Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech. (Full Time) - END SEMESTER EXAMINATIONS, APRIL / MAY 2024

ELECTRICAL AND ELECTRONICS ENGINEERING
Semester VI
EE5602 POWER ELECTRONICS
(Regulation 2019)

Time: 3hrs | Max.Marks: 100

CO 1	To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
CO 2	To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
CO 3	To understand the operation, characteristics and performance parameters of uncontrolled rectifiers.
CO 4	To understand the operation, characteristics and performance parameters of controlled rectifiers.
CO 5	To study the operation of AC voltage controller and various configurations of AC voltage controller.

BL – Bloom's Taxonomy Levels
(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1	Draw the snubber circuit and write its role.	2	1	L1
2	What you mean by resonant converter?	2	1	L1
3	Draw the single phase half bridge converter and its output voltage waveform.	2	2	L1
4	Name the merits of PWM techniques used for the inverter.	2	2	L1
5	Compare mid-point secondary transformer based full wave rectifier and full bridge rectifier.	2	3	L1
6	How the number of pulses in the output voltage of the rectifier influences in the filter design?	2	3	L1
7	Define Displacement factor.	2	4	L2
8	What is shoot through fault in the power electronic circuits?	2	4	L2
9	Mention the limitation of on-off control of AC voltage controller.	2	5	L2
10	Specify the drawback of single phase half wave AC voltage controller.	2	5	L2

PART- B (5 x 13 = 65 Marks)
(Restrict to a maximum of 2 subdivisions)

Q. No	Questions	Marks	CO	BL
11 (a) (i)	With necessary diagram, explain the operation of buck converter.	7	1	L3
(ii)	Explain the following control strategies used for DC – DC converters: (1) Constant frequency techniques (2) Variable frequency techniques	6	1	L3
	OR			
11 (b) (i)	Elucidate the operation of Boost converter with necessary waveforms and mathematical expressions.	7	1	L3

(ii)	Draw and explain the dynamic characteristics of MOSFET.	**6**	1	L3
12 (a) (i)	Explain the working principle of single phase full bridge inverter with RL load. Also derive its RMS output voltage.	**7**	2	L3
(ii)	Write the concept of following modulation techniques: (1) Single pulse width modulation (PWM) (2) Sinusoidal PWM	**6**	2	L3
	OR			
12 (b) (i)	Describe the three phase inverter with 180° mode of operation. Also draw its output line and phase voltage. Assume star connected load.	**7**	2	L3
(ii)	Explain any one harmonic elimination technique suitable for inverter.	**6**	2	L3
13 (a)	Write a technical note on the following: (1) Uncontrolled 2 – pulse rectifier (2) Voltage doubler circuit	**7** **6**	3	L4
	OR			
13 (b) (i)	Explain the operation of three phase 6 – pulse diode bridge rectifier. Also draw its relevant waveforms and mathematical expressions.	**7**	3	L4
(ii)	Write and justify the size of capacitor filter required for uncontrolled 1 – pulse and 2 – pulse converters.	**6**	3	L4
14 (a) (i)	Elucidate the operation of single phase full bridge rectifier with RL load. Also explain its rectifier, inverter operation and variation of output voltage against firing angle.	**7**	3	L4
(ii)	Explain the turn on process of SCR with the help of two transistor analogy.	**6**	3	L4
	OR			
14 (b)	Explain the operation of following converters with the help of its waveforms: (1) Three phase semi converter with RL load and $\alpha = 120°$. (2) Three phase Full converter with RL load and $\alpha = 120°$. Also derive its average output voltage.	**13**	4	L4
15 (a) (i)	Write the working principle of single phase AC voltage controller with RL load. Draw its voltage and current waveforms.	**7**	5	L4
(ii)	Describe the operation of single phase to single phase step-up cyclo-converter with necessary illustrations.	**6**	5	L4
	OR			
15 (b) (i)	Explain the TRIAC triggering concepts with positive and negative gate pulses.	**7**	5	L4
(ii)	Elucidate the working principle of three phase to three phase AC voltage controllers. Draw its output phase and line voltages.	**6**	5	L4

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q. No	Questions	Marks	CO	BL
16.	Develop a single phase Auto-sequential commutated current source inverter (CSI). Also explain its operation with suitable equations and waveforms. Specify the limitations of CSI and VSI.	**15**	5	L5