

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV EXAMINATION – SUMMER 2025****Subject Code:3142409****Date:19-05-2025****Subject Name:Basic Power Electronics Devices, Circuits And Applications****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) State any six applications requiring electrical energy conversion. | 03 |
| | (b) State the characteristics of Electrical Energy and comment on the storage of it. | 04 |
| | (c) Draw symbol and structure of diode. Draw symbol and VI characteristics of 1) Power Diode 2) Zener Diode. State two applications of power diode and Zener diode. | 07 |
| Q.2 | (a) Describe the concept of PWM explaining its principle. | 03 |
| | (b) Discuss Safe Operating Area (SOA) w.r.t. power switches. | 04 |
| | (c) Draw symbol and basic structure of thyristor. List and explain in brief, the Turn ON methods of thyristor. | 07 |
| OR | | |
| | (c) Describe two transistor model of thyristor. | 07 |
| Q.3 | (a) Compare signal diode and power diode. | 03 |
| | (b) Describe the switching characteristics of power diode with appropriate waveforms. | 04 |
| | (c) State the need for commutation in a thyristor. Explain Class C commutation with necessary figure and waveforms. | 07 |
| OR | | |
| Q.3 | (a) Draw only, a neat labelled diagram showing structure of power diode. | 03 |
| | (b) Comment on series and parallel operation of diodes. | 04 |
| | (c) Describe the structure and working of TRIAC with a neat diagram and waveforms. Explain any one application of TRIAC. | 07 |
| Q.4 | (a) Describe conduction losses and switching losses in power switches. | 03 |
| | (b) Compare Power BJT and Power MOSFET | 04 |
| | (c) Explain primary and secondary breakdown in Power BJT. | 07 |
| OR | | |
| Q.4 | (a) State the cause of false triggering of semiconductor switches in power electronics converters. Suggest a remedy to prevent the same. | 03 |
| | (b) Compare Si MOSFET and SiC MOSFET. | 04 |
| | (c) Draw and explain the vertical structure of Power MOSFET. Describe its working explaining the Field Effect. | 07 |
| Q.5 | (a) Classify power electronics converters. State applications of each of them. | 03 |
| | (b) Draw any one gate driver for power MOSFET. Describe its operation. | 04 |
| | (c) Discuss the need for protection of semiconductor power switches. Explain snubber circuits, over voltage and over current protection. | 07 |
| OR | | |
| Q.5 | (a) State any three limitations of Power MOSFET. | 03 |
| | (b) Describe Soft and Hard switching of transistor. | 04 |
| | (c) Draw the symbol and VI characteristics of IGBT. Comment on the gate drive requirement of IGBT with suitable waveforms. | 07 |
