

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**SIXTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018**

**Course Code: AE 312**

**Course Name: POWER ELECTRONICS (AE)**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer any two full questions, each carries 15 marks.*

Marks

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|---|---|-----|
| 1 | a) Name the different types of power diodes and based on which parameter they are classified?   | (2) |
|   | b) Sketch static V I characteristics of a thyristor. Label the various voltages, currents and the operating modes on the sketch.  | (5) |
|   | c) Explain the di/dt and dv/dt protection of a SCR  | (8) |
| 2 | a) Consider a single phase half wave controlled rectifier feeding a Resistive Inductive load. What arrangement has to be made to improve the power factor of the supply?  | (3) |
|   | b) Draw and explain the operation of a single phase AC voltage controller feeding resistive load. Draw the necessary waveforms.   | (7) |
|   | c) Explain the operating principle of single phase to single phase cyclo-converter with circuit and relevant waveforms.   | (5) |
| 3 | a) Compare Power MOSFET with BJT.   | (3) |
|   | b) Draw and explain the dynamic characteristics of GTO  | (5) |
|   | c) A single phase fully controlled bridge converter feeds an RL load. The load has resistance of 50 $\Omega$ and an inductive reactance. Assume the load current is continuous and ripple free. Find the average value load voltage, load current and RMS value of load voltage. The supply voltage is 230V, 50Hz. The thyristor triggering angle is 30°. | (7) |

**PART B**

*Answer any two full questions, each carries 15 marks.*

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|---|--|------|
| 4 | a) What is the principle of operation of a step down chopper? Explain with its circuit diagram and equations.  | (5)  |
|   | b) Explain the working principle of Class E chopper. Show all the quadrant operations with its equivalent circuits. Consider chopper switches as Power | (10) |

MOSFETs.

- 5 a) With circuit diagram and waveforms explain the operation of a current source inverter. (5)
- b) With neat circuit diagram, explain the operation of a three phase inverter with  $180^\circ$  conduction mode. Draw the phase voltage and line voltage waveforms. Find out RMS value of phase voltage and line voltage. Assume all switches in the circuit are power MOSFETs and star connected resistive load. (10)
- 6 a) Draw and explain the operation of a chopper circuit which operates in both first and second quadrant. (7)
- b) Consider a single phase full bridge inverter feeding a resistive inductive load. Explain the working of the circuit along with its output voltage and output current waveforms. Derive RMS value of output voltage. (8)

### PART C

*Answer any two full questions, each carries 20 marks.*

- 7 a) Name three types of dc power supplies and explain any two of them with its circuit diagram. (5)
- b) What are different types of UPS systems? Explain each type of UPS system. (5)
- c) With circuit diagram, waveforms and output voltage equation explain the operation of buck converter. (10)
- 8 a) Explain the role of microcontrollers in the control of power electronic circuits or in the electrical drives (7)
- b) What is the need for isolation in a power electronic circuit? Draw and explain the different types of isolation circuits that are commonly used in power electronic circuits. (8)
- 9 a) With circuit diagram and waveforms explain the operation of buck-boost converter. Also derive output voltage equation (10)
- b) Draw and explain the driver circuits for a power MOSFET (5)
- c) Explain opto-coupler based control circuit for power electronic circuits. (5)

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