

Register No.: ..... Name: .....

## SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

### SIXTH SEMESTER B.TECH DEGREE EXAMINATION (S), AUGUST 2023 ELECTRICAL AND ELECTRONICS ENGINEERING

(2020 SCHEME)

Course Code : 20EET306

Course Name: POWER ELECTRONICS

Max. Marks : 100

Duration: 3 Hours

#### PART A

*(Answer all questions. Each question carries 3 marks)*

1. Explain  $dv/dt$  protection of SCR.
2. Explain the structure of Power diode.
3. Draw the input and output voltage waveforms of single phase fully controlled rectifier feeding RLE load.
4. Explain with neat sketches, the working of 3 phase half-controlled rectifier connected to R load.
5. Compare voltage source and current source inverters.
6. What is Pulse Width Modulation? List different types of Pulse Width Modulation in inverters.
7. Explain the current limit control in DC-DC converters.
8. Derive the expression for output voltage of a Boost Converter.
9. Draw and explain the block diagram of an electric drive.
10. Explain regenerative braking control in drives.

#### PART B

*(Answer one full question from each module, each question carries 14 marks)*

##### MODULE I

11. a) Explain with proper illustration, the structure and static characteristics of a SCR. (8)  
b) Compare IGBT and MOSFET. (6)

##### OR

12. a) Explain the turn on methods of SCR. (6)  
b) Describe the reverse recovery characteristics of a Power diode. (8)

##### MODULE II

13. a) Compare the operation of single-phase full wave controlled rectifier for continuous and discontinuous conduction when feeding RL load with necessary waveforms. (10)  
b) Derive the output voltage equation for single phase half wave rectification with R load. (4)

**OR**

14. a) Draw the circuit of 3 phase fully controlled rectifier with RLE load and explain the working with necessary waveforms for a firing angle of  $30^\circ$ . Derive the expression for output voltage. (10)
- b) A single phase fully controlled bridge converter feeds a load that consists of a resistor of 5 ohm and an inductive reactance. The supply voltage is 230V, 50 Hz. The thyristor triggering angle is  $120^\circ$  and the load current is discontinuous with current extinction angle of  $210^\circ$ . Find average value of load voltage and current. (4)

**MODULE III**

15. a) Explain the  $180^\circ$  conduction mode of a three-phase bridge inverter with circuit and output voltage waveforms, indicating the devices conducting in each state. (10)
- b) Write short notes on THD. (4)

**OR**

16. a) Explain with waveforms, the working of a single-phase AC voltage controller with RL load. (6)
- b) Explain bipolar PWM in inverters with waveform (8)

**MODULE IV**

17. a) Explain the working of a Buck-Boost regulator, showing relevant waveforms and derive the expression for its output voltage. (8)
- b) Design filter elements of a buck regulator with an input voltage of 36 V and an output voltage of 12 V. The load current is 1.5 A. The peak to peak voltage ripple should not exceed 0.5%. The inductor current to be continuous. Assume switching frequency 30kHz. (6)

**OR**

18. a) Describe the working of four quadrant chopper with relevant circuit diagrams. (10)
- b) Explain the PWM control in DC-DC converters. (4)

**MODULE V**

19. a) Explain the working of a single-phase semiconverter drive. (6)
- b) Explain the speed control of the dual converter fed DC motor drive. (8)

**OR**

20. a) Explain the working of v/f control of Induction motor drive. (7)
- b) Describe the different modes of operation of two quadrant chopper-controlled DC drives. (7)

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