Code No: RR220205 **Set No. 1**

II B.Tech II Semester Supplimentary Examinations, Apr/May 2008
ELECTRO MECHANICS-II
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Draw the phasor diagram of a transformer on no load and explain the function of active and reactive components of no load current of transformer. [4+4]
   (b) Explain why transformer rating will be given in KVA but not in KW. [8]

2. (a) Explain various losses and derive the condition for minimum efficiency of a transformer .
   (b) The efficiency at unity power factor of 6600/384 volts 100 KVA 50 Hz single phase transformer is 98% both at full load and at half full load. The power factor on no load is 0.2 and the full load regulation at a lagging power factor of 0.8 is 4 %. Draw the equivalent circuit referred to L.V. side and insert all the values. [6+10]

3. (a) Explain the procedure to predetermine the efficiency and regulation of a transformer with all necessary equations. (need not explain test procedures if any)
   (b) The iron losses in a transformer core at normal flux density were measured at frequencies of 30 and 50Hz and the results being 34W and 55W respectively. Calculate the hysteresis and eddy current losses at 50Hz. [8+8]

4. (a) Draw the diagrams of the following transformer connections.
      i. Scott connection,
      ii. Zig-Zag,
      iii. V-V,
      iv. T-connection (3-phase to 3-phase)
   (b) A 50 Hz Scott-connected transformer supplies an unbalanced 2-phase load at 200 V per phase. For the leading phase (phase "A") the load has a resistance of 10 ohms and an inductance of 42.3 mH. For the other phase, the load consists of a resistor of 13.3 ohms and a capacitor of 318 micro-farads in series. Neglecting magnetizing current and the internal impedance of the transformer, calculate the line currents on the 3-phase side. The main transformer primary/secondary turns ratio is 12/1. [8+8]

5. (a) Explain why the rotor of polyphase induction motor can never attain synchronous speed
   (b) The rotor of a slip ring induction motor is connected to an AC source, where as its stator winding is short circuited. If rotating magnetic field produced by rotor winding' rotates clock wise, Explain the direction in which rotor must revolve. [8+8]

6. A 4-pole, 3-phase slip ring induction motor is coupled mechanically with a synchronous motor having 2 poles. The synchronous motor and stator of the induction motor are fed from 50Hz voltage source. What will be the frequency of the emfs at the rotor terminals if the synchronous motor is driven?
   (a) In a direction opposite to the induction motor stator rotating field.
   (b) In a direction of the induction motor stator rotating field. If the frequency of the rotor voltage is required to be 300Hz, then calculate
   (c) The number of poles that the induction motor must have. [6+6+4]
7. (a) Draw and explain the phasor diagram of 3-phase induction motor.
   (b) Discuss the phenomenon of crawling and cogging in an induction motor. [8+8]
8. (a) Explain the starting methods of wound rotor induction motor and its advantages. [6]
   (b) Calculate the value of resistance elements of 5-step starter for 3-phase 400V wound rotor induction motor. The full load slip is 3%, rotor resistance per phase is =0.015. If
      i. The starting current is limited to full load current.
      ii. The starting current is limited to 1.5 times full load current. [5+5]

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Code No: RR220205 **Set No. 2**

II B.Tech II Semester Supplimentary Examinations, Apr/May 2008
ELECTRO MECHANICS-II
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the various methods to reduce the leakage flux in transformer. [6]
   (b) Draw the phasor diagram of a single phase transformer with load having a leading power factor and explain. [4+6]

2. (a) When a transformer is supplied at 400 V 50 Hz the hysterisis loss is found to be 310 watts and eddy current loss is found to be 260 watts. Determine the hysterisis and eddy current loss when the transformer is supplied at 800 V 100 Hz.
   (b) A 230/460 volts transformer has a primary resistance if 0.2 Ω and reactance of 0.5Ω and the corresponding values for secondary are 0.75 Ω and 1.8 Ω respectively. Find the secondary terminal voltage when supplying 10 amps at 0.8 power factor lagging. [8+8]

3. (a) Derive the equation for saving in copper in using Auto transformer when compared to two winding transformer.
   (b) Obtain the equivalent circuit of an auto transformer. [8+8]

4. (a) Discuss the constructional details of the three phase transformers with necessary diagrams. Mention their advantages and disadvantages of different 3ϕ transformers.
   (b) Draw the phasor diagrams and winding connection of a three-phase transformer for [8+8]
      i. Group 1: phase displacement of zero degrees,
      ii. Group 2: phase displacement of 180 degrees.

5. (a) Discuss the points of similarities between a transformer and an induction machine. Hence, explain why an induction machine is called a generalized transformer.
   (b) Explain why an induction motor, at noload, operates at a very low power factor. [8+8]

6. (a) Explain the principle of 3-phase induction motor with the help of rotating magnetic field.
   (b) A 6-pole, 50Hz, 3-phase induction motor running on full load develops a useful torque of 160 N-m and the rotor emf is absorbed to make 120 cycles/min. Calculate the net mechanical power developed. If the torque loss in windage and friction is l2N- m, find the copper loss in the rotor windings, the input to

the motor and efficiency. [6+10]
Given stator losses=200W (inclusive of core loss)

7. A 10KW, 415V, 4-pole, 3-phase star connected induction motor gave the following test results.
No load test: 415V, 8A, 1200 watt
Blocked rotor test : 200V, 45A, 7000 watt
Stator and rotor ohmic losses are equal at stand still. Draw circle diagram and find efficiency and speed at half full load. [8+8]

8. The rotor of 3-phase slip ring induction motor has an induced voltage of 100V and impedance of 0.2 + j1 ohm at stand still. The induction motor has full load slip of 0.04 driving constant torque load and running at 1440 rpm. Calculate the voltage to be injected if the motor is to be driven at

   (a) 800 rpm

   (b) 1000 rpm. [8+8]

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Code No: RR220205 **Set No. 3**

II B.Tech II Semester Supplimentary Examinations, Apr/May 2008
ELECTRO MECHANICS-II
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Prove that the EMF induced in the windings of the transformer will lag behind the flux by 90^0.
   (b) Explain how equivalent circuit of transformer can be obtained? [6+10]

2. (a) Sketch the percentage voltage regulation of single phase transformer as a function of power factor from zero leading to zero power factor lagging at rated current and 50% of rated current. [4]
   (b) In a 25 KVA 2000/200 volts transformer iron and copper losses are 350 and 400 watts respectively. Calculate the efficiency on UPF at
      i. Full load
      ii. Half full load [4+4]

   Determine the load for maximum efficiency and, iron and copper losses in this case. [2+2]

3. A 20KVA, 2300/230V, two winding transformer is to be used as an auto transformer, with constant source voltage of 2300V. At full load of unity power factor, calculate the power output, power transformed and conducted. If the efficiency of the two winding transformer at 0.6p.f.is 96%, find the auto transformer efficiency at the same power factor. [10+6]

4. (a) What are the conditions required for the parallel operation of two transformers.
   (b) Derive the equations for the currents supplied by each transformer when two transformers are operating in parallel with equal voltage ratios. [6+10]

5. (a) Explain why the rotor of polyphase induction motor can never attain synchronous speed
   (b) The rotor of a slip ring induction motor is connected to an AC source, where as its stator winding is short circuited. If rotating magnetic field produced by rotor winding' rotates clock wise, Explain the direction in which rotor must revolve. [8+8]

6. (a) Derive the expression for torque in an induction motor.
   (b) Derive the condition for maximum torque. [8+8]

7. A 4KW, 400V, 3-phase, delta connected slip ring induction motor gave the following test results.
   No load test : 210V, 16A, power factor = 0.45

Blocked rotor test :400V, 3.3A, power factor =0.174
Draw circle diagram and final maximum torque and corresponding efficiency and line current. At stand still rotor and stator resistances are equal. [8+8]

8. The rotor of 3-phase slip ring induction motor has an induced voltage of 100V and impedance of 0.2 + j1 ohm at stand still. The induction motor has full load slip of 0.04 driving constant torque load and running at 1440 rpm. Calculate the voltage to be injected if the motor is to be driven at

   (a) 800 rpm

   (b) 1000 rpm. [8+8]

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Code No: RR220205 **Set No. 4**

II B.Tech II Semester Supplimentary Examinations, Apr/May 2008
ELECTRO MECHANICS-II
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain why hysteris and eddy current losses occur in a transformer. [6]
   (b) A transformer on load takes 1.5 amps at a power factor of 0.2 lagging when connected across 50 Hz 230 V supply. The ratio between primary and secondary number of turns is 3. Calculate the value of primary current when secondary is supplying a current of 40 amps at a power factor of 0.8 lagging. Neglect the voltage drop in the windings. Draw the relevant phasor diagram. [8+2]

2. (a) Define efficiency and regulation of a transformer. Show how the power factor affects both of them. [2+2+2]
   (b) The maximum efficiency of 50 KVA transformer is 97.4 % and occurs at 90 % of the full load. Calculate the efficiency of transformer at
      i. Full load 0.8 power factor lagging
      ii. Half full load 0.9 power factor [5+5]

3. (a) Explain the procedure to predetermine the efficiency and regulation of a transformer with all necessary equations. (need not explain test procedures if any)
   (b) The iron losses in a transformer core at normal flux density were measured at frequencies of 30 and 50Hz and the results being 34W and 55W respectively. Calculate the hysteresis and eddy current losses at 50Hz. [8+8]

4. (a) What are the conditions required for the parallel operation of two transformers.
   (b) Derive the equations for the currents supplied by each transformer when two transformers are operating in parallel with equal voltage ratios. [6+10]

5. (a) Discuss the points of similarities between a transformer and an induction machine. Hence, explain why an induction machine is called a generalized transformer.
   (b) Explain why an induction motor, at noload, operates at a very low power factor. [8+8]

6. (a) In an induction motor deduce the condition P_2:P_m:P_c::l:1-s:s
   (b) A 4-pole wound rotor induction motor is used as a frequency changer. The starter is connected to a 50 Hz 3-phase supply. The load is connected to the rotor slip rings. What are the possible speeds at which the rotor can supply power to this load at 25Hz? What would be the ratio of voltages at load terminals at these speeds? Assume the rotor impedance to be negligible.[8+8]

7. (a) Explain the torque development process in an induction motor and its dependence on rotor slip.

   (b) A 12 pole, 3-phase, 50Hz induction motor draws 2.80A and 110Kw under the block rotor test. Find the starting torque when switched on direct to rated voltage and frequency supply. Assume the stator and rotor copper losses to be equal under the blocked rotor test. [6+10]

8. The rotor of 3-phase slip ring induction motor has an induced voltage of 100V and impedance of 0.2 + j1 ohm at stand still. The induction motor has full load slip of 0.04 driving constant torque load and running at 1440 rpm. Calculate the voltage to be injected if the motor is to be driven at

   (a) 800 rpm

   (b) 1000 rpm. [8+8]

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