Q 8292

M.E. DEGREE EXAMINATION, MAY/JUNE 2006.

Second Semester

Power Electronics and Drives

PE 1652 — SOLID STATE DC DRIVES

(Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name the elements that constitute to form an electrical drive.

2. Give the classification of load torques and define them.

3. State the principle of phase control and its features.

4. Draw the regenerative braking characteristics of a separately excited motor.

5. State the disadvantages of the static ward – Leonard scheme, in comparison with the conventional scheme.

6. A 230 V, 960 rpm and 200 A separately excited dc motor has an armature resistance of 0.02 Ω. Calculate the duty ratio of the chopper for motoring operation at rated torque and 350 rpm.

7. Does the source current of a chopper fed dc drive contain harmonics? If so what is its effect and how can it be prevented?

8. What is the significance of modeling the drive elements?

9. Show the block diagram of a typical dc motor speed control system.

10. What are the requirements of a firing angle controller?

PART B — (5 × 16 = 80 marks)

11. Discuss about the following in brief :

(i) Speed detection in drives (6)

(ii) Control scheme of a separately excited dc motor drive using a microprocessor. (10)

12. (a) Briefly sketch an outline on the classes of duty and thereby selection of motor for typical applications. (16)

Or

(b) (i) A 250 V dc series motor drives a fan, the load torque being proportional to the 1.5th power of the speed. At a certain speed the motor takes 40 A. The machine resistance is 0.6 Ω. Find the extra resistance needed to reduce the speed to one half of the original speed saturation may be ignored. (8)

(ii) Explain the speed-torque characteristic of a separately excited dc motor highlighting on the constant torque and constant power operations too. (8)

13. (a) (i) A 2 pulse, phase controlled, bridge converter operating from a 220 V, 50 Hz mains feeds a load comprising a resistance of 3 Ω, an infinite inductance and a dc source of voltage 200 V. The commutation inductance is 1 mH. For a firing angle of 120°, determine the average value of the load current and overlap angle.

(ii) Explain the salient features of operation of three phase half controlled bridge circuit with neat waveforms, with an application for speed control.

Or

(b) (i) What are the criteria for selecting the value of load inductance of controlled rectifier? (6)

(ii) Show that under an ideal case of smoothing and instantaneous commutation $\frac{I_{v1}}{I_{1l}} = \frac{1}{v}$. On the other side of the converter, I_{v1} is the amplitude (rms value) of the v the harmonic and I_{1l} that of the fundamental. (10)

14. (a) (i) A dc chopper fed from 150 V feeds a load comprising $R = 0.2\,\Omega$, $L = 0.1$ mH and a back emf of 20 V . $T_0 N / T = 0.33$ and the period is 3 ms. Determine the mode of operation of the chopper. Find the average values of output voltage and current. (8)

(ii) What are the various schemes of control of choppers? How are they employed in control of dc drives? (8)

Or

(b) Explain the schemes to obtain reversible drives using choppers. (16)

15. (a) A 400 V, 2800 rpm, 80 A dc motor is fed from a phase controlled converter for speed control. Its electrical and mechanical time constants are 50 ms and 580 ms respectively. Design current and speed controllers for the closed loop speed control system. (16)

Or

(b) Write notes on :

(i) Simulation of chopper fed dc drive. (8)

(ii) P, I, D actions in closed loop speed control of drives. (8)