Exam. Code: 0933
Sub. Code: 33750

2125

B.E. (Electrical and Electronics Engineering)
Third Semester
PC-EE-4301: Electric Machinery - I

Time allowed: 3 Hours Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Unit.

x-x-x

1. (a) Differentiate between cumulative and differential compounding in DC generators. How does each affect voltage regulation?
   (b) A 220 V DC series motor draws 30 A at full load and runs at 800 rpm. If the load current reduces to 20 A, determine the approximate new speed assuming flux $\propto$ current and negligible losses.
   (c) Explain why the efficiency of a transformer is higher than that of other electrical machines. What losses contribute to its inefficiency?
   (d) A 100 kVA, 11 kV/400 V transformer has a per-unit impedance of 0.05 + j0.10. Calculate the voltage regulation at full load and 0.8 lagging power factor.
   (e) Explain how rotor resistance affects the torque–speed characteristics of a 3-phase induction motor. Why is this property useful in wound-rotor motors? (5x2)

UNIT - I

2. (a) A shunt generator has a full load current of 196 A at 220 V. The stray losses are 720 W and the shunt field coil resistance is 55 ohms. Find the armature resistance if it has a full-load efficiency of 88%. In addition, find the load current corresponding to maximum efficiency.
   (b) Explain the Ward Leonard method of Speed control of DC Motors. (2x5)

3. (a) Draw and explain the equivalent circuit and the phasor diagram of the transformer under RL load.
   (b) A short circuit test is conducted on a 5 kVA, 400 V/ 100 V single-phase transformer with 100 V winding shorted. The input voltage at full-load current is 40 V. The wattmeter, on the input reads 250 W. Find the power factor for which regulation at full-load is zero. (2x5)

4. A 3-phase, 50 Hz, 400 V, 6-pole induction motor is having the actual speed of 950 rpm. The power input to this motor is 50 kW. The losses of the motor are described as follows: Stator losses= 2000 W, Friction and windage losses= 3000 W.

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Calculate the following parameters of this induction motor:

a) Rotor copper losses
b) Output power
c) Efficiency (10)

UNIT - II

5. (a) A 6600/384 V, 200 kVA single-phase transformer has efficiency at unity of is 98% under both full-load and half-load conditions. The pf at no-load is 0.2 lagging and the full-load regulation at a lagging pf of 0.8 is 4%. Draw the equivalent circuit referred to the LV side by mentioning all the parameter values.

   (b) Explain the equivalent circuit of transformer referred to secondary side. (2x5)

6. (a) A 250 Volt DC shunt motor has an armature resistance of 0.5 ohm and a field resistance of 250 ohm. When driving a constant torque load at 600 rpm, the motor draws 21 A. What will be the new speed of the motor if an additional 250 ohm resistance is inserted in the field circuit?

   (b) Explain the various methods of speed control of DC motors. (2x5)

7. (a) The open circuit voltage across the slip rings of a 100 HP induction motor is 273 V at a standstill. What resistance in the rotor circuit will reduce its full-load speed by 25%? The full-load slip is 2% with no additional rotor resistance. Assume the rotor to be star connected.

   (b) How the performance of induction motor is affected by space harmonics? Describe the Cogging and Crawling phenomena along with suitable remedial measures of induction motor in detail. (2x5)

x-x-x