UNIVERSAL COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL ENGINEERING

AC MACHINES (2140906) SEMESTER: IV

ASSIGNMENT

POLY PHASE INDUCTION MOTOR

1. Derive the expressions of starting and running torques in 3-phase induction motor also obtain the condition for getting the maximum torque.
2. Draw and explain the torque slip characteristic of an induction motor also discuss the effect of rotor resistance on to it.
3. Obtain the equivalent circuit of an induction motor step by step.
4. Explain with the help of vector diagram the working of induction motor as a generalized transformer.
5. Explain the power stages of an induction motor also obtain the power balance equations from the equivalent circuit.
6. Explain in detail how the equivalent circuit parameters can be obtained by performing No Load and Blocked Rotor tests on induction motor.
7. Explain various starters used for induction motor with the help of suitable connection diagrams also give the comparison of starting currents and starting torques between various starters.
8. Derive the expression of minimum accelerating time of an induction motor. Also obtain the expression for optimum rotor resistance.
9. Explain various methods of speed control of an induction motor.
10. Explain in detail how high starting torque can be obtained by deep bar and double cage rotor construction in induction motor. Also draw the torque-slip characteristics and equivalent circuit of double cage induction motor.
11. Explain the effect of unbalanced supply voltage on induction motor also obtain the equivalent circuit and expression of torque when one line gets opened.
12. With the help of double revolving field theory explain why 1-phase induction motor is not self-starting? Explain how it can be made self-starting.
13. Explain in detail how the equivalent circuit parameters of 1-phase induction motor can be obtained by performing No Load and Blocked Rotor tests.
14. Write short notes on:
    1. capacitor start capacitor run induction motor
    2. shaded pole induction motor.

EXAMPLES:

1. A 746-kw, 3-phase; 16 pole induction motor has a rotor impedance of (0.02+j 0.15) Ω per phase at standstill. full load torque is obtained at 360 rpm. calculate (1) the ratio of maximum to full load torque(2) the speed at maximum torque and (3)the rotor resistance to be added to get the maximum starting torque.
2. A 3-phase induction motor has a 4-pole, star connected stator winding and runs on a 220 V, 50 Hz supply, the rotor impedance is (0.1+j 0.9) Ω per phase at standstill. the ratio of stator to rotor turns is 1.75.the full load slip is 5%.calculate for this load:
   (a) The load torque in kg-m (b) speed at maximum torque (c) rotor emf at maximum torque.
3. The full load shaft torque of 3-phase, 6 pole induction motor is 162.84 Nm.the rotor emf is observed to make 90cycles per minute. Calculate (a) motor output. (b) Cu loss in rotor. (c) Motor input and (d) efficiency if mechanical torque lost in windage and friction is 20.36 Nm and stator losses are 830 watts.
4. A 220 V,3-phase,4 pole 50 Hz star connected induction motor is rated 3.73KW.The equivalent circuit parameters are:
   R1=0.5Ω, X1=1Ω, equivalent rotor values are R2'=0.6Ω, X2'=1Ω. The magnetizing reactance is 30Ω.The stator core loss is 50W and rotational loss is 150W.for a slip of 0.04, find (1) input current (2) pf (3) air gap power(4) mechanical power(5) electromagnetic torque(6) output power
   (7) efficiency
5. A 40HP(29.84KW),50Hz,3-phase induction motor gave the following test results
   No load test :440V,16A,pf=0.15 **B.R. test**: 100V,55A,pf=0.225
   Ratio of rotor to stator cu losses on blocked rotor condition=0.9.Find the current, pf, speed and efficiency at full load. Also find the maximum torque and maximum output power.
6. A squirrel cage induction motor has a short circuit current of 4 times the full load value and has a full load slip of 5%. Determine a suitable auto transformer ratio if the supply line current is not to exceed twice the full load current.also, express the starting torque in terms of the full load torque.
7. In a double cage induction motor, if the outer cage has impedance at standstill of (2+j2) Ω and the inner cage impedance of (0.5+j5) Ω, determine the slip at which the two cages develop equal torques.
8. A 230 V, 50 Hz, 6 pole, single phase induction motor has the following constant.
   R1=0.15Ω, R2=0.2 Ω, X1=X2=0.4 Ω, Xm=20 Ω.
   If the core loss is 250W and friction and windage losses are 500W, determine the efficiency and torque at s=0.04.
9. A 3 phse 415V,6 POLE, 50 Hz,star connected slip ring induction motor has a total stator and rotor reactance of 1.2Ω referred to the stator.the machine drives pure inertia load; the moment of inertia of the rotor and load being 15 Kg-m^2. Direct on line starting is used and the rotor circuit resistance is adjusted so that the load is brought to 0.95 of the synchronous speed from rest in shortest possible time. Neglecting stator losses, compute the acceleration time and the value of the rotor resistance referred to the stator.

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ASSIGNMENT

Synchronous Machines

1. Explain concept of pitch factor and distribution factor in case of an alternator.
2. Explain the two reaction theory of salient pole synchronous machine.
3. What is armature reaction? Explain the effect of armature reaction on the Terminal voltage of an alternator.
4. What are the advantages of connecting alternators in parallel? Explain with diagram three dark lamp method of synchronizing two three phase Alternators.
5. List different methods for finding voltage regulation of an alternator and explain all method.
6. Explain the slip test for measurement of Xd and Xq of synchronous machines.
7. Explain hunting of synchronous machines and methods of its prevention.
8. What are the causes of harmonics in the voltage waveform of an alternator? How can these be minimized?
9. A 3-phase, 8-pole, 750 rpm star-connected alternator has 72 slots on the Armature. Each slot has 12 conductors and winding is short chorded by 2 slots. Find the induced emf between lines, given the flux per pole is 0.06 Wb.
10. A 440 volt, 50 KVA, 1ph alternator has an effective resistance of 0.2 ohm, A field current of. 5 A. produce armature current of 100 A, On short circuit and an e.m.f of 350 volts an open circuit calculate full load regulation at 0.8 p.f.(lagging).

11. The stator of a 3 ph, 16 pole alternator has 144 slots and there are 4 conductor per slot connected in two layers and the conductors of each phase are connected in series. If the speed of alternator is 375 rpm. Calculate the emf induced per phase. Resultant flux in air gap is 0.04 wb per pole sinusoidally distributed. Assume the coil span as 150 degree electrical.
12. A 4 KVA, 3 phase, 110V, 50Hz, star connected alternator has Xd = 3 ohm and Xq = 2ohm. The machine is delivering full load current of 0.8 p.f lagging at rated voltage.Find the induced emf, load angle and maximum power output of the alternator

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DEPARTMENT OF ELECTRICAL ENGINEERING

AC MACHINES (2140906) **SEMESTER: IV**

ASSIGNMENT

Synchronous Motor

1. Explain the effect of varying excitation at constant load on synchronous motor
2. Explain V and inverted V curves of synchronous motor.

3. Why synchronous motor is not self starting? Explain the methods of starting of synchronous motor.

4. Explain the working of synchronous phase modifier.

5. Explain hunting in synchronous machine.

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DEPARTMENT OF ELECTRICAL ENGINEERING

AC MACHINES (2140906) **SEMESTER: IV**

ASSIGNMENT

Commutator motors

1. Explain construction and working of Universal motor.
2. Discuss constructional features, working and application of Schrage motor in detail.
3. Explain construction and working of Repulsion motor.