

6E7151**6E7151****B.Tech. VI-Sem. (Main/Back) Examination, April/May - 2026****Bio Medical Engineering****6BM3-01 Power Electronics****BM, EC****Time : 3 Hours****Maximum Marks : 70****Instructions to Candidates:**

Attempt all Ten questions from Part A, Five questions out of Seven questions from Part B and Three questions out of Five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205).

PART - A**(Answer should be given up to 25 words only)****All questions are compulsory.****(10×2=20)**

- ✓ 1. Explain the concept of power electronics.
- ✓ 2. What is converter? Explain with example.
- ✓ 3. What is barrier potential? How are depletion layer and barrier potential affected by temperature?
- ✓ 4. How is the magnitude of breakdown voltage effected if a junction has highly doped?
5. What is rectifiers? What is meant by n-pulse rectifiers?
- ✓ 6. What is thyristor? What are the modes of operation of thyristor?
- ✓ 7. Justify the statement, "Higher the gate current, lower is the forward break-over voltage".
- ✓ 8. Are the turn-on and turn-off times of a thyristor constant?
- ✓ 9. Give four applications of phase-controlled rectifiers.
- ✓ 10. What is a DC chopper? Write the types of choppers.

PART - B
(Analytical / Problem Solving Questions)

Attempt any Five questions.

(5×4=20)

- ✓ 1. Describe the structural features of power diode. How do these differ from signal diodes?
- ✓ 2. Describe the principle operation of DC chopper. Also derive an expression for its average output voltage.
- ✓ 3. What are line-commutated inverters? How do they operate? Explain the line-commutated and force-commutated inverters?
4. Power flow from 1-phase source to load R can be controlled through the use of a thyristor. Discuss why this method of power flow control is called phase-controlled converter.
- ✓ 5. What are the importance of di/dt and dv/dt rating during the turn-on process of thyristor?
- ✓ 6. Snubber circuit for an SCR should primarily consist of capacitor only? But in actual practice, why a resistor is used in series with the capacitor?
7. R, L and C in SCR circuit meant for protecting against dv/dt and di/dt are $4\ \Omega$, $6\ \mu H$ and $6\ \mu F$, respectively. If the supply voltage to the circuit is 300V, calculate permissible maximum values of dv/dt and di/dt .

PART - C
(Descriptive / Analytical / Problem Solving / Design Questions)

Attempt any Three questions.

(3×10=30)

1. Describe the different modes of operation of a thyristor with the help of its static V-I characteristics.
- ✓ 2. A single-phase half-wave SCR circuit feeds power to a resistive load. Draw waveform for source voltage, load voltage, load current and voltage across the SCR for a given firing angle α . Obtain the average and rms load voltages in terms of source voltage and firing angle.
- ✓ 3. What is meant by step-up chopper? Explain the principle operation of step-up chopper. Sketch the input voltage, input current, output voltage and output current waveforms. State the various assumptions made. How can a step-up chopper be used for the regenerative braking of DC motor.
- ✓ 4. Define the following terms: i) Firing Angle, ii) Local Hot Spot Formation, iii) Latching and Holding current, iv) Thyristor Protection
5. A thyristor controlling the power in a load resistance R_L . The supply voltage is 220V dc and the specified limits for di/dt and dv/dt for the SCR are $50A/\mu s$ and $300V/\mu s$ respectively. Determine the values of the di/dt inductance and the snubber circuit parameters R_s and C_s . In case thyristor circuit is operated at a frequency of 1000Hz, find power loss in the snubber circuit and power rating of snubber resistor.