

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 (i) 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 μs , 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 <https://www.aktuonline.com>
 - (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.