

Fundamentals of Power Electronics (313335)

MSBTE Diploma · K-Scheme · Electrical Engineering (EE) · Sem III · Model Question Paper — Set C

Time: 3 Hours**Max. Marks: 70****Instructions:**

1. All questions are compulsory.
2. Answer each next main question on a new page.
3. Illustrate your answers with neat sketches wherever necessary.
4. Figures to the right indicate full marks.
5. Assume suitable data, if necessary.
6. Use of non-programmable electronic pocket calculator is permissible.
7. Mobile phone, pager and any other electronic communication devices are not permissible in the examination hall.

Q.1 Attempt any FIVE of the following:**10**

- a) List any four applications of power electronics.
- b) Draw the symbols of SCR, TRIAC and power MOSFET with terminal names.
- c) Define triggering of SCR. List any four turn-ON methods of SCR.
- d) Define chopping period and duty cycle. Find the average output voltage of a step-down chopper with $V_s = 200$ V and duty cycle 0.4.
- e) Compare controlled and uncontrolled rectifiers (any two points).
- f) Define photovoltaic (PV) cell.
- g) List the methods of protection of SCR.

Q.2 Attempt any THREE of the following:**12**

- a) Explain the construction of IGBT with neat sketch. State any two advantages of IGBT.
- b) Describe light triggering method of SCR.
- c) Explain self (class A) commutation with circuit diagram. Why is it called load commutation?
- d) A single phase fully controlled bridge rectifier with R load is supplied from 230 V, 50 Hz. If $R = 20 \Omega$ and $\alpha = 45^\circ$, draw the output waveform and calculate the average load voltage and load current.

Q.3 Attempt any THREE of the following:**12**

- a) Explain RC half-wave triggering circuit of SCR with waveforms. How does it give a firing angle greater than 90° ?
- b) Explain UJT relaxation oscillator used for triggering SCR with circuit diagram and waveforms.

- c) Compare half controlled and fully controlled single phase bridge converters (any four points).
- d) Explain the operation of step-up chopper with circuit diagram. Find the output voltage if $V_s = 48 \text{ V}$ and duty cycle = 0.6.

Q.4 Attempt any THREE of the following:

12

- a) Draw three phase fully controlled bridge rectifier with R load and its output voltage waveform for $\alpha = 90^\circ$. Calculate V_{dc} for a 400 V supply.
- b) Draw the circuit of pulse width modulator and explain multiple pulse modulation with waveforms.
- c) Explain constant frequency control of a step-down chopper. A chopper works at 1 kHz from 120 V DC; find T_{ON} and T_{OFF} to obtain 90 V output.
- d) Describe a solar power system with block diagram.
- e) Explain AC to AC converter using DC link with block diagram. List its applications.

Q.5 Attempt any TWO of the following:

12

- a) Draw the layer construction of SCR and explain its V-I characteristics. Define latching current and holding current.
- b) Draw and explain the R firing circuit of SCR. Draw the waveforms when the variable resistance R is (i) minimum and (ii) maximum.
- c) Explain single phase half wave controlled rectifier with R-L load and show the effect of freewheeling diode on the output waveforms.

Q.6 Attempt any TWO of the following:

12

- a) Draw the symbol and labelled V-I characteristics of (i) power MOSFET (ii) TRIAC (iii) IGBT.
- b) Explain single phase full bridge inverter with R load using IGBTs with circuit and waveforms. Compare full bridge and half bridge inverters (any three points).
- c) With the help of a block diagram, explain the speed control of fan using TRIAC. State its advantages over a resistive regulator.

Note: This is a **model question paper prepared by Ananda Technologies** only for practice and exam preparation, based on the pattern of previous MSBTE question papers and the K-scheme syllabus. It is **not an official MSBTE paper**, and it does **not** mean that these questions will come in the exam. Answers follow standard textbook points; marks shown are indicative. Free for students — anandatechnologies.in