R18

Code No: 155CU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, July/August - 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)	Define Latching current with illustration.	[2]
b)	Draw static V-I characteristics of SCR and list its modes of operation.	[3]
c)	What is meant by commutation?	[2]
d)	What are the advantages of single phase bridge converter over single phase mid converter?	[3]
e)	List the applications of step up choppers.	[2]
f)	Explain duty cycle in step down chopper operation.	[3]
g)	Write the applications of inverter.	[2]
h)	Explain the voltage control of 1-ϕ inverter.	[3]
i)	List any two applications of AC Voltage Controller.	[2]
j)	What type of gating signal is used in single phase ac voltage controller with RL load?	[3]

PART – B

(50 Marks)

2.a) List the different members of the thyristor family. Draw their characteristics and explain in brief.

b) Draw and explain the output characteristics of n-channel enhancement mode MOSFET. [4+6]

OR

3.a) With the help of neat structural diagram and suitable waveforms, explain the operation of IGBT.

b) Explain briefly Turn-on and Turn–off methods of SCR. [5+5]

4.a) Describe with neat circuit diagram and associated waveforms, operation of a 1- phase half wave-controlled converter with Inductive load.

b) A single phase fully rectifier is used to supply power to load having impedance of 200 ohms and 150 mH, from 230V, 50Hz, ac supply at a firing angle of 90 degrees. Calculate i) Average values of output voltage and current and ii) RMS values of output voltage and current. [6+4]

OR

5.a) Explain the operation of three phase fully controlled converter with relevant voltage and current waveforms and also derive the expression for average output voltage.

b) A single phase semi converter is delivering power to RLE load with R= 5Ω, L= 10 mH and E = 80 V. The ac source voltage is 230 V, 50 Hz. For continuous conduction, find the average value of output current for a firing angle of 50^0. If one of the SCR is damaged and open circuited find the new value of average output current on the assumption to continuous conduction. Also sketch the output voltage and current waveforms. [6+4]

6.a) Explain the different control strategies in DC-DC circuits.

b) Discuss the operation of Boost converter with the help of neat circuit diagram and waveforms. [4+6]

OR

7.a) Derive the expression for the output voltage of step-up chopper.

b) A class-A chopper circuit has a load resistance of 100 ohms, capacitance of 10 micro farads and inductance of 10 mH. Find the time for which thyristor will remain in ON state. What will be the turn ON time if the load resistance is decreased to 25 ohms? [5+5]

8.a) Explain the operation of single pulse width modulation of inverter with neat diagram.

b) A three-phase bridge inverter delivers power to a resistive load from a 400V DC source. For a star connected load of 8Ω per phase, determine RMS value of load current and RMS value of thyristor current for 120^0 conduction mode of operation. [6+4]

OR

9.a) Compare 180^0 and 120^0 conduction mode of 3ϕ transistorized bridge inverter.

b) Explain sinusoidal pulse modulation as used in PWM inverters. Write the important features of the same. [5+5]

10.a) Describe the operation of single phase half wave a.c. voltage regulator with the help of voltage and current waveforms. Also, derive the expression for average value of output voltage.

b) A single phase full –wave ac voltage controller is connected with a load of R = 10 Ω, with an input voltage of 230 V, 50 Hz. When the firing angle of thyristors is 45^0, determine i) power output at load, ii) average value of thyristor current and iii) rms value of thyristor current. [5+5]

OR

11.a) Explain the operation of a single phase AC voltage controller with a neat circuit diagram and output wave forms with respect to source voltage waveforms at α = 60 degrees for RL-load.

b) Explain the working of single phase cycloconverter with circuit diagram and relevant waveforms. [5+5]

---ooOoo---