

M.E.DEGREE EXAMINATIONS: JUNE 2011

Second Semester

POWER ELECTRONICS AND DRIVES

PED507: Solid State AC drives

Time: Three Hours

Maximum Mark: 100

Answer ALL Questions:-

PART A (10 x 2 = 20 Marks)

1. State two advantages of slip power recovery schemes for speed control of induction motors.
2. State the nature of torque developed by a three-phase induction motor with chopper controlled resistance.
3. What are the distinct features of current source inverter to a voltage source inverter?
4. What are the limitations of a square wave inverter over a PWM inverter while feeding AC motors?
5. What are the different types of field oriented control method?
6. What are the method of flux vector estimation required for higher speed ranges and lower speed ranges?
7. What is the use of hysteresis band controllers in a DTC?
8. Why do you want to operate DTC under field weakening mode?
9. State the limitations of load commutation with reference to the speed control of synchronous motor.
10. State the process of commutation of cycloconverter, when it feeds a synchronous motor. State the advantages of using a cyclo converter to control the speed of a synchronous motor.

PART B (5 x 16 = 80 Marks)

11. a) (i) A three-phase 415V, 50Hz, 4-Pole, star connected induction motor has the following equivalent circuit parameters: $R_1=1.01\Omega$, $R_2=0.69\Omega$, $X_1=1.08\Omega$, $X_2'=1.60\Omega$, $X_m=36\Omega$. The no-load loss is negligible. The rated torque proportional to square of the speed is 41 Nm, at full load speed of 1450 rpm. For a motor speed of 1290 rpm, determine (a) Load torque (b) rotor current I_2 (c) the stator supply voltage (d) the motor input current I (e) the motor input power P_i (f) the slip for maximum current (g) the maximum rotor current (h) the speed at maximum current and (i) the torque at maximum current. (12)

- (ii) How do you improve the efficiency of an induction motor by varying flux at different speed of operations? (4)

(OR)

- b) (i) With neat diagram explain the operation of slip energy recovery scheme. (12)
(ii) What are the effects of pole changing on the speed of an induction motor? (4)

12. a) (i) Explain the operation of CSI fed induction motor with its characteristics. (12)
(ii) Distinguish between voltage source and current source inverters. (4)

(OR)

- b) Explain the operation of speed control of induction motor for both balanced and unbalanced operation of the motor fed by AC voltage controller.

13. a) With neat diagram, explain the principles of operation of Direct vector control method for a three-phase induction motor. And explain the voltage model of flux vector estimation.

(OR)

- b) (i) Explain the operation of indirect vector control of induction motor with open-loop flux control method. (12)
(ii) Explain the field-weakening mode of operation. (4)

14. a) (i) Explain the principles of operation of Direct Torque Control method for a three-phase induction motor. (12)
(ii) State the advantages and disadvantages of DTC techniques. (4)

(OR)

- b) Explain DTC control strategy of three-phase induction motor and derive the expression for torque with stator and rotor fluxes.

15. a) Explain closed loop control of synchronous motor and state the advantages over open loop control method.

(OR)

- b) (i) Explain the principles of operation of Load commutator and state the advantages and disadvantages of load commutation. (8)
(ii) Explain the operation of load commutated cyclo converter fed synchronous motor. (8)
