Total number of printed pages: **2** **Programme(UG)/6th/UIE611**

2025

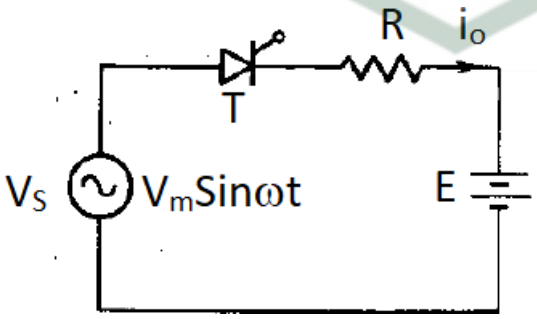
POWER ELECTRONICS

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?	10
	b)	Draw the I-V Characteristics of an SCR and define the terms- holding current and latching current.	5
	c)	Draw the equivalent circuits of SCR and IGBT using BJT or/and MOSFET.	5
2.	a)	What is GTO? How GTO can be turned off using a negative gate current? Explain with two transistor model.	5
	b)	Explain the working of UJT relaxation oscillator	8
	c)	What is equalization circuits. Derive the expression for equalization resistance of a series equalization circuit.	7
3.	a)	What is a phase controlled rectifier? Derive the expression for input power factor of a half wave controlled rectifier with resistive load.	2+6=8
	b)	A dc battery is charged through a resistor R as shown in fig.1. Derive an expression for the average value of charging current in terms of V_m, E, R etc. on the assumption that the SCR is fired continuously. For anAC source voltage of 230V, 50Hz find the value of average charging current for R=8Ω and E=150V.  Fig. 1	6

	c)	A single phase 230V, 1KW heater is connected across 1-phase, 230V, 50Hz power supply through an SCR. For firing angle delays of 45^o and 90^o , calculate the power absorbed in the heating element.	6
4.	a)	Derive the input-output relation of step-up and step up-down chopper.	8
	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 - average and rms values of output voltage) chopper efficiency	6
	c)	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 pulse width of the output voltage. In case pulse width is halved for constant frequency operation, find the newoutput voltage.	6
5.	a)	What is an inverter? Give the steady state analysis of a single phase bridge inverter and draw its output waveforms for R, RL and RLC load.	10
	b)	A single phase half bridge inverter has a resistance of 2.5Ω and input DC voltage of 50V. Calculate the following – The RMS voltage occurring at the fundamental frequency The power output Peak current and average current Harmonic RMS voltage 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)	What is SMPS? Explain the working of any one configuration of SMPS.	10
7	a)	What is UPS? Explain each type of UPS.	10
	b)	A separately excited DC motor is supplied from a 230V,50 Hz source through a single phase half wave controlled converter. Its field is fed through a 1-phase semi converter with zero degree firing angle delay. Motor resistance r_a=0.7Ω and motor constant is 0.5 V-sec/rad. For rated load torque of 15nm at 1000rpm and for continuous ripple free currents, determine- i. firing angle delay of the armature converter ii. rms values of thyristor and freewheeling diode currents iii. input power factor of the armature converter	10