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

PAPER ID : 2111 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION 2010-11

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) Compare salient and non salient pole synchronous machine.

   (b) Sketch and explain the open circuit and short circuit characteristics of a synchronous machine.

   (c) Derive the emf equation of a 3–phase alternator having star connected winding. Why synchronous impedance method of computing voltage regulation leads to pessimistic value for lagging power factor of load ?

   (d) An 8 pole, 3 phase, 60° spread, double layer winding has 72 coils in 72 slots. The coils are short pitched by two slots. Calculate the winding factor for the fundamental and third harmonic.

   (e) A 2200 V, 50 Hz, 3–phase, star connected alternator has an effective resistance of 0.5Ω per phase. A field current

of 30 A produced the full–load current of 200 A on short circuit and a line to line emf of 1100 V on open circuit. Determine

(i) the power angle of the alternator when it delivers full-load at 0.8 pf (lagging).

(ii) the SCR of the alternator.

(f) Derive an expression for the winding factor of an alternator.

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

(a) Explain the effect of varying of excitation of a synchronous generator connected to infinite busbar on the power factor, armature current and load angle.

(b) Write short notes on the following :

(i) Parallel operation of alternators

(ii) Process of synchronization.

(c) Two alternators working in parallel supply the following loads (1) lighting load of 500 kW (2) 1,000 kW at 0.9 pf lag (3) 500 kW at 0.9 pf lead (4) 800 kW at 0.8 pf lag. One alternator is supplying 1,500 kW at 0.95 lag. Calculate the load on the other machine.

3. Attempt any **two** of the following : **(10×2=20)**

(a) Write short notes on any **three** of the following :

(i) Principle of working of an induction motor

(ii) Torque–slip characteristics of a 3–phase induction motor

(iii) The effect of rotor resistance on torque of induction motor.

(iv) Induction generator.

(b) A 6 pole, 50 Hz 3-phase slip-ring induction motor has a resistance and reactance of 0.5Ω and 5Ω per phase respectively. Calculate (i) at what speed the torque is maximum ? (ii) the ratio of maximum torque/starting torque. What must be the external resistance per phase have so that the starting torque is half of the maximum torque ?

(c) Derive the exact equivalent circuit of a 3–phase induction motor. What is the difference between the exact and approximate equivalent circuit ? From the approximate equivalent circuit find the (i) rotor output (ii) output power (iii) output torque. Also find the slip at maximum torque.

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

(a) Why a starter is necessary to start an induction motor ? Mention the various methods of starting. Explain in detail auto transformer starting method of starting a squirrel cage induction motor.

(b) The rotor of a 4 pole, 50 Hz, slip-ring induction motor has a resistance of 0.25 Ω per phase and runs at 1440 rpm at full load. Calculate the external resistance per phase which must be added to lower the speed to 1200 rpm, the torque being the same as before.

(c) Write short notes on any **three** of the following :

(i) Crawling of induction motor

(ii) Slip power recovery scheme for speed control of slip-ring induction motor

(iii) Double cage induction motor

(iv) Cascade operation of 3-phase induction motors.

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

(a) Explain the two field revolving theory for single phase induction motors. Give its torque speed characteristics. Why this motor does not have any starting torque ? Show that this motor can run in either direction if once started.

(b) A 125 kW, 4 pole 110 V, 50 Hz single phase induction motor delivers rated output at a slip of 6%. The copper loss at full load is 25 watts. Calculate the full load efficiency and the rotor copper loss caused by the backward field. Rotational losses may be assumed to be 25 watts. Neglect stator copper loss.

(c) Write short notes on any **two** of the following :

(i) Capacitor motor

(ii) Shaded pole motor

(iii) Method of speed control of single phase induction motor.