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Code No: 07A40202 **R07** **Set No. 2**

II B.Tech II Semester Examinations,December 2010
ELECTRICAL MACHINES - II
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A 3 phase induction motor runs at almost 1000 rpm at no load and 950 rpm at full load when supplied with power from a 50Hz phase line.
   (a) How many poles has the motor?
   (b) What is the percentage slip at full load?
   (c) What is the corresponding speed of the rotor filed with respect to the rotor?
   (d) What is the corresponding frequency of the corresponding voltage?
   (e) What is the rotor frequency at the slip of 10%? [16]

2. (a) Explain why transformer rating is expressed in KVA or VA. Describe the significance of all the items mentioned on the name - plate of a single - phase transformer.
   (b) A 20 KVA, 2500/250 V, 50 Hz, 1-phase transformer has the following test results.
   O.C. test (l.v. side) : 250 V, 1.4 A, 105 W
   S.C. test(h.v. side) : 104 V, 8A, 320 W
   Calculate the efficiency at full-load and 0.8 lagging power factor. [8+8]

3. (a) Draw and explain the no-load phasor diagram of a 1-phase transformer. Discuss how primary leakage flux is accounted for in the phasor diagram.
   (b) A 2200/220V, 50 Hz, single phase transformer has exciting current of 0.6 A and a core loss of 361 W. When its h.v. side is energised at rated voltage. Calculate the two components of the exciting current. [8+8]

4. A bank of three single-phase transformers has its h.v. terminal connected to 3-wire, 3-phase, 11 kV system. Its l.v terminals are connected to a 3-wire, 3-phase load rated at 1500 KVA, 2200 V. Specify the voltage, current and KVA ratings of each transformer for both h.v and l.v windings for the following connections.
   (a) Y - Δ
   (b) Δ - Y
   (c) Δ - Δ

   The first symbol indicats h.v winding and the second symbol l.v winding. [16]

5. How would you determine the circle diagram of a 3 phase induction motor experimentally. [16]

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6. Define "Efficiency" and "all-day efficiency" of a transformer.
   A 100 KVA, 2200/220 V transformer has the following circuit parameters: R_1 = 0.23Ω, R_2 = 0.0023Ω,X_1 = 1.83Ω, X_2 = 0.013Ω,r_c(HV side) = 5.6kΩ, x_m(HV side) = 1.12kΩ. The transformer is subjected to the following daily load cycle:
   4 hours on no-load.
   8 hours on $1/4^{th}$ full-load at 0.8 p.f
   8 hours on 1/2 full-load at 4 p.f
   and 4 hours on full-load at 0.9 p.f
   Determine the 'all-day' efficiency of the transformer. [16]

7. (a) What happens if the emf is injected to the rotor circuit of induction motor?
   (b) An 8 pole, 50 Hz, 3 phase induction motor is running at 4 percent slip when delivering full load torque. It has standstill rotor resistance of 0.1 ohm and reactance of 0.6 ohm per phase. Calculate the speed of the motor if an additional resistance of 0.5 ohm per phase is inserted in the rotor in the rotor circuit. The full load torque remains constant. [8+8]

8. A 3-phase wound rotor induction motor develops a maximum torque of 4 times the full load torque at a slip of 0.20. The per phase rotor resistance is 0.40 ohm. The stator resistance and rotational losses are negligible.
   (a) Calculate the slip at full load torque. If the stator resistance were considered, would the value of slip at full load torque be smaller, same or large?
   (b) Calculate the value of external resistance that must be inserted in rotor circuit in order to obtain maximum torque at starting. [16]

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ELECTRICAL MACHINES - II
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Give the equivalent circuit of a transformer and define its parameters.
   (b) A 100 KVA, 50 Hz, 440/11000 V, 1-phase transformer has an efficiency of 98.5% when supplying full-load current at 0.8 p.f and an efficiency of 99% when supplying half full-load current at unity p.f. Find the iron losses and copper losses corresponding to full load current. [8+8]

2. A 3 phase squirrel cage induction motor has a motor starting current of 6 times its full load value the motor has a full load slip of 5%.
   Determine
   (a) the starting torque in terms of full load torque.
   (b) the slip at which maximum torque occurs, and
   (c) maximum torque in terms of full load torque. [16]

3. (a) What happens if the emf is injected to the rotor circuit of induction motor?
   (b) The rotor resistance per phase of an 8 pole, a 50Hz slip ring motor is 0.2 ohm and its full load speed is 730 rpm. Calculate the external resistance per phase that must be added to the lower speed to 620 rpm. Given that torque is same in two cases. [8+8]

4. (a) What are the various losses in an induction motor? On what factors do they depend?
   (b) A 3300V, 24 pole, 50Hz, 3 phase star connected induction motor has a slip ring rotor resistance of 0.016 ohm and stand still reactance of 0.265 ohm per phase. Calculate the speed at maximum torque and ratio of full load torque to maximum torque if the full load torque is obtained at 247 rpm. [8+8]

5. (a) Describe the tests to be done on a single phase transformer to determine the equivalent circuit parameters.
   (b) Two 1-phase transformer with equal turns have impedances of (0.5+j3) ohm and (0.6+j10) ohm with respect to the secondary. If they operate in parallel, determine how they will share a total load of 100 kw at p.f 0.8 lagging. [8+8]

6. (a) Write about core losses in a transformer. How they can be minimized?
   (b) An ideal transformer has a 150 turn primary and 750 turn secondary. The primary is connected to a 240 V, 50 Hz source. The secondary winding supplies a load of 4A at a lagging p.f of 0.8. Determine

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i. the transformation ratio
ii. current in the primary
iii. power supplied to the load and
iv. the flux in the core. [8+8]

7. The ratio of maximum torque to full load torque in a squirrel cage induction motor is 2.2:1. Determine the ratio of actual starting torque to full load torque for the following cases

   (a) direct starting
   (b) star delta starting
   (c) auto transformer starting with tapping of 70%
   (d) The rotor resistance and stand still reactance per phase are 0.5 and 5 ohm respectively. [16]

8. Determine Z_p, Z_s and Z_t transients in a transformer switching. Mention their significance. [16]

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Code No: 07A40202 **R07** **Set No. 1**

II B.Tech II Semester Examinations,December 2010
ELECTRICAL MACHINES - II
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What current flows in the transformer primary when its secondary is open? What is its function? Give its order of magnitude and power factor?
   (b) A 100 KVA, 2400/24 V, 50 Hz single phase transformer has an exciting current of 0.64A and a core loss of 700 watts, when its high voltage side is energised at related voltage and frequency. Calculate the two components of the exciting current. [8+8]

2. (a) Discuss about Scott-connection in transformers.
   (b) Two 220 V, 1-phase electrical furnaces take loads of 350 kW and 500 kW respectively at a power factor of 0.8 lagging. The main supply is at 11 kV, 3-phase, 50 Hz. Calculate the current in the three-phase lines which energise a Scott connected transformer combination. [8+8]

3. Describe and explain how to perform a blocked rotor test. What data can be obtained by the test? [16]

4. (a) Explain briefly how the speed control of induction motor is done by connecting two motors in cascade.
   (b) Two induction motors with 4 pole and 8 poles respectively are connected in cumulatively cascade. The frenquency in the secondary circuit of the 8 pole motor is observed to be 5 Hz. Determine the combined speed of the set and the slip in each machine. Assume suppply frenquency as 50 Hz. [8+8]

5. (a) Explain with neat diagrams the construction and working of a 3 phase induction motor.
   (b) A 6 pole induction motor is fed from 50 Hz supply. If the frequency of rotor emf at full load is 2Hz, find the full load speed and slip. [8+8]

6. (a) Show that in a 3 phase induction motor with negligible stator impedance maximum torque is developed at slip s = R_2/X_2, where R_2 and X_2 are resistance and standstill reactance respectively.
   (b) The following data pertains to an induction motor: stator impedance (1.2+j3) ohm, rotor stand still impedance (1.2+j2)ohm: no load shunt impedance = (12+j55)ohm: volts/phase=240. Determine:
      i. stator current,
      ii. equivalent rotor current,
      iii. input power factor,

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iv. mechanical power developed and
v. efficiency of motor at a slip of 5%. [8+8]

7. (a) Discuss the effect of variable frequency and supply voltage on the iron loss of a transformer.

(b) The constants of a single phase, 2200/220V, 50Hz transformer are as follows.
H.V. side :- R_1=0.3 Ω X_1=4.2Ω
L.V. side :- R_2=0.08 Ω X_2=0.04 Ω
Find the equivalent circuit parameters referred to H.V. side. [8+8]

8. (a) Describe the method by which the separation of the core losses of a transformer is acheived.

(b) A 20 KVA, 2200/220 V, 50 Hz transformer when tested gave the following results:
OC test : 220 V, 4.2 A, 148 W(lv side)
SC test : 86 V, 10.5 A, 360 W(hv side)
Calculate the equivalent circuit parameters when refered to h. v side. [8+8]

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Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain why parallel operation of transformers is necessary. Under what conditions, the no-load circulating current is zero in two single-phase transformers operating in parallel.
   (b) The iron loss in a transformer core at normal flux density was measured at frequency of 30 Hz and 50 Hz, the results being 30 W and 54 W respectively. Calculate
      i. the hysteresis loss and
      ii. the eddy current loss at 50 Hz. [8+8]

2. A 500 KVA, 3-phase, 50 Hz transformer has a voltage ratio (line voltage) of 33/11 KV and is delta/star connected. The resistance per phase are: high voltage 35 Ω, low voltage 0.876 Ω and the iron loss is 3050 W. Calculate the value of effecieny at full-load and one-half of full-load respectively at 0.8 p.f lagging. [16]

3. (a) Write about various losses, that occur in a transformer.
   (b) A 24 KVA, 2400/240 V, 50 Hz, step down transformer has R_1 = 25Ω, X_1 = 35Ω, R_2 = 250mΩ, X_2 = 350mΩ and X_m = 3kΩ. The effieciency of the transformer is maximum when it operates at 80% of its rated load and 0.866 p.f lagging. Determine
      i. its maximum efficiency
      ii. the efficiency at full load and 0.866 p.f lagging. [8+8]

4. (a) Develop the equivalent circuit for a 3 phase induction motor and explain how the mechanical power is taken care in the equivalent circuit.
   (b) A 3 phase 6 pole, 50 Hz induction motor has 160Nm as its useful full load torque. The rotor emf is observed to make 90 cycles per minute. Calculate
      i. motor output in Kw,
      ii. copper loss in rotor
      iii. motor input and
      iv. efficiency if mechanical torque lost in friction and windage is 20Nm and stator losses are 800W. [8+8]

5. (a) Describe principle and operation of 3 phase induction motor. Explain why rotor is forced to rotate in the direction of rotating magnetic field.
   (b) A 3-phase 50Hz induction motor is wound for 4 poles. Calculate
      i. the synchronous speed

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ii. the rotor speed when slip is 4% and

iii. rotor frequency when rotor runs at 600 rpm. [8+8]

6. (a) Explain the constructional features of single phase transformer.

(b) The emf per turn of a single-phase 10 KVA, 2200/220 V, 50 Hz transformer is 10V. Calculate

i. the number of primary and secondary turns and

ii. the net cross-sectional area of the core for a maximum flux density of 1.5T. [8+8]

7. A squirrel cage induction motor when started by star-delta starter, develops a starting torque of 0.4 times the full-load torque and takes from the supply a starting current of twice the full-load current. Calculate the supply line current and starting torque if this induction motor is started by

(a) across-the-line starter,

(b) auto-transformer starter with 80% tapping. [16]

8. (a) Explain briefly the different methods of speed control pf 3 phase induction motor.

(b) The stator of a 4 pole motor is joined to a 50Hz supply and the machine is mechanically coupled and joined in cascade with a 6 pole motor. Negelecting all losses. Determine the speed and output of the 6 pole motor when the total load on the combination is 85.6 Kw. [8+8]

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