

Fundamentals of Power Electronics (313335)

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

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) State any four advantages of power electronic systems.
- b) Draw the symbols of SCR, TRIAC, DIAC and IGBT and label their terminals.
- c) Define latching current and holding current of SCR.
- d) List the turn-ON methods of SCR.
- e) Define firing angle and conduction angle with reference to a phase controlled rectifier.
- f) A chopper has $T_{ON} = 3 \text{ ms}$ and $T_{OFF} = 1 \text{ ms}$. Calculate its duty cycle and chopping frequency.
- g) State any two applications of photovoltaic (PV) cell.

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

- a) Describe the construction of IGBT with a neat labelled diagram.
- b) Explain the RC triggering circuit of SCR with neat circuit diagram and waveforms.
- c) Explain class A commutation of SCR with circuit diagram and waveforms.
- d) Explain the working of single phase fully controlled bridge rectifier with R load. Draw the output waveform for $\alpha = 60^\circ$ and calculate the average output voltage for a 230 V, 50 Hz supply.

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

- a) Explain dv/dt protection of SCR using snubber circuit.
- b) State the need of freewheeling diode in a phase controlled rectifier with R-L load. Show its effect on the output voltage waveform.

- c) State the need of PWM in inverters and list its types. Explain single pulse modulation.
- d) Explain R triggering circuit of SCR with circuit diagram. Why is the firing angle limited to 90° in this circuit?

Q.4 Attempt any THREE of the following:

12

- a) Draw the circuit diagram and output voltage waveform of three phase fully controlled bridge rectifier with R load for $\alpha = 30^\circ$.
- b) Explain single phase half bridge inverter with R load with circuit diagram and waveforms.
- c) Explain the time ratio control strategies of a chopper with waveforms.
- d) Explain the speed control of ceiling fan using TRIAC with a neat circuit diagram.
- e) Draw the block diagram of AC to AC converter using DC link and explain the function of each block.

Q.5 Attempt any TWO of the following:

12

- a) Draw and explain the V-I characteristics of SCR showing the effect of gate current. Mark V_{BO} , V_{BR} , I_L and I_H on it.
- b) Explain the working of step-down chopper with circuit diagram and waveforms. Write the expression for output voltage. Calculate the average output voltage and chopping frequency when $V_s = 220$ V, $T_{ON} = 1.2$ ms and $T_{OFF} = 0.8$ ms.
- c) Explain single phase half controlled bridge rectifier with R-L load and freewheeling diode with circuit diagram and waveforms.

Q.6 Attempt any TWO of the following:

12

- a) Describe the construction and working of n-channel enhancement type power MOSFET with neat diagram. Draw its output characteristics.
- b) Explain single phase full bridge inverter with R-L load with circuit diagram and waveforms. State the function of feedback diodes.
- c) Draw the block diagram of solar PV power system with charge controller and explain it. List the types of solar charge controllers.

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