

Ref No. : Ex/PG/EE/T/113A/2018
**M.E. Electrical Engineering, 1st Year 1st Semester
Examination, 2018**

SUBJECT: STATIC CONVERTERS IN ELECTRIC DRIVES (MACHINES)

Time: Three Hours

Full Marks: 100

Answer any Five Questions.

- 1(a) Sketch the structure of a power MOSFET and explain the working principle of it. Why power MOSFET can not block any reverse voltage? 8
- (b) Explain why power BJT is operated in the Quasi-saturation region and how is it implemented? 8
- (c) What are the advantages of IGBT over power MOSFET? 2
- (d) What are the advantages and disadvantages of GTO over SCR? 2
2. (a) Explain the operation of the following converter system for driving D.C. Motor when the input is A.C., also mention the advantages & disadvantages of the schemes. 10
- i) Phase Control rectifier.
- ii) PWM rectifier + chopper.
- (b) Explain the operation of the following converter systems for driving 3-phase I.M. when the input is A.C. Also mention the advantages and disadvantages of the scheme. 10
- (i) Diode rectifier+ chopper+ fixed wave form inverter.
- (ii) PWM rectifier+ PWM inverter
3. (a) Explain the operation of the static Scherbius system for speed control of 3-phase I.M. in slip power recovery scheme. What are the advantages of this scheme over conventional Scherbius drive? 10
- (b) Explain why regeneration is inherent in 3-phase Induction Motor drive for speed control over wide range? 4
- (c) Explain how energy can be saved during starting of 3-phase I.M. while using slip controller. 6

4. Draw the control and power circuit and explain the operation of the following protection scheme in drive system: 20
(Answer any four)
- i) Input under voltage and over voltage protection.
 - ii) Over current protection.
 - iii) Thermal protection.
 - iv) Short circuit protection.
 - v) Protection against excessive regeneration.
5. (a) Explain with necessary circuit diagram how four quadrant operation of D.C. motor is achieved by using single phase dual converter systems in circulating current mode of operation. 12
- (b) Explain briefly with block diagram the speed control scheme of D.C. separately excited motor with speed feedback below rated speed incorporating $I_a R_a$ compensation. 8
6. (a) Give few examples of non-linear loads that inject harmonics in to the utility supply system and mention what are the effects of these harmonics on overall supply system ? 10
- (b) Explain how tuned filter installed by the consumer improves the system power factor in addition to elimination of harmonics injected by the consumer. 10