Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

## Question Paper Code : 20984

**B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.**

Fifth Semester

Electrical and Electronics Engineering

EE 3591 – POWER ELECTRONICS

(Common to: Mechanical and Automation Engineering/Mechatronics Engineering and Robotics and Automation)

(Regulations 2021)

Time : Three hours                                   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Thermal Resistance and give its unit.

2. Compare resonant converters with hard switched converters.

3. List and define different time durations associated with the dynamic characteristics of IGBT.

4. State the objective of selective harmonic distortion in Converters.

5. Draw the LC filter and mention its corner frequency.

6. Draw the very common snubber circuit for a power diode.

7. Define Distortion factor.

8. List any two industrial applications that need controllable dc power.

9. Define AC voltage controllers.

10. State the demerits of AC voltage controllers.

PART B — (5 × 13 = 65 marks)

11. (a)  Explain the basic step down (buck) converter with required diagram and waveform.

Or

(b)  Explain the operation of parallel loaded half bridge resonant dc to dc converter with suitable sketch.

12.  (a)  Explain the operation of single phase half bridge inverter with suitable diagram and also describe the carrier-based sinusoidal PWM (SPWM) scheme with necessary waveform.

Or

(b)  Explain the schematic of standard three-phase VSI topology and also explain the square wave operation of three phase VSI [use wave forms]

13.  (a)  Draw and illustrate the operation of single-phase idealized diode bridge rectifiers with input and output waveforms with appropriate labeling in waveforms.

Or

(b)  (i)  Draw and explain the working principle of Voltage Doubler (Single-Phase Rectifiers)                                                                (8)

(ii)  Explain the Concerns and remedies for line-current harmonics and low power factor.                                                                (5)

14.  (a)  Explain the Two-transistor behavioral model of a thyristor along with thermal protection with suitable sketch.

Or

(b)  Explain the operation of single phase full wave midpoint converter with suitable sketch and waveforms.

15.  (a)  Explain the operation of single phase AC controller with R load with required sketch.

Or

(b)  Explain about the pulse and high frequency carrier gating of single phase AC controller with RL load using required sketch.

PART C — (1 × 15 = 15 marks)

16.  (a)  Illustrate the design of Suitable buck converter for an off grid solar PV system of suitable rating with required diagram [Assume your own system]

Or

(b)  Illustrate the design of Suitable buck boost bidirectional converter for an hybrid system of suitable rating [solar PV and utility system] with required diagram [Assume your own system]