

Reg. No. :

Question Paper Code : 60579

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026.

Sixth Semester

Electrical and Electronics Engineering

EE8601 — SOLID STATE DRIVES

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the fundamental torque equation of a motor-load system.
2. Draw the speed-torque characteristics of low speed hoist load.
3. What type of three phase power converter is suitable for four quadrant operation of DC drive? Why?
4. What is called current limit control in chopper?
5. List out the drawbacks of stator voltage control for an induction motor drives?
6. Why rotor resistance control is suitable for slip ring type induction motor?
7. What is called marginal angle control in synchronous motor drives?
8. Write any four applications of synchronous motor drives?
9. Why closed loop control is needed for electrical drives?
10. Specify the significance of current controller in closed loop control of DC drive?

PART B — (5 × 13 = 65 marks)

11. (a) Write a brief note on the essential parts of an electric drive with a functional block diagram. What are the functions of power modulator?

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) Draw the power circuit for single phase controlled rectifier fed separately excited DC motor drive operates in two quadrant mode and explain its operation. Also derive the steady state speed-torque equation in continuous conduction mode. (7+6)

Or

- (b) Explain with neat diagram, the operation of four quadrant chopper fed DC motor drive. Draw its speed-torque characteristics in the four quadrant region. (11+2)
13. (a) Draw the power circuit of static Scherbius drive and explain its operation with the torque equation. Also draw its torque-speed curves indicating different inverter firing angles. (11+2)

Or

- (b) Write the fundamental principle of vector control. With a block diagram, describe direct vector control for an induction motor drive and summarize its salient features. (2+11)
14. (a) With schematic diagram, explain the principle of self controlled synchronous motor drive and mention its salient features.

Or

- (b) Explain the operation of synchronous motor drive using current source inverter with its schematic diagram.
15. (a) Draw the equivalent circuit of DC separately excited motor and derive its transfer function model with armature voltage control.

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 250 V separately excited DC motor has an armature resistance of 2.5Ω . When driving a load at 600 rpm with constant torque, the armature takes 20 A. This motor is controlled by a chopper circuit with a frequency of 400 Hz and an input voltage of 250 V. What should be the value of the duty ratio if one desires to reduce the speed from 600 to 400 rpm, with the load torque maintained constant?

Or

- (b) A 3-phase star connected, squirrel cage induction motor has the following ratings and parameters:

415 V, 50 Hz, 4-pole, 1370 rpm, $R_s = 2\Omega$, $R_r' = 3\Omega$, $X_s = X_r' = 3.5\Omega$

Motor is controlled with constant v/f ratio and frequency variation from 10Hz to 50Hz. Calculate the speed for a frequency of 30Hz and 80% of full load torque.