G 1323

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B.TECH. DEGREE EXAMINATION, MAY 2016

Seventh Semester

Branch : Electrical and Electronics Engineering

EE 010 703—DRIVES AND CONTROL

(New Scheme—2010 Admission onwards)

[Improvement/Supplementary]

Time : Three Hours

Maximum : 100 Marks

Part A

Answer all questions.
Each question carries 3 marks.

1. Explain different components of load torque.

2. What are the drawbacks of stepped wave inverter fed drive ?

3. Variable frequency control of induction motor is more efficient than stator voltage control. Why ?

4. Why has the static Kramer Drive a low range of speed control ?

5. Why a self-controlled synchronous motor is free from hunting oscillations ?

(5 × 3 = 15 marks)

Part B

Answer all questions.
Each question carries 5 marks.

6. Explain single-phase half-controlled rectifier – fed separately-excited motor with discontinuous conduction.

7. State and explain the issues which should be examined to decide the suitability of regenerative braking for a given traction application.

8. With neat diagram, explain a voltage source inverter feeding a 3-phase induction motor.

9. Explain the operation of VSI fed synchronous motor drive.

10. With a block diagram, explain the operation of an open loop control of a synchronous motor.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. (a) Explain the torque equation of loads with rotational motion. (4

(b) A 2-pole d.c. series motor runs at 750 r.p.m. when taking 100 A from 220 V supply a field coils connected in series. Resistances of armature and each field coil are 0.04 Ω respectively. Field coils are now connected in parallel. Determine the speed

(i) Torque remains the same.

(ii) Output power remains the same.

Neglect mechanical and core losses and assume linear magnetic circuit.

(8

Or

12. A 220 V, 960 r.p.m., 12.8 A separately excited d.c. motor has armature circuit resista inductance of 2Ω and 150 mH, respectively. It is fed from a single-phase half-controlled with an a.c. source voltage of 230 V, 50 Hz. Calculate :

(i) Motor torque for $\alpha = 60°$ and speed = 600 r.p.m.

(ii) Motor speed for $\alpha = 60°$ and T = 20 N-m.

13. A 230 V, 1200 r.p.m, 15 A separately excited motor has an armature resistance of 1.2 motor is operated under dynamic braking with chopper control. Braking resistance has a 20 Ω.

(i) Calculate duty ratio of chopper for motor speed of 1000 r.p.m. and braking torque 1.5 times rated motor torque.

(ii) What will be the motor speed for duty ratio of 0.5 and motor torque equal to i torque ?

Or

14. (a) What are the possible control modes of a d.c.-d.c. converter drive ? Explain with neat and waveforms of converter. (7

(b) A 220 V, 970 r.p.m., 100 A d.c. separately excited motor has an armature resistance o It is braked by plugging from an initial speed of 1000 r.p.m. Calculate :

(i) The resistance to be placed in armature circuit to limit braking current to t full-load values.

(ii) Braking torque.

(5

15. A 440 V, 50 Hz, 6-pole, 950 r.p.m., Y-connected induction motor has the following parameters referred to the stator :

$$R_s = 0.5\,\Omega,\ R'_r = 0.4\,\Omega,\ X_s = X'_r = 1.2\,\Omega,\ X_m = 50\ \Omega.$$

The motor is driving a fan load, the torque of which given by $T_L = 0.123\ Wm^2$. Now one phase of the motor fails. Calculate the motor speed and current. Will it be safe to allow the motor to run for a long period ?

Or

16. (a) Explain why stator voltage control is suitable for speed control of induction motor in fan and pump drives.

(6 marks)

(b) How the speed and power factor of a wound rotor induction motor are controlled by injecting a voltage in the rotor circuit ? What should be the relation between the frequency of the injected voltage and the frequency of the rotor induced voltage ?

(6 marks)

17. A 3-phase, 400 V, 50 Hz, 4-pole, 1400 r.p.m., Y-connected wound rotor induction motor has the following parameters referred to the stator :

$$R_s = 2\,\Omega,\ R'_t = 3\,\Omega,\ X_s = X'_t = 3.5\,\Omega.$$

The stator to rotor turns ratio is 2. The motor speed is controlled by static Scherbius drive. The inverter is directly connected to the source. Determine :

(i) The speed range of the drive when $\alpha_{max} = 165°$.

(ii) The firing angle for 0.4 times the rated motor torque and a speed of 1200 r.p.m.

(iii) Torque for a speed of 1050 r.p.m. and firing angle of 95°.

Or

18. (a) Explain the vector control of AC motors.

(6 marks)

(b) Describe the slip energy recovery scheme for the speed control of slip ring induction motor.

(6 marks)

19. (a) Describe the VSI drive with open loop control.

(5 marks)

(b) Discuss the closed-loop control of self-controlled synchronous motor drive fed from CSI.

(7 marks)

Or

20. Explain the operation of a.c. traction drive using PWM voltage source inverter induction motor drive with a provision for dynamic braking. What are its main features ?

[5 × 12 = 60 marks]