GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2022

POWER ELECTRONICS

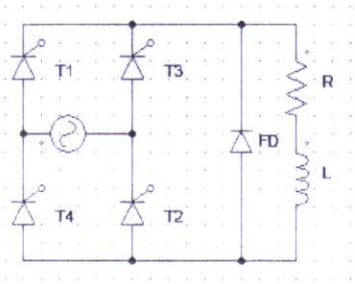
EI 604A

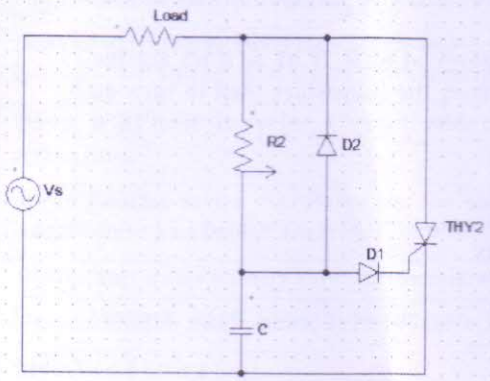
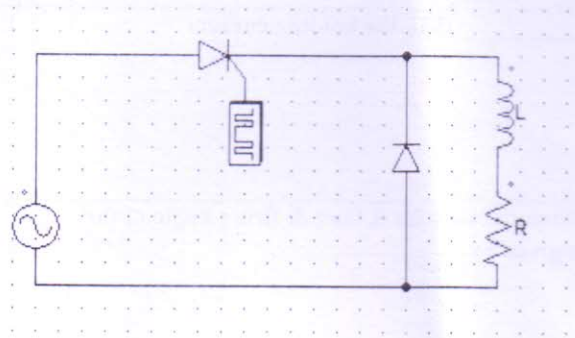
TIME ALLOTTED: 3HR **FULL MARKS:70**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)

Answer any ***ten*** from the following, choosing the correct alternative of each question: 10×1=10

1.			Marks	CO No.
(i)		Consider the two-transistor analogy of SCR, if α1 & if α2 are the common-base current gains of both the transistors then to turn-on the device a) α1 + α2 should approach zero b) α1 x α2 should approach unity c) α1 – α2 should approach zero d) α1 + α2 should approach unity	1	CO1
(ii)		For the below shown circuit has dis-continuous load current waveform.  Each thyristor pair conducts for a) π radians b) 2π radians c) < π radians d) > π radians	1	CO2
(iii)		The latching current is _____ than the holding current a) lower b) higher c) same as d) negative of	1	CO1
(iv)		For a single-phase thyristor circuit with R load & firing angle α, the conduction angle can be given by a) π+α b) 2π+α c) π-α d) α	1	CO2

	(v)		The type of commutation in which the pulse to turn off the SCR is obtained by separate voltage source is a) class B commutation b) class C commutation c) class D commutation d) class E commutation	1	CO1
	(vi)		A chopper may be thought as a a) Inverter with DC input b) DC equivalent of an AC transformer c) Diode rectifier d) DC equivalent of an induction motor	1	CO3
	(vii)		The figure shown below is that of a  a) R firing circuit b) RC half-wave firing circuit c) RC full-wave firing circuit d) UJT triggering circuit	1	CO2
	(viii)		In a 3-phase full converter using six SCRs, gating circuit must provide a) one firing pulse every 30° b) one firing pulse every 90° c) one firing pulse every 60° d) three firing pulses per cycle	1	CO2
	(ix)		In the below given circuit, the FD (Freewheeling diode) is forward biased at ωt =  a) 0 b) α	1	CO1

			c) π d) 2π		
	(x)		A cycloconverter is a _____ a) one stage power converter b) one stage voltage converter c) one stage frequency converter d) none of the mentioned	1	CO3
	(xi)		In a single-phase half-wave thyristor circuit with R load & Vs=Vm sinωt, the maximum value of the load current can be given by a) 2Vm/R b) Vs/R c) Vm/2 d) Vs/2	1	CO2
	(xii)		The dv/dt protection is provided in order to a) limit the power loss b) reduce the junction temperature c) avoid accidental turn-on of the device d) avoiding sudden large voltage across the load	1	CO1

GROUP – B
(Short Answer Type Questions)

Answer any ***three*** from the following: 3×5=15

				Marks	CO No.
2.	(a)		What is Holding current and Latching current?	3	CO1
	(b)		Draw the SCR Characteristics and point out these two parameters	2	CO1
3.			With the help of circuit, diagram and waveform explain the operation of UJT triggering circuit for one Thyristor.	5	CO2
4.			Describe the basic behavior of Thyristor using a two- transistor model and find its Anode current expression.	5	CO1
5.			Draw the circuit and derive the expression for output voltage of a single-phase bridge converter.	5	CO3
6.			Draw the circuit of step-up chopper and explain its working.	5	CO3

GROUP – C
(Long Answer Type Questions)

Answer any ***three*** from the following: 3×15=45

				Marks	CO No.
7.	(a)		What is reverse recovery period of power diode? What is snubber circuit? Explain it with the proper circuit diagram.	7	CO1
	(b)		Describe the V-I characteristics of TRIAC and modes of operation.	4	CO1
	(c)		Explain the operation of IGBTwith the representation of its schematic diagram.	4	CO1
8.	(a)		Draw the circuit of buck boost converter and explain its working.	4	CO3

	(b)		For a type A chopper, dc source voltage is 230 V, load resistance 10 Ω, drop across the switch is 2Vand duty cycle 0.4. Calculate average and RMS value of output voltage and chopper efficiency.	6	CO3
	(c)		Describe the working of a three-phase voltage source inverter with an appropriate circuit diagram.	5	CO2
9.	(a)		With the help of circuit diagram explain the operation of single-phase semi converter with RL load. Draw the waveform of input voltage, output voltage, load current and voltage across the Thyristor.	5	CO2
	(b)		With the help of circuit diagram, explain the working of three-phase semi controlled converter.	4	CO2
	(c)		A single-phase half-controlled rectifier supplies a resistive load draws an average current of 1.6A. If the converter is operated from a 240V,50 Hz supply and if the average value of the Output voltage is 81V, Calculate The firing angle, Load Resistance, the r.m.s. value of load voltage, DC power & the ripple factor.	6	CO2
10.	(a)		Draw a half Bridge Inverter Circuit and Explain its working and draw its O/P voltage and Current waveform.	5	CO2
	(b)		Draw a 3Phase inverter Circuit and explain its modes of operation.	7	CO3
	(c)		Write Fourier series expression for the output voltage from the single-phase half bridge Inverter Circuit.	3	CO3
11.	(a)		Write short notes on Any three of the following: - Single-phase to single-phase cycloconverter	5	CO3
	(b)		Induction heating	5	CO3
	(c)		SMPS	5	CO4
	(d)		IPM	5	CO4
	(e)		Buck Converter	5	CO4