Total number of printed pages: **3**

Programme(UG)/6th/UIE611

2024

POWER ELECTRONICS

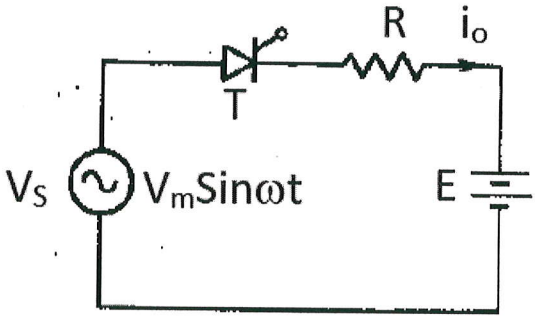
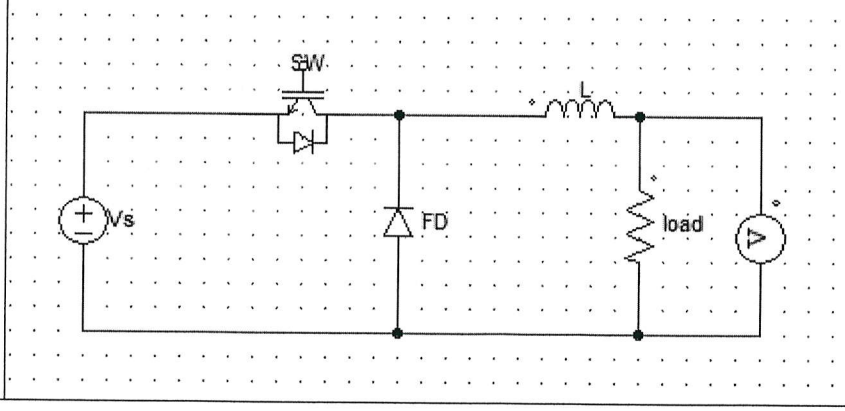
Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1.	a)	What are the different types of power diodes? How the reverse recovery time is significant in classification of power diodes?	8
	b)	Give a comparison between Power BJT and Power MOSFET.	5
	c)	What is HEMT? Explain the working of HEMT.	7
2.	a)	How an SCR can be protected against high di/dt and high dv/dt? Explain with neat diagram.	5
	b)	What is GTO? How GTO can be turned off using a negative gate current? Explain with two transistor model.	8
	c)	What is equalization circuits. Derive the expression for equalization resistance of a series equalizationcircuit.	7
3.	a)	A single phase 230V, 1KW heater is connected across 1-phase, 230V, 50Hz power supply through an SCR. For firing angle delays of 45° and 90° , calculate the power absorbed in the heating element.	6
	b)	A resistive load of 10ohm is connected through a half wave SCR circuit through 220, 50Hz single phase source. Calculate the power delivered to the load for firing angle of 60°. Also find the input power factor.	6

	c)	A dc battery is charged through a resistor R as shownin fig.1. Derive an expression for the average valueof charging current in terms of V_m, E, R etc. on the assumption that the SCR is fired continuously. For an AC source voltage of 230V, 50Hz find the value of average charging current for R=8Ω and E=150V.  Fig. 1	8
4.	a)	A step up chopper has an input voltage of 150V. The voltage output needed is 450V. Given, that the thyristor has a conducting time of 150μseconds. Calculate the chopping frequency.	6
	b)	For a type A chopper dc source voltage is 230V, loadresistance is 10Ω. Voltage drop across the chopper is 2V when it is on. For a duty cycle of 0.4 calculate - (i) average and rms values of output voltage (ii) chopper efficiency	6
	c)	For the step-down chopper shown in the figure below, dc source voltage = 230 V. Find the power delivered to the load of R = 10 Ω. Duty cycle = 40 %. Take voltage drop at the switch to be 2 V.  	8

5.	a)	A step up chopper has input voltage of 220V and output voltage of 660V. If the non-conducting timeof thyristor chopper is 100μS, compute the pulsewidth of the output voltage. In case pulse width is halved for constant frequency operation, find the newoutput voltage.	10
	b)	A single phase half bridge inverter has a resistance of 2.5Ω and input DC voltage of 50V. Calculate the following – i. The RMS voltage occurring at the fundamental frequency ii. The power output iii. Peak current and average current iv. Harmonic RMS voltage v. Total harmonic distortion	10
6.	a)	What is a cycloconverter? Explain the working of single phase to single phase step up cycloconverter.	2+8=10
	b)	A single-phase AC voltage converter has the following details – ON time = 6 min, OFF time = 4 min, frequency = 50Hz, and Voltage source V_o = 110V. Calculate the following. i. Triggering angle ii. Output Voltage	10
7		Write short notes on (any two)	10x2=20
	a)	UPS	
	b)	SMPS	
	c)	Single phase DC drives	