B.E. (ME, AS, EE, CE) Part-I, 1st Semester Final Examination, 2011
Basic Electrical Engineering (EE-1201)

Time : 3 hours | Full Marks : 70

Use separate answer script for each half.
Answer ***SIX*** questions, taking ***THREE*** from each half.
Two marks are reserved for neatness in each half.

FIRST HALF

1. (a) Define node, branch, loop and mesh in a dc circuit.
   (b) Using Maxwell's loop current method find the current through $R_3 = 2\Omega$ of Fig. 1.

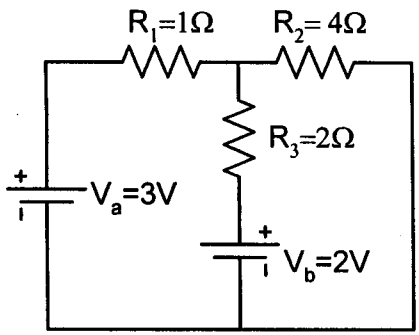

Fig. 1

[6+5]

2. (a) State and prove Maximum Power Transfer Theorem
   (b) Find the current drawn from the battery in the circuit shown in Fig. 2

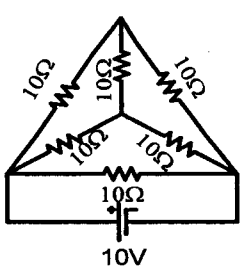

Fig. 2

[6+5]

3.(a) Derive the e.m.f. equation of a dc machine.
   (b) A 4 pole dc shunt generator with wave connected armature has 42 slots and 10 conductors per slot. The resistance of armature and field windings are 0.5 ohm and 220 ohm respectively and flux per pole is 125 mWb. When the generator is driven at 1200 rpm, calculate the voltage across a 10 ohm load resistance connected across the armature terminals.
   (c) Why is starter needed to start a dc motor?

[4+5+2]

4.(a) Explain the different torques that act on an indicating instrument.

(b) Briefly explain the construction and operation of a permanent magnet moving coil instrument.

[6+5]

5.(a) In connection with a magnetic circuit define (i) m.m.f., (ii) flux density, (iii) reluctance, (iv) permeability

(b) A ring-shaped electromagnet has an air gap 6 mm long, the mean length of the core being 50 cm and its cross-section 10 cm^2. Calculate the ampere-turns required to produce a flux density of 0.5 weber per $meter^2$ in the gap. (Assume the permeability of the iron as 1800).

[6+5]

SECOND HALF

6.(a) Define the following terms

i) Instantaneous value of an a.c. signal
ii) Power factor
iii) The angular frequency
iv) R.M.S value and form factor of a periodic current
v) Reactive power

(b) An alternating current varying sinusoidally with a frequency of 50 Hz has an R.M.S. value of 15 A. Write down the equation for the instantaneous value and find the instantaneous value at 0.002 secs after passing through a positive maximum value. At what time, measured from a positive maximum value, will the instantaneous current be 14.14A?

[(1+1+1+3+1)+4]

7.(a) Prove that for a balanced 3-phase supply feeding a balanced delta-connected load $I_{line} = \sqrt{3}\ I_{phase}$.

(b) A resistance of 8 ohm is connected in series with a pure inductance of 20 mH and a capacitance of 100 μF and the circuit is connected to a 100 V, 50 Hz sinusoidal supply. Calculate i) the r.m.s supply current, (ii) the voltage across the inductor, (iii) the voltage across the resistor and the power consumed.

[3 +(3 +2+3)]

8.(a) Derive the term 'Q' factor for a series RLC circuit.

(b) A circuit having a resistance of 4.0 Ω and inductance of 0.5H and a variable capacitance in series is connected across 100V, 50 Hz supply. Calculate

i) the capacitance to give resonance
ii) the voltages across the inductance and capacitance
iii) the Q factor of the circuit.

[5+6]

9.(a) Draw the characteristics showing variation of reactance and impedance with frequency for an RLC series circuit.

(b) A balanced star connected load of $(8 + j6)\ \Omega$ per phase is connected to a 3-phase, 400V (terminal) supply. Evaluate (i) the line current, (ii) the power factor, (iii) the total power and (iv) the total VA. Draw the complete phasor diagram.

[5+6]

10.(a) Draw the phasor-diagram of the transformer under lagging power factor load condition.

(b) Draw circuit connections along with instruments for (i) Open circuit test and (ii) Short circuit test on a 1- phase transformer. Mark the HV and LV sides. What parameters can be found from each of these tests?

(c) The primary and secondary windings of a 500 KVA, single phase transformer have resistances of 0.4 ohm and 0.0015 ohm respectively. The primary and secondary voltages are 6000V and 400V respectively and iron loss is 3.2 KW. Calculate the efficiency on (i) full load and (ii) half load, assuming the power factor of the load to be 0.8 for both the cases.

[2+5+4]