



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

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Semester End Examination; June - 2017

Electrical Machines - I

Time: 3 hrs

Max. Marks: 100

Note: Answer **FIVE** full questions, selecting **ONE** full question from each unit.

UNIT - I

- 1 a. With a neat sketch, explain the working of a constant voltage transformer. 6
- b. Show that an auto transformer will result in saving copper in place of two winding transformer. 6
- c. The no load current of transformer is 5 A at 0.3 pF when supplied at 230 V, 50 Hz. The number of turns on primary winding is 200. Calculate; 8
- i) The maximum value of flux in the core ii) The core loss iii) The Magnetizing current.
- 2 a. Derive EMF equation of single phase transformer. Draw the vector diagram of practical transformer for leading power factor. 7
- b. Develop the exact equivalent circuit of single phase transformer. From this derive approximate and simplified equivalent circuit of a transformer. 7
- c. A 230/460 V transformer has primary resistance of 0.2 Ω and reactance of 0.5 Ω the corresponding values for the secondary are 0.7 Ω and 1.8 Ω respectively. Find the secondary terminal voltage and supplying 10 A at 0.8 pF Lagging. 6

UNIT - II

- 3 a. Derive an expression for load division between two dissimilar transformers connected in parallel with unequal voltage ratios. 10
- b. A transformer has its efficiency of 0.98 at 15 kVA at UPF. During the day it is loaded as follows: 10
- 12 hours – 12 kW at pF 0.5,
- 6 hours – 12 kW at pF 0.8,
- 6 hours – 18 kW at pF 0.9. Find the all day efficiency.
- 4 a. Explain the sumpners test for testing two 1- ϕ transformer. Also explain why this is beneficial for finding efficiency of transformer. 10
- b. A 20 kVA, 2200/220 V, 50 Hz single phase transformer gave the following readings :

| | | | |
|---------|-------|--------|-------|
| OC test | 220 V | 4.2 A | 148 W |
| SC test | 86 V | 10.5 A | 360 W |

Determine;

- i) The equivalent resistance and reactance referred to secondary
- ii) The voltage regulation at full load, 0.8 pF lagging
- iii) The efficiency at full load, 0.8 pF lagging. 10

UNIT - III

- 5 a. Explain with necessary diagram, how two phase transformers can be used to convert a three phase supply to a two phase supply. If the load is balanced on side show that it will be balanced on other side. 8
- b. What are the advantages of single 3 phase transformers units over a bank of single phase transformer? 5
- c. A 3 phase, 100 kVA, 6600/1100 V transformer is delta connected on the primary and star connected on the secondary. The primary resistance per phase is 1.8Ω and secondary resistance per phase is 0.025Ω . Determine the efficiency when the secondary is supplying full load at 0.8 pF and the iron loss is 15 kW. 7
6. a With a neat diagram, explain : 10
- i) Open Delta or V-V connection ii) Delta-delta connection.
- b. A 3ϕ transformer as delta connected primary and a star connected secondary working on 50 Hz, 3ϕ phase supply. The line voltage of primary and secondary is 3300 V and 400 V respectively. The line current on the primary side is 12 A and secondary as a balanced load at 0.8 lagging pF. Determine the secondary phase voltage line current and the output. 10

UNIT - IV

- 7 a. Show that a rotating magnetic field can be produced by the use of 3ϕ current of equal magnitude. 8
- b. State the different method of speed control of 3ϕ induction motor and discuss in detail any one method. 6
- c. A 1000 V, 50 Hz, 3ϕ induction motor has connected to stator. The ratio of stator to rotor turns is 3.6. The standstill impedance of rotor per phase is $0.01 + j0.2 \Omega$. Calculate. 6
- i) Rotor current at start ii) Rotor pF at Start iii) Rotor current at slip is 3%.
- 8 a. Draw torque-slip characteristics of inductor-machines. Show braking, motoring and generating region. 7
- b. Explain with the help of neat sketches the difference between 3ϕ slip ring induction motor and 3ϕ squirrel cage induction motor 7
- c. A 400 V, 4 poles, 3ϕ , 50 Hz star connected induction motor has a rotor resistance and reactance per phase equal to 0.01Ω and 0.1Ω respectively. Determine starting torque. Assume ratio of stator to rotor turns as 4. 6

UNIT - V

- 9 a. Explain why single phase induction motor is not self starting. Describe any one method of starting of a single phase induction motor. 10
- b. Discuss the procedure for No Load test and blocked rotor test on a 3ϕ induction motor. How are parameters of equivalent circuit determined from test results? 10
10. Write short notes on : 20
- i) What are the limitations and application of shaded pole induction motor
- ii) Phenomenon of cogging and crawling in 3ϕ induction motor
- iii) Double revolving field theory of single phase induction motor.