M.E DEGREE EXAMINATIONS: JUNE/JULY 2013

Second Semester

POWER ELECTRONICS AND DRIVES

PED506: Solid State DC Drives

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

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

1. Show the variation of load and temperature rise with time for a continuous duty type of load connected to an electric motor.

2. What are all the conditions to be satisfied for regenerative braking operation to take place?

3. List out the input supply performance parameters of a phase controlled drive.

4. Compare the circulating current mode and non circulating current mode dual converter.

5. Explain briefly with suitable diagram current limit control of dc choppers.

6. What do you mean by a multi phase chopper?

7. What are the advantages of closed loop control?

8. Draw the basic phase locked loop control system for the speed control of dc motor.

9. State the different methods of speed sensing.

10. Give the transfer function relating speed and armature current of a dc motor.

PART B (5 x 16 = 80 Marks)

11. a) (i) Explain the different classes of motor duty with diagram.   (8)

    (ii) Describe the components of load torques with necessary diagram.   (8)

    (OR)

    b) (i) A motor runs at a constant speed of 500rpm with a cyclic loading as given   (8)

    below;   250Nm for 15 minutes

    350Nm for 20 minutes

    100Nm for 15 minutes

    No load for 10 Minutes

    Determine the rating of a suitable motor.

    (ii) Explain the multi quadrant operation of a drive with one example.   (8)

12. a) (i) Discuss in detail the principle of operation of a single phase full converter,   (8)

    feeding a separately excited dc motor, with relevant circuit diagrams and

waveforms. Assume the motor current is continuous

(ii) A separately excited motor operating from a single phase half controlled bridge (8) at a speed of 1400 rpm has an input voltage of 330 sin 314t and back EMF of 80 volt. The SCR's are fired symmetrically at $\alpha = 30^0$ in every half cycle. The armature has a resistance of 4 Ohms. Calculate the average armature current and the motor torque.

(OR)

b) Explain the operation of DC motor operating on three phase full converter with relevant circuit diagrams and wave forms. Also derive the expression for speed of a motor.

13. a) Explain the principle of operation of a Type - A chopper. Discuss in detail the steady state analysis of Type –A chopper.

(OR)

b) (i) (8)

A DC series motor is fed from a 600V source through a chopper. The DC motor has the following parameters: - Ra=0.04Ω, R$_f$=0.06 Ω, K = 4 x 10^{-3} N-m/ amp^2. Average armature current of 300 amp is ripple free. For a duty cycle of 60% determine: - (i) input power drawn from the source (ii) Motor speed and (iii) Motor torque.

(ii) Explain the operation of multiphase chopper. (8)

14. a) Explain the operation of a dc motor with closed loop speed control with inner current loop and field weakening.

(OR)

b) (i) Derive the transfer function of separately excited dc motor. (8)

(ii) Compare the performance of P, PI and PID controller response in a DC drive. (8)

15. a) What are the different types of firing angle control schemes used for the converters? Explain any two of them in detail.

(OR)

b) Describe the operation of Micro Computer based converter fed reversible dc drive with the necessary block diagram and flow chart.

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