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Code No. : 22755

**VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD**

*Accredited by NAAC with A++ Grade*

**M.E. (E.E.E.) II-Semester Main Examinations, September-2022**

**Power Electronics Convertors**

(Power Systems & 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.	Define reverse recovery time of fast-recovery diodes?	2	1	1	1
2.	List four power semiconductor switching devices used in power electronics converter.	2	1	1	1
3.	Draw the circuit diagram of a thyristor based single phase semi converter.	2	1	2	1
4.	List out the industrial application of rectifier.	2	3	2	1
5.	Draw the circuit diagram of a buck-boost chopper.	2	1	3	1
6.	Draw the circuit diagram of a Cuk Converter.	2	1	3	1
7.	Draw the circuit diagram of thyristor based three phase current source inverter	2	1	4	1
8.	Define modulation index for a PWM switched inverter	2	1	4	1
9.	List the applications of cyclo-converter	2	3	5	1
10.	Draw the circuit diagram of 3-phase matrix converter.	2	1	5	1
<b>Part-B (5×8 = 40 Marks)</b>					
11. a)	A single phase half-wave uncontrolled rectifier is connected to RL load. Derive an expression for load current in terms of applied voltage, impedance, angular frequency etc.	4	2	1	2
b)	A three-phase full-wave uncontrolled rectifier connected to a RLE load : L = 1.5 mH, R = 2.5 Ω, and E = 100 V. The line-to-line input voltage is Vab = 400 V, 50 Hz. (a) Determine (i) the average diode current ID(av), (ii) the rms diode current ID(rms), (iii) the rms output current Io(rms), and (iv) the input power factor PF	4	4	1	2
12. a)	A single phase full converter is connected to RLE load. The source voltage is 230 V, 50 Hz. The average load current of 10 A is continuous over the working range. For R = 0.4, L = 2 mH and E = 120 V, compute firing angle.	4	4	2	2
b)	A three-phase full-wave fully-controlled rectifier supply a highly inductive load with R = 10 Ω the supply is a three-phase star-connected with 400 V rms, calculate: (i) The load current when the firing angle α = 45°. (ii) The power drawn from the supply.	4	3	3	2
13. a)	Draw the circuit diagram of an IGBT based boost converter and explain the continuous conduction mode of operation with necessary waveforms and equations.	4	2	3	2

Contd... 2

b)	A DC-DC buck-boost converter with a DC input voltage of 50 V, output voltage of 100 V and switching frequency of 10 kHz, calculate (i) duty cycle (ii) value of inductor if inductor ripple current $\Delta I = 10\text{mA}$ .	4	4	3	2
14. a)	Explain the voltage control methods of single phase inverters with the help of waveforms and equations.	4	2	4	2
b)	Explain briefly the following modulation techniques with relative advantages and disadvantages. a) Multiple Pulse Width Modulation b) Sinusoidal PWM c) Third Harmonics PWM.	4	2	4	2
15. a)	A three phase AC voltage controller feeds a balanced star connected R-L load. The value of resistance is 10 Ohm and inductance is 6.5 mH. The controller is fed from a 3-phase supply of 400 V, 50 Hz. Determine for a firing angle of $30^\circ$ , the values of i) rms load current ii) rms load voltage iii) Power factor.	4	4	5	2
b)	Explain the principle and operation of single-phase cyclo converter with neat diagram and draw the waveforms.	4	2	5	2
16. a)	For a thyristor based 3-phase full converter feeding a highly inductive load, draw (i) Triggering sequences, (ii) Phase voltages, (iii) Output voltage (line-to-line voltages), (iv) Current through thyristor T1 and (v) Input supply current. Derive an expression for average output voltage of the converter.	4	2	1	2
b)	A three-phase, half wave converter is operated from a 3-phase, Y-connected 440 V, 50 Hz supply and the load resistance is $R = 20\ \Omega$ . If it is required to obtain an average output voltage of 50% of the maximum possible output voltage, calculate: i. Firing angle, ii. Rectification efficiency and iii. Input power factor.	4	4	2	2
17.	Answer any <i>two</i> of the following:				
a)	In a step down chopper the DC input voltage is of 100 V. The IGBT switch is having a switching frequency of 2 kHz. Find the duty cycle and average DC output voltage if the turn on period of switch is 0.2 ms.	4	4	3	2
b)	Explain bipolar switching scheme of a 1- phase sinusoidal PWM inverter with neat circuit diagram. Also draw necessary waveforms for under modulation (Amplitude of modulating wave is less than that of carrier wave).	4	2	4	2
c)	What are matrix converters? Give its advantages and disadvantages.	4	2	5	1

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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