B.TECH/EE/5TH SEM/ELEC 3101 (BACKLOG)/2020

ELECTRICAL MACHINE - II
(ELEC 3101)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) The maximum power in a synchronous machine is obtained when the load angle is
(a) 0 degree (b) 120 degree (c) 90 degree (d) 45 degree.

(ii) If the input to the prime mover of an alternator is kept constant but the excitation is changed, then the
(a) the active component of the output is changed
(b) the power factor remains constant
(c) reactive components of the output are changed
(d) the power factor is reduced.

(iii) Synchronizing torque comes into operation under all of the following cases except
(a) Phase difference between the two current
(b) Frequency difference between two voltages
(c) Changing the excitation current
(d) Phase difference between two voltages.

(iv) Which of the following methods is used to start a synchronous motor?
(a) Damper winding
(b) Star-delta starter
(c) Damper winding in conjunction with star-delta starter
(d) Resistance starter in the armature circuit.

(v) A synchronous motor can be used as a synchronous capacitor when it is
(a) under loaded (b) over loaded
(c) under excited (d) over excited.

(vi) A 200V, 10 kW, 4P, star connected 50 Hz IM has a full load slip of 5%. What is the synchronous speed of the motor?
(a) 1200 rpm (b) 1500 rpm (c) 1000 rpm (d) 3000 rpm.

(vii) A 15kW, 6P, 50 Hz IM has friction and windage loss to be 5% of the output. The machine is operating at full load with a slip of 4%. The output torque of the above machine will be
(a) 149.21 N-m (b) 145.74 N-m
(c) 154.38 N-m (d) 140.62 N-m.

(viii) A 50 Hz single phase induction motor runs with slip 4%. Find the frequency (in Hz) of the current induced in the rotor by the backward field.
(a) 50 Hz (b) 100 Hz (c) 2 Hz (d) 98 Hz.

(ix) A single phase resistor split phase induction motor draws $\theta_m = 60°$ lagging main winding current at starting. To have maximum starting torque, what should be the power factor angle of the auxiliary winding current (θ_a in degrees)?
(a) 60° (b) 30° (c) 15° (d) 90°.

(x) The function of compensating winding in ac series motor is
(a) to improve the efficiency of the machine
(b) to convert it into a two phase motor
(c) to provide starting torque
(d) to reduce reactance of armature winding.

Group – B

2. (a) Draw and explain the torque-slip characteristics of a three phase induction motor. Also sketch the torque slip curve for different values of rotor circuit resistance and explain it.

(b) A 10kW, 50Hz, 3 phase IM develops rated torque at 1440 r.p.m. In case the load torque is reduced to half, find the motor speed and the power output. Assume linear torque slip characteristics near operating range.

(5 + 2) + 5 = 12

3. (a) Blocked rotor test on a 3 phase, 40kW, 400V, 50Hz, 6P star connected IM gave the following data: 200V, 110A, p.f. = 0.4. Determine the starting torque for a 3 phase voltage of 380V at 45Hz. Neglect magnetizing current and assume stator and rotor ohmic losses equal.

(b) Explain in brief the methods used for reducing harmonic asynchronous torque.

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

5 + 4 + 3 = 12

Group – C

4. (a) Explain double revolving field theory as applied to a single phase induction motor.
A 220V, single phase induction motor gave the following test results:
Blocked rotor test: 120V, 9.6A, 460W
No load test: 220V, 4.6A, 125W

(b) The stator winding resistance is 1.5Ω and during the blocked rotor test the stator winding is open. Determine the equivalent circuit parameters. Also find the core, friction and windage loss.

6 + 6 = 12

5. (a) Describe the operation of a capacitor start and run motor and draw its typical torque-speed characteristics.

(b) Write short notes on switched reluctance motor.

(c) Compare single phase induction motor with a polyphase induction motor.

(4 + 1) + 5 + 2 = 12

Group – D

6. (a) Explain the phenomenon of armature reaction when an alternator is delivering a load current at purely lagging power factor.

(b) Explain the Potier-triangle method of determining the voltage regulation of an alternator.

5 + 7 = 12

7. (a) A 3-phase, star connected alternator is rated at 1600 kVA, 13500 V. The armature effective resistance and synchronous reactance are 1.5 Ω and 30 Ω respectively per phase. Calculate the percentage regulation for a load of 1280 kW at a power factor of (a) 0.8 leading (b) unity.

(b) What are the conditions necessary for parallel operation of alternators?

(c) Define short circuit ratio.

6 + 4 + 2 = 12

Group – E

8. (a) Draw the phasor diagram of a salient pole synchronous motor at lagging power factor and derive the necessary equation for torque angle δ.

(b) Write short note on V curve.

(2 + 4) + 6 = 12

9. (a) Write in brief about hunting phenomenon in a synchronous motor. Also mention the causes and effects of hunting.

(b) A 400 V, 500 kVA, 0.8 power factor leading delta connected 50 Hz synchronous machine has a synchronous reactance of 3Ω and negligible armature resistance. Its friction and windage losses are 2 kW and its core losses are 1.5 kW. Initially, the shaft load is 10 kW and the power factor of the motor is 0.8 leading.

(i) Determine line current, armature current and excitation voltage.

(ii) If the shaft load is increased to 20 kW determine the new values of line current, armature current and motor power factor.

6 + (3 + 3) = 12

Department & Section	Submission Link
EE	https://classroom.google.com/c/MjQ4NjQ1NDU0NDkx/a/MjcwOTk1NTc3NjQy/details