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Question Paper Code : 90525

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Sixth Semester

Electrical and Electronics Engineering

EE 8601 – SOLID STATE DRIVES

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the torque equation governing motor load system.

2. Draw the speed torque characteristics of high speed hoist load.

3. Write the principle of current limit control used for chopper fed DC motor drive.

4. Justify the statement chopper based DC drive performance is better than controlled rectifier fed DC drive.

5. Why stator voltage control is suitable for speed control of induction motor with fan loads?

6. What are the advantages with vector control for induction motor drives?

7. Why self controlled synchronous motor drive is free from hunting oscillations?

8. Compare the performance between CSI and VSI fed synchronous motor drives.

9. What is the need for closed loop control in electric drives?

10. What are the factors to be considered for selection of converter for electrical drives?

PART B — (5 × 13 = 65 marks)

11. (a) How electric drive differs from electric motor? Develop a functional block diagram for electric drive and mention the key components and its functions.

Or

(b) Describe the multi quadrant operation of an electric drive with motor / load torque characteristics. Also discuss the effect of speed variation and speed reversal.

12. (a) Explain the principle of two quadrant operation in single phase fully controlled rectifier fed DC motor drive. Also derive the steady state speed – torque equation in continuous conduction mode.

Or

(b) Explain with neat illustrations, the operation of four quadrant chopper fed DC motor drive. Draw its speed – torque characteristics.

13. (a) Explain the principle of v/f control for induction motor drive. How it is realized with voltage source inverters?

Or

(b) Explain with power circuit, how slip power recovery scheme helps to achieve sub synchronous speed control of slip ring induction motor with an improvement in overall efficiency.

14. (a) Explain the principle of self – control for synchronous motor drive in detail with necessary illustrations. Compare self control with v/f control.

Or

(b) Draw the power circuit for current source inverter fed synchronous motor drive and explain its operation.

15. (a) Derive the expression for transfer function of separately excited DC motor with armature voltage control scheme.

Or

(b) Explain how current controller and speed controllers are designed for electric drives with suitable mathematical expressions.

PART C — (1 × 15 = 15 marks)

16. (a) A 230 V, 960 rpm and 200 A separately exited DC motor has an armature resistance of 0.002 Ω. The motor is fed from a chopper which provides both motoring and breaking operations. The source has a voltage of 230V. Assume continuous conduction.

(i) Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm.

(ii) Calculate duty ratio of chopper for breaking operation at rated torque and 400 rpm.

Or

(b) Examine the operating regions of torque – speed curves for a variable speed induction motor drive with a variable – frequency, variable – voltage AC supply form PWM inverter.