

R16

Code No: 136DJ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, July - 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 is the two-transistor model of SCRs? [2]
- b) What is forced commutation? What are the advantages of forced commutation for the ac-dc converters? [3]
- c) What are line commutated converters? [2]
- d) Does the input power factor of converters depend on the load power factor? [3]
- e) What are the advantages of cyclo converter? [2]
- f) What is the discontinuous mode of operation of A. C. voltage regulator? [3]
- g) What is an AC chopper? [2]
- h) What is step down chopper? Draw its diagram. [3]
- i) How can a PWM control signal be obtained using a carrier wave and reference wave with the help of diagram? [2]
- j) Write are the applications of parallel inverter? [3]

PART – B

(50 Marks)

- 2.a) Explain in detail about the series connection of SCRs.
- b) Following are the specifications of a Thyristor operating from a peak supply of 400V Repetitive peak current $I_p = 200A$, $(di/dt)_{max} = 50 A/\mu s$, $(dv/dt)_{max} = 180 V/\mu s$. Design Snubber circuit if the minimum load resistance is 15 ohms. Take damping ratio as 0.7 and the time factor of safety as 2. [5+5]

OR

- 3.a) What are the main specifications and ratings of SCR to be considered while designing? Explain.
- b) A thyristor is triggered by a train of pulses of frequency 1 KHZ and duty cycle of 0.4. Calculate the pulse width if average power dissipation is 5 W. Estimate the maximum allowable gate power loss. [5+5]
- 4.a) Describe with neat circuit diagram and associated waveforms, operation of a single phase half wave-controlled converter with Inductive load.
- b) A single-phase full bridge converter using four SCRs feeds power to RLE load with $R=10$ ohms, $L=100mH$, and $E=100V$. The ac source voltage is 230V at 50Hz. Assuming continuous conduction. Determine the average value of load current for firing delay angle 45° . [5+5]

QA QA QA QA QA QA QA G

OR

5.a) Draw the output voltage waveform of 3-phase fully controlled rectifier for a firing angle of 60 degrees. Indicate firing sequence. Also derive expression for output voltage.

QA b) A 3 phase fully controlled bridge rectifier is operating from a 400V, 50 Hz supply. The load is highly inductive and current constant and continuous. Find the load voltage at firing angle of 45 deg. [5+5]

6. A single phase full wave ac voltage controller has a resistive load of $R=10\Omega$ and the input Voltage is $V_s=120V$ (rms), 60Hz. The delay angle of thyristors T_1 and T_2 are equal to 90 Degrees. Determine the rms output voltage V_o , the input PF, the average current of thyristors I_A , and the rms current of thyristors. [10]

OR

QA 7. Draw the circuit of single-phase voltage controller with antiparallel connection of two thyristors and an R-L load. Explain its working. Sketch load voltage and load current waveforms. Derive an expression for output voltage. [10]

8.a) Explain in detail about the time ratio control used in choppers.

b) Explain the working of Jones chopper. [5+5]

OR

QA 9.a) Derive expressions for minimum and maximum values of load current in a step down chopper with R-L-E load.

b) A step-up chopper has a source of 250 V (dc) in series with inductance of 0.1 H. If the semiconductor switch is operated with different values of duty ratio, plot output voltage vs duty ratio. [6+4]

10.a) Draw the circuit diagram and explain the working of series inverter.

QA b) With the help of neat circuit diagram and associated waveforms, explain operation of single phase full bridge voltage source inverter with RL load. [5+5]

OR

11.a) Explain sinusoidal pulse modulation as used in PWM inverters. Write the important features of the same.

b) Explain the principle of operation of parallel inverter. [6+4]

QA QA QA QA QA QA QA G

---ooOoo---

QA QA QA QA QA QA QA G

QA QA QA QA QA QA QA G