

**B.TECH.**  
**(SEM VI) THEORY EXAMINATION 2022-23**  
**POWER ELECTRONICS**

**Time: 3 Hours****Total Marks: 100****Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief. 2 x 10 = 20**

- (a) List any four advantages of power electronic converters.
- (b) Explain the term latching and holding current in SCR.
- (c) Draw the circuit arrangement and output characteristics of power BJT
- (d) Explain the working of TRIAC.
- (e) Compare non-circulating current mode and circulating current mode of operation of Dual-Converters.
- (f) How Freewheeling diode improves the power factor of the system ?
- (g) Draw the circuit arrangement of two-stage and multi-stage sequence control of a.c. voltage controllers.
- (h) Discuss in short the working of single-phase half-wave a.c. voltage controllers.
- (i) Explain Pulse Width Modulation (PWM) technique.
- (j) Compare voltage source and current-source inverters.

**SECTION B****2. Attempt any three of the following: 10x3=30**

- (a) Draw circuit symbol and static V-I characteristic of the following power semiconductor devices.
  - (i) Thyristor
  - (ii) MOSFET
- (b) Calculate the number of thyristors with a rating of 400 V and 95 A required in each branch of a series parallel combination for a circuit with total voltage and current rating of 11 KV and 1.7 kA respectively. Assume a derating factor of 16 %.
- (c) Explain in detail the working of single-phase fully-controlled bridge converter with circuit diagram in the following two-modes:
  - (i) Rectifying mode
  - (ii) Inversion mode.
- (d) Discuss the working of single phase to single-phase step up and step down cyclo converters with power circuit diagram and waveforms.
- (e) Write short note on current source inverter with neat diagram.

**SECTION C****3. Attempt any one part of the following: 10x1=10**

- (a) Summarize specification of power electronic switches and their applications of the followings
  - (i) IGBT
  - (ii) MOSFET
- (b) Latching current for an SCR inserted in between a DC voltage source of 220V and the load is 90 mA. Compute the minimum width of Gate Pulse current required to

turn on this SCR in the case of load  $R = 25 \Omega$  in series with  $L = 0.3 \text{ H}$ .

4. **Attempt any one part of the following:** **10x1=10**
- (a) List the various commutation techniques used in SCR. Explain in details any two commutation techniques of SCR with circuit diagram and corresponding wave forms.
  - (b) A step up chopper has input voltage of 220 V and output voltage of 660 V. If the conducting time of thyristor chopper is 100  $\mu\text{s}$ , compute the pulse width of output voltage. In case output voltage pulse width is halved for constant frequency operation, find the average value of new voltage.
5. **Attempt any one part of the following:** **10x1=10**
- (a) Explain in detail operation of three phase dual converter with circuit diagram. Discuss circulating current mode and non-circulating current mode.
  - (b) Analyze single phase semi controlled bridge converter with RLE load and freewheeling diode with the help of circuit diagram and corresponding waveforms
6. **Attempt any one part of the following:** **10x1=10**
- (a) Analyze and discuss the principle of phase control in single phase full wave ac voltage controller with RL load. Derive expression for the rms value of its output voltage.
  - (b) A single phase voltage controller has input voltage of 230 V, 50 Hz and a load of  $R = 15 \Omega$ . For 6 cycle on and 4 cycle off, determine
    - (i) rms output voltage,
    - (ii) input pf and
    - (iii) average and rms thyristor currents
7. **Attempt any one part of the following:** **10x1=10**
- (a) Write short note on full bridge voltage source inverter with neat diagram and explain its working.
  - (b) Write short note on various methods of voltage control of a single-phase inverter.