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Question Paper Code : 23434

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Sixth Semester

Electrical and Electronics Engineering

EE 1351 – SOLID STATE DRIVES

(Regulation 2004/2007)

(Common to B.E. (Part-Time), Fifth Semester, Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the factors that influence the steady state stability of a drive?

2. How are speed and torque related in the regenerative braking mode of a separately excited dc motor?

3. What is meant by critical speed in the operation of a converter fed drove?

4. State the advantages of chopper fed drives.

5. How is slip defined in the variable frequency induction motor drive?

6. Name the two types of slip power recovery schemes.

7. Why a self controlled mode of operation is preferred in a synchronous motor?

8. When can a synchronous motor be load commutated?

9. What are the merits of closed loop control in drives?

10. How are the speed and armature current of a dc series motor related in the frequency domain?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive the torque equation of a motor load combinatorial system. (6)

(ii) Discuss with a suitable example the multiquadrant operation of a drive motor. (10)

Or

(b) (i) Explain the regenerative braking torque–speed characteristics of a separately excited dc motor. (8)

(ii) Discuss the nature of the braking characteristics of a three phase induction motor when fed from fixed frequency and variable frequency sources. (8)

12. (a) (i) Describe using a power circuit the working of a three phase full converter fed separately excited dc motor drive. (10)

(ii) Establish an expression relating speed and torque when the drive operates in the continuos current mode. (6)

Or

(b) (i) Explain the motoring and braking modes of a chopper fed separately excited dc motor drive. (8)

(ii) A dc series motor is fed from a 600 volts dc source through a chopper. The armature and field resistances of the motor are 0.04 and 0.06 ohms respectively. If the motor constant is 4×10^{-3} Nm/amp^2 and the chopper duty cycle is 60%, determine the motor speed and torque for an average armature current of 300 Amperes. (8)

13. (a) (i) Describe the stator frequency control for the speed control of three phase induction motor. (8)

(ii) A three phase, 20kw, 970rpm, 50HZ, delta connected three phase induction motor has rotor leakage impedance of (0.5+j2) ohms. The stator leakage impedance and rotational losses are assumed negligible. If the motor is energised from a three phase, 400 V, 90 HZ source, then compute the motor speed at rated torque and the maximum torque. (8)

Or

(b) (i) Bring out the merits and demerits of voltage source and current source inverter fed drives. (8)

(ii) Derive an expression for the torque of a static Kramer drive. (8)

14. (a) (i) Describe using a block diagram the working of a self controlled synchronous motor drive. (8)

(ii) Develop a scheme for controlling the power factor of an inverter fed synchronous motor drive. (8)

Or

(b) (i) Discuss the constructional differences between a surface mounted and buried permanent magnet synchronous motor. (10)

(ii) Explain using voltage and current waveforms the working of a surface mounted permanent magnet synchronous motor. (6)

15. (a) (i) Develop a transfer function model of a first quadrant chopper fed separately excited dc motor. (8)

(ii) Design current and speed controllers to ensure that the current does not exceed its rated value and the speed remains regulated over the full operating range. (8)

Or

(b) Develop a transfer function based closed loop speed control scheme for a three phase full converter fed dc series motor drive. (16)
