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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. - 2014

Electrical Machines - I

Time: 3 hrs *Max. Marks: 100*

Note: *i) Answer **FIVE** full questions, selecting **ONE** full question from each Unit.*
ii) Assume suitable missing data if any.

Unit - I

1. a. What are the differences between shell type and core type transformer. Explain with necessary sketches. 8

   b. With necessary diagram, explain the construction and working principle of constant voltage transformer. 6

   c. Explain action of transformer on no load with phasor diagram with losses but no magnetic leakage. 6

2 a. Derive the equivalent circuit of starting transformer staring from fundamentals exact and approximate circuit. 8

   b. What is an auto transformer? What are the uses of auto transformer? Derive an expression for the saving of copper for a step up transformer. 8

   c. A 5 kVA 110/110 V single phase, 50 Hz, transformer has full load efficiency of 95% and an iron loss of 50 W. The transformer is now connected as an auto transformer to a 220 V supply. If it delivers 5 kW load at unity power factor to a 110 V circuit. Calculate the efficiency of the operation and the current drawn by the high voltage side. 4

Unit - II

3 a. What is voltage regulation of a transformer? Explain with neat circuit diagram O.C. and S.C. test to find the efficiency and voltage regulation of a transformer. 8

   b. Give an account of various losses that occur in the transformer. How these losses do are minimized. 6

   c. A 4 kVA 200/400 single phase transformer supplying full load current at 0.8 lagging power factor – the O.C. and S.C. tests results are as follows:

O.C. Test :	200 V	70 W	0.8 A (L.V. side)
S.C. Test :	20 V	60 W	10 A(H.V. Side)

   Calculate efficiency, secondary voltage and current drawn by the primary at the above load. Calculate the load at unity factor corresponding to maximum efficiency. 6

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4 a. With a neat diagram explain Sumpner's test for determining the efficiency and voltage regulation of a transformer. Mention its advantages and disadvantages. 8

b. Define All day efficiency of a transformer. Explain its importance in the design of distribution transformers. 6

c. A 5 kVA distribution transformer has full load efficiency at u.p.f. of 95% the copper and Iron losses then being equal. Calculate it's All day efficiency, if it is loaded throughout the 24 hrs as follows:

No load 10 Hrs, quarter load for 7 hours

Half load for 5 Hrs, full load for 2 Hrs

Assume load pf as unity. 6

Unit - III

5 a. State and explain the condition to be satisfied for successful parallel operation of transformers. 6

b. Explain with the help of connection and phasor diagrams. How Scott connection can be used to obtain two phase supply from 3 phase supply mains. 8

c. Two 2200/110 V, transformers are operated in parallel to share a load of 125 kVA at 0.8 p.f. lagging transforms are rated as below.

A:	100 kVA	0.9% resistance and 10% reactance
B:	50 kVA	1% resistance and 5% reactance

6

Find the kVA load carried by each transformer.

6 a. What are the advantages of a transformer bank of three single phase transformers over a unit three phase transformer of the same kVA rating? 6

b. What is Open-Delta connection? Prove that the capacity of V-V Bank is 58% of Δ - Δ capacity. 6

c. A Δ - Δ bank consisting of three 20 kVA, 2300/230 V transformers supplies a load on 40 kVA. If one of the transformers is removed, find for the resulting V - V connection

(i) kVA load carried by each transformer

(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. 8

Unit - IV

7 a. Explain with neat sketches the construction of squirrel cage and slip ring induction motor. Mention the advantages and disadvantages of each type. 8

Contd…3

b. In a 3 phase Induction motor, show that
Rotor Input: Rotor Copper loss: Mechanical power developed equal to 1:S:1-S. 6

c. The power input to the rotor of 400 V 50 Hz, 6 poles, 3ϕ induction motor is 75 kW. The rotor electromotive force is observed to make 100 complete alterations per minute. Calculate; (i) Slip (ii) Rotor speed
(iii) Rotor Copper loss/ phase (iv) Mechanical Power developed 6

8 a. Draw the complete torque slip characteristics of a 3 phase Induction motor indicating all the regions and explain. 7

b. A 3 phase.400 V, 50 Hz, 4pole induction motor has star connected stator winding the rotor resistance and reactance of 0.1 Ω and 1 Ω respectively. The FL speed is 1440 rpm. Calculate the torque developed on FL by the motor. Assume stator to rotor ratio as 2:1. 6

c. Write a brief note on the speed control of 3 phase induction motors. 7

Unit - V

9 a. Explain how the performance of a 3 phase induction motor is predetermined from the circle diagram by conducting open circuit and blocked rotor tests. 10

b. Explain the necessity of a starter for 3 phase induction motor and with necessary circuit diagram. Explain the working of a star-Delta starter. 6

c. Explain the phenomenon of cogging and crawling in 3 phase induction motor. 4

10 a. Explain why single phase induction motor is not self starting. Describe any one method of starting of a single phase induction motor. 7

b. With neat sketch, explain the construction, working principle and application of capacitor start single phase induction motor. 7

c. With the help of phasor diagram, explain the performance of an induction motor as an induction generator. 6

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