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

II B.Tech II Semester Supplementary Examinations, November/December 2005
ELECTRO MECHANICS-II
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

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) 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 for conducting OC and SC tests with neat diagrams. [4+4]
   (b) A 20 KVA, 2500/250V, 50Hz, Single phase transformer gave the following test results: OC test (LV side): 250V, 1.6A, 110W; SC test (HV side): 90V, 7A, 300W. Compute the parameters of the approximate equivalent circuit referred to LV side. [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) Describe the phenomenon of production of torque in an induction motor.
   (b) A 6 pole 50 Hz, 3-phase induction motor running on full load develops a useful torque of 160N-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 12 N-m, find the copper loss in the rotor windings, the input to the motor and efficiency. Given: starter losses = 200W (inclusive of core loss) [6+10]

7. A 4.5 KW, 400V, 50HZ, 3-phase delta connected induction motor gave the following test results.
   No load test: 400V, 4.2A, 480W
   Blocked rotor test: 215V, 15A, 1080W
   The ratio of stator to rotor resistance referred to stator is 2:1 Calculate the torque, line current, power factor and efficiency at 125% of full load. [8+8]

8. (a) Explain DOL starter with neat sketch and obtain the expression for starting torque in terms of full load torque.

   (b) A 3-phase induction motor rating 400V, 50HZ, 3-phase, 4KW draws staring current 5 times the full load current. What is the starting torque in terms of full load torque if applied voltage is rated voltage. Calculate the same if supply voltage is reduced to 90% of its rated value. The full load slip is 0.06. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆

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

II B.Tech II Semester Supplementary Examinations, November/December 2005
ELECTRO MECHANICS-II
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

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) 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 for conducting Sumpner's test along with all precautions to be taken while conducting the test with neat diagram.
   (b) The corrected instrument readings obtained from short circuit test on 10 KVA, 450/125V, 50Hz transformer are 9.65V, 22.2A, 120W, with low voltage winding short circuited. Compute voltage regulation for an 85% lagging load at 50% load. [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) With the help of neat sketch, explain the constructional features of a three-phase induction motors.
   (b) A 3-phase, 4-pole, 415 V, 50 Hz, delta connected induction motor running at a slip of 4%. The stator winding is delta connected with 240 conductors per phase, and the rotor winding is star connected with 48 conductors per phase. The per phase rotor winding resistance is 0.013 ohms and a leakage reactance of 0.048 ohms at standstill. Calculate the following: [8+8]
      i. The per phase rotor emf at standstill with the rotor open circuit,
      ii. The rotor emf and current at 4% slip,
      iii. The phase difference between the rotor emf and rotor current at 4% slip.

6. (a) Describe the phenomenon of production of torque in an induction motor.

(b) A 6 pole 50 Hz, 3-phase induction motor running on full load develops a useful torque of 160N-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 12 N-m, find the copper loss in the rotor windings, the input to the motor and efficiency. Given: starter losses = 200W (inclusive of core loss) [6+10]

7. A 400V, 3-phase, 8-pole, 50 Hz star connected induction motor gave the following test results.
No load test : 400V, 10A, 800 watt
Blocked rotor test : 160V, 30A, 1920 watt
Stator and rotor ohmic losses are equal. Calculate the efficiency line current, power factor at full load by drawing circle diagram. [8+8]

8. (a) Explain DOL starter with neat sketch and obtain the expression for starting torque in terms of full load torque.

(b) A 3-phase induction motor rating 400V, 50HZ, 3-phase, 4KW draws staring current 5 times the full load current. What is the starting torque in terms of full load torque if applied voltage is rated voltage. Calculate the same if supply voltage is reduced to 90% of its rated value. The full load slip is 0.06. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆

II B.Tech II Semester Supplementary Examinations, November/December 2005
ELECTRO MECHANICS-II
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Give the constructional differences between a core type and shell type transformers. How the iron losses are minimized. [3+3+2]
   (b) A single phase transformer has turns ratio of 144/432 and operates at maximum flux of 7.5 x 10^{-3} wb at 50 Hz. When on no load the transformer takes 0.24 KVA at a power factor of 0.26 lagging from the supply. If the transformer supplies a load of 1.2 KVA at a power factor of 0.8 lagging, determine
      i. Magnetizing current. [3]
      ii. Primary current [3]
      iii. Primary power factor [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 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) Discuss in detail the effect of
      i. current harmonics,
      ii. voltage harmonics on the performance of three phase transformers.
   (b) Explain how the harmonics can be suppressed using Star/Delta earthing transformer. Draw the relevant connection diagram. [8+8]

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) Derive the expression for torque in an induction motor.

(b) Derive the condition for maximum torque. [8+8]

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) A 3-phase, 4 pole, 50 Hz, squirrel cage Induction motor has rotor leakage impedance of 1 + j2 Ω/ph, stand still voltage of 100V per phase driving a constant torque load at 0.03 slip. What is speed of the motor, if

      i. supply voltage in increased by 25% and frequently in constant.

      ii. supply voltage in increased by 25% and frequency is decreased by 25%

   (b) A 3-phase, 400V, 6-pole, 50HZ, 960 rpm slip ring induction motor has rotor resistance of 0.1 ohm per phase and leakage reactance of 0.5 ohm per phase. The load torque is independent of the speed. [8+8]

      i. Calculate the speed of motor if 0.05 ohm is inserted in the rotor circuit.

      ii. What is the maximum external resistance that can be inserted in the rotor and corresponding speed.

⋆ ⋆ ⋆ ⋆ ⋆

II B.Tech II Semester Supplementary Examinations, November/December 2005

ELECTRO MECHANICS-II

(Electrical & Electronic Engineering)

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

Answer any FIVE Questions

All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Explain the functions of the following in a transformer
   i. Breather [2]
   ii. Conservator [2]
   iii. Oil [2]
   (b) Draw and explain phasor diagram of transformer on lagging load. [4+6]

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. Explain the test procedure to separate the iron losses of a transformer with neat circuit diagram, Tabulation and Model graph. [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) 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) 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 400V, 3-phase, 8-pole, 50 Hz star connected induction motor gave the following test results.
   No load test : 400V, 10A, 800 watt
   Blocked rotor test : 160V, 30A, 1920 watt
   Stator and rotor ohmic losses are equal. Calculate the efficiency line current, power factor at full load by drawing circle diagram. [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]

⋆ ⋆ ⋆ ⋆ ⋆