Printed Pages—3 **EEE012**

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

PAPER ID : 2494 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. VI) THEORY EXAMINATION 2010-11

SPECIAL ELECTRICAL MACHINES

Time : 3 Hours *Total Marks : 100*

Note :— Answer all the **FIVE** questions. All questions carry equal marks.

1. Answer any **four** parts of the following : **(5×4=20)**

   (a) Explain, how the equivalent ckt of an ordinary polyphase induction motor is also applicable to deep-bar induction motors.

   (b) In a double-cage polyphase induction motors, explain how the desirable features of high-starting torque and low-operating slip are attained.

   (c) Discuss the relative merits and disadvantages of single-cage and double-cage induction motors.

   (d) Show that the maximum electromagnetic torque in a polyphase induction motor is independent of rotor-ckt resistance.

   (e) Explain why a single-phase induction motor, as compared to a 3-ϕ induction motor, has larger slip, less efficiency and more noise.

   (f) Discuss the torque-pulserate characteristics of a stepping motor.

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

(a) (i) A 3-phase induction motor, driving a constant torque load, is connected to constant-frequency voltage source. For this explain the (i) with reduction in supply voltage, the stator current increases.

(ii) With a small increment in supply voltage, the supply current may decrease but with large increments, the supply current increases.

(b) A 30 kW, 400 V, 3-phase, 4-pole, 50 Hz induction motor has full-load slip of 5%. If the ratio of standstill reactance to resistance per rotor phase is 4, estimate the plugging torque at full-load speed. Neglect rotational losses and stator impedance. Find also the maximum torque.

(c) Discuss the phenomenon of "single phasing" when applied to the three-phase induction motors, designed for continuous working. Explain the difference in behaviour when the single-phasing occurs in the primary and the secondary windings.

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

(a) Draw the speed-torque characteristics of single-phase and three-phase induction motors and explain the reasons for which significant differences in their performance.

(b) A single-phase, 230-V, 50 Hz, 4-pole induction motor, when connected to ac source gave voltmeter, ammeter and wattmeter readings as 230 V, 2 A and 10 W respectively with the rotor driven at synchronous speed. Neglecting stator leakage impedance and rotational losses, estimate the torque at a slip of 0·05 at rated voltage and frequency. The motor has a magnetizing reactance of 220 Ω.

(c) Explain the slip power recovery scheme of a three-phase induction motor control. What are its advantages and disadvantages ?

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

(a) Explain the construction and principle of operation of a switched reluctance motor.

(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 losses caused by the backward field. Rotational losses may be assumed to be 25 watts. Neglect copper loss.

(c) Derive expressions for the brush e.m.fs. produced by rotating field in case of a.c. commutator machines. How can the same e.m.f. expressions be obtained by resolving the rotating field into its pulsating field components ?

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

(a) Discuss the construction, principle of operation and characteristics of universal motors.

(b) Discuss the principle of operation, hybrid stepper motors.

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

(i) Linear Induction Motor (LIM)

(ii) Repulsion Motors

(iii) Shaded-Pole Motors

(iv) Double Cage Induction Motor

(v) Capacitor Motor.