Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER– V EXAMINATION – SUMMER 2026

Subject Code:3151106 Date:25-05-2026

Subject Name:Power Electronics

Time:02:30 PM TO 05:00 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	CO (Course Outcome)	Cognitive Level (As per Revised Bloom's Taxonomy)
Q.1	**(a)**	Explain the various Turn On methods of SCR.	**03**	**CO-2**	**U**
	(b)	What are dv/dt and di/dt ratings of SCR? What happens if these rating exceeded? Explain	**04**	**CO-1**	**U**
	(c)	What is commutation? Explain complementary commutation circuit.	**07**	**CO-2**	**E**
Q.2	**(a)**	Explain snubber circuit.	**03**	**CO-1**	
	(b)	With help of neat diagram and associated waveform, explain the operation of resistance triggering circuit	**04**	**CO-2**	**A**
	(c)	A single phase semi converter is operated from 120 V, 60 Hz ac supply. The load resistance is 10 Ω, if the average output voltage is 25% of the maximum possible average output voltage, finds: 1. Delay angle 2. Average and rms output voltage 3. Average and rms thyristor current.	**07**	**CO-4**	**A**
		OR			
	(c)	A DC type A chopper has resistive load 20 Ω and input voltage of 220 volts. When the chopper remains on, its voltage drop is V_{ch} = 1.5 volts and chopping frequency is 10 kHz, if duty cycle is 80% determine: 1. Average output voltage 2. RMS output voltage 3. Chopper efficiency 4. Effective input resistance.	**07**	**CO-5**	**E**
Q.3	**(a)**	What is the function of Chopper? Explain the working of step down chopper.	**03**	**CO-5**	**U**
	(b)	With help of circuit diagram explain the working of class D chopper.	**04**	**CO-5**	**A**
	(c)	With help of neat circuit diagram and waveforms, explain the operation of PWM full bridge inverter with resistive load.	**07**	**CO-5**	**A**
		OR			
Q.3	**(a)**	Explain the multiphase choppers.	**03**	**CO-5**	**A**
	(b)	With help of circuit diagram explain the working of class B chopper.	**04**	**CO-5**	**N**

	(c)	With help of neat circuit diagram and waveforms, explain the operation of single phase current source inverter.	**07**	**CO-5**	**U**
Q.4	**(a)**	Explain the structure and characteristic of TRIAC.	**03**	**CO-1**	**R**
	(b)	Compare SCR and IGBT.	**04**	**CO-1**	**N**
	(c)	What are the on conditions for SCR? Explain the RC triggering circuit in detail.	**07**	**CO-2**	**U**
		OR			
Q.4	**(a)**	Explain the effect of freewheeling diode.	**03**	**CO-1**	**U**
	(b)	Compare static and dynamic latch up in IGBT.	**04**	**CO-1**	
	(c)	With help of neat circuit diagram and associated waveform explain the operation of single phase bridge converter for resistive load.	**07**	**CO-4**	**N**
Q.5	**(a)**	What are the advantages of SMPS over normal power supply? List out the various applications of SMPS.	**03**	**CO-5**	**N**
	(b)	Explain the working of fly back converter SMPS.	**04**	**CO-5**	**U**
	(c)	With help of block diagram explain the operation of off line uninterrupted power supply. Write the detail specifications of off line UPS.	**07**	**CO-7**	**A**
		OR			
Q.5	**(a)**	Define and explain power line disturbances.	**03**	**CO-7**	**N**
	(b)	Explain the design and application of power conditioner.	**04**	**CO-7**	**A**
	(c)	Explain the construction, working and applications of permanent magnet stepper motor drive.	**07**	**CO-6**	**A**

Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V EXAMINATION – SUMMER 2025

Subject Code:3151106 Date:15-05-2025

Subject Name:Power Electronics

Time:02:30 PM TO 05:00 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)**	Explain briefly the concept of power electronics.	**03**
	(b)	Define and compare holding and latching currents of SCR.	**04**
	(c)	What is commutation? With help of circuit and wave form explain self commutation by an LC circuit.	**07**
Q.2	**(a)**	Compare simple rectifier and controlled rectifier.	**03**
	(b)	With help of neat diagram and associated waveform, explain the operation of half wave RC triggering circuit.	**04**
	(c)	A complementary commutation circuits operate from DC supply of 120 V and use $R_1 = R_2 = 10\ \Omega$, commutating capacitor C = 10 μF. Calculate circuit turn off time and peak thyristor current.	**07**
		OR	
	(c)	A single phase full converter is supplied from 230 V, 50 Hz supply. The load current is continuous and ripples free. If the average current is 150 A and source inductance is 0.1 mH determine the overlap angle at (i) $\alpha = 10^0$ (ii) $\alpha = 30^0$ (iii) $\alpha = 60^0$	**07**
Q.3	**(a)**	Write the classification of DC Chopper.	**03**
	(b)	With help of circuit diagram explain the working of class E chopper.	**04**
	(c)	Explain the various voltage control methods of single phase inverter.	**07**
		OR	
Q.3	**(a)**	Enumerate the merits and demerits of load commutated chopper.	**03**
	(b)	With help of circuit diagram explain the working of Jones chopper.	**04**
	(c)	With help of neat circuit diagram and waveforms, explain the operation of single phase voltage source inverter.	**07**
Q.4	**(a)**	Explain the power integrated circuits.	**03**
	(b)	Compare DIAC and TRIAC.	**04**
	(c)	Which are the conditions to make SCR on? Explain the full wave RC triggering circuit in detail.	**07**
		OR	
Q.4	**(a)**	Explain the effect of freewheeling diode.	**03**
	(b)	What are advantages of IGBT? Explain the basic structure of IGBT.	**04**
	(c)	With help of neat circuit diagram and associated waveform explain the operation of single phase full wave controlled rectifier with resistive and inductive load.	**07**
Q.5	**(a)**	Explain the discontinuous mode of isolated fly back SMPS.	**03**
	(b)	Explain MOS controlled thyristor.	**04**

	(c)	With help of block diagram explain the operation of on line uninterrupted power supply. Write the detail specifications of on line UPS.	**07**

OR

Q.5	**(a)**	What is meant by EMI and EMC?	**03**
	(b)	Explain the capacity and efficiency of batteries used in UPS.	**04**
	(c)	Explain the construction, working and applications of separately excited DC motor drive.	**07**

****

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2024

Subject Code: 3151106 Date:18-05-2024

Subject Name: Power Electronics

Time:02:30 PM TO 05:00 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)**	Explain the basic requirements for the successful firing of SCR.	**03**
	(b)	Explain the structure and various triggering modes of operation of TRIAC.	**04**
	(c)	The half wave controlled rectifier has purely resistive load of R and delay angle $\alpha = 60^0$ determine. (i) Rectification efficiency (ii) Form factor and (iii) Ripple factor.	**07**
Q.2	**(a)**	Compare natural and forced commutations of SCR.	**03**
	(b)	Explain the various Turn-On methods of SCR in brief.	**04**
	(c)	Derive the average load voltage and load current equations of single phase half wave controlled rectifier with resistive and inductive load.	**07**
		OR	
	(c)	A dc chopper operates on 300V dc and frequency of 200 Hz, feeds an R-L load. Determine the ON times of the chopper for output voltage of 150V.	**07**
Q.3	**(a)**	Draw the schematic of step-up chopper and derive an expression for output voltage of chopper.	**03**
	(b)	Compare the Time Ratio control and current limit control strategies of chopper.	**04**
	(c)	With help of neat circuit diagram and waveforms, explain the operation of single phase half bridge voltage source inverter with resistive load.	**07**
		OR	
Q.3	**(a)**	What are the applications of chopper? Explain the working of class A chopper.	**03**
	(b)	Explain the multiphase chopper.	**04**
	(c)	With help of neat circuit diagram and waveforms, explain the operation of single phase full bridge square wave inverter with resistive load.	**07**
Q.4	**(a)**	Explain the dv/dt and di/dt ratings of SCR.	**03**
	(b)	What is commutation? Explain class D forced commutation.	**04**
	(c)	Design the basic structure of MCT and explain its turn on and turn off operations.	**07**
		OR	
Q.4	**(a)**	Explain the internal control pulse width modulation control method of inverter.	**03**
	(b)	Compare IGBT and Power MOSFET.	**04**
	(c)	Design the structure of MOSFET and explain its operation and V-I characteristics.	**07**

Q.5	**(a)**	Compare General Power supply and SMPS.	**03**
	(b)	Explain the working of fly back converter SMPS.	**04**
	(c)	With help of block diagram, explain the operation of on line UPS. List the important specifications of on line UPS.	**07**

OR

Q.5	**(a)**	What do you mean by EMI and EMC?	**03**
	(b)	Explain the working of induction motor.	**04**
	(c)	Write short note on permanent magnet stepper motor drive.	**07**

****

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- V EXAMINATION-SUMMER 2023

Subject Code: 3151106 Date: 26/06/2023

Subject Name: Power Electronics

Time: 02:30 PM TO 05:00 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.**

Q.1	**(a)**	Explain the structure and symbol of SCR.	**03**
	(b)	Draw and explain the class – B self-commutation of SCR using LC circuit.	**04**
	(c)	Explain the working of half wave-controlled rectifier with resistive load.	**07**
Q.2	**(a)**	Differentiate between one quadrant and two quadrant converter.	**03**
	(b)	What is power MOSFET? Explain its output characteristics.	**04**
	(c)	What is MOS controlled thyristor (MCT)? Explain turn on process of N-MCT.	**07**
		OR	
	(c)	Draw and explain the operation of fully controlled bridge circuit with RL load for single-phase controlled rectifier.	**07**
Q.3	**(a)**	Explain the basic structure of IGBT.	**03**
	(b)	Explain any one time ratio control (TRC) strategy for chopper operation.	**04**
	(c)	What is DC chopper? Explain the principle of chopper operation.	**07**
		OR	
Q.3	**(a)**	What is power integrated circuit (PIC)?	**03**
	(b)	What is step-up chopper? Explain in brief.	**04**
	(c)	Draw the circuit of Type B chopper and explain its operation with waveforms.	**07**
Q.4	**(a)**	List the advantages and disadvantages of pulse width modulated (PWM) inverters.	**03**
	(b)	A chopper circuit is operating on time ratio control (TRC) principal at a frequency of 2 kHz on a 220 V DC supply. If load voltage is 170 V, compute the conduction and blocking period of thyristor in each cycle.	**04**
	(c)	What is inverter? Explain the operation of single-phase full bridge inverter.	**07**
		OR	
Q.4	**(a)**	What are the drawbacks of square wave inverter?	**03**
	(b)	Explain the single-phase, half-wave converter for controlling separately excited DC motor.	**04**
	(c)	Explain the working of single phase current source inverter with resistive load.	**07**
Q.5	**(a)**	Draw the characteristics of TRIAC.	**03**
	(b)	Explain the block diagram of online UPS system.	**04**
	(c)	Explain the operation of flyback converter (SMPS) with circuit diagram and waveform.	**07**
		OR	
Q.5	**(a)**	Explain the chopper circuit used to drive DC series motor.	**03**
	(b)	How to calculate capacity and efficiency of UPS battery?	**04**
	(c)	What is resonant converter? Explain the working of series resonant inverter with unidirectional switch.	**07**

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3151106 Date:04/06/2022

Subject Name:Power Electronics

Time:02:30 PM TO 05:00 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)**	Give classification of thyristors family.	**03**
	(b)	Explain advantages of IGBT.	**04**
	(c)	Explain the construction, operation and characteristics of SCR	**07**
Q.2	**(a)**	Give the classification of inverters.	**03**
	(b)	Explain single phase AC chopper with necessary diagram.	**04**
	(c)	Draw and explain Three Phase Half wave controlled rectifier with required waveforms and equations.	**07**
		OR	
	(c)	Draw and explain the circuit of ac phase control using DIAC and TRIAC.	**07**
Q.3	**(a)**	Draw and explain Phase Locked Loop Control of DC Drives.	**03**
	(b)	Differentiate between online and offline UPS systems.	**04**
	(c)	What is SMPS? Give the classification of SMPS. Also List out advantages and disadvantages of SMPS.	**07**
		OR	
Q.3	**(a)**	What is Commutation? Explain briefly the classification of commutation techniques.	**03**
	(b)	Gives comparison between DC and AC Drives.	**04**
	(c)	Explain the principal of Dielectric Heating. Also gives application of Dielectric Heating.	**07**
Q.4	**(a)**	What is SMPS? Give the classification of SMPS.	**03**
	(b)	A 200 A SCR is to be connected in parallel with 300 A SCR. The on state voltage drops of the SCRs are 2.1 V and 1.75 V respectively. Calculate the series resistance that should be connected with each SCR if the two SCRs have to share the total current 500 A in proportion to their ratings.	**04**
	(c)	Draw and explain the V-I characteristics of UJT.	**07**
		OR	
Q.4	**(a)**	Why a freewheeling diode is connected in inductive loaded circuit?	**03**
	(b)	What is Pulse Width Modulation? How can it be used to control the output of chopper?	**04**
	(c)	Explain single phase half wave controlled rectifier with RL load with proper waveforms.	**07**
Q.5	**(a)**	Explain Step down Chopper.	**03**
	(b)	Explain regenerative and dynamic braking of dc motor.	**04**
	(c)	Explain Speed control of Motor	**07**

OR

Q.5	**(a)**	Write down the basic principle of induction heating.	**03**
	(b)	Explain UJT as relaxation oscillator.	**04**
	(c)	Write a short note on online UPS system.	**07**

****