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

2023

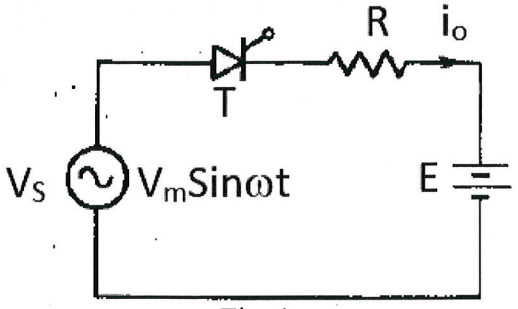
POWER ELECTRONICS

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 timeis significant in classification of power diodes?	8
	b)	Give a comparison between Power BJT and Power MOSFET.	5
	c)	Explain the working of an SIT.	7
2.	a)	How an SCR can be protected against high di/dt and high dv/dt? Explain with neat diagram.	5
	b)	Explain the working of UJT relaxation oscillator	8
	c)	What is equalization circuits. Derive the expression for equalization resistance of a series equalizationcircuit.	7
3.	a)	What is a phase controlled rectifier? Explain the working of a half wave phase controlled rectifier with RLE-load.	2+8=10
	b)	A single phase 230V, 1KW heater is connected across 1-phase, 230V, 50Hz power supply through anSCR. For firing angle delays of 45° and 90°, calculatethe power absorbed in the heating element.	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	4

4.	a)	What is a chopper? Obtain the output and input voltage relationships of Step up and Step up/down chopper.	2+4+4=10
	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)	A step up chopper has input voltage of 220V and output voltage of 660V. If the non-conducting time of 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.	8
5.	a)	What is an inverter? Give the steady state analysis of a voltage source single phase bridge inverter anddraw its output waveforms for R, RL, RLC – over damped and RLC- Under damped load.	2+4+4 =10
	b)	Give the Fourier analysis of output of a single phase bridge inverter.	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 any one configuration of SMPS	2+8=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