Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:2150903 Date:17/12/2021

Subject Name:Power Electronics – I

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)**	Plot V-I Characteristics of SCR and display all regions.	**03**
	(b)	Write advantages of IGBT over BJT.	**04**
	(c)	Compare different SCR Turn ON methods in brief. Why Gate triggering method generally preferred?	**07**
Q.2	**(a)**	Differentiate Natural Commutation and Forced Commutation.	**03**
	(b)	What is the need to isolate control circuit and power circuit? Explain Opto-coupler briefly.	**04**
	(c)	Describe Synchronized UJT Relaxation Oscillator for triggering of SCR with circuit diagram, Waveforms and Design equations.	**07**
		OR	
	(c)	Explain the need for protection of semiconductor power devices. Explain di/dt and dv/dt protection of SCR.	**07**
Q.3	**(a)**	Why 3-phase controlled converters are preferred over 1-phase controlled converters?	**03**
	(b)	A single phase fully controlled bridge converter is operated with resistive load = 10Ω, input voltage is 230V. Calculate form factor and ripple factor for 60° firing angle.	**04**
	(c)	Describe Two Quadrant Operation ($\alpha<90°$, $\alpha=90°$, $\alpha>90°$) of 1-phase full wave bridge converter with highly inductive load. Mention conclusions for above value of delay angle.	**07**
		OR	
Q.3	**(a)**	Define holding current and latching current of SCR.	**03**
	(b)	Discuss significance freewheeling diode in controlled rectifiers. How it will helps to improve the input power factor?	**04**
	(c)	Discuss various techniques to improve power factor in phase controlled converters. Explain PWM technique with waveforms.	**07**
Q.4	**(a)**	What is Current Limit Control method of a chopper?	**03**
	(b)	A step up chopper has input voltage of 220V and output voltage of 660V. If the non conducting time of thyristor chopper is 100 μSec, Compute the pulse width of output voltage. If pulse width is halved for constant frequency operation, find the new output voltage.	**04**
	(c)	Differentiate linear voltage regulator and SMPS. Explain complete switched mode regulator (SMPS) with its functional diagram.	**07**
		OR	
Q.4	**(a)**	Write output voltage equation for BUCK, BOOST and BUCK-BOOST converters.	**03**

	(b)	State application of DC to DC converters.	**04**
	(c)	Compare Step Up and Step Down chopper with reference to 1. Circuit Configuration, 2. Use, 3. External Inductance and 4. Waveforms.	**07**
Q.5	**(a)**	Draw only four quadrant operation of a DC Motor.	**03**
	(b)	Compare semi converter drive and full converter drive with reference to 1. Quadrant of operation, 2. Regenerative Braking, 3. Harmonics contents, 4. Motor Heating.	**04**
	(c)	Draw block diagram of DC motor drive and Explain each block.	**07**

OR

Q.5	**(a)**	Write merits and Demerits of a four quadrant (Type E) Chopper.	**03**
	(b)	Compare chopper drives and converter drives briefly.	**04**
	(c)	Describe Type C Chopper drive.	**07**

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