Code No: R22024 **R10** SET - 1

II B. Tech II Semester Supplementary Examinations January – 2014
ELECTRICAL MACHINES - II
(Electronics and Electronics Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) What is a transformer? Differentiate between step-up and step-down transformers.
   b) Draw and explain phasor diagram of a transformer on load.

2. a) Draw the approximate equivalent circuit of a transformer referred to the primary side and indicate how it differs from the exact equivalent circuit.
   b) Calculate the percentage voltage drop for a transformer with a percentage resistance of 2.5 % and a percentage reactance of 5 % of rating 500 kVA when it is delivering 400 kVA at 0.8 pf lagging.

3. Discuss how to conduct open-circuit and short-circuit tests on a single phase transformer in the laboratory. From the test results how the efficiency and regulation of the transformer is determined?

4. a) Give the merits and demerits of a delta/star connected three phase transformer.
   b) Two T-connected transformers are used to supply a balanced load of 100kVA at 400V from a balanced 11kV 3-ϕ supply. Determine,
      i) Current and voltage rating of each transformer coil
      ii) kVA rating of the main and teaser transformers?
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5. a) Bring out clearly, with the help of neat sketches the differences between the 3-phase slip-ring induction motor and 3-phase squirrel cage induction motor.
   b) A 3-phase, 50Hz induction motor has full load speed of 1440 r.p.m. Calculate the following:
   i) Number of poles ii) full load slip and rotor frequency
   iii) Speed of stator field with respect to stator structure and rotor structure
   iv) Speed of rotor field with respect to rotor structure, stator structure and stator field.

6. a) For an induction motor, derive a relationship between the starting torque and maximum torque explaining clearly the symbols used.
   b) A 746kW, 3-phase, 50Hz, 16-pole induction motor has a rotor impedance of (0.02+j 0.15) Ω at standstill. Full-load torque is obtained at 360 rpm. Calculate: i) the ratio of maximum to full-load torque ii) the speed at maximum torque and iii) the rotor resistance to be added to get maximum torque.

7. a) Explain how the circle diagram for a polyphase induction motor can be drawn from its test data.
   b) A 400V, 3-phase, 8-pole, 50Hz star-connected induction motor gave the following test results:
   No load test : 400V, 3.3A, $\cos\theta_o$=0.174
   Blocked rotor test : 210V, 16A, $\cos\theta_{sc}$ =0.45
   If, at full load and rated voltage, the power factor is at its maximum, then calculate full-load current, power factor, torque in N-m, speed, power output and efficiency. Stator and rotor ohmic losses are same.

8. a) Explain the principle of operation of a self-exited induction generator. Give the condition under which this generator may fail to build up?
   b) A 4-pole induction motor and 6-pole induction motor are connected in cumulative cascade at 50 Hz supply. The frequency in the secondary circuit of the 6-pole motor is observed to be 1.0 Hz. Determine the slip in each machine and combined speed of the set.

Code No: R22024 **R10** SET - 2

II B. Tech II Semester Supplementary Examinations January – 2014
ELECTRICAL MACHINES - II
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Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) Derive an expression for voltage per turn for a transformer.
   b) A 200 kVA, 3300/240 V, 50 Hz single phase transformer has 80 turns on the secondary winding. Assuming an ideal transformer, calculate
      i) Primary and secondary currents at full -load
      ii) The maximum value of flux and
      iii) Number of primary turns.

2. a) State the various losses which take place in the transformer. On what factors do they depend? Explain the steps taken to minimise these losses.
   b) In a 440/220V, 50 Hz transformer the total iron loss is 2500 W, when applied voltage is 220 V at 25 Hz the corresponding loss is 850 W. Calculate the eddy current loss at normal frequency and voltage.

3. a) Discuss the advantages and disadvantages of an auto-transformer as compared to a two-winding transformer.
   b) Explain parallel operation of transformer laving un equal voltage ratios? Discuss how the power is shaded?

4. a) Explain with necessary diagrams how two 3-phase transformers can be used to convert a 3-phase supply to a 2-phase one. If the load is balanced on one side, show that it will be balanced on other side.
   b) A balanced 3-ϕ, 100kW load at 400V and 0.8 p.f. lag is to be obtained from a balanced 2-ϕ, 1100V lines. Determine the kVA rating of each unit of the Scott-connected transformer.
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5. a) Explain the construction and working of a 3-phase induction motor.
   b) An induction motor has an efficiency of 0.9 when the shaft load is 45 kW. At this load, stator ohmic loss and rotor ohmic loss each is equal to the iron loss. The mechanical loss is one-third of the no-load losses. Neglect ohmic losses at no-load. Calculate the slip.

6. a) Draw the phasor diagram and equivalent circuit of a 3-phase induction motor.
   b) A 3-phase, 50Hz, 8-pole induction motor has a full-load slip 4%. The rotor resistance is 0.001Ω per phase and standstill reactance 0.005 Ω per phase. Find the ratio of maximum to full-load torque and speed at which the maximum torque occurs.

7. Compare the star/delta and auto-transformer method of starting of 3-phase squirrel cage induction motor on the basis of i) starting torque and starting current ii) adoptability to motor rating, terminal arrangements and iii) starting condition. Discuss also the limitation of these methods.

8. Explain principle of speed control of a 3-phase induction motor by i) adding resistance ii) injecting voltage. Draw the corresponding torque-speed characteristics and discuss the applications and limitations of these methods.

Code No: R22024 **R10** SET - 3

II B. Tech II Semester Supplementary Examinations January – 2014
ELECTRICAL MACHINES - II
(Electronics and Electronics Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) Draw general schematic diagram of a single phase transformer. Describe its working principle and deduce the expression for e.m.f in secondary winding?
   b) A 10 kVA, 500/250 V, 50 Hz single phase transformer has a net area of cross-section 90 cm^2 and maximum flux density is 1.2 T. Calculate the number of turns on both the primary and secondary.

2. a) Define the voltage regulation of the transformer. Deduce the expression for the voltage regulation.
   b) The daily variation of load on a 100kVA transformer is as follow:

8.00 A.M to 1.00 P.M	: 65kW, 45 kVAr
1.00 P.M to 6.00 P.M	: 80kW, 50 kVAr
6.00 P.M to 10.00 A.M	:30kW, 30 kVAr
10.00 A.M to 8.00 A.M	: No load.

   This transformer has no-load core loss of 370 W and a full load ohmic loss of 1200 W. Determine the all-day efficiency of the transformer.

3. a) Discuss the effect of circulating current at no-load, in two single phase transformers operating in parallel.
   b) Two transformers operating in parallel have different reactance to resistance ratios. Show that one transformer operates at a better p.f than the other.
   c) Show that if two transformers have same p.u. impedances, they will share the load in proportion to their kVA capacities.

4. a) Draw the Scott-connection of transformers and mark the terminals and turn-ratio.
   b) Discuss the construction of working principle if three winding transformer?
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5. a) Explain with the help of suitable diagrams, how rotating magnetic field is produced in a 3-phase induction motor.
   b) A 3-phase squirrel cage induction motor is operated at 400V, 50Hz supply with 4 poles. If it is working at 4% slip, determine i) rotor frequency ii) rotor current /phase.

6. a) Draw the torque-speed characteristics of poly-phase induction motor.
   b) A 6-pole, 50Hz, 3-phase slip-ring induction motor has resistance and reactance of 0.5Ω and 5Ω per phase respectively. Calculate (i) at what speed the torque is maximum (ii) the ratio of maximum torque/starting torque. What must be the external resistance per phase have so that the starting torque is half of the maximum torque.

7. A 3-phase, 400V induction motor gave the following test readings:

No-load	: 400V,	1250W,	9A
Short-circuit	: 150V,	4kW	38A

Draw the circle diagram. If the normal rating is 20.27 hp (metric), find from the circle diagram, the full-load values of current, power factor and slip.

8. a) How is the speed of a 3-phase induction motor controlled by its stator voltage control?
   b) A 4-pole induction motor and 6-pole induction motor are connected in cumulative cascade at 50 Hz supply. The frequency in the secondary circuit of the 6-pole motor is observed to be 1.0 Hz. Determine the slip in each machine and combined speed of the set.

Code No: R22024 **R10** SET - 4

II B. Tech II Semester Supplementary Examinations January – 2014
ELECTRICAL MACHINES - II
(Electronics and Electronics Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) What is an ideal transformer? Derive an expression for induced e.m.f in a transformer in terms of frequency, the maximum value of flux and number of turns of the windings.
   b) A single phase 2200/220V, 50 Hz transformer has core area 3600 mm^2, and the maximum flux density 1.6 T. Determine the number of turns of primary and secondary windings.

2. a) What is regulation? How it can be obtained from equivalent circuit parameters?
   b) A transformer with normal voltage impressed has a flux density of 1.4 Wb/m^2 and a core loss comprising of 1000W eddy current loss and 3000W hysteresis loss. What do these losses become under the following conditions?
   i) Increasing the applied voltage by 10% at rated frequency.
   ii) Reducing the frequency by 10% with normal voltage impressed.
   iii) Increasing both impressed voltage and frequency by 10%.

3. a) What are the different losses occur in a transformer on load? How can these losses be determined experimentally?
   b) A 30 kVA, single phase transformer has an iron loss of 457W and copper loss of 125 W, when delivering half the full load. At what percent of the full load will the transformer have maximum efficiency?

4. a) Why are the tap changing transformers required? Explain the operation of no load tap-changing transformer.
   b) A 3-phase Transformer has its primary connected in delta and secondary in star. It has an equivalent resistance of 1% and equivalent reactance of 6%. The primary applied voltage is 6,600V. What must be the ratio of transformation in order that it will deliver 4,800V at full load current and 0.8 p.f lag?
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5. a) Explain with neat sketches the principle of operation of induction motor.
   b) A 3-phase squirrel cage induction motor is operated at 400V, 50Hz supply it is having 4 poles. If is working at 4% slip determine i) rotor frequency ii) rotor current/ phase

6. a) Derive the expression for developed torque in a 3-phase induction motor and find the condition for maximum torque.
   b) Discuss the constructional details of double squirrel cage induction motor.

7. a) Explain, with the help of neat diagrams the working of a star-delta starter. What is its limitation?
   b) A squirrel cage induction motor takes 5 times full-load current and develops 2.5 times full-load torque when switched directly on the line. Determine the torque developed and the internal value of the current drawn from the supply mains when started through an auto-transformer with 60% tapping.

8. State and explain the various methods of speed control of 3-phase induction motors.