BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR

B.E. / B. Arch. Part I

2nd Semester (CST, ETC, IT, MIN,MET) Final Examination, 2012

Subject : Basic Electrical Engineering

Code No. **EE 1201**

Time : 3 hours

Branch: Electrical Engg.

Full Marks : 70

(i) Use separate answer script for each half
(ii) The questions are of equal value
(iii) Answer any ***six*** questions taking ***three*** from each half
(iv) **Two marks** reserved for neatness in each half

1st Half

1. a) What is a 'node' and a 'branch' in an electrical network? Give examples.
b) State and briefly explain Thevenin's theorem. Find the current through the 20 ohm resistor in **Fig. 1** using Thevenin's theorem. (All resistances are in ohms)

[2 + (4 +5)]

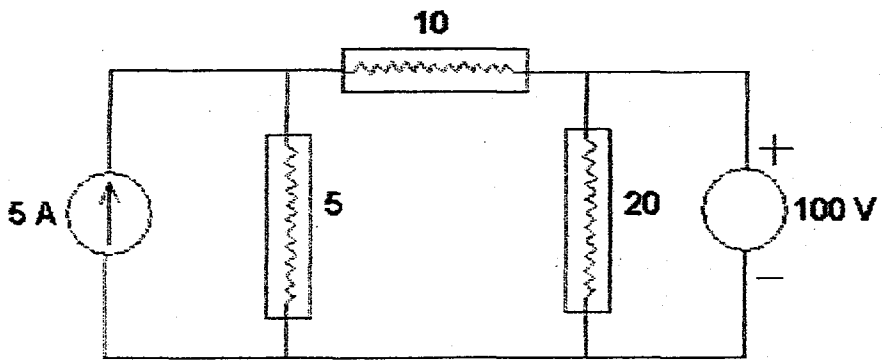

Fig. 1

2.a) Find branch currents I_1 and I_2 **(Fig. 2)** using Maxwell's Mesh current method.

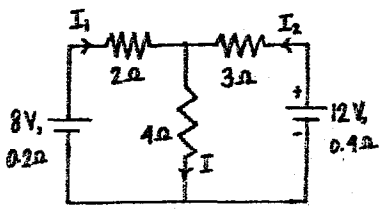

Fig. 2

b) Find the equivalent Resistance between A and B (**Fig.3**) using star-delta transformation. [6+5]

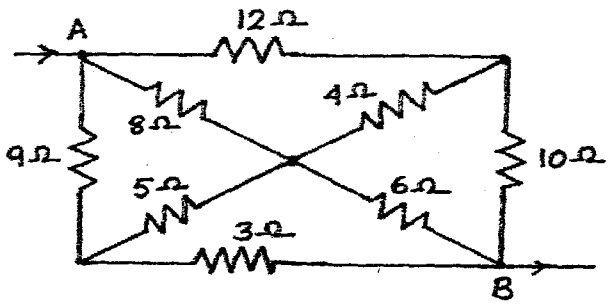

Fig. 3

3. a) Define the following quantities in a magnetic circuit and mention their units :
i) Magnetic Field Intensity ii) Reluctance iii) Flux Density

b) An iron ring (**Fig. 4**) has a cross-sectional area of 3 sq. cm and a mean diameter of 25 cm. An air gap of 0.4 mm has been made by a cut across the section of the ring. The ring is wound with a coil of 200 turns through which a direct current of 2 A is passed. If the total magnetic flux is 0.21 mWb, find the relative permeability of iron assuming no leakage. **[6+5]**

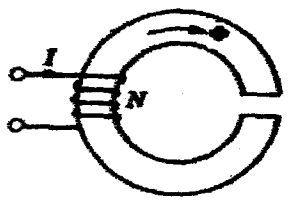

Fig. 4

4. a) Deduce the expression for the electromagnetic torque developed in a P-pole d.c. motor.

b) A 4-pole d.c. generator, with 400 armature conductors, has a useful flux of 0.04 Wb/pole. What is the e.m.f. generated if it is wave wound and the speed is 1200 r.p.m.? What must be the speed to generate the same e.m.f. if the machine is lap wound? **[5+6]**

5. a) Classify indicating instruments. What are the different torques acting in an indicating instrument?

b) Briefly describe the operating principle of a Moving Iron instrument with a schematic diagram. **[6+5]**

SECOND HALF

6. (a) An alternating current wave is expressed as $i(t) = 141.4 \times \sin(314 \times t + 10^0)$. Determine its (i) RMS value (ii) average value and (iii) phase angle . Derive the necessary equations.
(b) Calculate the form factor and crest factor of a sinusoidal voltage waveform.
(c) For the voltage waveforms $v_1(t) = 100 \times \sin(314 \times t + \frac{\pi}{2})$ and $v_2(t) = 200 \times \sin(314 \times t + \frac{\pi}{4})$, draw the phasor diagram of the two voltages. [5 + 4 + 2 = 11]

7. (a) In connection with a resonant R-L-C circuit explain the following terms:
(i) resonant frequency (ii) half power frequencies
(iii) band width (iv) quality factor
(b) A coil of resistance 2 Ω and inductance 0.01 H is connected in series with a capacitor across a 200V, 25 Hz single phase a.c. supply. Find the value of the capacitance of the capacitor for which maximum current will flow through the circuit and the maximum current. [6 + 5 = 11]

8. (a) Show that for a star connected system, line voltage is √3 times the phase voltage.
(b) A balanced wye-connected load having 8 Ω resistance in series with 6 Ω inductive reactance in each phase is supplied through lines each having 1 Ω resistance and 2 Ω inductive reactance. If the sending-end voltage between lines is 250 volts, what will be the voltage between lines at the load? [5 + 6 = 11]

9. (a) Define voltage regulation of a transformer. Develop an expression for calculating the voltage regulation of a two winding transformer under (i) lagging p.f. (ii) unity p.f. and (iii) leading p.f.

(b) A 40 kVA, 2500/500 V single phase transformer has the following parameters: $R_1 = 8\ \Omega$, $R_2 = 0.5\ \Omega$, $X_1 = 20\ \Omega$, $X_2 = 0.8\ \Omega$. Find the voltage regulation and the secondary terminal voltage at full load for a p.f. of 0.8 lagging. The primary voltage is held constant at 2500 V. [6 + 5 = 11]

10. a) Analytically justify how a rotating field is created in the air gap of a three phase induction motor when a balanced three phase ac supply is applied at the stator terminals.

b) Draw the torque-slip characteristics of a three phase inductor motor. What is the effect of variation of rotor resistance on this?

c) A 3-phase, 6-pole, 50 Hz Induction motor has a slip of 1% at no load and 3% at full load. Calculate (i) synchronous speed (ii) no load speed in r.p.m (iii) full load speed in r.p.m (iv) frequency of rotor current at full load. [3 + 3 + 5 = 11]