Total No. of printed pages = 4

CAI-402/EM&C/4th Sem/2014/N

ELECTRICAL MACHINES AND CONTROL

Full Marks – 70

Pass Marks – 28

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) What is transformer ? What is ideal transformer ? 3

   (b) Draw the transformer phasor diagram. 4

   (c) A 5 kVA, 1000/200V, 50 Hz single phase transformer gave the following test results :

   Open circuit test (*l.v.* side) : 200V, 1.2A, 90W.

   Short circuit test (h.v. side) : 50V, 5A, 110W.

   Compute the parameters of the approximate equivalent circuit referred to *l.v.* side. Also draw the exact equivalent circuit referred to *l.v.* side. 7

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2. (a) Derive the relation between phase voltage and line voltage for star connection. Also draw the phasor diagram. 7

(b) A 3 phase Y-connected load is supplied by an abc-sequence balanced three phase Y-connected source with a phase voltage of 120V rms. If the line impedance and load impedance per phase are $(1+j)\Omega$ and $(20+j10)\Omega$ respectively, determine the value of line currents and the load voltages. 7

3. (a) Develop the circuit model of a DC machine. 3

(b) Write the classification of DC machine on the basis of methods of excitation. 3

(c) A DC shunt generator gives an open circuit voltage of 240V, when loaded the terminal voltage falls to 220V. Determine the load current in case of armature circuit and field winding resistances are 0.1Ω and 50Ω respectively. Neglect the effect of armature reaction. 8

4. (a) Describe the working principle of a polyphase induction motor. 7

(b) A 400V, 3 phase, 6 pole, 50 Hz induction motor draws a power of 2 kW at no load and at rated voltage and frequency. At a full load slip of 3% the power input to motor is 50 kW and the stator ohmic loss is 1.5 kW. Neglect I^2R loss at no load. If the stator core loss and mechanical losses are assumed equal, then at a slip of 3% calculat :

(i) rotor ohmic loss

(ii) shaft power or output power. 7

5. (a) Draw the phasor diagram of synchronous generator. 7

(b) A 3 phase star-connected alternator is delivering 20 MW and 8 MVAR to an infinite bus at 11 kV. The alternator has synchronous impedance of $(0+3j)\Omega$. Determine the load angle and the excitation emf of the alternator. 7

6. (a) Explain why a single phase induction motor is not self-starting. 7

(b) Draw the equivalent circuit diagram of a single phase induction motor. Explain with diagram. 7

7. Write short notes on any *two* : 7×2=14

(a) Reluctance motor

(b) Hysteresis motor

(c) V-curves.