Code: 9A02407

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B.Tech II Year II Semester (R09) Regular & Supplementary Examinations, April/May 2013

ELECTRICAL MACHINES - II

(Electrical and Electronics Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Discuss the constructional features of transformers. Draw neat diagrams.

(b) Calculate the flux in the core of a single-phase transformer having a primary voltage of 460 V, at 50 Hz and 100 turns. If the flux density in the core is 2 tesla, calculate the net cross-sectional area of the core.

2 (a) With neat circuit diagrams, explain the procedure for conducting OC and SC tests on a given single-phase transformer to predetermine its regulation and efficiency.

(b) A 100 KVA, 1000 V/10000 V, 50 Hz, single-phase transformer has an iron loss of 1200 W. Find the maximum efficiency at 0.8 power factor lagging if the copper loss is 500 W with 6 A in high voltage winding. Also calculate the corresponding regulation if the equivalent leakage reactance referred to HV is 10 ohms.

3 (a) In a test for the determination of the losses of a 440 V, 50 Hz transformer, the total iron losses were found to be 2500 W at normal voltage and frequency. When the applied voltage and frequency were 220 V, 25 Hz, the iron loss were found to be 850 W. Calculate the hysteresis and eddy current losses at normal voltage and frequency.

(b) The following readings were obtained from OC and SC tests on 8 KVA, 400/120 V, 50 Hz, transformer.

OC Test on LV side 120 V, 4 A, 75 W

SC Test on HV side 9.5 V, 20 A, 110 W

Calculate the voltage regulation and efficiency at full load 0.8 P.F lagging.

4 (a) Explain the Scott connection in the transformer.

(b) A three phase 5000/500 V, 173.2 KVA star connected transformer has 75 turns on the secondary. Find the number of primary turns and secondary currents.

5 (a) Explain why the rotor of polyphase induction motor can never attain synchronous speed.

(b) Explain the constructional details of 3-phase induction motor.

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6 (a) Explain the following terms:
(i) Maximum torque. (ii) Full load torque and (iii) Starting torque.

(b) A 8 pole 50 Hz 3-phase slip ring induction motor has effective resistance of 0.08 ohms/ph. The speed corresponds to maximum torque is 650 rpm, find the value of resistance to be inserted in rotor circuit to obtain maximum torque at starting.

7 A 4.5 KW, 400 V, 50 HZ, 3-phase delta connected induction motor gave the following test results.

No load test: 400 V, 4.2 A, 480 W

Blocked rotor test: 215 V, 15 A, 1080 W

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 (a) Explain about the speed control of induction motor by Tandem operation and derive the formula of speed.

(b) The rotor of 4-pole 50 Hz slip ring the slip ring induction motor has a resistance of 0.3 Ω per phase runs at 1440 rpm, at full load. Calculate the external resistance per phase which must be added to lower the speed 1320 rpm, the torque being same as before.

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ELECTRICAL MACHINES - II

(Electrical and Electronics Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Explain the principal of operation of transformer. Derive its e. m. f. equation.

(b) A 1-phase transformer has 180 turns respectively in its secondary and primary windings. The respective resistances are 0.233 Ω and 0.067 Ω. Calculate the equivalent resistance of (i) the primary in terms of the secondary winding, (ii) the secondary in terms of the primary winding, and (ii) the total resistance of the transformer in terms of the primary.

2 (a) Derive the approximate equation of regulation of a transformer

(b) A 5 KVA, 2300/230 V, 50 HZ transformer was tested for the iron loss with normal excitation and copper losses at full load, and these were found to be 40 watts and 112 watts respectively. Calculate efficiency of the transformer at (i) Full load. (ii) Half full load. Assume the power factor of the load as 0.8.

3 (a) Explain the various simple tests conducted on a single transformer to find the approximate equivalent circuit of transformer.

(b) OC test is preferred to conduct on LV side and SC test is preferred to conduct on HV side. Explain the reasons.

4 A 3phase delta/star connected 11000/440 V, 50 Hz transformer takes a line current of 5 A, when secondary load of 0.8 lagging pf is connected. Determine the output of transformer.

5 A 4 pole, 3-Ø, 50 Hz, 415 V induction motor runs at a speed of 1440 rpm. Calculate: (i) The slip, (ii) Rotor frequency (iii) Take the power factor is 0.88.

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6 (a) Explain the various losses taking place in an induction motor. Also derive the relationship between rotor power input and rotor copper loss.

(b) A 4-pole, 400 V, 3-phase induction motor has a stand still rotor e.m.f of 100 V per phase. The rotor has resistance of 50 ohms/ph and standstill reactance of 0.5 ohms/ph. Calculate the maximum torque and slip at which it occurs. Neglect stator impedance.

7 (a) Explain no load tests and blocked rotor tests for an 3-phase induction motor.

(b) In a no load test, an induction motor took 10 A and 450 W with a line voltage of 110 V. If stator resistance per phase is 0.05 Ω and friction and windage losses amount to 135 W. calculate the exciting conductance and susceptance/ph.

8 (a) Describe how the speed control of induction motor is achieved from stator side?

(b) A cascaded set consists of 2 motors A and B with 4-pole and 6-poles respectively. The motor A is connected to 50 Hz supply, find

(i) Speed of the set.

(ii) Electric power transferred to motor B when the input to the motor A is 25 KW. Neglect losses.

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B.Tech II Year II Semester (R09) Regular & Supplementary Examinations, April/May 2013

ELECTRICAL MACHINES - II

(Electrical and Electronics Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Give the constructional features of "CORE" and "Shell" types of transformers, and give the advantages and disadvantages of each type.

(b) Derive the emf equation of a transformer.

2 (a) Draw the equivalent circuit of a transformer and show how the constants of primary and secondary windings may be combined to give a simplified equivalent circuit with the values of constants given in terms of secondary winding.

(b) Define and explain all day efficiency of a transformer

3 (a) With all necessary instruments draw a neat experimental set up to conduct OC and SC tests on a single phase transformer.

(b) A single phase 250/500 V transformer gave the following results:

OC test: 250 V, 1 A, 80 W on LV side.

SC test: 20 V, 12 A, 100 W on HV side.

Find the maximum efficiency of the transformer.

4 Two identical transformers each of rating 5 KVA, 200 V/100 V, 50 Hz transformers are connected in open delta. Calculate the KVA rating of the open delta bank when HV side is used as primary.

5 (a) Explain the constructional details of a 3-phase induction motor.

(b) A 3-phase induction motor runs at 1440 rpm at full load when supplied power from 50 Hz, 3-phase line. Calculate:

(i) The number of poles. (ii) Slip of full load.

(iii) Speed of the rotor field w.r.t rotor. (iv) Speed of the rotor field w.r.t stator.

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6 (a) A 12-pole, 3-phase, 50 HZ, IM draws 280 Amp and 110 KW under the blocked rotor test. Find the starting torque when switched on direct rated voltage and frequency supply. Assume the stator and rotor copper losses to be equal under the blocked rotor test.

(b) Why the starting current of IM is very high? Justify statement 'Though the staring current of IM is very high, the starting torque is poor'.

7 Explain how the performance of induction motor can be predicted by circle diagram. Draw the circle diagram for a three-phase, mesh connected, 22.38 KW, 500 V. 4-pole, 50 Hz induction motor. The data below gave the measurements of line current, voltage and reading of two wattmeters connected to measure the input.

No-Load	500 V	8.3 A	2.85 KW	-1.35 KW
Short circuit	100 V	32 A	-0.75 KW	2.35 KW

Also find the line current, p.f., efficiency and the maximum output from the circle diagram.

8 (a) With neat diagram explain the operation of 3-phase IM as induction generator.

(b) Two motors A and B with 10-poles and 12-poles respectively are cascaded. The motor A is connected to a 50 Hz supply. Find:

(i) Speed of the set

(ii) The electrical power transferred to the motor B when the input to the motor A is 60 KW. Neglect losses.

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B.Tech II Year II Semester (R09) Regular & Supplementary Examinations, April/May 2013

ELECTRICAL MACHINES - II

(Electrical and Electronics Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Derive an emf equation of a single phase transformer.

(b) The maximum flux density in the core of 250/3000 Volts 50 HZ single phase transformer is 1.2 webers per square meter. If the emf per turn is 8 volts, determine primary and secondary turns and area of the core.

2 (a) Define all day efficiency? Also derive the condition for maximum efficiency of a transformer.

(b) A single phase 150 KVA transformer has efficiency of 96 % at full load, 0.8 pf and at half load, 0.8 pf lagging. Find maximum efficiency of transformer and corresponding load.

3 (a) What are the advantages of Sumpner's test? Give the related calculation to find the efficiency of a transformer.

(b) In Sumpner's test on two identical transformer rated 500 KVA, 11/0.4 KV, 50 Hz, the wattmeter reading on HV side is 6 KW on rated voltage and on LV side is 15 KW when circulated full load current. Find the efficiency of each transformer on $3/4^{th}$ load and 0.8 pf lagging. What will be the maximum efficiency of each transformer?

4 (a) With neat phasor diagram, explain the voltage regulation of 3-phase transformer.

(b) An ideal 3-phase step down transformer connected in delta/star delivers power to a balanced 3-phase load of 120 KVA at 0.8 pf. The input line voltage is 11 KV and the turn's ratio of transformer (phase to phase) is 10. Determine the line voltage line currents, phase voltages, phase currents on both primary and secondary sides.

5 (a) Discuss the production of rotating magnetic field in induction motors.

(b) A 3-phase induction motor is wound for 4-poles and is supplied from 50 Hz system. Calculate:
(i) Synchronous speed. (ii) Rotor speed when slip is 4% and
(iii) Rotor frequency when rotor runs at 600 rpm.

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6 (a) Draw and explain the phasor diagram of 3-phase induction motor.
(b) Discuss the phenomenon of crawling and cogging in an induction motor.

7 (a) A 10 KW, 420 V, 3-phase, 4-pole, 50 HZ delta connected squirrel cage induction motor gave the following data on blocked rotor test. 210 V, 20 A, 5 KW stator core loss at rated voltage and frequency is 300 watts. The dc resistance measured between any two terminals of stator is 0.6 ohm. Determine the starting torque.
(b) A 10 KW, 400 V, 4-pole delta connected squirrel cage induction motor gave the following test results.
No load test : 400 V, 8 A, 250 W
Blocked rotor test : 90 V, 35 A, 1350 Watts.
DC resistance per phase of stator is 0.6, calculate equivalent circuit parameters.

8 (a) Explain briefly how the speed control of induction motor is achieved from rotor side?
(b) Two 50 Hz, 3-Φ induction motor having 6 and 4-poles respectively are cumulatively cascaded. The 6-pole motor being connected to the main supply.
Determine frequencies of rotor currents and the slips referred to each stator field. If the set has slip of 2%.

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