B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2009)

Sixth Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

EEE114: Solid State Drives

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The developed torque in fan and pump drives is

   a) $T \propto \omega$ b) $T \propto \omega^2$

   c) $T \propto \omega^3$ d) $T \propto IL^2$

2. Which type of drive can be used for hoisting machinery

   a) AC slip ring motor   b) Ward Leonard controlled DC shunt motor

   c) Synchronous motor   d) DC differentially compound motor

3. In single phase full converter, if α and β are firing and extinction angle, then load current is discontinuous if

   a) $(\beta - \alpha) > \pi$ b) $(\beta - \alpha) < \pi$

   c) $(\beta - \alpha) = \pi$ d) $(\beta - \alpha) = 3\pi/2$

4. A fully controlled line commutated converter operates as an inverter. In the range of firing angles

   a) 30° b) 45°

   c) 135° d) 90°

5. A 3-Φ IM operates at constant rotor frequency when the stator frequency is varied from zero to rated value. The torque developed by the motor is

   a) Constant from 0 to rated speed   b) Proportional to speed

   c) Proportional to $(speed)^2$ d) Inversely proportional to speed

6. Single phase domestic fan motors are controlled by single phase _____

   a) SCR voltage controller   b) SCR current controller

   c) TRIAC voltage controller   d) TRIAC current controller

7. In case the field of a synchronous motor is under excited, the power factor will be

   a) Leading   b) Unity

   c) Lagging   d) Zero

8. The disadvantage of load commutation is

   a) Harmonic torques
   b) The speed from 0 – 10 % of base speed is not possible

   c) Loss of efficiency due to losses.
   d) The speed control range is limited to 0 – 10 % of base speed

9. During braking motor current

   a) Is below the rated limit
   b) Exceeds the limit

   c) Is equal to rated the limit
   d) zero

10. An Increase in speed from steady state produces

    a) Negative error
    b) Positive error

    c) Zero error
    d) Infinity error.

PART B (10 x 2 = 20 Marks)

11. Write down the fundamental torque equation of motor-load system.
12. What are all the components of load torque?
13. Give some applications of chopper fed dc drives
14. Mention the disadvantages of conventional Ward-Leonard schemes.
15. What is meant by V/f control?
16. List out the different types of slip power recovery system.
17. What is constant margin angle control of synchronous motor drive?
18. Specify the classifications of PMSM.
19. Mention the advantages of closed loop control system.
20. Draw the speed control loop diagram.

PART C (5 x 14 = 70 Marks)

21. a) (i) Analyze the characteristics of different types of loads used in electric drives. (7)

    (ii) Discuss about the multi quadrant dynamics in the speed-torque plane (7)

    (OR)

    b) Give a detailed account on regenerative braking of a dc motor and induction motor drives.

22. a) (i) Describe the operation of a single phase fully controlled converter fed separately excited dc motor with neat wave forms. (7)

    (ii) A 200 V, 875 rpm, 150 A separately excited motor has an armature resistance of 0.06Ω. It is fed from a 1Φ fully controlled rectifier with an ac source voltage of (7)

220V, Assuming continuous conduction, Calculate

      a) firing angle for rated motor torque and 750 rpm

      b) firing angle for rated motor torque and (–500)rpm.

(OR)

b)   With necessary diagrams explain the operation of chopper for forward motoring and braking control of separately excited dc motor and draw its speed-torque curves.

23. a)   Explain with schematic diagram of sub-synchronous speed control of slip-ring induction motor under slip power recovery scheme. Also derive an expression for the developed torque

(OR)

b) (i)   Enumerate the operation of the constant slip speed control of an induction motor drive.   (7)

(ii)   Discuss the operation of an open-loop variable frequency voltage source inverter fed induction motor drive.   (7)

24. a) (i)   Give a brief explanation on the open loop v/f control of multiple synchronous motor.   (7)

(ii)   Describe using a circuit the self controlled mode of operation of a synchronous motor.   (7)

(OR)

b) (i)   With relevant block diagram explain power factor control of synchronous motor.   (7)

(ii)   Write short notes on permanent magnet synchronous motor   (7)

25. a)   Explain the closed loop operation of armature voltage control method with field weakening mode control in detail.

(OR)

b) (i)   Derive the transfer function of separately excited DC motor.   (7)

(ii)   Develop a design procedure of speed controller for electric drives.   (7)

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