

B.E./B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

Fifth Semester

ELECTRICAL AND ELECTRONICS ENGINEERING**20EEPC502 - POWER ELECTRONICS**

(Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

Answer ALL Questions

PART - A (10 × 2 = 20 Marks)

- | | <i>Marks,
K-Level,CO</i> |
|---|------------------------------|
| 1. Name the limitation of high frequency operation of a power electronic device. | 2,K1,CO1 |
| 2. Why are IGBT becoming popular in power electronics based applications? | 2,K2,CO1 |
| 3. Classify the various modes of operation of single phase fully controlled bridge converter. | 2,K2,CO2 |
| 4. A two pulse converter is fed with a 230V, 50 Hz supply. The load on the converter is a pure resistance of $R=10\ \Omega$. Obtain the average output voltage for a firing angle of $\alpha =135^\circ$. | 2,K2,CO2 |
| 5. Define DC Chopper and write down its applications. | 2,K1,CO3 |
| 6. Design the circuit of a step down chopper. | 2,K2,CO3 |
| 7. Why diodes should be connected in antiparallel in VSI ? | 2,K1,CO4 |
| 8. Discuss PWM control and types of PWM techniques. | 2,K1,CO4 |
| 9. Enumerate some of the industrial applications of a cyclo - converter. | 2,K1,CO5 |
| 10. Mention the advantages of matrix converter over conventional converter. | 2,K1,CO5 |

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) (i) Discuss the different modes of operation of thyristor with the help of its static V-I characteristics. 7, K2,CO1
- (ii) Discuss why TRIAC is rarely operated in first quadrant with -ve gate current and in third quadrant with +ve gate current ? 6, K2,CO1
- OR**
- b) (i) Snubber circuit for an SCR should primarily consist of capacitor only. But in practice a resistor is used in series with the capacitor, Why ? 7, K2,CO1
- (ii) Discuss the turn off characteristics of SCR and explain the mechanism of turn OFF. 6, K2,CO1

12. a) (i) A single phase bridge converter is utilized to produce regulated DC output voltage. The input voltage is 230 V and the load current is 8A for a firing angle of 30 degree.
- (a) Calculate the dc output voltage. 3, K2, CO2
- (b) Calculate the dc output voltage and current if a freewheeling diode is used at the output for the same firing angle. 4, K2, CO2

- (ii) Examine the single phase half wave rectifier circuit with RL load and freewheeling diode. 6, K2, CO2

OR

- b) Describe the operation of single phase dual converter with aid of relevant waveforms. Obtain the expression of its instantaneous circulating current. 13, K2, CO2

13. a) Explain the following types of choppers with neat diagrams.
- (i) Type A chopper 5, K2, CO3
- (ii) Type E chopper 8, K2, CO3

OR

- b) (i) A type - 'A' chopper has supply voltage V_s of 200V and duty cycle of 0.4 and 0.6 for these duty cycles, calculate
- (a) Average and rms values of output voltage. 3, K2, CO3
- (b) Output power for R load of 10 Ohm. 2, K2, CO3
- (c) Ripple factor. 2, K2, CO3

- (ii) Explain the operation of step up chopper and derive an expression for its output voltage. 6, K2, CO3

14. a) Describe the principle of operation of three phase voltage source inverter with 180° conduction mode with necessary waveforms and circuits. Also obtain the expression for line to line voltage. 13, K2, CO4

OR

- b) With neat diagram explain the need for space vector modulations employed in inverters also explain the advantage SVM over other technique employed in inverters. 13, K2, CO4

15. a) Describe the operating principle of single phase bidirectional AC voltage regulator with neat diagram. Also derive the average and RMS output voltage. 13, K2, CO5

OR

- b) Describe the operating principle of single phase to single phase cyclo-converter with continuous and discontinuous load current with circuit and waveform. 13, K2, CO5

PART - C (1 × 15 = 15 Marks)

16. a) A load commutated chopper, fed from a 230V dc source has a constant load current of 50A. For a duty cycle of 0.4 and a chopping frequency of 2kHz, Evaluate the
- (i) The value of commutating capacitance. 4,K2,CO3
 - (ii) Average output voltage. 4,K2,CO3
 - (iii) Circuit turn-off time for one SCR pair. 4,K2,CO3
 - (iv) Total commutation interval. 3,K2,CO3

OR

- b) With a neat power circuit diagram, explain the operation of buck-boost regulator. Draw the load voltage and load current waveforms and derive the expression for the output voltage. 15,K2,CO3