



P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Third Semester, B.E. - Electrical and Electronics Engineering

Semester End Examination; Dec. - 2015

Electrical Machines - I

Time: 3 hrs

Max. Marks: 100

Note: i) Answer **FIVE** full questions, selecting at least **ONE** full question from each **unit**.

ii) Assume suitable missing data, if any.

UNIT - I

- 1 a. With necessary diagram explain the construction and working principle of constant voltage transformer. 8
- b. Derive an expression for saving of copper when an autotransformer used. 6
- c. Write a short note on constant current transformer. 6
- 2 a. What are the differences between shell type and core type transformer? 5
- b. Derive an equivalent circuit of a single phase transformer and show that the parameters of primary and secondary winding may be combined to give a simplified equivalent circuit referred to primary side. 10
- c. Write a short note on ideal transformer. 5

UNIT - II

- 3 a. What is All day efficiency of a transformer? Explain how to calculate it? 6
- b. Explain the short circuit test and open circuit test on transformer. 6
- c. A 5 kVA, 500/250 V, 50 Hz, single phase transformer gave the following readings :
 OC Test: 500 V 1 A 50 W (LV side open)
 SC Test: 25 V, 10 A, 60 W (LV side shorted) 8
 Determine; (i) The efficiency on full load, 0.8 lag pf
 (ii) The voltage regulation on full load, 0.8 leading pf
 (iii) The efficiency of 60% of full load , 0.8 lead pf.
- 4 a. What is voltage regulation of a transformer? Explain Sumpner's test. 6
- b. Write a short note on losses in a transformer. 6
- c. Two similar 200 kVA, single phase transformers gave the following results when tested by Sumpner's test :
 Mains Wattmeter $W_1 = 4$ kW 8
 Series Wattmeter $W_2 = 6$ kW at full load current
 Find out individual transformer efficiencies at :
 (i) Full load at unity pf (ii) Half load at 0.8 pf lead

UNIT - III

- 5 a. What are the conditions for parallel operation of three phase transformers? 6
- b. Write a short note on Scott connection of transformer. 6
- c. A Δ - Δ bank consisting of three 40 kVA, 2300/230 V transformers supplies a load of 80 kVA, If one transformer is removed, find for the resulting V-V connection
- i) kVA load carried by each transformer 8
- ii) Percent of rated load carried by each transformer
- iii) Total kVA rating of V-V bank
- iv) Ratio of the V-V bank to Δ - Δ bank transformer ratings.
- 6 a. What is open-delta connection? Prove that the capacity of V-V bank is 58% of Δ - Δ capacity. 6
- b. Write a short note on Tap changing of transformers. 6
- c. A three phase step down transformer with per phase turns ratio 47.6:1 connected to delta/star and is supplying a load of 400 kW, 0.8 lagging pf at 400 V. Sketch the connection diagram and show in it different line voltages. 8

UNIT - IV

- 7 a. Explain how rotating magnetic field produced in 3 - phase induction motor. 8
- b. List the differences between Squirrel cage and slip ring induction motor. 6
- c. A 6-pole, 3-phase, 50 Hz induction motor develops a maximum torque of 30 N-m at 960 rpm. Determine the torque exerted by the motor at 5% slip. The rotor resistance per phase is 0.6Ω . 6
- 8 a. In a 3-phase induction motor, show that $P_2:P_c:P_m$ is equal to 1:S:1-S. 6
- b. Write a brief note on speed control of 3 - phase induction motor. 6
- c. A 24 pole, 50 Hz, star connected induction motor has rotor resistance of 0.016Ω per phase and rotor reactance of 0.265Ω per phase at stand still. It is achieving its full load torque at a speed of 247 rpm. Calculate the ratio of :
- (i) Full load torque to maximum torque (ii) Starting torque to maximum torque. 8

UNIT - V

- 9 a. Explain how the performance of a 3 - phase induction motor is predetermined from the circle diagram by conducting no load and blocked rotor tests. 12
- b. Write a short note on induction generator. 8
- 10 a. Explain why single phase induction motors are not self starting. 8
- b. Write a note on shaded pole motor. 6
- c. Write a short note on cogging and crawling in three phase induction motor. 6