

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV(NEW) EXAMINATION – WINTER 2022****Subject Code:3140915****Date:21-12-2022****Subject Name:Power Electronics****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		Marks
Q.1	(a) Draw only basic structure of power MOSFET and IGBT and name each layer and part.	03
	(b) Explain buck converter with relevant waveforms.	04
	(c) Describe three different modes of operation of a thyristor with the help of its static V-I characteristics.	07
Q.2	(a) Write advantages and disadvantages of PWM technique to generate gate pulse.	03
	(b) Derive inverter output voltage.	04
	(c) Draw circuit diagram and necessary waveforms of single phase fully controlled center-tapped ac to dc converter with R load. Derive equation for V_{RMS} .	07
OR		
	(c) Describe the working of a single phase full converter in the rectifier mode with RLE load. Derive an expression for the average output voltage in terms of source voltage and firing angle.	07
Q.3	(a) Explain the difference between line commutated and force-commutated inverters.	03
	(b) Distinguish between on-off control and phase angle control.	04
	(c) Explain working of 3 phase bridge inverter with star connected resistive load with 120° mode using gate signals, output phase voltage and line voltage.	07
OR		
Q.3	(a) What do you mean by Pulse Width Modulation? State advantages and disadvantages of PWM technique.	03
	(b) Derive an expression for the resistance used for static voltage equalization for a series connected string.	04
	(c) Discuss Space Vector Pulse Width Modulation Technique in brief.	07
Q.4	(a) Derive only expression of RMS output voltage of single phase full wave AC voltage controller with R load.	03
	(b) Write a note on Matrix converter.	04
	(c) Describe the principle of step-up chopper. Derive an expression for the average output voltage in terms of input dc voltage and duty cycle. State the assumptions made.	07
OR		
Q.4	(a) Explain RC firing circuit of SCR.	03
	(b) Derive output voltage equation for single phase half wave rectifier.	04

- (c) Explain the working principal of buck-boost converter with circuit diagram of different modes of operation. **07**

- Q.5** (a) List any three industrial applications of ac voltage controller. Enumerate its merits and demerits. **03**

- (b) Derive output voltage equation of single phase AC Voltage controller. **04**

- (c) Show that the fundamental rms value of per-phase output voltage of low-frequency for an m pulse cyclo-converter is given by **07**

$$V_{or} = V_{ph} \left(\frac{m}{\pi} \right) \sin \left(\frac{\pi}{m} \right)$$

OR

- Q.5** (a) Write any six applications of Power Electronics. **03**

- (b) For type A chopper, dc source voltage = 230 V, load resistance 10 Ω . Take a voltage drop of 2 V across chopper when it is on. For a duty cycle of 0.4, calculate (i) average and rms values of output voltage and (ii) chopper efficiency. **04**

- (c) Discuss why 3-phase to 1-phase cyclo-converter requires positive and negative group phase-controlled converters. Under what conditions, the groups work as inverters or rectifiers? **07**
