

**Answer any FIVE questions
All questions carry equal marks**

- - -

- 1.a) Explain the different modes of operation of I-phase fully controlled rectifier-fed separately excited motor for motoring mode of operation.
- 2.a) The speed of a 150 HP, 650V, 1750 rpm, separately excited d-c motor is controlled by a 3- ϕ , full converter. The converter is operating from a 3- ϕ , 460 v, 50 HZ supply. The rated armature current of the motor is 170 A. The motor parameters are $R_a=0.099 \Omega$, $L_a=0.73 \text{ mH}$, $K_a\phi=0.33 \text{ u/rpm}$. Determine
 - a) No-load speed at firing angle $\alpha=30^\circ$. Assume that at no load, the armature current is 10% of rated current and is continuous.
 - b) The firing angle to obtain rated speed of 1750 rpm at rated motor current. Also, compute the supply power factor.
- 3.a) Draw the output voltage of 3- ϕ full bridge inverter for a firing angle of 120° considering DC motor as load? Assume continuous ripple free load current? Obtain the average output voltage expression.
- 4.a) Draw the control schematic of a two quadrant three-phase converter-controlled DC motor Drive?
 - b) Discuss the control modeling of three phase converter?
5. Explain the different current control schemes that are used for dc motor control.
- 6.a) Explain the time ratio control, current limit control in case of chopper fed demotors.
 - b) Obtain the expression of ripple current for the ratio control.
- 7.a) Discuss the Pulse Width Modulated (PWM) current control used in chopper fed demotor.
 - b) Obtain the Transfer function of current controller.
8. Draw the flow chart for the dynamic simulation of chopper-controlled dc motor. Derive the necessary state equations.