Second Semester Examination – 2010

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.

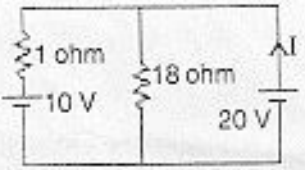
1. Answer the following questions : 2×10

   (a) Differentiate between ideal voltage source and practical voltage source.

   (b) A resistor of value 5 ohm is connected across a dc source of 10 V with internal resistance 0.5 ohm. If the dc source is

replaced by another of value 12 V, find the internal resistance to maintain the same load current.

(c) Calculate current supplied by 20 V source as shown in the figure.



(d) A circular iron ring wound with 100 turns of coil develops a magnetic flux of 10 milli weber when the coil carries a current of 1A. Find the mmf of the source and reluctance of the ring.

(e) Two impedances of value (2 + j6) ohms and (8 – j12) ohms are connected in series. What would be the resulting power factor?

(f) What is the rms value of an alternating quantity ? Find the rms and average value of a sinusoidal voltage specified as v = 200 sin314t.

(g) Three identical impedances connected in delta fashion draw a line current of $(2 \angle 30°)$ A, when connected across a 400 V, 50 Hz, three phase AC supply. Find the phase current and total power consumption.

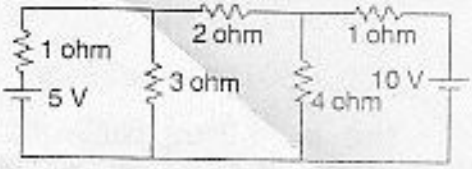
(h) A PMMC ammeter of resistance 2 ohms has a full scale value of 5 A. What would be the new range if a shunt of value 0.5 ohm is connected ?

(i) Explain the role of armature and commutator as in the case of a DC machine.

(j) Find the probable number of poles of an induction motor having no load speed of 1480 rpm, when supplied from a three phase 50 Hz, AC supply.

2. (a) Applying Thevenin's Theorem to the circuit given below, calculate the current thr

2 ohm resistor. Also, verify your answer with the help of Norton's Theorem 5



(b) Also, verify your answer with the help of Norton's Theorem. 5

3. Explain Superposition principle as applicable to electrical circuits. With the help of this principle solve the following problem. Two batteries are connected in parallel with emf and internal resistances as 120 V, 10 ohm and 150 V, 20 ohm respectively. Another load resistor of 50 ohm is connected across the battery terminals. Calculate : 10

(a) Current through the 50 ohm resistor,

(b) Magnitude and flow of current in each battery,

(c) Current in the 50 ohm resistor, if the batteries were connected in series.

4. (a) Derive the expression for emf induction in a DC shunt generator. 4

(b) For a practical DC shunt generator having 8 poles, find the possible number of armature conductors to induce an emf of 200 V on open circuit. Given that the flux per pole is 0.1 miliweber, and the machine is driven by a prime mover at 1000 rpm. Assume that the armature is lap connected. How would your answer deviate if the armature were wave connected ? Neglect armature reaction. 6

5. (a) A resistance of 20 ohms, an inductor of inductance of 20 H and a capacitor of capacitance 200 microfarad are connected to a single phase 230 V AC source of varied frequency. Find the condition for maximum rms current in the circuit, and the required frequency of the supply source. What would be the impedance and

power factor of the circuit during this condition ? 5

(b) A capacitor (50 microfarad) is connected in series with a resistor (100 ohm) and the combination is supplied from a single phase AC source of value 230 V, 50 Hz. Calculate the impedance, current, power factor, and power consumption in the circuit. Also find the value of a suitable inductor to be connected in series with the combination so as to maintain unit power factor. 5

6. (a) A balanced three phase star load has load impedance of (5 – j10) ohms per phase and is supplied from a balanced three phase 400 V, 50 Hz AC supply.

Calculate the values for : 6

(i) line voltages,

(ii) phase voltages,

(iii) line currents,

(iv) phase currents,

(v) total power consumption and power factor.

(b) With the help of a neat diagram, explain the operation of moving iron type ammeters and voltmeters. Also indicate the expression of various torques produced in this instrument during operation. 4

7. (a) Explain the working of a nuclear power plant with a neat sketch of the components. Also explain the working of heat exchanger and condenser units. 5

(b) An inductor of 20 H is connected to a DC supply of 100 V through a resistor having resistance 100 ohms in series with a key. Find the time constant for the given setup and the steady state current in the circuit after the key is switched ON. Assuming that the key is switched ON at t = 0, calculate

the time required for the circuit current to reach 80% of the steady state current. 5

8. Write short notes on any **two** : 5×2

(a) Construction, Working and Classification of single phase Transformers.

(b) Comparison between single phase and three phase AC circuits.

(c) Speed control mechanism of DC Shunt motors.

(d) Construction, Operation, Range extension of PMMC voltmeters.