3/12/17

Indian Institute of Engineering Science and Technology, Shibpur

B.Tech. (CST, EE, ETC, IT) 1st Semester Final Examination, November-2017

Basic Electrical Engineering (EE-1201)

Time: 3 Hours **Full Marks: 70**

(i) Use separate answer script for each half
(ii) Answer ***Six*** questions taking any ***Three*** from each half
(iii) **Two marks** reserved for neatness in each half

FIRST HALF

1. (a) Show the connection diagram of shunt excitation type DC generator and relate the armature current, line current and the field current.

   (b) Derive the equation of torque for a dc motor.

   (c) An 8-pole lap wound dc generator has 1000 armature conductors; flux of 20 mWb per pole and emf generated is 400 V. What is the speed of the machine? What will be the generated emf if the armature conductors were wave connected and the machine is run at the same speed?

   [3+4+(2+2)]

2. (a) Derive an expression for the emf induced in a transformer winding.

   (b) Draw the no load phasor diagram of a single phase transformer.

   (c) A 1000 kVA single phase transformer has primary and secondary turns of 400 and 100 respectively and induced voltage in the secondary is 1000V. Find (i) the primary voltage, (ii) the primary and secondary full load current and (iii) the secondary current when 100 kW load at 0.8 p.f. is connected at the output.

   [4+4+3]

3. (a) State superposition theorem and explain it.

   (b) Prove that under maximum power transfer condition the power transfer efficiency of the circuit is only 50%.

   (c) Find the current through the 2 Ω resistor in the Fig.1 using Norton's theorem. [3+3+5]

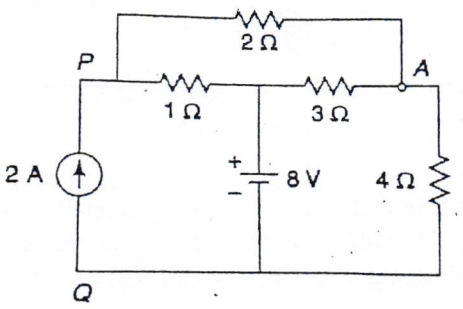

Fig. 1

4. (a) Explain with the aid of a typical B-H curve the meaning of the following terms:

Relative permeability, coercivity and remanence.

What information can be derived from the B-H loop?

What is meant by magnetic hysteresis?

(b) An iron ring has a mean circumference of 80 cm and cross-sectional area of 5 cm^2 and a coil of 150 turns is wound uniformly on the ring. Calculate the exciting current for a flux of 6.4 X 10^{-4} Wb. Assume relative permeability of iron 600.

[7+4]

5. Write short notes on: (any two)

(a) Distinction between magnetic and electric circuits.

(b) Linear and non linear elements.

(c) Starting of DC motor.

(d) Hysteresis loss in magnetic circuit

[5.5 x 2]

SECOND HALF

6. (a) A sinusoidal alternating current of frequency 60Hz has rms value of 15 A. (i) write down the equation for instantaneous value (ii) Find the value of current after 1/200 second (iii) Find the time taken to reach 15A for the first time, and (iv) find its average value.

(b) Apply the Superposition Theorem to the network shown below (Fig. 2) and obtain the current, I in the $3 + j4\ \Omega$ impedance.

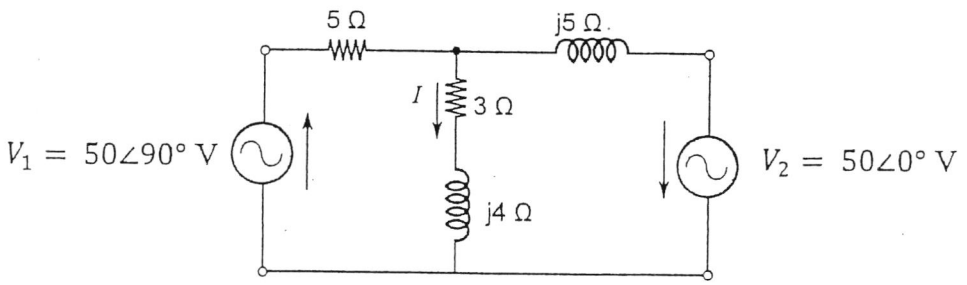

Fig.-2

[(2+1+2+1)+5]

7. (a) A coil of resistance 20 Ω and inductance 0.2 H is connected in series with a condenser of capacitor 75μF across a 200V, 50Hz supply. Determine the following (i) Impedance (ii) current (iii) power factor (iv) voltage across the coil and (v) voltage across the condenser. Draw the phasor diagram.

(b) A 15 mH inductor is in series with a parallel combination of an 80 Ω resistor and 20μF capacitor. If the angular frequency of the applied voltage is ω=1000 radians/second, find the total admittance of the network.

[(1+1+1+1+1+2)+4]

8. (a) Give the properties of R-L-C series resonance and also draw graph showing the variation of resistance, inductive reactance and capacitive reactance with frequency.

(b) A coil of resistance 40 Ω and inductance 0.75 H forms part of a series circuit for which resonant frequency is 45Hz. If the supply is 250 V, 50 Hz, find (i) line current (ii) power factor (iii) power consumed and (iv) voltage across the coil.

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

9. (a) Explain two wattmeter method to measure 3-ph power in Y connected load. Derive the phase angle in terms of wattmeter readings.

(b) A balanced 3-phase star connected load of 18 kW taking a leading current of 60A when connected across a 3-ph 440 V, 50 Hz supply. Find (i) the power factor of the load and (ii) per phase resistance and reactance of the load.

[5+(2+2+2)]

10. (a) A 3-ph induction motor runs at a speed of 1485 RPM at no load and at 1350 RPM at full load when supplied from a 50Hz, 3 phase line. (i) How many poles does the motor have? (ii) What is the slip at no-load and at full-load? (iii) What is the frequency of rotor voltages at no-load and at full load? (iv) What is the speed at both no-load and full load of the rotor field with respect to rotor?

(b) Explain how and under what conditions a rotating magnetic field is created in a 3-phase induction motor.

[(1+2+2+2)+4]