

M.E. Second Semester (Electrical & Elect.) (New-CGS)
13291 : Elective-I : Power Electronics Controlled Drives : 2 EEEME 4

P. Pages : 2

Time : Three Hours



AW - 3844

Max. Marks : 80

- Notes :
1. Due credit will be given to neatness and adequate dimensions.
 2. Assume suitable data wherever necessary.
 3. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION – A

1. a) Draw the schematic diagram of speed controlled two quadrant separately excited DC motor drive and explain its operation in detail. 7
b) Derive the expression for average load voltage and load current for single phase full converter fed separately excited DC motor. Draw the output voltage and current waveforms for $\alpha = 60^\circ$. Assume continuous condition. 7

OR

2. a) Explain with necessary diagram the converter configuration for a four quadrant DC motor drive. 7
b) Explain the operation of three phase fully controlled rectifier for firing angle of 60° in case of R-L load. Also derive the expression for average output voltage for the same firing angle. 7
3. a) A 220V DC source is connected to a separately excited DC motor through a chopper operating at 500 Hz. The load torque at 1500 RPM is 35 Nm. The motor has $L_a = 2\text{mH}$, $R_a = 0\Omega$, $R_f = 1\Omega$, $K_m = 1.3\text{V sec/rad}$. Motor and chopper losses are neglected. Calculate. 7
i) Minimum and maximum value of armature current excursion.
ii) Obtain expressions for armature current during ON and OFF period of chopper cycle.
b) Explain the operation of two quadrant DC chopper fed separately excited DC motor exhibiting forward motoring and forward regeneration modes. Along with speed torque characteristics. 6

OR

4. a) Draw a neat block diagram for a closed loop operation of a chopper fed dc separately excited motor and explain each block elaboratively. Mention few advantages. 7
b) A 230V, 960 RPM and 200A separately excited DC motor has an armature resistance of 0.02Ω . The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230V. Assuming continuous conduction. 6
i) Calculate duty ratio of chopper for motoring operation at rated torque and 350 RPM.
ii) Calculate duty ratio of chopper for braking operation at rated torque and 350 RPM.
5. a) Explain induction motor dynamics during starting and braking. 7

- b) Develop a flow chart for the computation of triggering angle versus conduction angle as a function of power factor angle. 6
6. a) Compare Scherbius and Kramer drive System. Show that Scherbius drive can operate in the Subsynchronous and super-synchronous range of operation. 6
- b) Explain why the drive based on slip energy recovery principle are more efficient than the drive based on the rotor resistance control technique. 7

SECTION – B

7. a) Draw circuit diagram of variable frequency induction motor drive where no force commutation of SCRs is required. Explain it's working in detail. 7
- b) For a frequency controlled induction motor explain the terms in details, the constant slip-speed control and constant air gap flux control. 6

OR

8. a) Explain with block diagram the operation of a DC link voltage source inverter for speed control of three phase induction motor drive. 7
- b) Explain the operation of the induction motor when direct method of vector control is adopted. 6
9. a) Develop and explain flowchart for indirect vector controlled induction motor. 6
- b) Discuss the advantages of variable frequency induction motor drive. 7

OR

10. a) Explain key performance characteristics and applications of vector controlled induction motor. 7
- b) What is vector control? Explain implementation of indirect vector control scheme for three phase induction motor. 6
11. a) Explain modelling of PM Brushless dc motor. 7
- b) What do you mean by phase advancing? Explain. 7

OR

12. a) Explain with block schematic the speed controlled PMBDCM drive scheme without flux weakening. 7
- b) Write a short note on design of current controllers for PMBDCM drive. 7
