SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

V SEMESTER

1905503 - POWER ELECTRONICS

Regulation – 2019

Academic Year 2022 – 2023 ODD

Prepared by

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SUBJECT: 1905503 - POWER ELECTRONICS

SEM / YEAR: V / III

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UNIT I - POWER SEMI-CONDUCTOR DEVICES

SYLLABUS: Study of switching devices, SCR, TRIAC, GTO, BJT, MOSFET, IGBT and IGCT- Static characteristics: SCR, MOSFET and IGBT - Triggering and commutation circuit for SCR- Introduction to Driver and snubber circuits.

PART - A

Q.No	Questions	BT Level	Competence	CO
1.	Define the term pinch off voltage of MOSFET.	BTL-1	Remembering	CO1
2.	List the advantages of GTO over SCR.	BTL-1	Remembering	CO1
3.	Examine how Is $\frac{di}{dt}$ and $\frac{dv}{dt}$ protection provided in SCR?	BTL-1	Remembering	CO1
4.	Power BJT is a current controlled device. Why?	BTL-1	Remembering	CO1
5.	Mention the types of power transistors.	BTL-1	Remembering	CO1
6.	Tabulate the various forced commutation techniques used to turn off SCR.	BTL-1	Remembering	CO1
7.	Distinguish between SCR and TRIAC.	BTL-2	Understanding	CO1
8.	Predict the secondary breakdown in BJT	BTL-2	Understanding	CO1
9.	What are the different types of power MOSFET?	BTL-2	Understanding	CO1
10.	Summarize the conditions under which a transistor operates as a switch.	BTL-2	Understanding	CO1
11.	List any two advantages of TRIAC over SCR.	BTL-3	Applying	CO1
12.	Illustrate the need of snubber circuit.	BTL-3	Applying	CO1
13.	Define circuit turn off time of SCR.	BTL-3	Applying	CO1
14.	Compare the merits and demerits of MOSFET.	BTL-4	Analysing	CO1
15.	What is meant by commutation of SCR and list its types.	BTL-4	Analysing	CO1
16.	Mention the merits and demerits of GTO.	BTL-1	Remembering	CO1
17.	Define the term holding current.	BTL-5	Evaluating	CO1
18.	Compare the merits and demerits of IGBT.	BTL-4	Analysing	CO1
19.	Define the term latching current.	BTL-5	Evaluating	CO1
20.	Why are IGBT becoming popular in power electronics-based applications?	BTL-5	Evaluating	CO1
21.	Draw TRIAC characteristics.	BTL-6	Creating	CO1
22.	Why TRIAC is not popular as compared to SCR? Justify	BTL-6	Creating	CO1
23.	Write down the applications of IGBT?	BTL-2	Understanding	CO1
24.	IGBT is a voltage-controlled device. Why?	BTL-1	Remembering	CO1

PART - B

1.	Examine the structure and different modes of operation of TRIAC with its characteristics. (13)	BTL-1	Remembering	CO1
2.	With neat sketch explain the turn on and turn off characteristic of SCR. (13)	BTL-1	Remembering	CO1
3.	Explain the working of current commutation technique. (13)	BTL-1	Remembering	CO1

4.	Describe with circuit IGBT static I-V, transfer and turn –on and turn–off characteristics. (13)	BTL-1	Remembering	CO1
5.	Describe the UJT triggering circuit with neat sketch. (13)	BTL-1	Remembering	CO1
6.	(i) Discuss the different modes of operation of thyristor with the help of its static V-I characteristics. (7) (ii) Discuss why TRIAC is rarely operated in first quadrant with –ve gate current and in third quadrant with +ve gate current. (6)	BTL-2 BTL-2	Understanding Understanding	CO1
7.	(i) Snubber circuit for an SCR should primarily consist of capacitor only. But in practice a resistor is used in series with the capacitor, Why-Discuss. (7) (ii) Discuss the turn off characteristics of SCR and explain the mechanism of turn OFF. (6)	BTL-2 BTL-2	Understanding Understanding	CO1
8.	Summarize the various types of commutation circuits for SCR (13)	BTL-2	Understanding	CO1
9.	Write short notes on: a. Snubber circuit for BJT. (7) b. Commutation circuit of SCR. (6)	BTL-2	Understanding	CO1
10.	Compare BJT, MOSFET and IGBT. (13)	BTL-3	Applying	CO1
11.	Examine the basic structure, working and the turn ON and turn OFF processes of IGBT with its equivalent circuit. (13)	BTL-3	Applying	CO1
12.	(i) Draw and explain the steady state and switching characteristics of SCR. (7) (ii) With a neat diagram explain how the snubber circuit protects the MOSFET. (6)	BTL-4 BTL-4	Analysing Analysing	CO1
13.	Explain the steady state and switching characteristics of MOSFET. (13)	BTL-4	Analysing	CO1
14.	Compare and contrast the performance characteristics of SCR and MOSFET. (13)	BTL-3	Applying	CO1
15.	Analyze the various types of power diodes. (13)	BTL-4	Analysing	CO1
16.	Explain the principle of operation and characteristics of GTO. (13)	BTL-5	Evaluating	CO1
17.	Design a suitable snubber circuit for BJT which is used as a switching device in AC to DC conversion circuit. (13)	BTL-6	Creating	CO1
	PART - C			
1.	Explain the switching performance of BJT with relevant waveforms indicating clearly the turn-on, turn-off times and their components. (15)	BTL-4	Analysing	CO1
2.	Design the switching model, equivalent circuit and switching waveforms and times of MOSFET. (15)	BTL-5	Evaluating	CO1
3.	Design a suitable driver circuit for MOSFET which is used as switching device in AC to DC conversion circuit. (15)	BTL-5	Evaluating	CO1
4.	Design the switching model, equivalent circuit and switching waveforms and times of IGBT. (15)	BTL-6	Creating	CO1
5.	Design a suitable driver circuit and snubber circuit for SCR which is used a switching device in AC to DC conversion circuit. (15)	BTL-6	Creating	CO1

UNIT II - PHASE-CONTROLLED CONVERTERS

SYLLABUS: 2-pulse, 3-pulse and 6-pulse converters– performance parameters –Effect of source inductance— Firing Schemes for converter–Dual converters, Applications-light dimmer, Excitation system, Solar PV systems

Q.No	Questions	BT	Competence	COs
1.	Mention some of the applications of controlled rectifier.	BTL-1	Remembering	CO2
2.	What is meant continuous current operation of thyristor converter?	BTL-1	Remembering	CO2
3.	Define overlap angle.	BTL-1	Remembering	CO2
4.	Show the power factor of semi converter is better than full converter.	BTL-1	Remembering	CO2
5.	Examine the effect of source impedance on the performance of converter.	BTL-1	Remembering	CO2
6.	Give any two differences single phase full and semi converter.	BTL-2	Understanding	CO2
7.	Express the displacement factor for two pulse converter.	BTL-2	Understanding	CO2
8.	Predict the circuits turn–off time for single phase full converter.	BTL-2	Understanding	CO2
9.	Illustrate the PIV of a thyristor.	BTL-3	Applying	CO2
10.	Classify the various modes of operation of single phase fully controlled bridge converter.	BTL-4	Analysing	CO2
11.	Distinguish between symmetric and asymmetric semi converter configuration.	BTL-4	Analysing	CO2
12.	Why power factor of semi converter is better than full converter?	BTL-5	Evaluating	CO2
13.	Predict by what power factor the DC output voltage of 6-pulse converter is reduced due to the effect of source inductance.	BTL-2	Understanding	CO2
14.	List the firing Scheme of Controllers.	BTL-1	Remembering	CO2
15.	What is meant by phase control?	BTL-1	Remembering	CO2
16.	List some of the application of converters.	BTL-1	Remembering	CO2
17.	What is dual converter?	BTL-1	Remembering	CO2
18.	Examine is the cause of circulating current in dual converters.	BTL-2	Understanding	CO2
19.	A two-pulse converter is fed with a 230V, 50 Hz supply. The load on the converter is a pure resistance of R=10 Ω. Obtain the average output voltage for a firing angle of α=135°	BTL-6	Creating	CO2
20.	Examine the harmonic factor for converter.	BTL-3	Applying	CO2
21.	Examine the term voltage ripple factor.	BTL-3	Applying	CO2
22.	Explain the inversion mode of converter.	BTL-4	Analysing	CO2
23.	Summarize the roles of freewheeling diode in a Full converter.	BTL-5	Evaluating	CO2
24.	A single phase full converter feeds power to RLE load with R= 6Ω, E=60V.The full load inductance value is very large so as to maintain the load current continuous and ripple free. The ac source voltage is 230V and 50Hz. Find the average value of the output voltage for a firing angle delay of 50°.	BTL-6	Creating	CO2
	PART – B			
1.	Describe the operation of three phase semi converter with R load and also draw the output voltage waveforms for 30° and 90°. (13)	BTL-1	Remembering	CO2

2.	Explain the operation of a single-phase full converter with RLE load using relevant waveforms. Obtain the expressions for its average output voltage and RMS value of output voltage. (13)	BTL-1	Remembering	CO2
3.	Explain the operation of single-phase half-controlled rectifier with inductive load. Also derive an expression for the average output voltage. (13)	BTL-1	Remembering	CO2
4.	Explain the operation of a single-phase full bridge converter with RL load for continuous and discontinuous load currents. (13)	BTL-1	Remembering	CO2
5.	Analyze the effect of source inductance in the operation of single phase fully controlled converter with relevant diagram and analysis. (13)	BTL-4	Analysing	CO2
6.	Discuss the effect of series inductance on the performance of the single-phase full converter indicating clearly the conduction of various thyristors during one cycle. (13)	BTL-2	Understanding	CO2
7.	A 230 V, 50 Hz supply is connected to load resistance of 12Ω through half wave- controlled rectifier. If the firing angle is 60 degrees, Calculate (i) Average output voltage. (4) (ii) RMS output voltage. (3) (iii)Ratio of rectification and (3) (iv)Transformer utilization factor. (3)	BTL-3	Applying	CO2
8.	Explain the operation of a three phase, fully controlled bridge converter with associated waveforms. (13)	BTL-4	Analysing	CO2
9.	Describe the operation of a single phase two pulse bridge converter using 4 SCR'S with relevant waveforms.	BTL-2	Understanding	CO2
10.	Summarize the operation of single phase two pulse midpoint converter with relevant voltage and current waveforms. (13)	BTL-5	Evaluating	CO2
11.	(i) Explain the operating principle of single-phase dual converter. (7) (ii) A single-phase full converter is connected with R-load. The source voltage is 230 V 50 Hz. The average load current is 10A For R=20 Ω find the firing angle. (6)	BTL-1 BTL1	Remembering Remembering	CO2
12.	Explain in detail about applications of converters. (13)	BTL-4	Analysing	CO2
13.	Discuss the operation of dual converter with complete circuit diagram and waveform. (13)	BTL-2	Understanding	CO2
14.	Describe the operation of single-phase dual convertor with aid of relevant waveforms. Obtain the expression of its instantaneous circulating current. (13)	BTL-2	Understanding	CO2
15.	(i) A single-phase bridge converter is utilized to produce regulated DC output voltage. The input voltage is 230 V (a) Calculate the dc output voltage. (3) (b) Calculate the dc output voltage and current if a freewheeling diode is used at the output for the same firing angle. (4) (ii) Examine the single-phase half wave rectifier circuit with RL load and freewheeling diode. (6)	BTL-3	Applying	CO2

16.	(i) A three-phase full converter charges a battery from a three –phase supply of 230 V, 50Hz. The battery is 200 V and its internal resistance is 0.5 Ω. On account of inductance connected in series with the battery, charging current is constant at 20 A. Compute firing angle delay and supply power factor. (13)	BTL-4	Analysing	CO2
17.	A single phase half wave rectifier with an AC voltage of 150V has a pure resistive load of 9 Ω. The firing angle of the thyristor is π/2. Determine the (i) Rectification Efficiency (ii) Form Factor (iii) Transformer derating factor (iv) Peak inverse voltage of the SCR (v) Ripple factor of the SCR. Assume the transformer ratio is 2:1. (13)	BTL-6	Creating	CO2
	PART – C			
1.	The full-wave three-phase controlled rectifier has a three-phase 415V, 50Hz source (240 V Phase), and provides a 100A constant load current. Determine: (i) The average and rms thyristor current. (5) (ii) The rms and fundamental line current. (5) (iii) The fundamental apparent power. (5)	BTL-5	Evaluating	CO2
2.	Explain the working of Semi Converter. Draw and Find out the expression for the output voltage. (15)	BTL-5	Evaluating	CO2
3.	With neat sketch explain the working of Dual Converter, and also find out the expression for its output voltage. (15)	BTL-6	Creating	CO2
4.	Explain the application of converter in Solar PV System. (15)	BTL-6	Creating	CO2
5.	Explain the applications of light dimmer and Excitation system. (15)	BTL-6	Creating	CO2

UNIT III - DC TO DC CONVERTERS

SYLLABUS: Step-down and step-up chopper-control strategy– Introduction to types of choppers-A, B, C, D and E -Switched mode regulators- Buck, Boost, Buck- Boost regulator, Introduction to Resonant Converters, Applications-Battery operated vehicles.

PART – A

Q.No	Questions	BT Level	Competence	COs
1.	Define Duty cycle.	BTL-1	Remembering	CO3
2.	Define DC Chopper.	BTL-1	Remembering	CO3
3.	Write the applications of DC Chopper.	BTL-1	Remembering	CO3
4.	Name any two applications of SMPS.	BTL-1	Remembering	CO3
5.	What are the advantages of dc chopper?	BTL-1	Remembering	CO3
6.	What is constant frequency control of chopper?	BTL-1	Remembering	CO3
7.	What is time control in DC-to-DC converter?	BTL-1	Remembering	CO3
8.	What is meant by 'current limit control' of a chopper?	BTL-1	Remembering	CO3
9.	What is the effect of load inductance on the load current waveform in the case of DC chopper?	BTL-2	Understanding	CO3
10.	Write down the control strategies for chopper circuit.	BTL-2	Understanding	CO3
11.	Show the circuit diagram of a boost converter.	BTL-2	Understanding	CO3
12.	What is resonant converter? States its advantages.	BTL-2	Understanding	CO3
13.	A step up chopper is operated with a duty ratio of 0.6 for a dc input of 100 V. Determine the output voltage for a load resistance R_L of 5 ohm.	BTL-5	Evaluating	CO3
14.	Write down the expression for the average output voltage for step down and step-up chopper.	BTL-2	Understanding	CO3
15.	Classify the switched mode regulators and write its advantages.	BTL-3	Applying	CO3
16.	What are the different types of chopper with respect to commutation process?	BTL-5	Evaluating	CO3
17.	Briefly state the working of four quadrant DC chopper.	BTL-3	Applying	CO3
18.	Explain load commutated chopper.	BTL-4	Analysing	CO3
19.	Differentiate voltage and current commutated choppers.	BTL-4	Analysing	CO3
20.	Why forced commutation is used in DC chopper?	BTL-4	Analysing	CO3
21.	What are the disadvantages of frequency modulation chopper?	BTL-5	Evaluating	CO3
22.	Compare ZVS and ZCS.	BTL-5	Evaluating	CO3
23.	Design the circuit of a step-down chopper.	BTL-6	Creating	CO3
24.	Generalize the purpose of commutation circuit in a chopper.	BTL-6	Creating	CO3

PART – B

1.	With neat diagrams, describe the construction and working of step-down and step-up chopper and its steady state analysis. Also give its application. (13)	BTL-1	Remembering	CO3
2.	Explain the control strategies of chopper. (13)	BTL-1	Remembering	CO3
3.	Explain the working of buck converter with neat waveform and also derive the expression for peak-to-peak voltage across the capacitor. (13)	BTL-1	Remembering	CO3
4.	With a neat power circuit diagram, explain the operation of boost converter. Draw the load voltage and load current waveforms and derive the expression for the output voltage. (13)	BTL-1	Remembering	CO3
5.	Discuss L Type and M type zero current switching resonant converters. (13)	BTL-2	Understanding	CO3

6.	Draw the power circuit diagram of a buck-boost regulator and explain its operation with equivalent circuit for different modes and its waveforms. (13)	BTL-2	Understanding	CO3
7.	What is resonant switching? Explain its concept with relevant circuit diagram. (13)	BTL-2	Understanding	CO3
8.	Explain the operation of Class A, B & C chopper. (13)	BTL-4	Analysing	CO3
9.	Explain the operation of Class C and Class D types of two quadrant chopper. (13)	BTL-4	Analysing	CO3
10.	A step down DC Chopper has input voltage of a 230V with 10 Ohms load resistor connected, voltage drop across chopper is 2V when it is ON. For duty cycle of 0.5. Calculate (i) Average and RMS value of output voltage. (7) (ii) Power delivered to load. (6)	BTL-3	Applying	CO3
11.	(i) A type –'A' chopper has supply voltage Vs of 200V and duty cycle of 0.4 and 0.6 for these duty cycles, calculate (i) Average and rms values of output voltage. (5) (ii) Output power for R load of 10 Ohm. (4) (iii) Ripple factor. (4)	BTL-3	Applying	CO3
12.	Explain the various modes of operation of Boost DC-DC converter with necessary waveforms.	BTL-4	Analysing	CO3
13.	Classify the basic topologies of switching regulators and explain the operation of buck regulators with continuous load current using suitable waveforms	BTL-4	Analysing	CO3
14.	Draw the diagram of voltage commutated chopper and explain its operation with different mode diagrams and relevant waveforms. (13)	BTL-4	Analysing	CO3
15.	Explain in detail the different modes of operation of load commutated and current commutated choppers with relevant circuit diagram. (13)	BTL-4	Analysing	CO3
16.	Explain the different classes of chopper with neat sketch. (13)	BTL-4	Analysing	CO3
17.	Draw and explain the block schematic of SMPS and mention its advantages over linear power supply. (13)	BTL-5	Evaluating	CO3
	PART – C			
1.	For a current commutated chopper, peak commutating current is twice the maximum possible load current. The source voltage is 230V dc and main SCR turn-off time is 30µsec.For a maximum load current of 200A,Evaluate (i) The value of the commutating inductor and capacitor.(5) (ii) Maximum capacitor voltage. (5) (iii) The peak commutating current. (5)	BTL-5	Evaluating	CO3
2.	Explain with neat circuit and operation of Class E chopper. (15)	BTL-4	Analysing	CO3
3.	A load commutated chopper, fed from a 230V dc source has a constant load current of 50A.For a duty cycle of 0.4 and a chopping frequency of 2kHz, Evaluate the (i) The value of commutating capacitance. (4) (ii) Average output voltage. (4) (iii) Circuit turn-off time for one SCR pair. (4) (iv) Total commutation interval. (3)	BTL-5	Evaluating	CO3

4.	For Type A step down chopper of dc source voltage=230V, load resistance = 10 ohm. Take a voltage drop of 2V across chopper when it is ON. For a duty cycle of 0.4, calculate (i) average and rms values of output voltage and (ii) chopper efficiency. (15)	BTL-6	Creating	CO3
5.	Explain the application of DC-to-DC Converter in EV (15)	BTL-6	Creating	CO3

UNIT IV - INVERTERS

SYLLABUS: Single phase and three phase voltage source inverters (both120^0 mode and 180^0 mode)– Voltage& harmonic control--PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM – Introduction to space vector modulation –Current source inverter, Applications-Induction heating, UPS.

PART – A

Q.No	Questions	BT Level	Competence	COs
1.	List the various advantages of using PWM control.	BTL-1	Remembering	CO4
2.	What is the advantage of 120 ° mode of inverter operation	BTL-1	Remembering	CO4
3.	What is the main classification of inverter?	BTL-1	Remembering	CO4
4.	What are the disadvantages of PWM control?	BTL-1	Remembering	CO4
5.	Tell why diodes should be connected in antiparallel.	BTL-1	Remembering	CO4
6.	What is harmonic elimination by PWM?	BTL-1	Remembering	CO4
7.	What is meant by voltage source inverter?	BTL-1	Remembering	CO4
8.	Express the applications of a CSI.	BTL-2	Understanding	CO4
9.	Discuss PWM control and types of PW techniques.	BTL-2	Understanding	CO4
10.	Draw the circuit diagram of single-phase current source inverter?	BTL-1	Remembering	CO4
11.	How is the inverter circuit classified based on commutation circuitry?	BTL-2	Understanding	CO4
12.	What is a current source inverter?	BTL-2	Understanding	CO4
13.	What are the merits and demerits of CSI?	BTL-2	Understanding	CO4
14.	What is the function of feedback diodes in bridge inverter?	BTL-3	Applying	CO4
15.	Show the methods of reduction of harmonic content.	BTL-3	Applying	CO4
16.	What are the different types of PWM methods for voltage control within inverter?	BTL-3	Applying	CO4
17.	What are the main differences between voltage-source and current source inverters?	BTL-3	Applying	CO4
18.	Compare SPWM and SVM	BTL-4	Analysing	CO4
19.	Differentiate CSI and VSI.	BTL-4	Analysing	CO4
20.	List the application of Inverters	BTL-4	Analysing	CO4
21.	What is meant by space vector modulation	BTL-5	Evaluating	CO4
22.	Evaluate the disadvantages of the harmonics present in the inverter system?	BTL-5	Evaluating	CO4
23.	Why thyristors are not preferred for Inverter?	BTL-6	Creating	CO4
24.	State the necessity of return current diodes in inverter.	BTL-6	Creating	CO4
	PART – B			
1.	Describe the operation of 3 phase bridge inverter for 120-degree mode of operation with aid of relevant phase and line voltage waveforms. (13)	BTL-1	Remembering	CO4
2.	Describe the principle of operation of 3 phase voltage source inverter with 180˚conduction mode with necessary waveforms and circuits. Also obtain the expression for line-to-line voltage. (13)	BTL-1	Remembering	CO4
3.	State the different methods of voltage control of inverters. Also describe about PWM control. (13)	BTL-1	Remembering	CO4
4.	Describe in detail, the various types of PWM methods available for voltage control employed in an inverter. (13)	BTL-1	Remembering	CO4
5.	Explain the SPWM and modified SPWM techniques for inverter switching. (13)	BTL-2	Understanding	CO4

6.	Describe the operation of 3 phase bridge inverter for 180-degree mode of operation with aid of relevant phase and line voltage waveforms. (13)	BTL-2	Understanding	CO4
7.	Explain the Principle of operation of 3-phase auto sequentially commutated CSI with power circuit. Draw the equivalent circuits and relevant waveforms.	BTL-2	Understanding	CO4
8.	Examine the operation of single-phase capacitor commutated CSI with R load. (13)	BTL-3	Applying	CO4
9.	What is PWM? List the various PWM techniques and explain any two of them. (13)	BTL-4	Analysing	CO4
10.	Demonstrate the working of a single-phase full bridge inverter supplying R, RL loads with relevant circuit and waveforms. (13)	BTL-3	Applying	CO4
11.	(i) Explain Multiple PWM. (7) (ii) Explain Sinusoidal PWM. (6)	BTL-4	Analysing	CO4
12.	Explain the different methods of voltage control adopted in an inverter with suitable waveforms. (13)	BTL-4	Analysing	CO4
13.	With a neat circuit and relevant waveforms discuss the operation of an ideal single-phase CSI. (13)	BTL-2	Understanding	CO4
14.	With neat diagram explain the need for space vector modulations employed in inverters also explain the advantage SPVWM over other technique employed in inverters. (13)	BTL-4	Analysing	CO4
15.	Explain in detail the different types of harmonic control inverters. (13)	BTL-5	Evaluating	CO4
16.	Design a circuit diagram and explain the operation of modified mcmurray half bridge Inverter with different mode of operation. (13)	BTL-6	Creating	CO4
17.	Explain the Application of inverter in UPS. (13)	BTL-4	Analysing	CO4
	PART C			
1.	Design and develop the gating signal using a modified pulse width modulation for an inverter. (15)	BTL-5	Evaluating	CO4
2.	Explain the Application of inverter in Induction heating. (15)	BTL-5	Evaluating	CO4
3.	Explain the Harmonic reduction by transformer corner lines and stepped wave inverters. (15)	BTL-5	Evaluating	CO4
4.	Design a suitable gate scheme for proper functioning of three phase voltage source inverter in 120^{o} operating and obtain phase and line voltage waveforms. (15)	BTL-6	Creating	CO4
5.	Design a suitable gate scheme for proper functioning of three phase voltage source inverter in 180^{o} operating and obtain phase and line voltage waveforms. (15)	BTL-6	Creating	CO4

UNIT V - AC TO AC CONVERTERS

SYLLABUS: Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo converters – Introduction to Matrix converters, Applications –welding, SMPS -HVDC and FACTS Systems

PART – A

Q.No	Questions	BT Level	Competence	C
1.	What does ac voltage controller mean?	BTL-1	Remembering	CO5
2.	What is meant by bidirectional or half-wave ac voltage controller?	BTL-1	Remembering	CO5
3.	Write the principle of operation of cyclo - converter.	BTL-1	Remembering	CO5
4.	List the merits and demerits of AC voltage controller.	BTL-1	Remembering	CO5
5.	Why half wave AC voltage regulator not used.	BTL-1	Remembering	CO5
6.	What is a matrix converter?	BTL-1	Remembering	CO5
7.	What is the principle of ON-OFF control of AC controller?	BTL-1	Remembering	CO5
8.	What is meant by negative group in cyclo – converter.	BTL-1	Remembering	CO5
9.	Give the expression for RMS and average output voltage of single phase half wave ac voltage controller.	BTL-2	Understanding	CO5
10.	Explain the term sequence control of ac voltage controller.	BTL-2	Understanding	CO5
11.	Give the advantage of sequence control of ac voltage regulators.	BTL-2	Understanding	CO5
12.	List the applications of AC voltage controller.	BTL-2	Understanding	CO5
13.	Examine the types of cyclo - converters and explain.	BTL-3	Applying	CO5
14.	What are the applications of cyclo-converter?	BTL-3	Applying	CO5
15.	Enumerate some of the industrial applications of a cyclo - converter.	BTL-3	Applying	CO5
16.	What type of gating signal is used in single phase ac voltage controller with RL load?	BTL-3	Applying	CO5
17.	Explain the application of SMPS.	BTL-4	Analysing	CO5
18.	Differentiate phase control and sequence control of voltage controller.	BTL-5	Evaluating	CO5
19.	Explain the necessity of FACTS Devices in the power system and write its classification.	BTL-4	Analysing	CO5
20.	What is meant by SMPS? List the types of SMPS.	BTL-4	Analysing	CO5
21.	Compare integral cycle control and phase control in AC voltage controller.	BTL-5	Evaluating	CO5
22.	Generalize a positive converter group in cyclo - converter.	BTL-6	Creating	CO5
23.	What is Matrix converter?	BTL-2	Understanding	CO5
24.	Mention the advantages of matrix converter over conventional converter.	BTL-6	Creating	CO5
	PART – B			
1.	Draw and describe the circuit diagram of single-phase AC voltage controller with RL load. Explain the circuit operation with necessary waveforms. (13)	BTL-1	Remembering	CO5
2.	Describe the operation of two stage sequence control of Ac voltage controller. (13)	BTL-1	Remembering	CO5
3.	Explain the operation of Step up & Step down cycloconverter with power circuit and waveforms. (13)	BTL-4	Analysing	CO5

4.	Decribe the operating principle of single phase to single phase cyclo - converter with continuous and discontinuous load current with circuit and waveform. (13)	BTL-1	Remembering	CO5
5.	Explain the operation of multistage control of AC voltage controllers with neat diagram. (13)	BTL-4	Analysing	CO5
6.	Explain the operation of 3ϕ to 1ϕ cycloconverter with power circuit and waveforms. (13)	BTL-4	Analysing	CO5
7.	Write a short note on the following (i) Integral cycle control. (7) (ii) Step-up cyclo – converter. (6)	BTL-2	Understanding	CO5
8.	Discuss the operation of three phase to three phase cyclo - converter with neat diagram and waveforms. (13)	BTL-2	Understanding	CO5
9.	(i) What is the importance of power factor control in a converter? Explain it in details. (7) (ii) Write a short note on Matrix converter. (6)	BTL-2	Understanding	CO5
10.	A single- p h a s e full wave AC voltage controller has an input voltage of 230V 50Hz and it is feeding a resistive load of 10 Ohms. If the firing angle of thyristor is 110 degrees. Calculate the output RMS voltage, input power factor and average current of thyristor. (13)	BTL-3	Applying	CO5
11.	A single-phase voltage controller has input voltage of 230V 50Hz and a load of R=15 Ohm. For 6 cycles ON and 4 cycles OFF. Calculate (i) RMS output voltage. (5) (ii) Input power factor. (4) (iii) Average and rms thyristor currents. (4)	BTL-3	Applying	CO5
12.	A resistive load of 5 Ohm is fed through a single phase full wave AC voltage controller from 230V 50 Hz source. If the firing angle of thyristor is 120 degree. Calculate the (i) Output RMS voltage. (5) (ii) Input power factor. (4) (iii) Average current of thyristor. (4)	BTL-3	Applying	CO5
13.	(i) Explain about the construction and working principles of HVDC Systems and also explain about its types. (7) (ii)Explain about the working of Welding and its effects (6)	BTL-4	Analysing	CO5
14.	With the aid of circuit diagram and waveform explain the operation of power factor control in Ac voltage regulator. (13)	BTL-4	Analysing	CO5
15.	Explain with circuit diagram and waveform the principle of operation of three phase AC voltage controller with neat diagram. (13)	BTL-4	Analysing	CO5
16.	Explain the working principle of SMPS and discuss about its industrial applications (13)	BTL-5	Evaluating	CO5
17.	Design a converter circuit for FACTS Devices and explain the operation with a neat diagram. (13)	BTL-6	Creating	CO5
	PART - C			
1.	Describe the operation of single-phase ac voltage controller with the help of voltage and current waveform. Also derive the expression for average value of the output voltage. (15)	BTL-5	Evaluating	CO5

2.	A single phase full wave ac voltage controller has a resistive load of 5 Ohm and an input voltage 230 V, 50Hz. The firing angles of thyristors T1 and T2 is 120 degree. Evaluate (i) The rms value of load voltage. (3) (ii) Input power factor. (3) (iii) Average value of current of thyristor. (4) (iv) RMS current of thyristor. (3) (v) Load power. (3)	BTL-5	Evaluating	CO5
3.	A 1 Ø full wave ac voltage controller feeds a load of R=20Ω with an input voltage of 230V, 50 HZ. firing angle for both the thyristor is 45 º. Evaluate, (i) RMS value of output Voltage. (3) (ii) The load power and input power factor. (3) (iii) Average and rms current of Thyristors. (2) (iv) Also calculate above parameters when both thyristor firing angle is 30 degree. (7)	BTL-5	Evaluating	CO5
4.	Design a single phase full wave ac voltage controller with resistive load and obtain the expression for rms output voltage and load current. (15)	BTL-6	Creating	CO5
5.	Design a single phase to single phase step down cyclo converter with centre –tapped transformer configuration and also explain the operation with output current and	BTL-6	Creating	CO5

Course Outcomes:

Cos	Course Outcome
CO1	Ability to acquire the knowledge of different types of power semiconductor devices and their switching.
CO2	Ability to acquire the knowledge on operation, characteristics and performance parameters of controlled rectifiers.
CO3	Ability to acquire the knowledge on operation, switching techniques and basics topologies of DC-DC switching regulators.
CO4	Ability to acquire the knowledge on different modulation techniques of pulse width modulated inverters and harmonic reduction methods.
CO5	Ability to acquire the knowledge on operation of AC voltage controller and various configurations.