

Advance Power Electronics (315340)

MSBTE Diploma · K-Scheme · 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. 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 circuit symbols of SIT and MCT and label their terminals.
- b) Define thermal resistance of an SCR and state its unit.
- c) State any two functions of a DC chopper.
- d) Write the expressions for average output voltage of a step-down chopper and a step-up chopper in terms of duty cycle.
- e) Define inverter. State any two applications of inverter.
- f) Define voltage stabilizer. State any two applications of it.
- g) State any two applications of Variable Frequency Drive (VFD).

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

- a) Explain the construction and working of Static Induction Transistor (SIT) with V-I characteristics.
- b) Explain the working of Type A (first quadrant) chopper using MOSFET with circuit diagram and output waveforms.
- c) Explain the working of a single-phase current source inverter with resistive load. Draw the load current and voltage waveforms.
- d) Explain the working of a servo controlled voltage stabilizer with a neat diagram.

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

- a) State the need of di/dt and dv/dt protection of SCR. Draw the protection circuit and explain dv/dt protection using R-C snubber.
- b) Classify choppers according to the quadrant of operation. Draw the quadrant diagram showing Type A to Type E choppers.
- c) Compare voltage source inverter (VSI) and current source inverter (CSI) on any four points.

- d) Draw the block diagram of a charge controller used in a solar PV system and explain the function of each block.

Q.4 Attempt any THREE of the following:

12

- a) A step-down MOSFET chopper is fed from a 200 V DC supply and feeds a resistive load of $10\ \Omega$. The chopping frequency is 1 kHz and duty cycle is 0.4. Calculate: (i) T_{on} and T_{off} (ii) average output voltage and current (iii) RMS output voltage (iv) output power.
- b) Name the types of PWM techniques used in inverters. State any four advantages of PWM control.
- c) Compare on-line UPS and off-line UPS on any four specifications.
- d) With a block diagram, explain the use of AC-to-AC converter with DC link in wind power generation.
- e) Classify rechargeable batteries. Compare NMC and NCA lithium-ion batteries (any four points).

Q.5 Attempt any TWO of the following:

12

- a) Draw the circuit of a Type C (two-quadrant) chopper. Explain its operation in first and second quadrant with waveforms.
- b) Explain the working of a three-phase bridge VSI with star-connected resistive load in 180° conduction mode. Draw gating signals, line and phase voltage waveforms.
- c) Explain the working of an electrical traction system with a neat labelled block diagram. State its applications.

Q.6 Attempt any TWO of the following:

12

- a) Explain sinusoidal pulse width modulation (SPWM) with suitable waveforms. Define modulation index.
- b) Explain the working of a flyback converter (SMPS) with circuit diagram. State any four advantages of SMPS over linear power supply.
- c) With a neat block diagram, explain the construction and working of a Plug-in Hybrid Electric Vehicle (PHEV).

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