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B. Tech  
CPEE 5304

Sixth Semester Examination – 2008

ELECTRICAL MACHINES – II

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory  
and any **five** from the rest.

The figures in the right-hand margin  
indicate marks.

1. Answer the following questions : 2×10
- (i) What are the advantages of short-pitch coil in the armature winding in an ac machine ?
  - (ii) A full-pitched coil of Ni ampere-turns placed in the stator slots. What is the peak amplitude of the fundamental mmf wave ?

P.T.O.

- (iii) From the stator of an induction motor what frequency of rotor currents would you observe ?
- (iv) A synchronous motor is floating on infinite mains at no load. If its excitation is now increased, what is going to happen ?
- (v) For controlling the speed of an induction motor the frequency of the supply is increased by 10%. For maximum torque to remain constant what you will do ?
- (vi) Why block rotor test is done in an induction motor ?
- (vii) The power input to an induction motor is 40 kW when it is running at 5% slip. The stator resistance and core loss are assumed negligible. What is the magnitude of torque developed in synchronous watt ?

(viii) A single phase self-starting motor has two stator winding placed at what electrical degree apart and what kind of supply is given ?

(ix) Where is the Delta-Delta connection applied ?

(x) Two 3 limb, 3-phase delta-star connected transformers are supplied from the same source. One of the transformers is Dy1 and the other is Dy11 connection. What would be the phase difference of the corresponding phase voltage of the secondaries ?

2. (a) Explain how the Potier triangle can be drawn with the help of OCC and any points on the zpfc. 4

(b) Explain the method of determining the voltage regulation by Potier triangle method. 4

(c) How it is different than other methods ? 2

3. (a) In an alternator, a lagging current has the effect of weakening the main field, but in a synchronous motor, the effect of lagging current is to strengthen the main field. Explain. 5
- (b) An alternator connected to an infinite bus, is supplying some power. For constant power input from the primemover, if the field current is increased, explain what happens to the load angle. Will the rotor move towards the resultant air-gap mmf or away from it ? 5
4. (a) From the equivalent circuit of a cylindrical rotor alternator, derive an expression for its power input and power output. 5
- (b) A 3-phase star connected alternator has synchronous impedance of  $1 + j10 \Omega$  per phase. It is operating at a constant voltage of 6.6 kV and its field current is adjusted

to give an excitation voltage of 6.4 kV. Find the power output, armature current and pf under the conditions of (i) maximum power output and (ii) maximum power input. 5

5. (a) Develop the phasor diagram for a polyphase induction motor. How does it differ from the phasor diagram of a transformer ? 5
- (b) A 3-phase, 400 V, 50 Hz induction motor takes a power input of 35 kW at its full-load speed of 890 rpm. The total stator losses are 1 kW and the friction and windage losses are 1.5 Kw. Calculate : 5
- (a) slip
  - (b) rotor ohmic losses
  - (c) shaft power
  - (d) shaft torque
  - (e) efficiency.



6. (a) Sketch the torque-slip characteristic of an induction motor working at rated voltage and frequency. Explain and draw these characteristics, with respect to the normal one, if the following changes are made : 5

- (i) Applied voltage is reduced to half at rated frequency
- (ii) Both the applied voltage and frequency are reduced to half.

(b) For a 3-phase induction motor, the rotor ohmic loss at maximum torque is 16 times that at full-load torque. The slip at full load torque is 0.03. If stator resistance and rotational losses are neglected, then calculate : 5

- (i) slip at maximum torque
- (ii) the maximum torque in terms of full-load torque
- (iii) the starting torque in terms of full-load torque

7. (a) How three phase to six phase conversion is possible ? Explain your answer with necessary connection diagrams. 5

(b) What is a three winding transformer ? Where it is used ? 5

8. (a) Two transformers connected in open-delta supply a 400 kVA balanced load operating at 0.866 power factor lagging. The load voltage is 440 V. What is the (a) kVA supplied and (b) kW supplied by each transformer ? 5

(b) Describe the construction and principle of operation of a repulsion induction motor. 5