

Electrical Machine – I

Paper - IV

P. Pages : 3

Time : Three Hours



KNT/KW/16/7281/7310

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Due credit will be given to neatness and adequate dimensions.
 9. Assume suitable data whenever necessary.
 10. Diagrams and equations should be given whenever necessary.
 11. Illustrate your answers whenever necessary with the help of neat sketches.
 12. Use of non programmable calculator is permitted.

1. a) Explain with circuit diagram and suitable equation open circuit and short circuit test on a 3 phase transformer. 7

b) Obtain the equivalent circuit of a 200/400V, 50 Hz, single phase transformer from the following test data - 7
OC Test - 200V, 0.7A, 70W - L.V. side
SC Test - 15 V, 10A, 85W - H.V. side
Calculate the secondary voltage when delivering 5 kw at 0.8 pf lag, the primary voltage being 200 V.

OR

2. a) Explain Dy11 and Yd6 connections with phasor diagram. 6

b) A 50 kVA transformer has efficiency of 98% on full load at 0.8 power factor and 98.5% on half full load at 0.9 power factor. Determine all day efficiency of this transformer for the following load cycle : 8
6 Hours - 5 kw at power factor of 0.6
12 Hours - 40 kw at p.f. of 0.8
6 Hours - 30 kw at p.f. of 0.85

3. a) Explain back to back test on single phase transformer. 6

b) A Scott connected transformer set is rated at 11,000V on 3phase side and at 80V on two phase side. When teaser transformer is loaded upto 500 kw, unity power factor and the main transformer, upto 800 kw at unity power factor, calculate the line currents on 11 kv side. 7

OR

4. a) Discuss different cooling methods of transformer. 6

- b) A load of 500 kVA at 0.8 pf lagging is to be shared by two three phase transformers A and B of equal ratings. If the equivalent delta impedances as referred to secondary are $(2+j6)$ for A and $(2+j5)$ for B. Calculate the load supplied by each transformer. 4
- c) Explain polarity test on 3 phase transformer. 3
5. a) Explain armature reaction in D.C. machine. 5
- b) A 2 pole series motor runs at 707 rpm, when taking 100A at 85V and with the field coils in series. The resistance of each field coil is 0.03Ω and that of armature 0.04Ω . If the field coils are connected in parallel and load torque remains constant. Find - 8
- a) Speed
- b) Additional resistance to be inserted in series with the motor to restore the speed to 707 rpm.
- OR**
6. a) Draw torque Vs Armature current and speed Vs armature current characteristics for DC shunt and d.c. series motor. Justify the nature of characteristics. 4
- b) Explain field weakening method for speed control of shunt motor. 3
- c) A 200V DC shunt motor takes 4 Amp at no load when running at 700 rpm. The field resistance is 10Ω and armature resistance is 0.6Ω . Calculate : 6
- i) Speed on load
- ii) Developed torque in N-m
- iii) Efficiency when input to motor is 8 kw.
7. a) Draw torque slip characteristics of a wound rotor induction motor and explain its performance when - 6
- i) Rotor resistance is increased gradually.
- ii) Applied voltage is reduced by 10%.
- iii) The rotor is made to run more than synchronous speed.
- b) For a 3-phase Induction motor, show that per phase input power to rotor can be divided in the ratio of : $1:S: (1-S) = P_g : \text{rotor ohmic loss} : P_m$ 4
- c) Explain double cage Induction motor with its torque slip characteristics. 4
8. Draw the circle diagram for a 3 phase, 6 pole, 50 Hz, star connected induction motor from the following data (line values) - 14
- No load test : 400V, 9A, 1250W
- S/c test : 200V, 50A, 6930W
- Full load current : 50A
- Stator loss at stands full = 0.55 times total copper loss.
- From circle diagram, find -
- i) power factor, slip, output, speed and torque at full load.
- ii) starting torque
- iii) maximum torque in syn. Watt and slip for maximum torque.

9. a) Name various methods of speed control of cage type and slip ring Induction motor. 7
Explain in short speed control on stator voltage side of 3-ph Induction motor.
- b) A 3 phase, delta connected, cage type I.M. when connected directly to 400V, 50Hz supply 6
takes a starting current of 100A in each stator phase. Calculate the line current drawn from supply when it is started using -
i) DOL starting
ii) Star - Delta starting
iii) Auto transformer starting with 70% tap. In which method the starting torque shall be maximum.

OR

10. a) Explain crawling in 3 phase Induction motor. 4
b) Explain regenerative braking in three phase induction motor. 4
c) The power input to a 500V, 50Hz, 6 pole Induction motor, 3 ϕ , at 975 rpm is 40 kw. The 5
stator losses are 1 kw and the friction and windage losses total are 2 kw, calculate :
i) The rotor cu loss
ii) shaft power
11. a) Explain "Capacitor start - Induction run" 1 phase, Induction motor give its application also. 7
b) Explain double field revolving theory for a single phase Induction motor. 6

OR

12. a) Explain shaded pole Induction motor alongwith its applications. 7
b) Whether single phase I.M. are self starting or not. Explain statement in detail. 6

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