

R18

Code No: 155CU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, January/February - 2023

POWER ELECTRONICS
(Electrical and Electronics Engineering)

Time: 3 Hours

Max. Marks: 75

- Note:** i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

- 1.a) What are the various methods of SCR commutation? [2]
- b) What are the various power semiconductor devices? [3]
- c) What is meant by half controlled rectifier? [2]
- d) List various applications of controlled converters. [3]
- e) What are the basic copper classifications? [2]
- f) What are the drawbacks of buck converter? [3]
- g) What is meant by PWM control? [2]
- h) What is the need for voltage control in an inverters? [3]
- i) What is the difference between on-off control and phase control? [2]
- j) What are the advantages of circulating current mode of operation cyclo –converter? [3]

PART – B

(50 Marks)

- 2.a) Explain the construction and VI characteristics of power diode.
- b) For an SCR, the gate- cathode characteristics has straight line slope of 130. For trigger source voltage of 15 V, and allowable gate power dissipation of 0.5 watts, calculate the value of gate source resistance. [6+4]

OR

- 3.a) With neat sketch, describe the constructional details and working of an enhanced type power MOSFET with characteristics.
- b) Discuss the switching performance of BJT with relevant waveforms indicating clearly the turn on, turn off times and their components. [5+5]

- 4.a) Explain the operation of single phase half wave controlled rectifier with RL load.
- b) A three phase fully controlled bridge converter is feeding a constant and ripple free load current of 10 A at a firing angle of 30° . Calculate the approximate total harmonic distortion and the rms value of fundamental component of the input current. [6+4]

OR

5. Discuss, in detail, the operation of single phase fully controlled SCR bridge converter with RLE load. Draw the relevant waveforms. [10]

6.a) Draw the schematics of step down and step up choppers and derive an expression for output voltage in terms of duty cycle for a step up and step down chopper.

b) A DC chopper circuit is operating on TRC principle at a frequency of 400 Hz on a 220 V DC supply. If the load voltage is 165 V, Compute the conduction and blocking period of thyristor in each cycle. Also calculate the duty cycle. [6+4]

OR

7. Explain the operation boost and buck boost converter with neat circuit diagram and wave forms. [10]

8.a) Discuss the function of three phase voltage source inverter supplying a balanced star connected load is 180° operating mode

b) The single phase full bridge inverter has a resistive load of 2.5 ohms and the DC input voltage of 50 V, determine (i) the rms output voltage at the fundamental frequency, (ii) the output power, (iii) the average and peak currents of each thyristor and (iv) the peak reverse blocking voltage of each thyristor. [5+5]

OR

9.a) Describe the sinusoidal PWM technique with necessary waveforms.

b) Draw and explain the operation of single phase modified McMurray full bridge inverter. [5+5]

10.a) Describe the operation of single phase unidirectional AC voltage controller with neat diagrams.

b) A single phase full wave controller feeds power to a resistive load of 100 ohms from a 230 V, 50 Hz supply. Calculate (i) rms output voltage, (ii) input power factor and (iii) half cycle average current at delay angles $\alpha_1 = \alpha_2 = \alpha = 90^\circ$. [6+4]

OR

11.a) Explain with a neat circuit diagram the working of a step up and step down cycloconverters.

b) A single phase bridge type cycloconverter has input voltage of 230 V, 50 Hz and the load of $R = 10$ ohms. Output frequency is $1/3^{\text{rd}}$ of input frequency for a firing angle of 30° . Calculate (i) RMS output voltage, (ii) rms current of each converter, (iii) rms current of each thyristor and (iv) input power factor. [6+4]

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