VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD
Accredited by NAAC with A++ Grade
B.E. (E.E.E.) VI-Semester Advanced Supplementary Examinations, August-2022
Power Electronics

Time: **3 hours**   Max. Marks: **60**

*Note: Answer all questions from **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Compare Power BJT and Power MOSFET.	2	3	1	2
2.	Sketch the V-I characteristics of power diode.	2	1	1	1
3.	Name the performance parameters of phase-controlled rectifiers.	2	1	2	1
4.	Compare full converter and semi-converter.	2	3	2	2
5.	Differentiate the time ratio control and current limit control of a chopper.	2	1	3	1
6.	A Step-up chopper is operating at a frequency of 1 kHz on a 22V DC supply. If the load voltage is 88 V, calculate the conduction (ON) and blocking (OFF) periods of the chopper.	2	4	3	2
7.	What are the limitations of square wave inverters?	2	1	4	1
8.	Differentiate bipolar sinusoidal pulse width modulation and unipolar sinusoidal pulse width modulation.	2	1	4	1
9.	Classify AC voltage controllers.	2	1	5	1
10.	Give any two applications of a cyclo-converter.	2	1	5	2

Part-B (5 × 8 = 40 Marks)

11. a)	With a neat circuit and relevant waveforms, explain the Resistance firing circuit used for triggering an SCR.	4	2	1	2
b)	Explain the operation of thyristor and sketch the static V-I characteristics of thyristor.	4	2	1	2
12. a)	With a neat circuit, explain the operation of single-phase half-wave controlled rectifier with R load. Draw the output voltage and the output current waveforms. Also derive the expression for average load voltage.	4	3	2	2
b)	For a three-phase full converter, sketch the time variations of input voltage and the voltage across one thyristor for one complete cycle for a firing angle delay of (a) 0^0 and (b) 30^0.	4	2	2	2

			M	L	CO	PO
13.	a)	Giving the basic circuit diagram and the waveforms of gate pulses, inductor current, inductor voltage and capacitor current, explain the operation of boost converter. Derive the expressions for the output voltage and ripple inductor current.	6	2	3	2
	b)	A Buck- Boost converter has an input voltage of 15V and the average output voltage of 45V. Calculate the duty cycle.	2	4	3	2
14.	a)	Explain the operation of single-phase half bridge voltage source inverter feeding R-load and RL-load with neat circuit and waveforms.	4	2	4	2
	b)	In a single pulse modulation of PWM inverters, the pulse width is 144^0. For an input voltage of 200 V dc, (a) Calculate the rms value at the fundamental component of the output voltage. (b) Determine the THD of the inverter.	4	4	4	2
15.	a)	Explain the operation of a three-phase bridge inverter with 180^0 conduction mode giving operation table (showing conduction devices in six intervals in one cycle) and waveforms of six gate signals, phase to neutral voltages of three phases and three-line voltages over period of about two cycles (720^0).	6	2	5	2
	b)	Draw the circuit diagram of a single phase step-down cyclo-converter.	2	1	5	1
16.	a)	Explain the complementary commutation of a thyristor with a neat circuit and relevant waveforms.	4	2	1	2
	b)	Explain the operation of single – phase, half-controlled bridge converter feeding an inductive load with the associated waveforms for continuous conduction. Derive the expression for mean output voltage and mean output current.	4	3	2	2
17.		Answer any *two* of the following:				
	a)	The buck converter has an input voltage of 14V, the required output voltage is 6V, the peak-to-peak output ripple voltage is 15mV and the switching frequency is 30kHz. If the peak-to-peak ripple current of the inductor is limited to 0.6 A. Determine (a) the duty cycle (b) the filter inductance and (c) the filter capacitance.	4	4	3	2
	b)	Explain the operation of single-phase full bridge voltage source inverter feeding RL-load with a neat circuit and waveforms. Derive the expression for the rms output voltage.	4	3	4	2
	c)	For a single-phase ac voltage controller feeding a resistive load, draw the waveforms of source voltage, gating signals, output voltage, source and output currents and voltage across one SCR. Also derive the expression for the power factor.	4	3	5	2

M : Marks;   L: Bloom's Taxonomy Level;   CO; Course Outcome;   PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	40%
iii)	Blooms Taxonomy Level – 3 & 4	40%

*****