Code No. : 16348 AS O

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD
Accredited by NAAC with A++ Grade
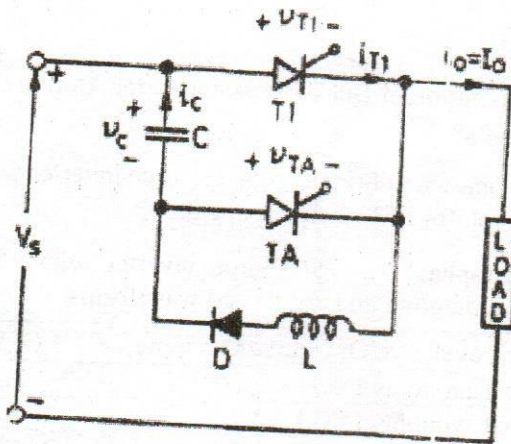### B.E. (E.E.E.) VI-Semester Advanced Supplementary Examinations, July-2023
Power Electronics

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.	Sketch the reverse recovery characteristics of power diode.	2	1	1	1,2
2.	Define finger voltage of a thyristor.	2	1	1	1,2
3.	What are the advantages of freewheeling diode in the phase-controlled rectifiers?	2	1	2	1,2
4.	Define firing angle.	2	1	2	1,2
5.	Name the control strategies used in choppers.	2	1	3	1,2
6.	Give any two applications of DC-DC converters.	2	1	3	1,2
7.	What are the advantages of pulse width modulation control in inverters?	2	1	4	1,2
8.	Compare voltage source inverter and current source inverter.	2	2	4	1,2
9.	List the control strategies of AC voltage controller for regulating the power flow.	2	2	5	1,2
10.	Give any two applications of AC-AC converters.	2	1	5	1,2

Part-B (5 × 8 = 40 Marks)

11. a)	Explain the UJT-triggering of SCR with a neat circuit and associated waveforms.	4	2	1	1,2
b)	For the circuit shown below, Vs = 100 V, L = 50 µH and C = 90 µF. For a constant load current of 60 A, calculate. (a) peak value of current through capacitance and current through main and auxiliary thyristors (b) circuit turn-off times for main and auxiliary thyristors.	4	4	1	1,2

			M	L	CO	PO
12.	a)	Explain the operation of single-phase full-wave controlled bridge rectifier with resistive load. Draw waveforms of source voltage, gate current, load voltage and load current for a given firing angle α. Hence obtain expression for average load voltage in terms of source voltage and firing angle.	4	3	2	1,2
	b)	A single phase transformer, with secondary voltage of 230 V, 50 Hz, delivers power to resistive load of R = 10 Ω through a half-wave controlled rectifier circuit. For a firing angle delay of 45°, determine (a) the rectification efficiency (b) form factor (c) voltage ripple factor (e) PIV of thyristor	4	4	2	1,2
13.	a)	With a neat circuit, explain the operation of Buck converter. Also sketch the waveforms of supply voltage, gate signal, inductor voltage, inductor current, capacitor voltage and capacitor current. Derive an expression for mean output voltage.	4	3	3	1,2
	b)	The buck converter has an input voltage of 12 V, the required output voltage is 5 V, the peak-to-peak output ripple voltage is 20 mV and the switching frequency is 25 kHz. If the peak-to-peak ripple current of the inductor is limited to 0.8 A. Assume the load resistance R= 500 Ω. Determine (a) the duty cycle (b) the filter inductance L (c) the filter capacitance C (d) the critical values of L and C.	4	4	3	1,2
14.	a)	With a neat circuit and relevant waveforms, explain the operation of single phase current source inverter.	4	2	4	1,2
	b)	In single pulse modulation of PWM inverters, the pulse width is 144°. For an input voltage of 400 V dc, (a) Calculate the rms value at the fundamental component of the output voltage. (b) Determine THD of the inverter.	4	4	4	1,2
15.	a)	With a neat circuit, explain the operation of a single-phase full wave ac voltage controller feeding a resistive load. Also sketch the waveforms of source voltage, gating signals, output voltage, output current and voltage across one SCR.	4	2	5	1,2
	b)	Explain the operation of single phase step-down cyclo-converter. Sketch the input and output voltage waveforms with marking the conduction of various thyristors.	4	2	5	1,2
16.	a)	Sketch the switching characteristics of a thyristor during its turn-on and turn-off processes. Also explain each sub-interval during turn-on and turn-off process.	4	2	1	1,2
	b)	With a neat circuit and relevant waveforms, explain the operation of three phase full converter with resistive load.	4	2	2	1,2
17.		Answer any *two* of the following:				
	a)	With a neat circuit, explain the operation of Buck-Boost converter. Derive the expression for average output voltage.	4	3	3	1,2
	b)	Explain the operation of a single-phase half bridge voltage source inverter with resistive load. Derive the expression for RMS output voltage.	4	3	4	1,2
	c)	Explain the operation of a three-phase voltage source inverter with 180° conduction mode with neat circuit diagram and associated waveforms.	4	2	5	1,2

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%

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