



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
END SEMESTER EXAMINATION, DECEMBER 2021

Course: Power Electronics
Program: B. Tech-Electrical Engg.
Course Code: ECEG 3031

Semester: V
Time 03 hrs.
Max. Marks: 100

SECTION A

(5Q x 4M = 20 Marks)

S. No.		CO
Q1	Draw and label the basic structure of Power Diode and Power MOSFET.	CO1
Q2	Compare Single Phase Half Wave and Single Phase Full Wave Rectifier.	CO2
Q3	List the types of choppers and their applications.	CO3
Q4	“Pulse width modulated inverter is superior to square wave inverter” justify the statement with relevant facts.	CO4
Q5	Define latching and holding current as applicable to an SCR. Show these currents in static I/V characteristics of SCR.	CO1

SECTION B

(4Qx10M = 40 Marks)

Q6	Explain the series and parallel operations of SCR in detail.	CO1
Q7	i. With the help of neat diagram, discuss the working of single phase half wave rectifier with RLE load. (5 marks) ii. A single phase-230V, 1 kW heater is connected across a single phase 230V, 50 Hz supply through an SCR. For firing angle delay of 45° and 90°, calculate the power absorbed in the heater element. (5 marks)	CO2
Q8	i. Discuss in detail working of Type C and Type E choppers. (6 marks) ii. A type-A chopper has input DC voltage of 200 V and a load of $R = 10 \Omega$ in series with $L = 80 \text{ mH}$. If load current varies linearly between 12 A and 16 A, find the time ratio T_{on}/T_{off} for this chopper. (4 marks)	CO3
Q9	I. Describe the basic working principle of single phase to single-phase step-down cycloconverter for both continuous and discontinuous conduction. Mark the conduction of various Thyristors.	CO4

	OR	
	II. Explain the working of MacMurray Bedford full bridge inverter and list various types of inverters with their applications.	CO4
Section C		
(2Qx 20M= 40 Marks)		
Q10	<p>i. Explain the working of single phase full converter bridge rectifier with RLE load.</p> <p>ii. A single phase full converter feeds power to RLE load with $R = 6 \Omega$, $L = 6\text{mH}$ and $E = 60\text{V}$. The AC source voltage is 230 V, 50 Hz. For continuous conduction, find the average value of load current for a firing angle delay of 50°. In case one of the four SCR gets open circuited due to a fault, find the new value of average load current taking the output current as continuous. Sketch waveform for the new output voltage and indicate the conduction of various SCR's.</p>	CO2
Q11	<p>i. Describe the principle of step up chopper. Derive an expression for the average output voltage in terms of input voltage and duty cycle.</p> <p>ii. A step up chopper has output voltage of two to four times the input voltage. For a chopping frequency of 2000 Hz, determine the range of off periods for the gate signal.</p> <p style="text-align: center;">OR</p> <p>i. Discuss the working of load-commutated chopper with relevant voltage and current waveforms. Show voltage variation across each pair of SCR's as a function of time.</p> <p>ii. A load commutated chopper fed from 230 V, DC source, has a constant load current of 50 A. For a duty cycle of 0.4 and a chopping frequency of 2 kHz, compute :</p> <ul style="list-style-type: none"> • The average output voltage • The value of commutating capacitance • Circuit turn off time for one thyristor pair and • Total commutation interval 	CO3
		CO3