USN | | | | | | | | | | |

06EE46

Fourth Semester B.E. Degree Examination, May/June 2010
Transformers and Induction Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART - A

1 a. Explain the different classification of transformers, mentioning the field of application for each. **(10 Marks)**

b. Write the phasor diagram of a practical transformer on no load and explain. **(05 Marks)**

c. A single phase transformer has a turns ratio of 1 : 10 and the secondary winding has 1000 turns. When the primary winding is connected to 25 volts supply, the maximum value of flux in the core is found to be 2.25 mWb. Determine i) The frequency of the supply ii) Number of primary turns iii) Secondary terminal voltage on open circuit. **(05 Marks)**

2 a. From first principles, develop the equivalent circuit of a transformer, referred to primary, and explain. **(06 Marks)**

b. Draw the complete phasor diagram of a single phase transformer under full load conditions, lagging connected to a lagging power factor load and explain. **(06 Marks)**

c. Obtain the equivalent circuit parameters of a 200/2000V single phase, 30 KVA step up transformer having the following test results.

O.C. test :	200V, 6.2A, 360 W :	L.V. Side
S.C test :	75V, 18A, 600 W :	H.V. Side

Write the equivalent circuit referred to LV side. **(08 Marks)**

3 a. State the causes which produce a dissipation of power in the working material of a transformer. Discuss how these losses are affected by variation of voltage and frequency. **(06 Marks)**

b. With a neat circuit diagram, explain Sumpner's test conducted on transformers. Explain how the parameters can be obtained from this test. **(06 Marks)**

c. A 1 ϕ, 50 Hz, 40 KVA transformer has got a maximum efficiency of 97% at 80% of load at unity p.f. During the day it is loaded as follows :
6 AM to 3PM : 6kW at 0.6 p.f lagging
3 PM to 11PM : 25 kW at 0.8 p.f. lagging
11PM to 6AM : 30kW at 0.9 p.f lagging.
Determine the all – day efficiency of the transformer. **(08 Marks)**

4 a. State and explain the conditions to be satisfied for successful parallel operation of transformers. **(07 Marks)**

b. Explain with circuit diagram and phasor diagram, how two transformers connected in open delta can supply 3ϕ power successfully. **(06 Marks)**

c. Two 110 volts single phase electric furnaces take loads of 500 kW and 800 kW respectively at a power factor of 0.71 lagging and are supplied from 6600V, 3 - phase, 50Hz mains through a Scott – connected transformer combination. Calculate the currents in the 3 – phase lines neglecting transformer losses. Draw the phasor diagram. **(07 Marks)**

PART - B

5 a. Show that a rotating magnetic field of constant magnitude is produced by a balanced 3ϕ supply in uniformly distributed coils and explain how this principle is applied in 3 - phase induction motors. **(10 Marks)**

b. Differentiate between squirrel cage and slip ring induction motors. **(04 Marks)**

c. A 6 pole, 3 - phase, 50Hz induction motor gives full load output of 20HP when running at 945 rpm. Under this condition stator losses amount to 1 kW. Allowing 13.65 N-m for mechanical torque lost in friction and windage loss, find i) Rotor copper loss ii) Power input to the motor iii) Efficiency. **(06 Marks)**

6 a. With a neat circuit diagram, explain no load and blocked rotor test conducted on 3 phase induction motors to construct circle diagram. **(08 Marks)**

b. A 15HP, 400V, 50Hz, 3 – phase, 4 pole delta connected induction motor gave the following test results.
No load test : 400V, 8A, 1000 Watts ; Blocked rotor test : 100V, 25A, 1750 Watts.
Construct the circle diagram and estimate i) Full load current and power factor ii) Maximum possible power output iii) Best possible operating power factor. **(12 Marks)**

7 a. Draw the complete torque slip characteristics of a 3 ϕ induction motor indicating all the regions and explain. **(08 Marks)**

b. Explain the phenomenon of cogging and crawling in 3 phase induction motor. What is their effect and how it is avoided? **(06 Marks)**

c. A 3 – phase, 400 volts, 50Hz, 4 pole star connected induction motor has stator impedance of $Z_1 = (0.07 + j\ 0.3)\ \Omega$ per phase and rotor impedance of $Z_2^1 = (0.08 + j\ 0.3)\ \Omega$ per phase referred to stator side. The magnetizing reactance is 10 Ω / phase and core loss resistance is 50Ω / phase. Under these conditions the slip is found to be 4 %. Using appropriate equivalent circuit, calculate i) Stator current and power factor ii) Torque developed iii) Gross efficiency. **(06 Marks)**

8 a. Explain any three important methods, with suitable circuits, how speed control can be achieved in 3 – phase induction motors. **(10 Marks)**

b. With neat sketches, explain the construction, working principle and applications of i) Split phase and ii) capacitor start single phase induction motors. **(10 Marks)**

*****