5. (a) A soft iron ring of relative permeability of 2000 has a mean diameter of 75 cm and a cross sectional area of 20 cm^2. A radial airgap of 2 mm width is cut in the ring that is wound with a coil of 1500 turns. Calculate the current required to produce an airgap flux of 0.55 milli-weber. Neglect leakage and fringing. Given $\mu_0 = 4\pi \times 10^{-7}$ H/m. 5

(b) A single-phase two winding transformer is designed to operate at 230/115 V, 50 Hz. Calculate the magnitude of the secondary no-load voltage and its frequency if the high voltage side of the transformer is connected to 2+2+1

(i) 230 V, 40 Hz

(ii) 115 V, 25 Hz

(iii) 230 V dc

6. (a) A coil is connected in series with a capacitor of 10 micro-farads and the series combination is connected across a 250 V single-phase ac mains. The resistance of the coil is 3.5 ohms. What must be the inductance of the coil in order that maximum current occurs at a frequency of 5

(i) 30 Hz

(ii) 40 Hz

(iii) 110 Hz ?

(b) A balanced three phase star conected load of 250 kW takes a lagging current of 200 A with a line voltage of 1000 V, 50 Hz. Find the circuit constants (resistance and inductance) of the load per phase. 5

a) Derive the mathematical expression for the charge stored in the capacitor of a R-C series circuit connected across a d.c voltage source. 4

b) The emf (electromotive force) per turn for a single phase, 2200/220 V, 50 Hz transformer is approximately 15 volts. Calculate

(i) the number of primary and secondary turns and

(ii) the net cross sectional area of the core, for a maximum flux density of 1.25 Wb/m^2 in the core. 3+3

8. (a) Explain with the help of a block diagram the principle of power generation in a nuclear power plant. 5

(b) A moving coil instrument gives a full scale deflection of 25 mA when potential difference across its terminals is 250 mV. Calculate 5

(i) the shunt resistance for measuring currents up to 25 A and

(ii) series resistance for measuring voltage up to 500 V.

Total number of printed pages – 8 **B. Tech**

BENG1102/BE 2102

Second Semester Examination – 2009

BASIC ELECTRICAL ENGINEERING

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

(a) Three resistance of 12 ohms, 24 ohms and 30 ohms magnitude are connected in series and the series combination is connected across a 220 volts d.c. source. Compute the power dissipated in each resistor and the total power drawn from the source.

(b) Four resistance of 15 ohms, 30 ohms, 35 ohms and 50 ohms magnitude are connected in parallel across a 230 volts d.c. source. Compute the power dissipated in each resistor and the total power drawn from the source. What is the total current ?

(c) An inductor of inductance 50 milli-henries is connected in series with a capacitance of 10 micro-farads. Find the impedance of the circuit when the frequency is

(i) 50 Hz and

(ii) 5 kHz

(d) A direct voltage of 200 V is applied to a coil of resistance 20 ohms and inductance of 2000 milli-henries. Find the time taken for the current through the coil to reach one-half of its final value.

(e) A resistor of 25 ohms in series with a 0.45 micro-farad capacitor is connected across a supply at 270 V, 70 Hz. Find the current through the capacitor.

(f) A Circuit consists of a resistor of 10 ohms in series with an ideal inductor of 4.5 henries. The frequency is 70 Hz. Calculate the conductance and the susceptance of the circuit.

(g) A 3-phase balanced star-connected load is connected to a symmetrical 3-phase 440 V balanced supply. The current in each phase is 60 amperes and lags 45 degrees behind the corresponding phase voltage. Find the phase voltage and the total power.

(h) An iron ring with a circular cross section of 7.5 cm diameter and a mean circumference of 150 cm is wound with a coil of 750 turns. Calculate the flux in the magnetic circuit for an exciting current of 2.5 A in the coil. The relative permeability of iron is 1600 and μ_0 equals $4\pi \times 10^{-7}$ H/m.

(i) What do you mean by the term 'slip' of a three-phase induction motor ? Calculate the 'slip' of a six-pole induction motor

running at 960 RPM while drawing power from a 50 Hz three-phase balanced source.

(j) Two admittances 0.025 ∠−50° and 0.015 ∠45° are connected in parallel. Find out the resultant impedance in rectangular form.

2. (a) Using Superposition Theorem, find the current flowing in the 40-ohm resistor in Fig.1 below. 6

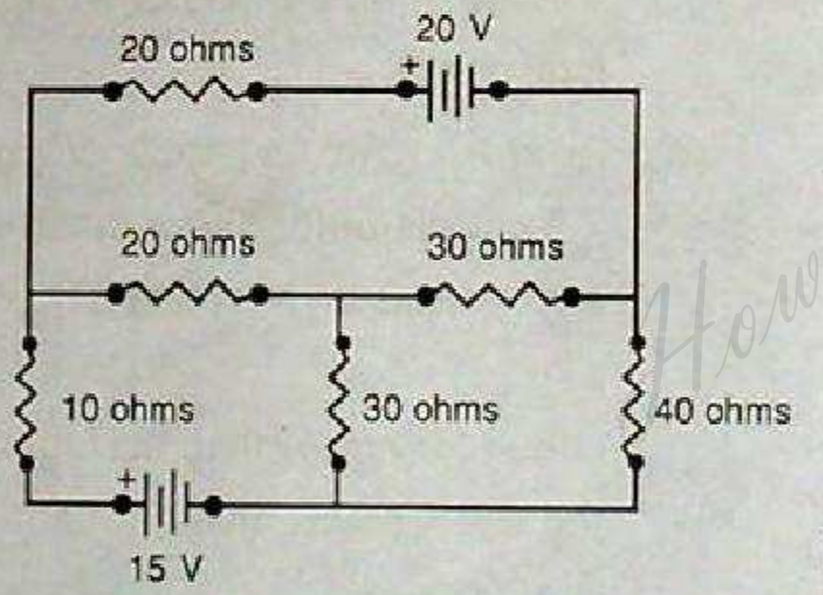

Fig – 1

(b) State and briefly explain 'Thevenin's Theorem' with one example. 4

3. (a) Describe the voltage build up process in a d.c. shunt generator. Define 'critical field resistance. 5

(b) A single-phase a.c. supply voltage of 230 V at 50 Hz is applied to a coil of inductance 4.5 henries and resistance of 2.25 ohms in series with a capacitance C. Calculate the value of the capacitance C so as to obtain a potential difference of 255 V across the coil. 5

(a) A 3-phase, 3-wire, 415 volts, 50 Hz, *RYB* system of balance supply is connected to a delta connected load with Z_{RY}=120 ∠40° ohms, Z_{YB}=155 ∠50° ohms and Z_{BR}=100 ∠−30° ohms. Obtain the three line currents and draw the complete phasor diagram showing the line voltages, line currents and phase currents. The supply neutral is earthed. 7

(b) What are the expressions for

(i) the 'torque developed' and

(ii) 'back emf induced' in a d.c. shunt motor ?

Explain all the terms in the expressions very briefly. 3