Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2023

Subject Code:3140915 Date:01-02-2024

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)**	What is an IGBT? Sketch the equivalent circuit and transfer characteristics of an IGBT.	**03**
	(b)	Draw the SCR static V-I characteristics and explain its behavior in forward conduction, forward blocking and reverse blocking modes.	**04**
	(c)	Draw and explain the resistance triggering and R-C triggering circuits.	**07**
Q.2	**(a)**	Draw only switching characteristics of SCR during turn-on and turn-off process.	**03**
	(b)	State the advantages & disadvantages of current source inverter & voltage source inverter.	**04**
	(c)	Draw gate voltage and phase voltage waveform and explain 3 phase inverter operation for 120° conduction mode	**07**
		OR	
	(c)	Explain Space Vector Pulse Width Modulation Technique in brief.	**07**
Q.3	**(a)**	What is pulse width modulation? List the various PWM techniques.	**03**
	(b)	Classify of different techniques for voltage control of inverter. Explain anyone.	**04**
	(c)	Draw the circuit diagram of three-phase full converter connected to RL load with continuous conduction. Draw the waveforms of output voltage, output current for firing angle equal to 45°.	**07**
		OR	
Q.3	**(a)**	What is the purpose of connecting diodes in antiparallel with thyristors in inverter circuits?	**03**
	(b)	Derive output voltage equation for single phase half wave rectifier.	**04**
	(c)	Explain working of 1-ϕ semi converter with the help of voltage and current waveform under resistive load.	**07**
Q.4	**(a)**	Describe the working of freewheeling diode in phase-controlled rectifier.	**03**
	(b)	Write advantages disadvantages and application of single-phase full wave AC voltage controller.	**04**
	(c)	Explain multi-quadrant operation of DC-DC converter.	**07**
		OR	
Q.4	**(a)**	Draw only the possible configurations of a single-phase voltage controller.	**03**
	(b)	Describe application of TRIAC as Single-phase Fan regulator with circuit diagram and waveform.	**04**
	(c)	Explain AC Voltage controllers with (i) on-off control method and (ii) integral cycle control method.	**07**

Q.5	**(a)**	What is a cycloconverter? Enumerate some of its industrial applications.	**03**
	(b)	Write a short note on matrix converter.	**04**
	(c)	Explain the operation of three-phase to single phase cycloconverters.	**07**

OR

Q.5	**(a)**	Draw the basic circuit diagram of 3-phase to 3-phase cycloconverter.	**03**
	(b)	Explain the snubber circuit and its design.	**04**
	(c)	Explain working of 1-ϕ to 1-ϕ cycloconverter with input frequency 50Hz and output frequency 10Hz.	**07**

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