Code No: T0222 **R07** SET - 1

II B. Tech II Semester Supplementary Examinations Dec – 2012
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) Describe in detail the constructional details of a single-phase transformer, including the measures taken to minimize iron and copper losses and selection of core geometry.
   b) Derive the emf equation of a single-phase transformer and obtain the transformation ratio.
   c) Describe the various losses in a transformer.

2. a) Derive the condition for maximum efficiency of single-phase transformer.
   b) The hysteresis and eddy current losses of a transformer are 300 W and 250 W, respectively, if the supply voltage is 500 V at 50 Hz. Find the hysteresis loss and eddy current loss if the supply voltage is 1,000 V& 100 Hz.

3. a) Explain how the equivalent circuit parameters are determined from OC and SC tests?
   b) A 2-winding 10 kVA 440/110 V transformer is reconnected as a step-down 550/440 V auto transformer. Compare the volt-ampere rating of the autotransformer with that of original 2-winding transformer. Calculate the power transferred to the load: i) inductively
   ii) conductively.

4. a) What are the disadvantages of voltage harmonics in transformers? Explain how these harmonics can be eliminated.
   b) A 400 kVA load at 0.7 power factor lagging is supplied by three 'single-phase' transformers connected in $\Delta - \Delta$. Each of the $\Delta - \Delta$ transformer is rated at 2000 kVA, 2300/230 V. If one defective transformer is removed from the service, calculate for the V – V connection: (i) the kVA load carried by each transformer (ii) percent rated load carried by each transformer (iii) total kVA rating of the transformer bank in V – V (iv) ratio of V – V to $\Delta - \Delta$ bank transformer ratings.

5. a) Compare cage and wound 3-phase induction motor with reference to construction, performance and applications.
   b) A three phase, 6-pole, 50 Hz induction motor has a slip of 1 % at no load, and 3 % at full load. Determine: i) synchronous speed ii) no-load speed iii) full-load speed
   iv) Frequency of rotor current at standstill v) frequency of rotor current at full load.
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6. a) Based on approximate equivalent circuit, derive an expression for electromagnetic torque developed by a 3-phase induction motor and hence determine the condition for maximum torque.
   b) Explain the phenomena of Crawling and Cogging. What are the problems with Crawling and Cogging? Explain how these are avoided.

7. a) Explain in detail about the working of auto-transformer starter with a suitable diagram for induction motors.
   b) 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 the line starter.

8. a) Explain briefly how the speed control of induction motor is achieved from stator side.
   b) A certain 3-Φ, 6-pole, 50 Hz induction motor when fully-loaded, runs with a slip of 3%, find the value of resistance necessary in series per phase of the rotor to reduce the speed by 10%, assume that the resistance per phase is 0.2 Ω.

Code No: T0222 **R07** SET - 2

II B. Tech II Semester Supplementary Examinations Dec – 2012
ELECTRICAL MACHINES - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 80

Answer any **FIVE** Questions
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1. a) Why the primary of the transformer draw and current from the main supply when the secondary is not carrying any load. Explain in detail.
   b) The emf per turn of a 1-phase, 6.6 kV/440 V, 50Hz transformer is 12 V. Calculate i) the number of turns in the HV and LV windings ii) the net cross-sectional area of the core for a maximum flux density of 1.5 T.

2. a) Define the voltage regulation of a transformer and derive the condition for
   i) zero regulation ii) maximum regulation.
   b) The maximum efficiency of a 100 kVA, 1-phase transformer is 98 % and occurs at 80 % of full load at 0.8 power factor lagging. If the leakage impedance of the transformer is 5 %, find the voltage regulation at full load.

3. a) Explain the procedure to conduct the Sumpner's test and obtain the different circuit parameters to estimate the performance of the transformer.
   b) A 11500/2300V transformer is rated at 100 kVA as a 2-winding transformer. If the two windings are connected in series to form an autotransformer, what would be the voltage ratio and output?

4. a) Explain about the star-star, star-delta and delta-star connections used in 3-phase connection of transformers. Discuss their advantages and disadvantages.
   b) Two single phase furnaces working at 110 V are connected to a 3.3 kV, 3-phase supply through Scott connected transformers. Determine the currents in 3-phase lines when the power taken by each furnace 500 kW at a power factor of 0.8 lagging. Neglect the losses.

5. a) Describe with neat sketch the construction and principle of operation of a 3-phase cage type induction motor.
   b) A 3-phase slip-ring induction motor gives a reading of 60 V across slip rings when at rest with normal stator voltage applied. The rotor is star connected and has an impedance of (0.8+j6) ohms per phase. Find the rotor current when the machine is (i) at standstill with slip-rings joined to a star connected starter with phase impedance of (4+j3) ohms and (ii) running normally with a 5 % slip.
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Code No: T0222 **R07** SET - 2

6. a) What is the purpose of using deep-bar cage rotors? Explain the construction and working of a deep-bar cage motor.
   b) The power input to a 3 phase, 6-pole, 440V, 50 Hz induction motor is 80 kW. The rotor e.m.f is observed to make 100 complete revolutions per minute. Calculate i) slip ii) rotor speed iii) mechanical power developed iv) rotor copper losses per phase v) rotor resistance per phase if the rotor current is 65 A.

7. a) Explain the working of star-delta starter with a neat diagram
   b) A three-phase cage induction motor has a short circuit current equal to 5 times the full load current. Find the starting torque as a percentage of full-load torque if the motor is started by i) an auto-transformer ii) a resistance the stator circuit.
   starting current in i) and ii) is limited 2.5 times the full-load current and the full-load slip is 4 %.

8. a) Describe static slip power recovery scheme of speed control with neat sketch. What are the merits of this method over other methods of speed control?
   b) A 4 pole, 50 Hz, wound rotor Induction Motor has a rotor resistance of 1.1ohms/ ph and runs at 1460 rpm at full load. Calculate the additional resistance per phase to be inserted in the rotor circuit to lower the speed to 1200 rpm, if the torque remains constant.

Code No: T0222 **R07** SET - 3

II B. Tech II Semester Supplementary Examinations Dec – 2012
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) Draw the no load and on load phasor diagram for a single-phase transformer on lagging load taking secondary terminal voltage as the reference phasor.
   b) A single-phase transformer has 400 primary and 1000 secondary turns. The net cross-sectional area of the core is 60cm^2. If the primary winding be connected to 50 Hz supply at 520 V, Calculate i) The peak value of flux density in the core ii) The voltage induced in the secondary winding.

2. a) Develop the exact equivalent circuit of a single phase transformer. From this derive the approximate and simplified equivalent circuits of the transformer. State the various assumptions made.
   b) In a transformer if the load current is kept constant, find the power factor at which the maximum efficiency occurs.

3. a) Explain about the auto transformer and compare it with two winding transformer.
   b) A 6 kVA, 250/500V, 1-phase, 50 Hz, transformer has the following tests results:
   O.C. test (LV side): 250 V, 1.2 A, 80 W
   S.C. test (HV side): 25 V, 10 A, 95 W
   Calculate the circuit parameter referred to LV side. Also calculate the regulation and efficiency of the transformer at full load and half load at 0.8 power factor lagging.

4. a) Explain the principle of operation of ON-LOAD and OFF-LOAD tap changers.
   b) Two electric furnaces are supplied with single phase current at 80 V from a three-phase, 11000 V systems by means of two single-phase Scott-connected transformer, with similar secondary windings. When the load on the main transformer is 80 kW and on the teaser transformer is 500 kW, determine the currents in three-phase lines (i) at unity power factor (ii) at 0.5 power factor lagging. Draw the phasor diagrams.

5. a) Explain the principle of production of rotating magnetic field in a 3-phase induction motor.
   b) A 3-phase, 4-pole, 50 Hz induction motor has a slip of 4 %. Calculate: i) the speed of the motor ii) frequency of rotor e.m.f.
   If the rotor has a resistance of 1 ohm and standstill reactance of 4 ohms, calculate the power factor i) at standstill ii) at a speed of 1400 r.p.m.
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Code No: T0222 **R07** SET - 3

6. a) Develop the equivalent circuit of a poly phase induction motor. Explain how its equivalent circuit is similar to transformer equivalent circuit.
   b) In a three-phase induction motor, show that $P_g : P_{rc} : P_{md} = 1 : s : (1-s)$.
   where the symbols have their usual meanings.

7. a) Explain the need of starter for starting of a 3 - phase induction motor. Briefly discuss about various starting methods of 3-phase Induction motors.
   b) A 4-pole, 3-phase, 50 Hz induction motor has a starting current which is 5 times its full load current when directly switched on. What will be the % reduction in starting torque if i) star delta switch is used for starting ii) autotransformer with 60% tapping is used for starting.

8. a) Explain the pole-changing methods of speed control of a 3-phase induction motor.
   b) Explain the principle of operation of an induction generator.

Code No: T0222 **R07** SET - 4

II B. Tech II Semester Supplementary Examinations Dec – 2012
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) Draw the diagram of a single-phase transformer, name the parts, state the material used for each part and the reason for using such material.
   b) The core of a 100 KVA, 11000/550 V, 1-phase core type transformer has a cross-section of 400 cm^2. Find (i) the number of H.V and L.V turns per phase and (ii) the emf per turn if the maximum core density is not exceeding 1.3 Tesla. Assume a stacking factor of 0.9. What will happen if its primary voltage is increased by 10% on no-load?

2. a) Describe various losses in a transformer. Explain how each loss varies with the load current, supply voltage and frequency.
   b) A 2300/230 V, 500 kVA, 50 Hz distribution transformer has core loss 1600 W at rated voltage and copper loss 7.5 kW at full load. During the day it is loaded as follows.

% load	0 %	20 %	50 %	80 %	100 %	125 %
Power factor	--	0.7 lag	0.8 lag	0.9 lag	1	0.85 lag
Hours	2	4	4	5	7	2

   Determine the All-day efficiency of the transformer.

3. a) The following readings were obtained from Open Circuit and Short Circuit tests on 5 kVA, 220/400V, 1-phase, 50 Hz, transformer:
   O.C. test: 220 V, 2 A, 100 W (LV side)
   S.C. test: 40 V, 11.4 A, 200 W (HV side)
   Determine the efficiency and approximate regulation of the transformer at full load 0.9 power factor lagging.
   b) Explain the operation of auto transformer with a neat diagram. Also discuss the applications of the auto transformer

4. a) Explain the Scott connection of transformer for three phases to two phase conversion. Draw the relevant phasor diagram. Also state the relative advantages and disadvantages.
   b) Explain the advantages of using the tertiary winding in a bank of star – star transformers.

5. a) What are the different parts of a cage and slip-ring type induction motors? State the materials used for each part and also give reason for its use.
   b) A three phase induction motor is wound for 4 poles and is supplied from 50Hz system. Calculate i) The synchronous speed ii) The rotor speed when slip is 4% iii) rotor frequency when rotor runs at 600 rpm.
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6. a) Derive the torque-slip equation for a 3-phase induction motor and also the equation for slip at which maximum torque occurs.
   b) The impedances at standstill of the inner and outer windings of a double cage rotor are (0.01+j0.5) ohms and (0.05+j0.1) ohms respectively. Calculate the ratio of torques due to the two winding i) at starting ii) when running with a slip of 5 %.

7. Explain the procedure to draw the circle diagram of a 3-phase induction motor. What information can be drawn from the circle diagram?

8. a) Explain the method of speed control of a 3-phase induction motor by varying the supply frequency.
   b) A 3-phase, 4-pole, 50 Hz induction motor and a 3-phase, 6-pole, 50 Hz induction motor are connected in cumulative cascade. The frequency in the secondary circuit of the 6- pole motor is observed to be 1 Hz. Determine the slip in each machine and the combined speed of the set.