor of the circuit. **[10]**

Q.11) (A) Derive and explain with Phasor diagram the relations between Line Values and Phase Values of Current and voltages for a 3-phase balanced delta connected lagging power factor load. **[08]**

(B) The three equal impedances of each of $10\angle 60^{o}$ Ohms are connected in star across 3-phase, 400 volts 50Hz supply. Calculate :

(1) Line Voltage and Phase Voltage

(2) Power Factor and Active Power consumed

(3) If the same three impedances are connected in delta to the same source of supply what is the active power consumed ? **[06]**

(C) Differentiate Shell Type and Core Type Transformer. **[04]**

OR

Q.12) (A) A 25 kVA, 50 Hz, Single Phase Transformer has the iron loss and full load copper loss of 350 and 400 watts respectively. Find the efficiency of the transformer at (1) 50% of full load at unity p.f. and (2) 75% of full load at 0.8 lagging p.f. **[08]**

(B) What is an Auto Transformer ? State the advantages, limitations and applications. **[06]**

(C) Explain the Concept of Balanced Loading. **[04]**
