Code No. : 16341 N

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD
Accredited by NAAC with A++ Grade
B.E. (E.E.E.) VI-Semester Main Examinations, May/June-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.	Classify power diodes.	2	2	1	1,2
2.	Sketch the gate V-I characteristics of thyristor.	2	1	1	1,2
3.	Define firing angle of thyristor.	2	1	2	1,2
4.	Give any two applications of phase-controlled rectifiers.	2	1	2	1,2
5.	Name the control strategies of choppers.	2	1	3	1,2
6.	Define duty cycle.	2	1	3	1,2
7.	Compare voltage source inverter and current source inverter.	2	2	4	1,2
8.	Give any two advantages of sinusoidal pulse width modulation.	2	1	4	1,2
9.	Draw the circuit diagram of single-phase half wave-controlled ac voltage controller.	2	1	5	1,2
10.	Which commutation is employed for step-up cycloconverter?	2	1	5	1,2

Part-B (5 × 8 = 40 Marks)

		M	L	CO	PO
11. a)	With a neat circuit and relevant waveforms explain the operation of RC half wave triggering circuit for Thyristor.	4	2	1	1,2
b)	For the circuit shown below, Vs = 200 V, L = 100 μH and C = 250 μF. For a constant load current of 60 A, calculate (a) the peak value of currents through capacitance, main and auxiliary thyristors (b) circuit turn-off times for main and auxiliary thyristors.	4	4	1	1,2,3

		M	L	CO	PO
12. a)	Explain the operation of single-phase full-wave-controlled bridge rectifier with R-L load. Draw the waveforms of source voltage, gate current, load voltage and load current for a given firing angle α. Hence obtain expression for average load voltage under continuous conduction mode.	4	2	2	1,2,3

			M	L	CO	PO
b)	A 3-phase fully controlled bridge converter is fed from 400 V, 50 Hz. AC source and is operating at a firing angle of 60^0. The load current is assumed constant at 10 A due to high load inductance. Calculate the average output voltage, the input displacement factor (IDF) and the input power factor (IPF) of the converter.		4	4	2	1,2
13. a)	With a neat circuit diagram, 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 the expression for mean output voltage.		4	3	3	1,2,3
b)	The boost converter has an input voltage of 25V, the required output voltage is 75V, the average load current is 0.6A and the switching frequency is 30kHz. If the filter inductance and the filter capacitance values are 350μH and 500μF respectively, determine (a) the duty cycle (b) ripple current of the inductor (c) the ripple voltage of filter capacitor (d) critical values of L and C.		4	4	3	1,2,3
14. a)	Explain the operation of a three-phase bridge inverter with 120^0 conduction mode with neat circuit diagram and operation table (showing conduction devices in six intervals in one cycle). Also sketch the waveforms of six gate signals, phase to neutral voltages of three phases and three line voltages over period of about two cycles (720^0).		4	2	4	1,2
b)	In single pulse modulation of PWM inverters, the pulse width is 120^0. For an input voltage of 220 V dc, Calculate (a) the rms value at the fundamental component of the output voltage. (b) Determine THD of the inverter.		4	4	4	1,2,3
15. a)	Explain the operation of a single-phase full wave ac voltage controller feeding an R-L 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)	A single phase voltage controller has input voltage of 230 V, 50 Hz and a load of R = 15 Ω. For 6 cycles ON and 4 cycles OFF, determine (i) the RMS output voltage (ii) the input power factor (iii) the average thyristor current.		4	4	5	1,2,3
16. a)	Describe the different modes of operation of a thyristor with help of its static V-I characteristics.		4	2	1	1,2
b)	Compare full converter and semi-converter.		4	4	2	1,2,3
17.	Answer any *two* of the following:					
a)	With a neat circuit diagram, explain the operation of Buck-Boost converter. Also sketch the waveforms of supply voltage, gate signal, inductor voltage, inductor current, capacitor voltage and capacitor current. Derive the expression for mean output voltage.		4	3	3	1,2,3
b)	Explain the operation of single phase half bridge voltage source inverter with resistive load with associated waveforms.		4	2	4	1,2
c)	With a neat circuit and relevant waveforms, explain the operation of a single phase step-down cycloconverter to get the output frequency is equal to one third of the input frequency.		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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