GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2021

POWER ELECTRONICS

EE402

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)	A chopper has Vs as the source voltage, R is the load resistance and α as the duty cycle. The rms value of the output voltage is a) αVs b) √αVs c) Vs/√α d) √(1-αVs)	1	CO2
(ii)	For a two quadrant type-A chopper, regenerative braking is a) possible at low speeds b) possible at high speeds c) possible at both high & low speeds d) not possible at all	1	CO5
(iii)	The range of firing angle for R firing circuit is a) 0° − 90° b) 90° − 180° c) 0° − 180° d) 45° − 90°.	1	CO1
(iv)	RC snubber circuit is used to limit rate of a) rise of current in SCR b) rise of voltage across SCR c) rise of capacitance of depletion layer d) all of these.	1	CO1
(v)	In an SCR holding current is a) equal to latching current b) less than I_L c) more than I_L d) not related to I_L.	1	CO1

(vi)	Cycloconverter is a a) AC to AC converter b) AC to DC converter c) DC to AC converter d) DC to DC converter	1	CO2
(vii)	d*i*/d*t* protection for an SCR is achieved by a) *R* in series with SCR b) *L* in series with SCR c) *R* across SCR d) none of these	1	CO1
(viii)	Each diode of a 3- phase half-wave diode rectifier conducts for a) 60° b) 120° c) 180° d) 90°	1	CO2
(ix)	An IGBT has three terminals called a) collector, emitter, base b) drain, source, base c) drain, source, gate d) collector, emitter, gate.	1	CO1
(x)	The advantage of 180° conduction mode of 3-ph inverter circuit over 120° conduction mode is a) it needs less number of switches b) there is no paralleling of switches c) devices in series are not simultaneously switched load terminals are not left open during switching	1	CO2
(xi)	The forward voltage drop across an SCR in the on state a) increases slightly with load current b) decreases slightly with load current c) remains unchanged d) changes linearly with load current.	1	CO1
(xii)	An ideal power diode must have a) low forward current carrying capacity b) large reverse breakdown voltage c) high ohmic junction resistance d) high reverse recovery time	1	CO1

GROUP – B
(Short Answer Type Questions)

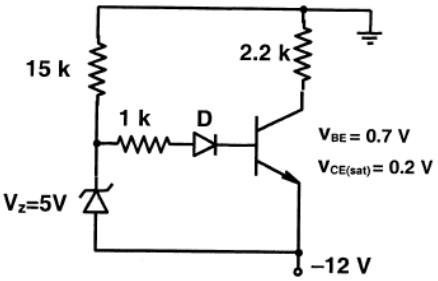
(Answer any *three* of the following) **3 x 5 = 15**

		Marks	CO No.
2.	Draw a comparison between power transistor, power MOSFET & IGBT in relation to their application in power electronics.	5	CO1
3.	Why are freewheeling diode connected in rectifier circuits to copeup with *R-L* load? (Give waveforms).	5	CO2
4.	Define Holding Current and Latching current. What is a snubber circuit?	5	CO2, CO1

5.	Explain with relevant circuit diagrams & waveforms, the principle of operation of single phase to single phase step-up cycloconverter.	5	CO2
6.(a)	Describe the classifications of power Diode.	1	CO1
(b)	What is Softness factor?	4	CO1

GROUP – C
(Long Answer Type Questions)

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

		Marks	CO No.
7.(a)	Explain the principle of operation & derive the expression of average output voltage of a 3 phase full converter supplying a very high inductive load.(With the help of associated waveforms & circuit diagrams)	7	CO2
(b)	A three phase fully controlled charges a battery from a supplied with 230 V ,50 Hz. The battery emf is 200V and its internal resistance is 0.5 Ω. On account of inductance connected in series with the battery, charging current is constant at 20 A. i) firing angle delay and supply power factor. ii) In case it is desired that power flows from dc source to ac load in first part find the firing angle delay for the same current.	8	CO2
8. (a)	Explain type B chopper with proper circuit diagram.	8	CO2
(b)	 The transistor used in the circuit shown below has a β of 30 and I_{CBO} is negligible. If the forward voltage drop of diode is 0.7V, then What amount of current through the collector?	7	CO3
9.(a)	A single phase transformer ,with secondary voltage of 230 V, 50 Hz, delivers power to load R =10 Ω through a half wave controlled rectifier circuit . For a firing angle delay of 60°. Determine (a) the rectification efficiency (b) Form Factor (c) Voltage ripple factor (d) Transformer Utilization factor and (e) PIV of thyristor.	7	CO3

	(b) Explain the operation of fully controlled bridge circuit with R-L load (rectifying and inverting mode). Draw the waveform.	8	CO2
10.(a)	How is the working of a full bridge single phase inverter different from that of half bridge circuit? Explain with the help of diagrams.	7	CO2
(b)	A single-phase full-bridge voltage source inverter (VSI) is fed from a 300 V battery. A pulse of 120º duration is used to trigger the appropriate devices in each half-cycle. What is the rms value of the fundamental component of the output voltage?	5	CO3
(c)	Why voltage control is needed in Inverter circuits? Write the name of various methods for the control of output voltage of inverters.	3	CO3
11.	Write short note on (any three)	3X5=15	
	(a) GTO	5	CO1
	(b) Methods of triggering of SCR.	5	CO1
	(c) MOSFET	5	CO2
	(d) Dual Converters	5	CO3
	(e) UPS	5	CO3