Printed Pages : 4 TEE501

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

PAPER ID : 2055 Roll No.

B.Tech

(SEM V) ODD SEMESTER THEORY EXAMINATION 2009-10
ELECTROMECHANICAL ENERGY CONVERSION- II

Time : 3 Hours] *[Total Marks : 100*

Note : *Attempt all questions.*

1 Attempt any **four** of the following : **5×4=20**

(a) Draw and explain the equivalent circuit diagram and phasor diagram of a synchronous machine.

(b) What is armature reaction ? What measures are taken to over come its effect and how ?

(c) What do you know about voltage regulation of an alternator ? Name the various methods of obtaining the same. Describe any one of them in detail.

(d) How does the parallel operation of two alternators differ from the condition when an alternator run with an infinite bus bar ? How is the power sharing affected in parallel operation when (i) Excitation of one of them is changed and (ii) Steam input to one of them is changed ?

(e) Discuss about synchronizing power.

(f) Explain power angle characteristics of cylindrical rotor alternator.

2 Attempt any **two** of the following : **10×2=20**

(a) What is the effect of saliency of field poles in the synchronous machines ? Draw a phasor diagram showing relationship between the induced emf and the terminal voltage for an alternator running over excited.

(b) The full load current of a 3.3 kV, star connected synchronous motor is 160 A at 0.8 p.f. lagging. The resistance and synchronous reactance of the motor are **0.8Ω** and **5.5Ω** per phase respectively. Calculate the excitation emf, torque angle, efficiency and shaft output of the motor. Assume the mechanical stray load loss to be 30 kW.

(c) Discuss about the following :

(i) Hunting

(ii) Damper winding

(iii) V-curves.

3 Attempt any **four** of the following : **5×4=20**

(a) Describe the principle of rotating magnetic field in a 3 phase induction motor.

(b) Draw the slip-torque characteristics of 3 ph. induction motors at subsynchronous, supersynchronous and reverse direction speeds. Explain the physical meaning of these modes of operation.

(c) Develop an equivalent circuit diagram for a three phase induction motor. Show in the circuit that $R_2\left(\frac{1-s}{s}\right)$ is the electrical equivalent of mechanical load on motor, where R_2 is the rotor resistance.

(d) A 6-pole, 50 Hz, 3 phase induction motor running on full load develops a useful torque of 160 Nm when the rotor emf makes 120 complete cycles per minute. Calculate the shaft power output.

(e) Derive the expression for torque in a 3 phase induction motor. How is this affected by the rotor parameters ? Draw suitable slip torque characteristics to show the variation in torque due to change in rotor resistance.

(f) A 4-pole, 400 V, 3 phase induction motor has a stand still reactance of 0.5 ohm per phase, standstill rotor emf of 100 V per phase and rotor resistance of 50 milli ohm per phase. Calculate the maximum torque and the slip at which it occurs. Neglect the stator impedance.

4 Attempt any **two** of the following : **10×2=20**

(a) Why starter is needed for operation of 3-phase induction motor ? List different starting methods of slip ring type and squirrel cage type induction motors. An induction motor has a starting current of six times the full load current and a full load slip of 0.05. Find in PU of full-load values the line current and starting torque with

(i) Direct starting

(ii) Star-delta starting.

(b) Explain the role of deep bar and double cage rotor in squirrel cage induction motor. The impedances at standstill of the inner and outer cages of a double cage rotor are $(0.01 + j0.5)\Omega$ and $(0.05 + j0.1)\Omega$ respectively. The stator impedance may be assumed negligible. Calculate the ratio of the torques due to the two cages :

(i) at starting

(ii) when running with a slip of 5%

(c) Explain constant (U/f) method of speed control of 3 phase induction motor. A 50 Hz, 3-phase induction motor has a rated voltage V_1. The motor's break down torque at rated voltage and frequency occurs at slip of 0.2. The motor is run from a 60 Hz supply of voltage V_2. The stator impedance can be neglected. Find the ratio of currents and torques at starting if $V_2 = V_1$.

5 Attempt any **two** of the following : **10×2=20**

(a) Why is a 1-phase induction motor non-self starting ? Explain double revolving field theory in detail.

(b) Explain about single phase ac series compensated motor in detail.

(c) What do you know about stepper motors ? What are the areas of application of the same ?