Code: 15A02401

R15

B.Tech II Year II Semester (R15) Regular Examinations May/June 2017

ELECTRICAL MACHINES – II

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Mention the functions of the two components of exciting current in a transformer.

(b) What is the difference between cylindrical-type and sandwich-type winding?

(c) What are the necessary conditions required for parallel operation of single phase transformer?

(d) List the possible ways of connecting a bank of three transformers for three phase service.

(e) Why should the rotor of a 3-phase induction motor rotate in the same direction as that of its rotating magnetic field?

(f) What is the effect of introducing resistance in the rotor circuit of a 3-phase induction motor?

(g) What is meant by crawling?

(h) Mention the effect of variation of supply frequency in an induction motor.

(i) How the speed of induction motor is controlled by variable - frequency?

(j) How is it possible to get frequencies lower than the supply frequency in a 3-phase WRIM?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Obtain the equivalent circuit of a single phase transformer referred to LV side and HV side.

(b) A single phase 50 Hz transformer has 100 turns on the primary and 400 turns on the secondary winding. The net cross sectional area of core is 250 cm^2. If the primary winding is connected to a 230 V, 50 Hz supply, determine: (i) The e.m.f induced in the secondary winding. (ii) The maximum value of flux density in the core.

OR

3 (a) Explain why hysteresis and eddy current looses occur in a transformer? What are the methods to reduce these losses?

(b) A 10 kVA, 2500/250 V, single phase transformer has resistances and leakage reactance's as follows: R_1 = 4.8 Ω, R_2 = 0.048 Ω, X_1 = 11.2 Ω and X_2 = 0.112 Ω subscripts 1 and 2 denote high voltage and low voltage windings respectively. With primary supply voltage held constant at 2500 V, calculate the secondary terminal voltage when: (i) The LV winding is connected to a load impedance of 5+j3.5 Ω. (ii) The transformer delivers its rated current at 0.8 p.f lagging on the L.V side.

UNIT – II

4 Mention the different tests that are conducted on transformer. Explain the procedure for conducting Sumpner's test along with all precautions to be taken while conducting the test with neat diagram.

OR

5 (a) How auto transformer is different from ordinary two winding transformer? What are the advantages & disadvantages of auto transformer?

(b) In a Scott-connection, calculate the values of the of the currents on the 3-phase side if the loads on the 2-phase side are 300 kW and 450 kW both at 100 V and 0.707 p.f. lag and the 3-phase line voltage is 3300 V. The 300 kW load is on the leading phase on the 2-phase side. Neglecting transformer losses.

Contd. in page 2

UNIT – III

6 (a) Discuss the points of similarities between a transformer and an induction machine. Hence, explain why induction machine is called a generalized transformer.

(b) A 100 kW (output), 3300 V, 50 Hz, 3-phase, star-connected induction motor has a synchronous speed of 500 r.p.m. The full-load slip is 1.8% and F.L. power factor 0.85. Stator copper loss = 2440 W. Iron loss = 3500 W. Rotational losses = 1200 W. Calculate: (i) The rotor copper loss. (ii) The line current. (iii) The full load efficiency.

OR

7 (a) Show that in an induction motor the rotor input: power developed: rotor copper losses :: 1: (1-s):s, where s is the fractional slip.

(b) In a 6-pole, 3-phase, 50 Hz motor with star connected rotor, the rotor resistance per phase is 0.3 Ω, the reactance at standstill is 1.5 Ω per phase and an e.m.f between the slip rings on open circuit is 175 V. Find: (i) Rotor e.m.f per phase. (ii) Rotor frequency and reactance at a speed of 950 rpm.

UNIT – IV

8 Sketch and explain the slip torque characteristics of an induction motor working at rated voltage and frequency and also explain with respect to the normal one, if the following changes are made: (i) Applied stator voltage is reduced to half at rated frequency. (ii) Both the applied voltage and frequency are reduced to half.

OR

9 (a) Develop an expression for torque of an induction motor and obtain the condition for maximum torque.

(b) The rotor resistance and stand still reactance of a 3-phase induction motor are 0.02 Ω / phase and 0.1 Ω / phase respectively. At normal voltage, the full-load slip is 3%. Estimate the percentage reduction in stator voltage to develop full-load torque at half full-load speed. Also calculate the power factor.

UNIT – V

10 (a) Why a starter is necessary to start an induction motor? Explain Auto-transformer starter in detail.

(b) The rotor of a 4-pole, 50 Hz slip ring induction motor has a resistance of 0.25 Ω per phase and runs at 1440 r.p.m at full load. Calculate the external resistance per phase which must be added to lower the speed at 1200 r.p.m, the torque being the same as before.

OR

11 Explain in detail the different methods for the speed control of induction motors.

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