

Electrical machine - II

CD- 5535

[Total Marks : 100

MASTER

Con. 5034-07.

(REVISED COURSE)
(3 Hours)

- N. B. : (1) Question No. 1 is compulsory.
 (2) Attempt any four questions out of remaining.
 (3) Assume data wherever necessary.

1. (a) Derive torque equation for three phase induction motor and hence explain torque speed characteristics in motoring zone. (Use Thevenin's model approach.) 10
 (b) Explain need of starter for three phase induction motor and explain star delta starter, compare its starting torque with torque of DOL at starting. 10
2. (a) Explain split phase and capacitor start capacitor run single phase induction motors in detail. Draw phasor diagrams and speed torque diagrams. 10
 (b) A 230V, 4 pole, 50Hz single phase induction motor has the following constants and losses. 10

$$r_1 = 2.3 \Omega \quad x_1 = 3.2 \Omega$$

$$r_2 = 4.2 \Omega \quad x_2 = 3.2 \Omega$$

$$x_m = 74 \Omega$$

Core loss = 98 watts.
 Friction and windage loss = 30 watts.

If this motor is running with a slip 0.05 at rated voltage and frequency, then compute the stator current, pf, power output, torque and efficiency with its auxiliary winding open.

3. (a) Explain Blondel's two reaction theory. Draw phasor diagram. 10
 (b) A 3 phase 6 pole 1000 rpm alternator has 4 slots / ph / pole with 8 conductors per slot coils are chorded by one slot. The fundamental flux is 18.7 mwb, 3rd harmonic flux is 1.72 mwb and fifth harmonic. Flux is 0.6 mwb. Find distribution and pitch factors for fundamental, third and fifth harmonic. Find resultant ph voltage on no load if alternator is star connected. 10
4. (a) Explain speed control methods for 3 phase sq. cage induction motor. Explain only necessity of V/f control. 10
 (b) Derive expression for distribution factor and coil span factor. 10
5. (a) Derive equivalent circuit of 3ph induction motor. 10
 (b) A 10kW, 400v, 3ph, 4pole, 50Hz slip ring induction motor develops rated o/p i.e 10 kW at rated voltage and frequency and with slip rings shorted. Maximum torque is equal to twice the full load torque and occurs at a slip of 10% with zero external resistance in roter circuit. Starter resistance and rotational losses are neglected. Determine : 10
- (1) Slip and rotor speed at full load torque
 - (2) Rotor ohmic loss at full load torque
 - (3) Starting torque at rated voltage and frequency
 - (4) If now rotor resistance is trebbled by inserting resistance in rotor circuit. Find slip at maximum torque for same full load torque.

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6. (a) A 220V, 50Hz, 6 pole star connected alternator with ohmic resistance of 15 0.06 Ω per phase gave following data

Field current I _f in A	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.8	2.2	2.6	3.0	3.4
Open Circuit Voltage E _o in Volts	29	28	87	116	146	172	194	232	261.5	284	300	310

During short circuit test, a full load current of 40A was circulated when field current was 1.2A. A field current of 3.2A was required to circulate a full load current at rated voltage under zero power factor. Find percentage regulation at full load current of 40A at power factor of 0.8 lag by zero para factor method and new ASA method.

(b) Explain crawling in induction motor. 5

7. (a) Explain starting of synchronous motor. 10

(b) A three phase sq. cage induction motor has a short circuit current of 5 times the full load current. Its full load slip is 5%. Calculate the starting torque as a percentage of full load torque if motor is started by— 10

(a) Direct on line starter

(b) Star Delta Starter

(c) Auto transformer starter, limiting the motor starting current to twice the motor full load current. Also find starting current drawn from the supply in terms of motor full load current. What is the percentage auto transformer tapping in this case.

(d) Auto transformer starter limiting the supply line starting current to twice the full load current. Find auto transformer tapping in this case also.