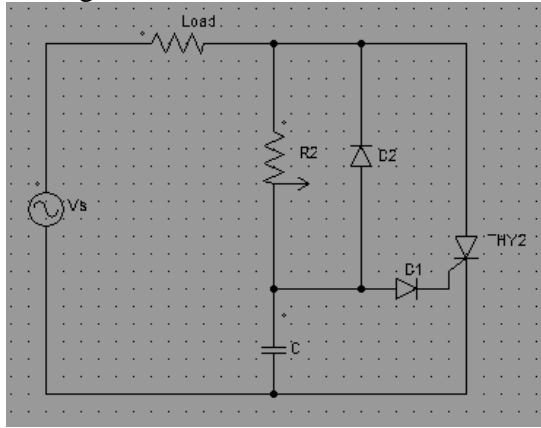# GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2021
POWER ELECTRONICS
EI604A

**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**

			Marks	CO No
1.	(i)	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
	(ii)	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
	(iii)	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
	(iv)	The figure shown below is that of a	1	CO2

a) R firing circuit
b) RC half-wave firing circuit
c) RC full-wave firing circuit
d) UJT triggering circuit

(v)	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
(vi)	In the below given circuit, the FD (Freewheeling diode) is forward biased at ωt =	1	CO1

a) 0
b) α
c) π
d) 2π

(vii)	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
(viii)	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
(ix)	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
(x)	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

(xi) For the below shown circuit has dis-continuous load current waveform.   1   CO2
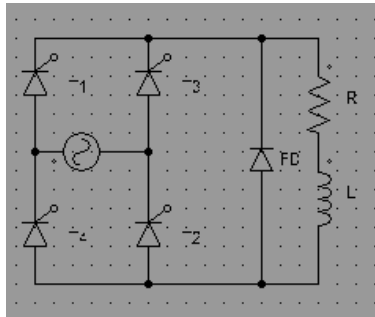
Each thyristor pair conducts for
a) π radians
b) 2π radians
c) $< \pi$ radians
d) $> \pi$ radians

(xii) The latching current is _____ than the holding current   1   CO1
a) lower
b) higher
c) same as
d) negative of

GROUP – B
(Short Answer Type Questions)
Answer any *three* from the following: **3×5=15**

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

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 IGBT with 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)	Sketch the waveform of input voltage, output voltage and output current of a three phase fully controlled converter with R load operating at $\alpha = 30o$.	4	CO2
	(c)	With the help of circuit diagram, explain the working of three-phase semi controlled converter.	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.		Any **three** of the following:-	3X5=15	CO3
	(a)	Single-phase to single-phase cycloconverter	5	CO2
	(b)	Buck Converter	5	CO3
	(c)	Push-pull resonant ballast	5	CO4
	(d)	IPM	5	CO4
	(e)	Induction heating	5	CO4