[06 – 3113]

III/IV B.E. DEGREE EXAMINATION.

First Semester

Electrical and Electronics Engineering

PERFORMANCE AND DESIGN OF ELECTRICAL MACHINES — II

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory and answer any other FOUR questions.

1. Answer the following :

(a) Why should Dry Type Transformers never be over-loaded?

(b) Why are Small Distribution Transformers not used for Industrial Control Applications?

(c) What is the major cause of noisy operation of the single phase induction motor?

(d) List the applications of single phase induction motors.

(e) Why the starting torque of Squirrel cage induction motor is LOW?

(f) What is the effect of no. of poles on speed of motor?

(g) List the various cooling methods of power transformers.

2. (a) Derive the condition for maximum efficiency of a transformer.

(b) Two single phase transformers A and B of ratings 500 kVA and 250 kVA are supplying a load of 750 kVA at 0.8 pf lagging. Their OC voltages are 405 V and 410 V respectively. Transformer A has 1 % resistance and 5 % reactance. Transformer B has 1.5 % resistance and 4 % reactance. Find circulating current at no load and current supplied by each transformer and kVA shared by each transformer.

3. (a) What are the limitations of Sumpners test? Give the related calculation to find the approximate equivalent circuit of transformer.

(b) Two similar single phase transformer are put to back to back test. Power input from supply line is 16 kW on no load and power output of auxiliary transformer when the rated current is circulated through the secondaries is 25 kW. Calculate for each transformer the full load efficiency at 0.8 pf lagging, the maximum efficiency and the corresponding load.

4. (a) Deduce the expression for (rotor side) starting current, starting power factor, standstill frequency and standstill EMP of squirrel cage IM.

(b) A 3 – Φ, 50 Hz, 4 pole, 400 V, wound rotor IM has a Δ connected stator winding and star connected rotor winding. Rotor conductors are 80 % of stator conductors. For speed of 1425 RPM calculate slip, the rotor induced emf/ph between the two slip rings and frequency of rotor current.

5. (a) What are the specific advantages of rotor resistance starter over any other type of starter? What is the reason that rotor resistance starters are limited in use?

(b) The rotor of a 3 – Φ IM has per phase rotor impedance of $0.04 + j\ 0.2\Omega$. What external resistance must be added in external circuit to get half of maximum torque at starting? By what percentage will this external resistance change the current and power factor of the motor at starting?

6. (a) Explain, the speed of single phase Induction motor can be controlled by supply voltage where as them is not possible with 3 – Φ IM, why?

(b) The constants of a quarter HP, 230 V, 50 Hz, 4 pole single phase IM are as follows :

Stator resistance = 10.0 Ω; Stator reactance = 12.8 Ω. Magnetising reactance = 258 Ω, Rotor resistance referred to stator = 11.65 Ω, Rotor reactance referred to stator = 12.8 Ω. The total

load is such that the machine runs at 3% slip, when the voltage is at 210 V. The iron losses are 35.5 W at 210 V. If mechanical losses are 7 W; Calculate

(i) Input current

(ii) Power developed

(iii) Efficiency.

7. (a) List the applications of single phase Induction motor. What are the limitations of single phase induction motor?

(b) Explain the equivalent circuit of single phase Induction motor.

8. (a) What is meant by Stepped core in a transformer? Describe available choices with help of sketches.

(b) Calculate approximate overall dimensions for a 200 KVA, 6600/440V, 50 Hz, 3 phase core type transformer. The following data may be assumed. Emf per turn = 10 V, maximum flux density = 1.3 wb/m^2, current density = 2.5 A/mm^2, window space factor = 0.3, overall height = overall width, stacking factor = 0.9 use 3 stepped core. For a 3 stepped core :

Width of largest stamping = 0.9 d

Net iron area = 0.6 d^2 where d is the diameter of circumscribing circle.
