

Advance Power Electronics (315340)

MSBTE Diploma · K-Scheme · 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. 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) Draw the symbol of FCT and state any two applications of it.
- b) Define dv/dt rating and di/dt rating of an SCR.
- c) Define duty cycle of a chopper. Find the average output voltage of a step-down chopper if $V_s = 110\text{ V}$ and duty cycle is 0.75.
- d) Name any four types of converters used in SMPS.
- e) Define modulation index and frequency modulation ratio in sinusoidal PWM.
- f) List the types of AC voltage stabilizers.
- g) State any two needs of a Variable Frequency Drive in industry.

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

- a) Explain the construction and working of MCT with its equivalent circuit.
- b) Explain the principle of DC chopper with a neat block diagram. Derive $V_o = D \cdot V_s$.
- c) Explain the working principle of a current source inverter. Why is a large inductor connected in series with the DC source?
- d) State the necessity of voltage stabilizer and draw its general block diagram. Explain the function of each block.

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

- a) Compare di/dt protection and dv/dt protection of SCR (any four points).
- b) Explain the four-quadrant operation of a Type E chopper with circuit diagram.
- c) Explain multiple-pulse (uniform) PWM technique with waveforms.
- d) Explain the servo type voltage stabilizer. State its advantages and disadvantages.

Q.4 Attempt any THREE of the following:**12**

- a) Explain the role of heat sink in thermal protection of SCR. State any four specifications of a heat sink.
- b) A step-up chopper using MOSFET has an input of 48 V, duty cycle 0.6 and switching frequency 20 kHz. Calculate the output voltage, T_{on} and T_{off} . Compare step-up and step-down chopper on any two points.
- c) Compare 120° and 180° conduction modes of a three-phase VSI (any four points).
- d) Explain the specifications of a battery used in UPS: backup time and transfer time. A UPS supplies a 600 W load from a 24 V, 150 Ah battery bank; inverter efficiency is 85 %. Estimate the backup time.
- e) Draw the block diagram of AC-to-AC converter with DC link used in wind power generation and explain it.

Q.5 Attempt any TWO of the following:

12

- a) Classify choppers on the basis of quadrant operation. Explain the working of a second-quadrant (Type B) chopper with circuit and waveforms.
- b) Explain sinusoidal PWM with waveforms. A single-phase full-bridge SPWM inverter has $V_{dc} = 300$ V, reference amplitude 4 V at 50 Hz and carrier amplitude 5 V at 1 kHz. Find modulation index, frequency modulation ratio and RMS value of fundamental output voltage.
- c) Explain the function and block diagram of a charge controller in a PV system. Compare PWM and MPPT charge controllers.

Q.6 Attempt any TWO of the following:

12

- a) State the types of SMPS. Explain the block diagram of SMPS and state its advantages over linear power supply.
- b) Compare on-line UPS and off-line UPS on six specifications. Draw the block diagram of off-line UPS.
- c) Explain the control unit and drive mechanism of an electric vehicle with a neat block diagram.

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