

Advance Power Electronics (315340)

MSBTE Diploma · K-Scheme · 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. 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 two advantages and any two disadvantages of MCT.
- b) State the purpose of a snubber circuit and name its components.
- c) Name the control strategies used for a chopper.
- d) State the role of the freewheeling diode in a chopper circuit.
- e) Classify inverters on the basis of (i) input source and (ii) output phases.
- f) Define the following terms related to UPS: (i) Response time (ii) Load power factor.
- g) State any two advantages of a plug-in hybrid electric vehicle over a conventional IC engine vehicle.

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

- a) Draw and explain the V-I characteristics of MCT. State how it is turned ON and turned OFF.
- b) Explain the working of a step-up chopper using MOSFET with circuit diagram and waveforms.
- c) Explain the difference between 180° and 120° conduction modes of a three-phase inverter (any four points).
- d) Explain the working of a relay type voltage stabilizer with a neat diagram.

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

- a) An SCR dissipates 25 W. Its thermal resistances are $\theta_{jc} = 0.6 \text{ }^{\circ}\text{C/W}$ and $\theta_{cs} = 0.3 \text{ }^{\circ}\text{C/W}$. If the maximum junction temperature is $125 \text{ }^{\circ}\text{C}$ and ambient temperature is $40 \text{ }^{\circ}\text{C}$, find the maximum thermal resistance of the heat sink (θ_{sa}). Also find case and sink temperatures.
- b) Explain time ratio control and current limit control strategies of a chopper with waveforms.

- c) Draw the circuit diagram of a single-phase current source inverter and state the function of each component.
- d) What is VFD? Explain its block diagram.

Q.4 Attempt any THREE of the following:

12

- a) Compare SIT, MCT and FCT on any four points.
- b) Draw the circuit of a Type B chopper and explain its operation. State its application.
- c) A three-phase bridge VSI operating in 180° conduction mode is fed from 400 V DC and supplies a star-connected resistive load of $10\ \Omega$ per phase. Calculate RMS line voltage, RMS phase voltage, RMS phase current and load power.
- d) Explain the working of a static voltage stabilizer with block diagram. State its advantages.
- e) State the functions of a charge controller in PV system. Compare PWM and MPPT charge controllers.

Q.5 Attempt any TWO of the following:

12

- a) Draw the circuit of a Type D chopper. Explain its operation with waveforms and derive the expression of average output voltage. Find the output voltage for $V_s = 220\text{ V}$ when duty cycle is 0.7 and 0.3.
- b) Explain the working of a three-phase VSI in 120° conduction mode with gating sequence and output voltage waveforms.
- c) Draw the block diagram of a Plug-in Electric Vehicle (PEV) and explain. Compare PEV and PHEV (any four points).

Q.6 Attempt any TWO of the following:

12

- a) Explain the working of a push-pull converter with circuit diagram. State its advantages and limitation.
- b) Explain on-line UPS with block diagram. Describe its specifications: input voltage range, output frequency, THD and load power factor.
- c) Explain why an AC-DC-AC converter is used in variable speed wind power generation. Draw the block diagram and explain each block.

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