K 1201

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2004.

Seventh Semester

Electrical and Electronics Engineering

EE 432 — SOLID STATE DRIVES

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the requirements of an adjustable speed drive.

2. Draw the torque-speed curves of a series motor a varying flux and various voltages.

3. What are the uses of phase controlled rectifiers in DC drives?

4. What is discontinuous conduction mode?

5. What is the reactive power due to harmonics in single phase AC voltage controller fed drive?

6. What are the influences of the type of load on a ac motor drive?

7. State the limitation of rotor resistance control.

8. Mention few general features of an induction motor on a CSI.

9. Give two salient features of cycloconverters used to control the synchronous motor speed.

10. What happens to the stator current of a synchronous motor when $\dfrac{V}{f}$ is kept constant?

PART B — (5 × 16 = 80 marks)

11. (i) Describe the desirable modifications to the N–T curve of synchronous motor for speed control.   (8)

    (ii) Give a brief explanation on the selection of drives.   (8)

12. (a) With neat sketches explain the various schemes of reversible DC drive.

(16)

Or

(b) (i) A separately excited dc motor rated at 10 kW 240 V 1000 rpm is supplied from a fully controlled two pulse bridge converter. The converter is supplied at 250 V 50 Hz supply. An extra inductance is connected in the load circuit to make the conduction continuous. Determine the speed, power factor and efficiency of operation for thyristor firing angles of 0 and 60° assuming the armature resistance of 0.4Ω and an efficiency of 87% at rated conditions. Assume constant torque load.

(10)

(ii) What is TRC control scheme?

(6)

13. (a) Discuss in brief about the control of an induction motor by stator voltage variation using 3 phase voltage controller.

(16)

Or

(b) (i) Describe briefly the PWM inverter fed induction motor drive. (10)

(ii) A 100 hp, 460 V, 60 Hz, star connected squirrel cage induction motor has the equivalent circuit parameters $r_1 = 0.06Ω$, $r_2' = 0.35Ω$, $x_1 + x_2' = 0.6Ω$, $X_m = 8Ω$. The motor drives a fan which requires 100 hp at a speed of 1000 rpm. Determine the firing angles required for a speed range of 200 to 1000 rpm. (6)

14. (a) (i) A 440 V 50 kW 50 Hz 3 phase slip ring induction motor has the equivalent circuit parameters $r_1 = 0.07Ω$, $r_2 = 0.05Ω$, $x_1 + x_2' = 0.2Ω$, $X_m = 20Ω$. The speed of the motor rated load is 1420 rpm. Determine the resistance required in the chopper circuit so that the speed can be controlled in the range 1420–1000 rpm at constant torque. Determine the TR for 1100 rpm. (6)

(ii) Explain the four quadrant operation of subsynchronous converter cascade with braking scheme.

(10)

Or

(b) Explain the closed loop scheme of

(i) Speed control of polyphase induction motor by rotor resistance control.

(12)

(ii) Compare this scheme of control with the slip power recovery scheme.

(4)

2

K 1201

(i) Describe the self control of synchronous motor fed from VSI. Discuss about the separately controlled synchronous motor fed from VSI. (12)

(ii) Compare the above two schemes. (4)

Or

(b) (i) Explain the closed loop control scheme of adjustable speed synchronous motor drive. (10)

(ii) Write a brief note on brushless excitation. (6)

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