Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–IV (NEW) EXAMINATION – WINTER 2020

Subject Code:3140915 Date:26/02/2021

Subject Name:Power Electronics

Time:02:30 PM TO 04:30 PM Total Marks:56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			Marks
Q.1	**(a)**	Draw waveform of full bridge topology of 1-Phase bridge inverter with resistive load.	**03**
	(b)	Discuss SVPWM technique in brief.	**04**
	(c)	Sketch unipolar and bipolar PWM	**07**
Q.2	**(a)**	Derive output voltage equation for signle phase full wave rectifier	**03**
	(b)	State the merits & demerits of current source inverter & voltage source inverter.	**04**
	(c)	Explain 3 phase inverter operation for 120^{o} with the gate voltage and phase voltage waveform	**07**
Q.3	**(a)**	Derive output voltage equation for signle phase half wave rectifier.	**03**
	(b)	Give classification of different techniques for voltage control of inverter. Explain any one.	**04**
	(c)	Analysis of working of 3-ϕ half wave controlled rectifier with RL load with continuous conduction mode	**07**
Q.4	**(a)**	Derive AC voltage controller average output voltage equation	**03**
	(b)	Explain protection of SCR and its design.	**04**
	(c)	Explain Dual Converter.	**07**
Q.5	**(a)**	Expalin CSI	**03**
	(b)	Explain Snubber circuit and its design	**04**
	(c)	Explain the basic principle of operation of a cycloconverter with neat equivalent circuit diagram.	**07**
Q.6	**(a)**	Explain any one chopper.	**03**
	(b)	Derive inveter output voltage	**04**
	(c)	Explain Buck Boost converter	**07**
Q.7	**(a)**	Explain Matrix converter	**03**
	(b)	Define Mid point CycloConvereter.	**04**
	(c)	Explain DC to DC converter.	**07**
Q.8	**(a)**	Give Application of Power Electronics.	**03**
	(b)	Explain Buck converter.	**04**
	(c)	Explain three stage sequence control AC voltage controller with RL load	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2021

Subject Code:3140915 Date:30/12/2021

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)**	Derive output voltage equation for single phase half wave rectifier.	**03**
	(b)	Discuss SVPWM technique in brief.	**04**
	(c)	Explain working of 1-ϕ semi converter with the help of voltage and current waveform under resistive load.	**07**
Q.2	**(a)**	Compare the RC firing circuit and R firing circuit based on its circuit diagram.	**03**
	(b)	State the merits & demerits 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)	Describe the effect of high switching frequency on harmonics spectrum in single phase full bridge inverter.	**07**
Q.3	**(a)**	Justify the statement, why SCR is not suitable for dc to ac converter for low power applications?	**03**
	(b)	Classify of different techniques for voltage control of inverter. Explain anyone.	**04**
	(c)	Analysis of working of 3-ϕ half wave controlled rectifier with RL load with continuous conduction mode.	**07**
		OR	
Q.3	**(a)**	Describe the working of freewheeling diode in phase controlled rectifier.	**03**
	(b)	Distinguish between full controlled bridge converter and half controlled bridge converter.	**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**
Q.4	**(a)**	Explain protection of SCR and its design.	**03**
	(b)	Explain Snubber circuit and its design	**04**
	(c)	Explain the parallel operation of SCR.	**07**
		OR	
Q.4	**(a)**	Draw and explain static V-I characteristics of SCR.	**03**
	(b)	Explain Matrix converter	**04**
	(c)	Write short note cycloconverters.	**07**
Q.5	**(a)**	Give four points of difference between on-off control and phase angle control.	**03**
	(b)	Explain Buck converter.	**04**
	(c)	Explain working of 3 phase bridge inverter with star connected resistive load with 180° mode using gate signals, output phase voltage and line voltage.	**07**
		OR	

Q.5	**(a)**	Enlist various control techniques for output voltage control.	**03**
	(b)	Sketch bipolar PWM	**04**
	(c)	Explain multi-quadrant operation of DC-DC converter.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV EXAMINATION – SUMMER 2020

Subject Code: 3140915 Date:04/11/2020

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.**

			Marks
Q.1	**(a)**	Explain IGBT with its physical construction diagram and characteristics.	**03**
	(b)	Draw the SCR static V-I characteristics and explain its behavior in forward conduction, forward blocking and reverse blocking modes.	**04**
	(c)	Explain working of 1-ϕ semi converter with the help of voltage and current waveform under resistive load.	**07**
Q.2	**(a)**	Compare the RC firing circuit and R firing circuit based on its circuit diagram.	**03**
	(b)	Describe the effect of high switching frequency on harmonics spectrum in single phase full bridge inverter.	**04**
	(c)	Derive the output voltage equation in case of buck and boost converter and draw the comparison.	**07**
		OR	
	(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 60°.	**07**
Q.3	**(a)**	Write application of cycloconverters.	**03**
	(b)	Write advantages and disadvantages of PWM technique to generate gate pulse.	**04**
	(c)	Draw necessary waveforms and explain working of single phase full controlled rectifier circuit with R-L load.	**07**
		OR	
Q.3	**(a)**	Justify the statement why SCR is not suitable for dc to ac converter for low power applications.	**03**
	(b)	Explain construction of Power MOSFET.	**04**
	(c)	Describe the working of a single phase full bridge inverter with relevant circuit and waveforms for R-L Load.	**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 important features of sinusoidal pulse width modulation used in PWM inverters.	**04**

	(c)	Explain working of 3 phase bridge inverter with star connected resistive load with 180˚ mode using gate signals, output phase voltage and line voltage.	**07**

OR

Q.4	**(a)**	Describe the working of freewheeling diode in Phase controlled rectifier.	**03**
	(b)	Write a short note on matrix converter.	**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**
Q.5	**(a)**	List the various voltage control techniques in DC-DC converters.	**03**
	(b)	Give four points of difference between on-off control and phase angle control.	**04**
	(c)	Explain the working principal of buck-boost converter with circuit diagram of different modes of operation.	**07**

OR

Q.5	**(a)**	Draw the output voltage waveform of three-phase half-wave controlled rectifier with the R-load.	**03**
	(b)	State at least two reasons to control or eliminate the harmonics in inverters. List out different techniques to eliminate harmonics in inverter.	**04**
	(c)	Explain the parallel operation of SCR.	**07**

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GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2021

Subject Code:3140915 Date:05/10/2021

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)**	Sketch switching characteristics of IGBT.	**03**
	(b)	Compare IGBT and MOSFET on the basis of a) circuit symbol b)Charge carriers c) switching frequency d) Tolerance to electrostatic discharge	**04**
	(c)	Explain working of Buck-Boost converter using circuit diagram for various modes of operation.	**07**
Q.2	**(a)**	Define THD. Enlist two effects of harmonics.	**03**
	(b)	Summarize limitations of 1- ϕ half bridge inverter.	**04**
	(c)	Explain working of Flyback converter with circuit diagram and waveforms.	**07**
		OR	
	(c)	Explain working of Forward converter with circuit diagram and waveforms.	**07**
Q.3	**(a)**	Compare unipolar sinusoidal modulation and bipolar sinusoidal modulation.	**03**
	(b)	Explain inverter mode operation of 1- ϕ bridge rectifier.	**04**
	(c)	Explain working of 3- ϕ inverter for 120° conduction mode using the gate voltage and phase voltage waveform.	**07**
		OR	
Q.3	**(a)**	Discuss SPWM technique in brief.	**03**
	(b)	Sketch circuit diagram and waveforms of V_s, I_g, V_o, I_o and V_t for 1- ϕ full bridge controlled rectifier with R-L load with free wheeling diode.	**04**
	(c)	Explain space vector modulation for 3- ϕ inverter.	**07**
Q.4	**(a)**	Enlist methods of power factor improvement for AC-DC converters.	**03**
	(b)	Explain principle of on-off control for AC voltage controller.	**04**
	(c)	Explain working of 1- ϕ dual converter.	**07**
		OR	
Q.4	**(a)**	Explain relationship between delay angle and load angle.	**03**
	(b)	Explain method to provide over voltage protection to power electronic switch.	**04**
	(c)	Derive equation of output voltage for 1- ϕ AC voltage controller with RL load.	**07**
Q.5	**(a)**	Derive equation of average and RMS voltage for 1- ϕ full bridge controlled rectifier with R load.	**03**
	(b)	Explain working principle of cycloconverter.	**04**
	(c)	Derive equation of output voltage for 1- ϕ AC voltage controller with RL load.	**07**

OR

Q.5	**(a)**	Enlist methods of SCR firing and draw circuit for any one of them.	**03**
	(b)	Explain working principle of matrix converter.	**04**
	(c)	Obtain characteristics of TRIAC. Explain working of TRIAC in 1- ϕ AC voltage controller.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3140915 Date:11-07-2022

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 circuit of 1-ϕ half wave controlled rectifier with R load. Draw waveforms for input voltage, trigger pulses at $\alpha=30^{\circ}$, output voltage and voltage across the switching device.	**03**
	(b)	Explain forward blocking and forward conduction mode of operation for SCR using sketch of SCR forward V-I characteristics.	**04**
	(c)	Explain operation of IGBT using sectional view.	**07**
Q.2	**(a)**	What is buck regulator? Draw circuit diagram and waveforms for voltage across freewheeling diode, current through inductor.	**03**
	(b)	Explain working of 2-quadrent chopper.	**04**
	(c)	Explain working of half bridge inverter with R-L load using circuit diagram and waveforms of triggering signal, output voltage, output current, voltage across switch and voltage across diode.	**07**
		OR	
	(c)	Explain working of 3-ϕ A.C. voltage controller with star connected R load using circuit diagram and waveforms of input phase voltages, triggering waveforms and output R phase voltage for $\alpha=60^{\circ}$.	**07**
Q.3	**(a)**	Describe positions of space vector on the basis of switching states.	**03**
	(b)	For boost regulator, derive the formula of rise time and fall time of inductor current. Also derive the formula of output voltage.	**04**
	(c)	Explain cause of presence of harmonics in output of inverter. Explain 4 effects of switching frequency on harmonic spectrum.	**07**
		OR	
Q.3	**(a)**	Enlist control techniques for output voltage control of switching regulators. Explain briefly any one of them.	**03**
	(b)	Describe unipolar and bipolar sinusoidal pulse width modulation for inverter.	**04**
	(c)	Derive the expression for RMS value of output voltage for 1-ϕ full wave bi-directional controller. Find RMS value of output voltage for 230V ac input with $\alpha=45^{\circ}$.	**07**
Q.4	**(a)**	Enlist power factor improvement techniques for AC-DC converter. Explain briefly any one of them.	**03**
	(b)	Explain the principle of pulse width modulation for inverter.	**04**
	(c)	Analyze briefly 7 technical parameters required for selection of power electronic switch.	**07**
		OR	

Q.4	**(a)**	Derive an expression for average value of output voltage for 1-ϕ half wave controlled rectifier with RL load.	**03**
	(b)	Determine four applications of inverters in power system.	**04**
	(c)	Determine 7 important parameters which can be derived from datasheet of SCR.	**07**
Q.5	**(a)**	Compare 120° and 180° modes of conduction on the basis of 1) conduction of number of device 2) conduction of each device 3) output phase voltage (draw waveform for each case)	**03**
	(b)	Describe briefly three adverse effects of electromagnetic interference. Discuss briefly one remedial step to reduce EMI.	**04**
	(c)	Explain working of 1-ϕ current source inverter with necessary waveforms.	**07**
		OR	
Q.5	**(a)**	Enlist 3 applications of DC-DC converter.	**03**
	(b)	The single phase half bridge inverter has the Dc input of 100V. The load resistance is 10Ω. Determine 1) RMS value of output voltage 2) The fundamental component of RMS value	**04**
	(c)	Explain working of 1-ϕ to 1-ϕ cycloconverter with input frequency 50Hz and output frequency 10Hz.	**07**

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