

M. TECH.**THEORY EXAMINATION (SEM-II) 2016-17****POWER SEMICONDUCTOR CONTROLLED ELECTRIC DRIVE****Time : 3 Hours****Max. Marks : 70****Note : Be precise in your answer. In case of numerical problem assume data wherever not provided.****SECTION- A****1 Attempt all parts of this Section 7×2=14**

- (a) What are the advantages of flux control?
- (b) What is a brushless dc motor?
- (c) What are the advantages of voltage source inverter fed drives?
- (d) What is a four-quadrant dc drive?
- (e) What is a mechanical time constant of dc motors?
- (f) What is meant by speed regulation of dc drives?
- (g) What are the advantages and disadvantages of three-phase full converter fed dc motor drive?

SECTION- B**2 Attempt any three parts of the following 3×7=21**

- (a) Explain the working of single-phase two quadrant SCR drive of a separately excited dc motor. Draw various currents and voltage waveforms in support of your answer.
- (b) Explain the principle of combined regenerative and rheostatic braking of dc separately excited motor with the help of neat and clean circuit diagram.
- (c) Explain the closed-loop scheme using a cyclo-converter to control the speed of a poly-phase induction motor. Also discuss the limitation and advantages of this scheme.
- (d) What is the principle of phase-locked-loop control of dc drives? Also mention its advantages.
- (e) What is a switched reluctance motor? How is the step of a variable reluctance stepper motor controlled?

SECTION- C**3. Attempt all questions in this section. 5×7=35**

- (a) Describe the V/f control of induction motors? Also explain the flux weakening mode.

OR

Explain the indirect vector control scheme of induction motor drive. How it differs from direct vector control scheme?

- (b) Discuss the schematic arrangement of the static Kramer's drive for speed control. How it differs from conventional Kramer's drive?

OR

Discuss the advantages of micro computer controlled drive. Draw the schematic diagram of microcomputer controlled four quadrant dc drive.

- (c) Draw the mathematical block diagram of chopper fed separately excited dc motor drive for closed loop speed control. Also draw the block diagram to analyse the transient response of the drive for

- (i) Step change in voltage
- (ii) Step change in torque

OR

Discuss the closed-loop control scheme of a permanent magnet synchronous motor drive with the help of neat and clean schematic diagram.

- (d) A 3-phase, 11.2 kW, 1750 rpm, 460 V, 60 Hz, 4-pole, Y-connected induction motor has the following parameters: $R_s = 0$, $R_r' = 0.38$ ohm, $X_s = 1.14$ ohm, $X_r' = 1.71$ ohm and $X_m = 33.2$ ohm. The motor is controlled by varying the supply frequency. If the breakdown torque requirement is 35 N-m, calculate

- (i) The supply frequency
- (ii) The speed at the maximum torque.

OR

Discuss the closed loop scheme of a 3-phase PWM current source inverter-fed induction motor drive along with the mathematical modelling of the same.

- (e) Two dc-dc converters control a dc separately excited motor and they are phase shifted in operation by $\pi/2$. The supply voltage to the dc-dc converter drive is $V_s = 220$ V, the total armature circuit resistance is $R_m = 4$ ohm, the total armature circuit inductance is $L_m = 15$ mH, and the frequency of each dc-dc converter is 350 Hz. Calculate the maximum peak-to-peak load ripple current.

OR

Explain the operation of self controlled synchronous motor drive with the help of neat and clean schematic diagram.