

Fundamentals of Power Electronics (313335)

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

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 the need of power electronic systems (any two).
- b) Draw the symbols of n-channel power MOSFET and IGBT and label their terminals.
- c) Define commutation of SCR. State its two main types.
- d) State any two applications of SCR.
- e) Define the following terms w.r.t. chopper: (i) T_{ON} (ii) T_{OFF} (iii) Chopping period.
- f) State the types of solar charge controllers.
- g) State any four methods of triggering (turning ON) an SCR.

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

- a) Explain the working of IGBT with positive gate voltage. Draw its output characteristics.
- b) Explain R firing circuit of SCR with neat circuit diagram and waveforms.
- c) Compare R triggering and RC triggering of SCR (any four points).
- d) A single phase half wave controlled rectifier with R load is fed from 230 V, 50 Hz supply. If $R = 50 \Omega$ and $\alpha = 45^\circ$, draw the circuit and waveforms and calculate the average output voltage and current.

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

- a) Explain resonant (class A) commutation of SCR with series L-C circuit. Draw the current and capacitor voltage waveforms.
- b) Explain di/dt protection of SCR. Why is it necessary?

- c) Explain three phase fully controlled bridge rectifier with R load. Draw the output voltage waveform for $\alpha = 60^\circ$ and find V_{dc} for 415 V, 50 Hz supply.
- d) Explain single phase half bridge inverter with R load. Find the RMS output voltage and load power if the total DC supply is 220 V and $R = 10 \Omega$.

Q.4 Attempt any THREE of the following:

12

- a) Explain sinusoidal pulse width modulation (SPWM) with waveforms.
- b) Explain step-down chopper with circuit and waveforms for duty cycle 0.25. Find the average output voltage if $V_s = 240$ V.
- c) Explain variable frequency control strategy of a chopper with waveforms. State its drawbacks.
- d) Explain the function of converter station in HVDC transmission with neat diagram.
- e) Draw the circuit of fan regulator using TRIAC and DIAC and explain its working.

Q.5 Attempt any TWO of the following:

12

- a) Draw the V-I characteristics of SCR for gate currents $I_{G2} > I_{G1} > I_G = 0$. Explain forward blocking, forward conduction and reverse blocking modes. Mark I_L and I_H .
- b) Explain single phase fully controlled bridge rectifier with (i) R load and (ii) highly inductive R-L load, with waveforms for $\alpha = 45^\circ$. Calculate V_{dc} in both cases for 230 V supply. State the effect of connecting a freewheeling diode across the R-L load.
- c) Explain class F (line) commutation with circuit diagram and waveforms.

Q.6 Attempt any TWO of the following:

12

- a) Describe the construction and V-I characteristics of TRIAC. Draw the V-I characteristics of DIAC and state its use.
- b) Explain single phase full bridge inverter with R load with circuit diagram and waveforms. Calculate the RMS output voltage, fundamental RMS voltage and output power for $V_s = 200$ V and $R = 20 \Omega$.
- c) Explain AC to AC converter using DC link in a variable speed wind power generation system with block diagram. List any two other applications of AC-DC-AC converters.

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