

Reg No : Name :

**MAR ATHANASIOUS COLLEGE OF ENGINEERING, KOTHAMANGALAM**

(Govt. Aided Autonomous Institution)

Fourth Semester B.Tech Degree Examination, May, 2026

Course Code: B24EE2T06

Course Name: POWER ELECTRONICS

Max. Marks: 100

Duration:3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)**Answer all questions**

1. Explain dv/dt triggering of SCR.
2. State whether continuous gate current is required to keep an SCR in ON state
3. Explain the function of freewheeling diode in phase controlled rectifiers.
4. Explain the concept of phase controlled rectifiers and give some of its applications.
5. Determine the modulation index when the reference signal has an amplitude of 8 V and the carrier signal has an amplitude of 10 V.
6. Explain PWM method and list the various PWM techniques used in inverters.
7. Derive the expression for output voltage ripple for a buck converter operating in continuous conduction mode.
8. What is Time Ratio Control (TRC) and how is it used to vary the output voltage in choppers?
9. Describe the operating principle of a single-phase to single-phase step-up cycloconverter with the help of a midpoint circuit configuration.
10. Draw the circuit diagram of a single phase full wave AC voltage controller feeding an RL load. Also derive the expression for load current.

PART - B: 70 Marks (5 Qns x 14 Marks)**Answer any One full question from each module.****Module 1**

11. Describe the basic structure, static and dynamic characteristics of power diode.

OR

12. a. Explain the constructional difference between a power MOSFET and ordinary MOSFET. (8 Marks)
b. Draw and explain switching characteristics of power MOSFET. (6 Marks)

Module 2

13. Describe the working of a 3 phase half wave rectifier with RL load in continuous conduction mode with a neat circuit diagram and waveforms for a firing angle of 60° . Also derive the expression for average output voltage.

OR

14. a. Sketch the output voltage, output current and thyristor voltage waveform of a single phase (10 Marks) fully controlled converter with RLE load in continuous conduction mode and derive the average output voltage.
- b. A single phase fully controlled converter supplies a load of $10\ \Omega$ from 230 V (rms). For a firing angle of 0° , Find the average output current (4 Marks)

Module 3

15. a. Explain the working of a single phase full bridge inverter feeding R load with a neat circuit diagram and waveforms. (8 Marks)
- b. Describe the methods used for minimization of harmonics in inverters. (6 Marks)

OR

16. Explain the working of three phase square wave inverter with resistance load in 180° conduction mode. Describe the switching sequence with neat waveforms.

Module 4

17. Draw the circuit diagram of a Class E chopper and explain its operation. Discuss the quadrants in which this chopper operates.

OR

18. a. With circuit diagram and waveforms, describe the operation of a buck-boost DC-DC converter. (8 Marks)
- b. Derive expressions for the output DC voltage and the design equations for the filter inductor and capacitor of a buck-boost DC-DC converter. (6 Marks)

Module 5

19. a. What are the applications of cycloconverters? (4 Marks)
- b. Explain the operation of a three-phase to three-phase cycloconverter employing 3-phase half-wave circuits with a neat schematic diagram and circuit diagram. (10 Marks)

OR

20. a. Describe the operation of single-phase AC voltage controller for R load with relevant waveforms. (8 Marks)
- b. Derive expression for rms value of output voltage of a single-phase AC voltage controller for R load (6 Marks)
