22-4-16

Indian Institute of Engineering Science and Technology, Shibpur

B. Tech - M. Tech Dual Degree 2nd Semester (CE, ME, MetE, MinE, AE)

Examination, April-2016

Basic Electrical Engineering (EE-1201)

Full Marks: 70 **Time: 3 hours**

(i) Answer ***SIX*** questions taking any ***THREE*** questions from each half
(ii) All parts of a question ***MUST*** be answered in the same place
(iii) Two marks are reserved in each half for neat and organized answer-script

First Half

1. (a) State and prove Maximum Power Transfer Theorem.
(b) Find the current through the 5 ohm resistance in the circuit shown in the **Fig. Q1b** using Thevenin's theorem. The resistance values are in ohm.

[5+6]

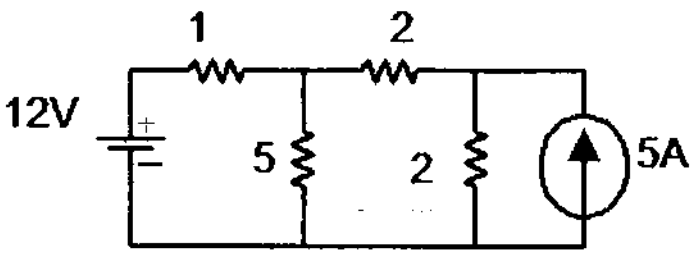

Fig. Q1b

2. (a) Define the following terms in connection with an electrical circuit: (i)Node and (ii)Mesh
(b) In the network shown in **Fig.Q2b** find out the resistance between points A and B

[3+8]

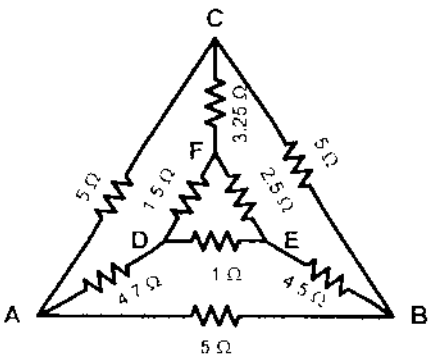

Fig.Q2b

3. (a) Name different types of torque produced in an electrical indicating instrument and mention their functions.

(b) Core of an electromagnet is shown in the **Fig.Q3b** whose area of cross-section is 12 cm^2 and Mean length of iron path is 50 cm. It is excited by two coils each having 400 turns. When the current in the coils is 1.0A, the resulting flux density gives a relative permeability of 1300. Calculate (i) reluctance of the iron part, (ii) reluctance of the air gap, (iii) total reluctance, (iv) total flux, (v) flux density in the air gap. Neglect leakage and fringing.

[4+7]

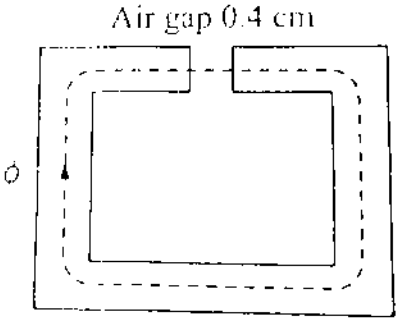

Fig.Q3b

4. (a) Derive the torque equation of a dc machine.

(b) Calculate the flux per pole required for a 4 pole generator with 350 conductors generating 250V at 1200 rpm, when armature is lap-wound. Also find out the value of generated emf if the armature were wave wound and runs at 1200 rpm.

(c) Categorise dc machines into different groups on the basis of their excitation.

[4+4+3]

5. (a) Derive the emf equation of a transformer.

(b) Draw the phasor diagram of a transformer at no load condition.

(c) A 10 kVA, 200/400V, 50 Hz single phase transformer gave the following test results:

Open Circuit test (lv winding open):

Voltmeter reading = 200V, Ammeter reading =1.3A, Wattmeter reading = 120W

Short Circuit test (lv winding short circuited):

Voltmeter reading = 20V, Ammeter reading =25A, Wattmeter reading = 200W

Determine the approximate equivalent circuit parameters referred to lv side.

[3+2+6]

Second Half

6. (a) Calculate the RMS value, average value, peak factor and form factor of the voltage waveform as shown in **Fig.Q6a**.

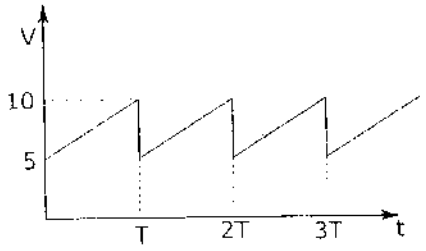

Fig.Q6a

(b) When A 100V, 50 Hz. ac source is connected to a coil A, the resulting current is 8A and the power delivered is 120W. When the same source is connected to coil B, the resulting current is 10A and the power delivered is 500W. What current and power will be taken from the same source, if the two coils are joined in series and connected to it?

[(2+2+1+1)+(2+3)]

7. (a) Two impedances, $Z_1=(12+j15)\ \Omega$ and $Z_2=(8-j4)\ \Omega$, are connected in parallel. If the potential difference across this combination is (230+j0)V, calculate, (i) the current supplied to each branch and the total current, (ii) the power consumed by each branch and the total power and (iii) the power factor of each branch and the overall power factor.

(b) Find the voltage V using Thevenin's theorem for the circuit shown in **Fig. Q7b.**

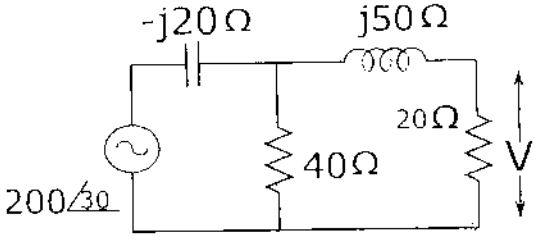

Fig. Q7b.

[(3+2+2)+4]

8. (a) Define half power frequency and bandwidth for a series RLC circuit.

(b) A 125 V ac source supplies a series circuit consisting of a 20.5 mF capacitor and a coil whose resistance and inductance are 1.06 Ω and 25.4 mH respectively. The source frequency is adjusted so as to bring the circuit to resonance. Determine, (i) the source frequency and the current supplied by the source, (ii) voltage across the capacitor and the coil and (iii) the resistance that must be connected in series with the circuit to limit the capacitor voltage to 300V.

[(2+2) +(3+2+2)]

9. (a) Explain the term 'phase sequence'. What is its significance?

(b) A balanced 3-ph star connected load is fed from a 400V, 3-ph, 50 Hz. supply. The current per phase is 25A (lagging) and the total active power absorbed by the load is 13.856 kW. Determine, (i) the resistance and inductance of the load per phase, (ii) the total reactive power and (iii) the total apparent power.

[(2+1)+(2+2+2+2)]

10.(a) A 3-ph, 6-pole, 50 Hz. induction motor has a slip of 1% at no load and 3% at full load. Find, (i) the synchronous speed, (ii) the no-load speed, (iii) the full load speed, (iv) the frequency of rotor currents at standstill and (v) the frequency of rotor-currents at full load.

(b) Explain the principle of working of a 3-phase induction motor.

[(1+1+1+1+1)+(6)]

---------- X ----------