

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID :

Roll No.

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B. Tech.

(Semester-V) Odd Semester Carry Over Theory Examination, 2012-13

ELECTROMECHANICAL ENERGY CONVERSION-II

Time : 3 Hours]

[Total Marks : 100

Note : Attempt questions from each Section as per instructions.

Section-A

1. Attempt *all* parts of this question. Each part carries 2 marks. 2×10=20
- Why may an alternator winding be chorded ?
 - Why Potier reactance is slightly higher than leakage reactance ?
 - How synchronous motor can be used to regulate the voltage at the receiving end of the long transmission line ?
 - How the synchronous motor is made self starting ?
 - What is the effect of varying excitation of an alternator running in parallel with the other alternator ?
 - Why the air gap between stator and rotor of an induction motor B made very small?
 - Why the slots on the rotor of induction motor are usually skewed ?
 - Why double squirrel cage induction motor has high starting torque and operating efficiency ?
 - Why single phase induction motor are not self starting ?
 - Why are a.c. series motors built with range number of armature conductors ?

Section-B

Attempt any *three* parts of this question. Each part carries 10 marks.

10×3=30

2. (a) (i) Discuss briefly the load characteristics of alternator for different load power factor. 5
- (ii) A 500V, 50Hz, 3-phase circuit takes 20 ampere at a lagging power factor of 0.8. A synchronous motor is used to raise the power factor to unity. Calculate the KVA input to the motor and its power factor when driving a mechanical load of 7.5 kW. Motor has an efficiency of 80%. 5
- (b) A squirrel cage induction motor has a slip of 4.5% at full load. Its starting current is 4 times the full load current. The stator impedance and magnetising current may be neglected, the rotor resistance is assumed constant. Calculate the maximum torque and the slip at which it would occur.
- (c) The rotor of a 6 pole, 50 Hz, 3 phase induction motor has a resistance of 0.2Ω per phase and runs at 970 rpm. If load torque remains unchanged, calculate the additional rotor resistance that will reduce the speed by 15 percent.
- (d) Explain the cross field theory as applied to a single phase induction motor.
- (e) Explain the construction, working and applications of a stepper motor.

Section-C

Attempt *all* questions of this Section. Each question carries 10 marks.

3. Attempt any three parts of this Section. 5×2=10
- (a) Draw and explain the phasor diagram of salient pole alternator supplying a lagging p.f. load.
- (b) A 2.3KV, 3-phase star-connected synchronous motor has $Z_s = (0.2 + j2.2)$ ohms per phase. The motor is operating at 0.6 p.f. leading with line current of 200 A. Determine the generated emf per phase.
- (c) Derive expression for synchronising power and synchronising torque when two alternators are connected in parallel.

4. Attempt any one part :

10×1=10

- (a) For a salient pole alternator supplying full load lagging p.f. show that power output per phase is given by :

$$P = \frac{EV}{X_d} \sin \delta + \frac{V^2}{2} \left[\frac{1}{X_q} - \frac{1}{X_d} \right] \sin 2\delta.$$

- (b) Explain with neat phasor diagram the effect of varying excitation upon the armature current and power factor of a 3-phase synchronous motor when input power to the motor is maintained constant.

5. Attempt any one part :

10×1=10

- (a) The starting and maximum torque of three phase induction motor are 1.5 times and 2.5 times its full load torque. Determine the percentage change in rotor circuit resistance to obtain a full load slip of 0.04. Neglect stator impedance.
- (b) A 50 HP, 6 pole, 50Hz slip ring induction motor runs at 960 rpm on full load with rotor current of 35A. Allowing 300 watt for copper loss in the short circuiting gear and 1260 watt for mechanical losses, find the resistance R_2 per phase of the three phase rotor winding.

6. Attempt any one part :

10×1=10

- (a) A squirrel cage type induction motor when started by means of a star-delta starter takes 200% of full load current and develops 40% of full load torque at starting. Calculate the starting torque and current if an autotransformer with 75% tapping were employed.
- (b) In a double cage induction motor if the outer cage has an impedance at standstill of $(3+j1.2)$ ohms, determine the slip at which the two cages develop equal torque if the inner cage has an impedance of $(0.5+j3)$ ohms at standstill.

7. Attempt any two parts :

5×2=10

- (a) With the help of double revolving field theory draw equivalent circuit of single phase induction motor.
- (b) Explain the construction and principle of operation and working of a universal motor. Mention its applications.
- (c) Describe the working of repulsion motor. Write its merits and demerits.