

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2021****Subject Code:2150903****Date:05/10/2021****Subject Name:Power Electronics – I****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.

- Q.1** (a) How to select SCR, IGBT and MOSFET according to its application? Write brief note for selection of each device. **03**
- (b) Explain the principle of step down chopper with the help of circuit diagram and output voltage waveform. **04**
- (c) What do you mean by commutation of SCR? Explain the need of commutation in Thyristor circuits. Discuss the commutation scheme employing parallel-resonance turn off with a neat schematic and waveforms. **07**
- Q.2** (a) Freewheeling diode improves the input power factor in phase controlled converter. Justify the statement **03**
- (b) Draw the circuit diagram of single-phase half wave controlled rectifier. Also draw the waveform of output voltage and voltage across switch for RL-load with $\alpha = 45^\circ$. (Explanation not required) **04**
- (c) Explain the working of UJT relaxation oscillator with the help of circuit diagram and waveforms. Derive the expression for frequency of waveform. **07**
- OR**
- (c) Write a short note on various voltage ratings of SCR. **07**
- Q.3** (a) Explain in brief with the help of neat circuit diagram, the use of pulse-transformer in the triggering circuits. **03**
- (b) What is the purpose of having parallel operation of SCRs? What care must be taken when paralleling the SCR? **04**
- (c) Explain the operation of three phase half wave controlled converter with RL load. Sketch the associated waveforms of output voltage and voltage across any one thyristor for $\alpha = 45^\circ$. Assume continuous conduction. **07**
- OR**
- Q.3** (a) Snubber circuit for an SCR should primarily consist of capacitor only. But in actual practice, a resistor is used in series with the capacitor. Discuss in brief **03**
- (b) What is the necessity of connecting SCRs in Series? What are the problems associated with series connection of SCRs? **04**
- (c) Discuss the effect of source inductance on the performance of a single-phase full converter indicating clearly the conduction of various thyristors during one cycle. **07**
- Q.4** (a) State advantages of single phase bridge converter over single phase mid-point converter. **03**

- (b) Enumerates the two merits and two demerits of load commutated chopper **04**
- (c) Discuss the working of a current commutated chopper circuit with relevant voltage and current waveforms. **07**
- OR**
- Q.4** (a) Explain time ration control strategies used for chopper. **03**
- (b) Explain with a neat circuit diagram the basic principle of a dual converter. **04**
- (c) Discuss the working of a voltage commutated chopper circuit with relevant voltage and current waveforms. **07**
- Q.5** (a) Briefly discuss the role of Power Electronics in industry. **03**
- (b) Explain principle of power control for DC motor drive with DC-DC Converter. **04**
- (c) Explain single phase fully controlled converter based drive for separately excited DC motor. **07**
- OR**
- Q.5** (a) State the advantages of three phase controlled rectifier over single phase controlled rectifier for drive system. **03**
- (b) IGBT is superior to power BJT and power MOSFET: Justify with advantages. **04**
- (c) Using relevant circuit diagram and waveforms, explain regenerative braking control in DC machines using chopper circuit. **07**