

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – SUMMER 2024****Subject Code:3140915****Date:10-07-2024****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

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|------------|--|-----------|
| Q.1 | (a) Draw only basic structure of power MOSFET and IGBT and name each layer and part. | 03 |
| | (b) Draw the symbol of Transistor, SCR, MOSFET, IGBT, DIAC, TRIAC, GTO. | 04 |
| | (c) Describe three different modes of operation of a thyristor with the help of its static V-I characteristics. | 07 |
| Q.2 | (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) Write significance of freewheeling diode in control rectifier with necessary circuit diagram and waveforms. | 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 | |
| | (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) What is buck regulator? Draw circuit diagram and waveforms for voltage across freewheeling diode, current through inductor. | 03 |
| | (b) Explain buck converter with relevant waveforms. | 04 |
| | (c) Describe the principle of step-up chopper. Derive an expression for the average output voltage in terms of input dc voltage and duty cycle. State the assumptions made. | 07 |
| | OR | |
| Q.3 | (a) What do you mean by Pulse Width Modulation? State advantages and disadvantages of PWM technique. | 03 |
| | (b) Distinguish between on-off control and phase angle control. | 04 |
| | (c) Draw gate voltage and phase voltage waveform and explain 3 phase inverter operation for 120° conduction mode. | 07 |
| Q.4 | (a) Describe positions of space vector on the basis of switching states. | 03 |
| | (b) Classify of different techniques for voltage control of inverter. Explain anyone. | 04 |
| | (c) Describe Full-bridge single-phase voltage source inverter with circuit diagram and waveform. | 07 |

OR

- Q.4** (a) Write advantages of SVPWM technique over SPWM techniques. **03**
(b) Derive output voltage equation for single phase half wave rectifier. **04**
(c) Explain cause of presence of harmonics in output of inverter. Explain 4 effects of switching frequency on harmonic spectrum. **07**
- Q.5** (a) List any three industrial applications of ac voltage controller. Enumerate its merits and demerits. **03**
(b) What is a cycloconverter? Enumerate some of its industrial applications. **04**
(c) Describe three phase full-wave controlled AC –DC converter with R load with circuit and waveform. **07**
- OR**
- Q.5** (a) Write a short note on matrix converter. **03**
(b) Explain working of Dual converter with circuit diagram. **04**
(c) Explain working of 1- ϕ to 1- ϕ cycloconverter with input frequency 50Hz and output frequency 10Hz. **07**
