SRM

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

SUBJECT: EE8552 - POWER ELECTRONICS

SEM / YEAR: V / III

Academic Year : 2019 – 20 ODD

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**	**COs**
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.	Name the limitation of high frequency operation of a power Electronic device.	BTL-1	Remembering	CO1
5.	Mention the advantages of 'RC' triggering over 'R' triggering.	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.	Discuss reverse recovery time in diodes.	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.	Classify the types of diodes.	BTL-3	Applying	CO1
14.	Compare the merits and demerits of IGBT and 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 and latching current.	BTL-5	Evaluating	CO1
18.	Why are IGBT becoming popular in PE based applications?	BTL-5	Evaluating	CO1
19.	Draw TRIAC characteristics.	BTL-6	Creating	CO1
20.	Why TRIAC is not popular as compared to SCR? Justify	BTL-6	Creating	CO1
PART - B				
1.	Examine the structure and different modes of operation with the characteristics of TRIAC. (13)	BTL-1	Remembering	CO1
2.	Explain the working of current commutation technique . (13)	BTL-1	Remembering	CO1
3.	Describe with circuit IGBT static I-V, transfer and turn –on and turn–off characteristics. (13)	BTL-1	Remembering	CO1

4.	Describe the UJT triggering circuit with neat sketch. (13)	BTL-1	Remembering	CO1
5.	(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 I quadrant with –ve gate current and in III quadrant with +ve gate current. (6)	BTL-2 BTL-2	Understanding Understanding	CO1
6.	(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
7.	Summarize the various types of commutation circuits for SCR (13)	BTL-2	Understanding	CO1
8.	(i) Explain the steady state and switching characteristics of MOSFET with aid of diagrams. (7) (ii)Demonstrate the working of a complementary commutation. (6)	BTL-3 BTL-3	Applying Applying	CO1
9.	Examine the basic structure of IGBT and Explain its working .Give its equivalent circuit and explain the turn ON and turn OFF processes. (13)	BTL-3	Applying	CO1
10.	(i) Explain and draw 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
11.	(i) Analyze the constructional details of an SCR. Sketch its schematic diagram and explain its operation. (7) (ii) Explain turn-ON and turn-OFF characteristics of SCR. (6)	BTL-4 BTL-4	Analysing Analysing	CO1
12.	(i) Analyze the various types of power diodes. (7) (ii) Explain and draw steady state and switching characteristics of SCR. (6)	BTL-4 BTL-4	Analysing Analysing	CO1
13.	Explain the principle of operation and characteristics of GTO (13)	BTL-5	Evaluating	CO1
14.	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.	Design the switching model, equivalent circuit and switching waveforms and times of MOSFET. (15)	BTL-5	Evaluating	CO1
2.	Design a suitable driver circuit for MOSFET which is used a switching device in AC to DC conversion circuit. (15)	BTL-5	Evaluating	CO1
3.	Design the switching model, equivalent circuit and switching waveforms and times of IGBT. (15)	BTL-6	Creating	CO1
4.	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.	Define overlap angle.	BTL-1	Remembering	CO2
2.	Examine power factor of semi converter is better than full converter.	BTL-1	Remembering	CO2
3.	Examine the effect of source impedance on the performance of converter.	BTL-1	Remembering	CO2
4.	Express the displacement factor for two pulse converter.	BTL-2	Understanding	CO2
5.	Predict the circuits turn –off time for single phase full converter.	BTL-2	Understanding	CO2
6.	Illustrate the PIV of a thyristor.	BTL-3	Applying	CO2
7.	Classify the various modes of operation of single phase fully controlled bridge converter.	BTL-4	Analysing	CO2
8.	Distinguish between symmetric and asymmetric semiconductor configuration.	BTL-4	Analysing	CO2
9.	Why power factor of semi converter is better than full converter?	BTL-5	Evaluating	CO2
10.	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
11.	List the firing Scheme of Controllers.	BTL-1	Remembering	CO2
12.	What is meant by phase control?	BTL-1	Remembering	CO2
13.	List the some of the application of converters.	BTL-1	Remembering	CO2
14.	Examine is the cause of circulating current in dual converters.	BTL-2	Understanding	CO2
15.	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
16.	Examine the harmonic factor for converter.	BTL-3	Applying	CO2
17.	Examine the term voltage ripple factor.	BTL-3	Applying	CO2
18.	Explain the inversion mode of converter.	BTL-4	Analysing	CO2
19.	Summarize the roles of freewheeling diode in a Full converter.	BTL-5	Evaluating	CO2

20.	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 230 V 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 semiconverter 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.	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
4.	(i) 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
5.	A 230 V ,50 Hz supply is connected to load resistance of 12Ω through half wave controlled rectifier .If the firing angle is 60m degree ,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
6.	Explain the operation of a three phase ,fully controlled bridge converter with associated waveforms. (13)	BTL-4	Analysing	CO2
7.	Summarize the operation of single phase two pulse midpoint converter with relevant voltage and current waveforms. (13)	BTL-5	Evaluating	CO2
8.	(i) Label 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
9.	Explain in detail about applications of converters. (13)	BTL-4	Analysing	CO2
10.	Discuss the operation of dual converter with complete circuit diagram and waveform. (13)	BTL-2	Understanding	CO2
11.	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

12.	(i) A single phase bridge converter is utilized to produce regulated DC output voltage. The input voltage is 230 V and the load current is 8A for a firing angle of 30 degree. (a) Calculate the dc output voltage (b) Calculate the dc output voltage and current if a freewheeling diode is used at the output for the same firing angle. (7) (ii) Examine the single phase half wave rectifier circuit with RL load and freewheeling diode. (6)	BTL-3 BTL-3	Applying Applying	CO2
13.	(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. (7) (ii) Explain briefly the working of dual converter with a neat circuit diagram. (6)	BTL-4 BTL-4	Analysing Analysing	CO2
14.	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. (ii) The rms and fundamental line current (iii) The fundamental apparent power. (15)	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.	Explain the working of Dual Converter. Draw and Find out the expression for the output voltage. (15)	BTL-6	Creating	CO2
4.	Explain the application of converter in Solar PV 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 and write down the application of DC chopper.	BTL-1	Remembering	CO3
3.	Name any two application of SMPS.	BTL-1	Remembering	CO3
4.	What is constant frequency control of chopper?	BTL-1	Remembering	CO3
5.	What is time control in DC to DC converter?	BTL-1	Remembering	CO3
6.	What is meant by 'current limit control ' of a chopper?	BTL-1	Remembering	CO3
7.	What is the effect of load inductance on the load current waveform in the case of DC chopper?	BTL-2	Understanding	CO3
8.	Write down the control strategies for chopper circuit.	BTL-2	Understanding	CO3
9.	Show the circuit diagram of boost converter.	BTL-2	Understanding	CO3
10	What is a resonant converter?states its advantages.	BTL-2	Understanding	CO3
11	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 of RL-5 ohm.	BTL-5	Evaluating	CO3
12	Classify the advantages of switched mode regulators	BTL-3	Applying	CO3
13	Briefly state the working of four quadrant DC chopper	BTL-3	Applying	CO3
14	Explain load commutated chopper.	BTL-4	Analysing	CO3
15	Differentiate voltage and current commutated chopper.	BTL-4	Analysing	CO3
16	Why forced commutation is used in DC chopper?	BTL-4	Analysing	CO3
17	What is the disadvantages of frequency modulation chopper?	BTL-5	Evaluating	CO3
18	Compare ZVS and ZCS.	BTL-5	Evaluating	CO3
19	Design the circuit of a step down chopper	BTL-6	Creating	CO3
20	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 steady state analysis..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 of 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 converter. (13)	BTL-2	Understanding	CO3
6.	Draw the power circuit diagram of a buck-boost regulator and explain its operation with equivalen circuit for different modes and waveforms. (13)	BTL-2	Understanding	CO3
7.	What is resonant switching? Explain its concept with relevant circuit diagram. (13)	BTL-2	Understanding	CO3

8.	A step down DC Chopper has input voltage of a 230V with 10Ohms load resistor connected, voltage drop across chopper is 2 V 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
9.	(i)A type –'A' chopper has supply voltage Vs and duty cycle of 0.4 and 0.6 for these duty cycles, calculate (i)average and rms values of output voltage (3) (ii)output power for R load of 10 Ohm (2) (iii)ripple factor (2) (ii)Explain the operation of step up chopper and derive an expression for its output voltage. (6)	BTL-3 BTL-3	Applying Applying	CO3
10	Draw the diagram of voltage commutated chopper and explain its operation with different mode diagrams and relevant waveforms. (13)	BTL-4	Analysing	CO3
11	Explain in detail the different modes of operation of load and current commutated chopper with relevant circuit diagram. (13)	BTL-4	Analysing	CO3
12	Explain the different classes of chopper with neat sketch. (13)	BTL-4	Analysing	CO3
13	Draw and explain the block schematic of SMPS and mention its advantages over linear power supply. (13)	BTL-5	Evaluating	CO3
14	A battery operated electric car is controlled by a voltage commutated chopper. The battery voltage is 100V, starting current is 100A,thyristor turnoff time is 20µsec,chopper frequency is 400Hz. Design the value of commutating capacitor C and commutating inductor L. (13)	BTL-6	Creating	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 a)The value of the commutating inductor and capacitor. (5) b)Maximum capacitor voltage (5) c)The peak commutating current. (5)	BTL-5	Evaluating	CO3
2.	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 a)the value of commutating capacitance (4) b)average output voltage (4) c)circuit turn-off time for one SCR pair (4) d)total commutation interval (3)	BTL-5	Evaluating	CO3
3.	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
4.	Explain the application of DC to DC Converter. (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 of inverters	BTL-1	Remembering	CO4
2.	What is the advantage of 120 ° mode of inverter operation over	BTL-1	Remembering	CO4
3.	Define space vector modulation.	BTL-1	Remembering	CO4
4.	Tell why diodes should be connected in antiparallel inverter	BTL-1	Remembering	CO4
5.	What is harmonic elimination by PWM?	BTL-1	Remembering	CO4
6.	What is meant by voltage source inverter?	BTL-1	Remembering	CO4
7.	Express the applications of a CSI.	BTL-2	Understanding	CO4
8.	Discuss PWM control and types of PW techniques.	BTL-2	Understanding	CO4
9	What is a current source inverter?	BTL-2	Understanding	CO4
10	What are the advantages of PWM control in inverter.	BTL-2	Understanding	CO4
11	What is the function of feedback diodes in bridge inverter.	BTL-3	Applying	CO4
12	Show the methods of reduction of harmonic content.	BTL-3	Applying	CO4
13	What are the main differences between voltage-source and current source inverters?	BTL-3	Applying	CO4
14	Compare SPWM and SVM	BTL-4	Analysing	CO4
15	Differentiate CSI and VSI.	BTL-4	Analysing	CO4
16	List the application of Inverters	BTL-4	Analysing	CO4
17	What is meant by space vector modulation	BTL-5	Evaluating	CO4
18	Evaluate the disadvantages of the harmonics present in the inverter system?	BTL-5	Evaluating	CO4
19	Why thyristors are not preferred for Inverter?	BTL-6	Creating	CO4
20	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 inverters. Describe about PWM control in inverter. (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.	Write in detail about voltage and harmonic control with neat diagram. (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 (13)	BTL-2	Understanding	CO4

8.	Examine the operation of single phase capacitor commutated CSI with R load. (13)	BTL-3	Applying	CO4
9.	Demonstrate the working of a single phase full bridge inverter supplying R, RL loads with relevant circuit and waveforms. (13)	BTL-3	Applying	CO4
10	(i)Explain Multiple PWM. (7) (ii) Explain Sinusoidal PWM. (6)	BTL-4	Analysing	CO4
11	Explain the different methods of voltage control adopted in an inverter with suitable waveforms. (13)	BTL-4	Analysing	CO4
12	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
13	Explain in detail the different types of harmonic control of inverters. (13)	BTL-5	Evaluating	CO4
14	Design a circuit diagram and explain the operation of modified mcmurray half bridge Inverter with different mode of operation. (13)	BTL-6	Creating	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 and UPS. (15)	BTL-5	Evaluating	CO4
3	Design a suitable gate scheme for proper functioning of three phase voltage source inverter in 120° operating mode and obtain phase and line voltage waveforms. (15)	BTL-6	Creating	CO4
4	Design a suitable gate scheme for proper functioning of three phase voltage source inverter in 180° operating mode 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 .

PART - A

Q.No	Questions	BT Level	Competence	COs
1.	Write the principle of operation of cycloconverter.	BTL-1	Remembering	CO5
2.	List the merits and demerits of AC voltage controller.	BTL-1	Remembering	CO5
3.	Why half wave AC voltage regulator not used.	BTL-1	Remembering	CO5
4.	What is a matrix converter?	BTL-1	Remembering	CO5
5.	What is the principle of ON-OFFcontrol of AC controller	BTL-1	Remembering	CO5
6.	What is meant by negative group in cycloconverter	BTL-1	Remembering	CO5
7.	Give the expression for RMS and average output voltage of single phase half wave ac voltage controller.	BTL-2	Understanding	CO5
8.	Explain the term sequence control of ac voltage controller.	BTL-2	Understanding	CO5
9.	Give the advantage of sequence control of ac voltage	BTL-2	Understanding	CO5
10	List out the applications of AC voltage controller.	BTL-2	Understanding	CO5
11	Examine the types of cycloconverters and explain.	BTL-3	Applying	CO5
12	Enumerate some of the industrial applications of a	BTL-3	Applying	CO5
13	What type gating signal is used in single phase ac voltage	BTL-3	Applying	CO5
14	Explain the application of AC to AC Converter.	BTL-4	Analysing	CO5
15	Differentiate phase control and sequence control of voltage controller	BTL-4	Analysing	CO5
16	What is the control of firing angle in AC voltage controller	BTL-4	Analysing	CO5
17	Evaluate the application of cycloconverters	BTL-5	Evaluating	CO5
18	Compare integral cycle control and phase control in AC voltage controller.	BTL-5	Evaluating	CO5
19	Generalize a positive converter group in cycloconverter.	BTL-6	Creating	CO5
20	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.	Describe the operating principle of single phase to single phase cycloconverter with continuous and discontinuous load current with circuit and waveform. (13)	BTL-1	Remembering	CO5
4.	Write a short note on the following (i)Integral cycle control (7) (ii)step-up cycloconverter (6)	BTL-2	Understanding	CO5

5.	Discuss the operation of three phase to three phase cycloconverter with neat diagram and waveforms. (13)	BTL-2	Understanding	CO5
6.	(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
7.	A single phase 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 thyrisitor is 110 degree. Calculate the output RMS voltage , input power factor and average current of thyristor. (13)	BTL-3	Applying	CO5
8.	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 pf (4) (iii)Average and rms thyristor currents. (4)	BTL-3	Applying	CO5
9.	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
10	(i)What is meant by Multistage sequence control? Explain it with relevant circuit diagram. (7) (ii)Compare single phase and three phase cycloconverters. (6)	BTL-4	Analysing	CO5
11	With the aid of circuit diagram and waveform explain the operation of power factor control in AC voltage regulator. (13)	BTL-4	Analysing	CO5
12	Explain with circuit diagram and waveform principle of operation of three phase AC voltage controller with neat diagram. (13)	BTL-4	Analysing	CO5
13	Compare the advantages and disadvantages of Cycloconverter and DC link converter. (13)	BTL-5	Evaluating	CO5
14	Design a matrix converter and explain the operation with a neat diagram. (13)	BTL-6	Creating	CO5
	PART - C			
1.	A single phase fullwave 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

2.	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 °.Evaluate 1.rms value of output Voltage 2.Calculate load power and input power factor 3.average and rms current of Thyristors Also calculate above parameters when both thyristor firing angle is 30 degree. (15)	BTL-5	Evaluating	CO5
3.	Design a single phase full wave ac voltage controller with resistive load and obtain the rms output voltage and load current expression . (15)	BTL-6	Creating	CO5
4.	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 voltage waveforms. (15)	BTL-6	Creating	CO5

Course Outcomes:

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