QUESTION BANK

Name of the Department : **Electrical and Electronics Engineering**

Subject Code & Name : **EE8552 & Power Electronics**

Year & Semester : **III & V**

UNIT I POWER SEMI CONDUCTOR DEVICES

PART-A

1.Why IGBT is very popular nowadays?

a. Lower hate requirements
b. Lower switching losses
c. Smaller snubbed circuit requirements

2. What are the different methods to turn on the thyristor?

a. Forward voltage triggering
b. Gate triggering
c. dv/dt triggering
d. Temperature triggering
e. Light triggering

3. What is the difference between power diode and signal diode?
Power diode Signal diode 1.Constructed with n-layer, called drift region between p+ layer and n+ layer.Drift region is not present. 2.The voltage, current and power ratings are higher.Lower3.Power diodes operate at high speeds. Operates at higher switching speed.

4. IGBT is a voltage controlled device. Why?
Because the controlling parameter is gate-emitter voltage.

5. Power MOSFET is a voltage controlled device. Why?
Because the output (drain) current can be controlled by gate-source voltage.

6. Power BJT is a current controlled device. Why?
Because the output (collector) current can be controlled by base current.

7. What are the different types of power MOSFET?

a. N-channel MOSFET
b. P-channel MOSFET

8. How can a thyristor turned off?

A thyristor can be turned off by making the current flowing through it to zero.

9. Define latching current.
The latching current is defined as the minimum value of anode current which it must attain during turn on process to maintain conduction when gate signal is removed.

10. Define holding current.
The holding current is defined as the minimum value of anode current below which it must fall to for turning off the thyristor.

11. What is a snubber circuit?
It consists of a series combination of a resistor and a capacitor in parallel with the thyristors. It is mainly used for dv / dt protection.

12. What losses occur in a thyristor during working conditions?

a. Forward conduction losses
b. Loss due to leakage current during forward and reverse blocking.
c. Switching losses at turn-on and turn-off.
d. Gate triggering loss.

13. Define hard-driving or over-driving.

When gate current is several times higher than the minimum gate current required, a thyristor is said to be hard-fired or over-driven. Hard-firing of a thyristor reduces its turn-on time and enhances its di/dt capability.

14. Define circuit turn off time.
It is defined as the time during which a reverse voltage is applied across the thyristor during its commutation process.

15. Why circuit turn off time should be greater than the thyristor turn-off time?
Circuit turn off time should be greater than the thyristor turn-off time for reliable turn-off, otherwise the device may turn-on at an undesired instant, a process called commutation failure.

16. What is the turn-off time for converter grade SCRs and inverter grade SCRs?
Turn-off time for converter grade SCRs is 50 – 100 ms turn-off time for converter grade SCRs and inverter grade SCRs and for inverter grade SCRs is 3 – 50 ms.

17. What are the advantages of GTO over SCR?

a. Elimination of commutation of commutating components in forced commutation, resulting in reduction in cost, weight and volume.

b. Reduction in acoustic noise and electromagnetic noise due to elimination of commutation chokes.
c. Faster turn-off, permitting high switching frequencies.
d. Improved efficiency of the converters.

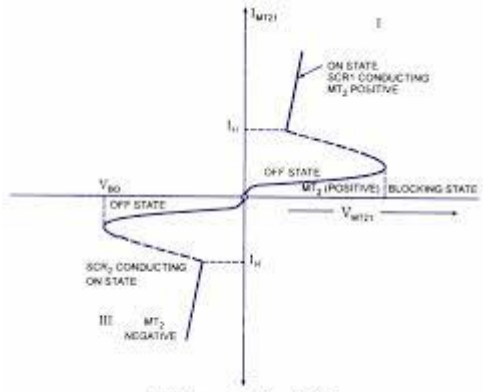
18. What is a natural or line commutation?
Natural or Line commutation is a Class-F SCR commutation technique in which, a thyristor is turned off due to natural current zero and voltage reversal after every half cycle.

19. What is the difference between SCR and triac?
SCR stands for silicon controlled rectifier. TRIAC stands for triode for alternating current. The SCR is unidirectional device. The TRIAC is bidirectional device. TRIACs differ from SCRs in that they allow current flow in both directions, whereas an SCR can only conduct current in a single direction. Most TRIACs can be triggered by applying either a positive or negative voltage to the gate (an SCR requires a positive voltage).

20. Illustrate the need of snubber circuit.
Snubbers are energy-absorbing circuits used to suppress the voltage spikes caused by the circuit's inductance when a switch, electrical or mechanical, opens. The most common snubber circuit is a capacitor and resistor connected in series across the switch (transistor).

21. Compare the merits and demerits of IGBT and MOSFET.
MOSFET is a majority carrier device wherein the conduction is by electrons' flow, whereas IGBT is a current flow comprising both electrons and holes. ... This is the advantage of low on-state voltage drop compared to MOSFET which is a smaller chip size and less expensive device.

22. Draw TRIAC characteristics.



V-I Characteristic of a Triac

23. Why TRIAC is not popular as compared to SCR? Justify

Disadvantages of Triac: It has (dv/dt) rating lower than SCR. Lower ratings are available compared to SCR. We need to be careful about the triggering circuit as it can be triggered in either direction.

24. Summarize the conditions under which a transistor operates as a switch.

NPN Transistor as a Switch

When a sufficient voltage (V_{in} > 0.7 V) is applied between the base and emitter, collector to emitter voltage is approximately equal to 0. Therefore, the transistor acts as a short circuit. ... Thus, when the transistor is switched ON, current will flow from source to ground through the load.

PART-B

1. Examine the structure and different modes of operation with the characteristics of TRIAC.
2. (i) Describe the turn off characteristics of SCR and explain the mechanism of turn OFF.
   (ii) Describe in detail about the current commutation method of turn off SCR.
3. Describe with circuit IGBT static I-V, transfer and turn –on and turn–off characteristics
4. (i)Discuss the different modes of operation of thyristor with the help of its static V-I characteristics.
   (ii)Discuss why TRIAC is rarely operated in I quadrant with –ve gate current and in III quadrant with +ve gate current.
5. (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.
   (ii)Discuss the dynamic characteristics of a thyristor during its turn –ON and turn-OFF process. Discuss briefly the nature of these curves.
6. Summarize the various types of commutation circuits for SCR .
7. (i) Explain the static and switching characteristics of MOSFET.
   (ii) Demonstrate the working of a complementary commutation.
8. (i) Explain and draw steady state and switching characteristics of SCR.
   (ii) With a neat diagram explain how the snubber circuit protects the MOSFET.
9. Explain the principle of operation and characteristics of GTO .
10. Design a suitable snubber circuit for BJT which is used as a switching device in AC to DC conversion circuit.

UNIT II PHASE CONTROLLED CONVERTERS

PART-A

1.What is the function of freewheeling diodes in controlled rectifier?
It serves two process.
a. It prevents the output voltage from becoming negative.

b. The load current is transferred from the main thyristors to the freewheeling diode, thereby allowing all of its thyristors to regain their blocking states.

2. What are the advantages of freewheeling diodes in a controlled in a controlled rectifier?

a. Input power factor is improved.
b. Load current waveform is improved and thus the load performance is better.

3. What is meant by delay angle?
The delay angle is defined as the angle between the zero crossing of the input voltage and the instant the thyristors is fired.

4. What are the advantages of single phase bridge converter over single phase mid-point converter?
a. SCRs are subjected to a peak-inverse voltage of 2Vm in a fully controlled bridge rectifier. Hence for same voltage and current ratings of SCrs, power handled by mid-point configuration is about
b. In mid-point converter, each secondary winding should be able to supply the load power. As such, the transformer rating in mid-point converter is double the load rating.

5. What is commutation angle or overlap angle?
The commutation period when outgoing and incoming thyristors are conducting isknown as overlap period. The angular period, when both devices share conduction is known as the commutation angle or overlap angle.

6. What are the different methods of firing circuits for line commutated converter?

a. UJT firing circuit.
b. The cosine wave crossing pulse timing control.
c. Digital firing schemes.

7. Give an expression for average voltage of single phase semiconverters.

Average output voltage $V_{dc} = (V_m / \pi)(1 + \cos \alpha)$

8. What is meant by input power factor in controlled rectifier?

The input power factor is defined as the ratio of the total mean input power to the total RMS input volt-amperes. PF = (V1 I1 cos φ1) / (Vrms Irms)

where V1 = phase voltage, I1 = fundamentalcomponent of the supply current, ϕ1 = input displacement angle, Irms = supply rms current.

9. What are the advantages of six pulse converter?

a. Commutation is made simple.
b. Distortion on the ac side is reduced due to the reduction in lower order harmonics.
c. Inductance reduced in series is considerably reduced.

10. What is meant by commutation?

It is the process of changing the direction of current flow in a particular path of the circuit. This process is used in thyristors for turning it off.

11.What is meant by phase controlled rectifier?

It converts fixed ac voltage into variable dc voltage.

12. Mention some of the applications of controlled rectifier.

a. Steel rolling mills, printing press, textile mills and paper mills employing dc motor drives.
b. DC traction
c. Electro chemical and electro-metallurgical process
d. Portable hand tool drives
e. Magnet power supplies
f. HVDC transmission system

13. Why is the power factor of semi converter better than that of full converter?

Input power factor is more. The input displacement factor is defined as the cosine of the input displacement angle. For supplying given load, the semi converter receives less reactive power due to freewheeling action when compared with full converter. Therefore, the power factor is better in semi converter.

14. What are the two configuration of single phase 2 pulse controlled rectifier?

• Midpoint converter • Bridge Converter

15. What is meant by inversion mode?

In single phase full converter ∝ > 90 the voltage at the dc terminal is negative. Therefore, power flows from load to source & the converter operates as line commutated inverter. Source voltage Vs is negative & Current is positive. This is known as inversion mode or synchronous mode.

16. What is the difference between half controlled & fully controlled bridge rectifier?

Half Controlled Bridge Rectifier

• Power circuit consists of mixture of diodes & SCRs • It is one quadrant Converter • The Dc output voltage has limited control level. • Input power factor is more. Full Controlled Bridge Rectifier • Power circuit consists of SCRs only • It is 2 quadrant Converter • The Dc output voltage has wider control level. • Input power factor is less.

17. What are the advantages of six-pulse converter?

• Commutation is made simple. • Distortion on the ac side is reduced due to the reduction in lower order harmonics. • Inductance reduced in series is considerably reduced.

18. Define Displacement Factor.

The input displacement factor is defined as the cosine of the input displacement angle.

19. What is dual converter?

It consists of two similar single phase or three phase fully controlled converter which are connected in parallel at the input side and are connected inverse parallel at the output side.

20. Write any four parameters of phase controlled converter?

• Input displacement factor. • Input power factor. • Input harmonic factor. • Current ripple factor

21. Define Total Harmonics distortion.

It is defined as the ratio of the total harmonic content to the fundamental component

22. What are the advantages of single phase bridge converter over single phase midpoint converter?

SCRs are subjected to a peak-inverse voltage of 2Vm in a fully controlled bridge rectifier. Hence for same voltage and current ratings of SCrs, power handled by mid-point configuration is about In mid-point converter, each secondary winding should be able to supply the load power. As such, the transformer rating in mid-point converter is double the load rating.

23. What is turn off time for two pulse converter?

50-100 micro second

24. What is the effect of source impedance on the performance converter?

The input ac power sources supplying an ac to dc power converter have been assumed to be ideal with no source impedance. Although this assumption simplifies the analysis of the converters, in most practical situations, they are not fully justified. Most ac dc converters are supplied from transformers. The series impedance of the transformer cannot always be neglected. Even if no transformer is used, the impedance of the feeder line comes in series with the source. In most cases this impedance is predominantly inductive with negligible resistive component. The presence of source inductance does have significant effect on the performance of the converter. With source inductance present the output voltage of a converter does not remain constant for a given firing angle. Instead it drops gradually with load current. The converter output voltage and input current waveforms also change significantly.

25. What is meant by rectification mode in single phase fully controlled converter?

In single phase full converter $\propto < 90$ the voltage at the dc terminal is positive. Therefore, power flows from source to load & the converter operates as a rectifier. Source voltage is Vs & Current is positive. This is known as rectification mode.

PART-B

1. Describe the operation of three phase semiconverter with R load and also draw the output voltage waveforms for 30° and 90°.
2. Examine the circuit and output wave form working of single phase two pulse fully controlled converter with RL load discontinuous current mode of operation.
3. Analyze the effect of source inductance in the operation of single phase fully controlled converter with relevant diagram and analysis .

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.
(ii) Describe the working of single phase dual converter in two modes.

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.
   (ii) Rms output voltage
   (iii)Ratio of rectification and
   (iv)Transformer utilization factor.
6. Explain the operation of a three phase ,fully controlled bridge converter with associated waveforms.
7. Summarize the operation of single phase two pulse midpoint converter with relevant voltage and current waveforms.
8. Describe with the neat sketch of voltage and current waveform of a circulating current type dual converter.

9. 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.

10. 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.

UNIT III DC TO DC CONVERTERS

PART-A

1.What are the two types of control strategies?

a. Time Ratio Control (TRC)
b. Current Limit Control method (CLC)

2. What is meant by TRC?
In TRC, the value of Ton / T is varied in order to change the average output voltage.

3. What are the two types of TRC?
a. Constant frequency control
b. Variable frequency control

4. What is meant by FM control in a dc chopper?
In frequency modulation control, the chopping frequency f (or the chopping period T) is varied. Here two controls are possible.
a. On-time Ton is kept constant
b. Off period Toff is kept constant.

5**. What is meant by PWM control in dc chopper?**
In this control method, the on time Ton is varied but chopping frequency is kept constant. The width of the pulse is varied and hence this type of control is known as Pulse Width Modulation (PWM).

6. Write down the expression for the average output voltage for step down and step up chopper.
Average output voltage for step down chopper is VO = VS. Average output voltage for step up chopper is VO = VS x [1/ (-1)].

7. What are the different types of chopper with respect to commutation process?
a. Voltage commutated chopper.
b. Current commutated chopper.
c. Load commutated chopper.

8. What is meant by voltage commutation?
In this process, a charged capacitor momentarily reverse biases the conducting thyristor and turn it off.

9. What is meant by current commutation?
In this process, a current pulse is made to flow in the reverse direction through the conducting thyristor and when the net thyristor current becomes zero, it is turned off.

10. What is meant by load commutation?

In this process, the load current flowing through the thyristor either becomes zero or is transferred to another device from the conducting thyristor.

11. What are the advantages of current commutated chopper?

a. The capacitor always remains charged with the correct polarity.
b. Commutation is reliable as load current is less than the peak commutation current ICP.
c. The auxiliary thyristor TA is naturally commutated as its current passes through zero value.

12. What are the advantages of load commutated chopper?

a. Commutating inductor is not required.
b. It is capable of commutating any amount of load current.
c. It can work at high frequencies in the order of kHz.
d. Filtering requirements are minimal.

13. What are the disadvantages of load commutated chopper?

a. For high power applications, efficiency becomes very low because of high switching losses at high operating frequencies.
b. Freewheeling diode is subjected to twice the supply voltage.
c. Peak load voltage is equal to twice the supply voltage.
d. The commutating capacitor has to carry full load current at a frequency of half chopping frequency.
e. One thyristor pair should be turned-on only when the other pair is commutated. This can be realized by sensing the capacitor current that is alternating.

14. What is a resonant converter?

A resonant converter is a type of electric power converter that contains a network of inductors and capacitors called a "resonant tank", tuned to resonate at a specific frequency. They find applications in electronics, in integrated circuits.

15. Write the advantages of resonant converters.

Resonant converters are very promising topologies, due to their inherent features such as high-efciency and very high-switching-frequency operation. Consequently, they have a small footprint and low switching losses due to zero-voltage-switching (ZVS) operation.

16. Classify the advantages of switched mode regulators

High efficiency Low heat generation Boost/buck/negative voltage operation possible.

17. What is the basic principle used in a switching regulator?

If the output voltage is lower than the set voltage, the switch is turned on, supplying power from the input to the output. The magnetic energy stored in the inductor is supplied to the output load, and it returns to the inductor.

18. How does a buck regulator work?
The switching transistor between the input and output of the Buck Converter continually switches on and off at high frequency. To maintain a continuous output, the circuit uses the energy stored in the inductor L, during the on periods of the switching transistor, to continue supplying the load during the off periods.

19. What is the principle of chopper?
DC to DC Chopper Circuit- Operating Principle: A chopper is a high speed ON/OFF semiconductor switch. It connects source to load and disconnects the load from source at a fast speed. By doing this, a chopped load voltage is obtained from a constant DC supply of magnitude Vs.

20. What is meant by step down chopper?
A Step-down chopper is a static device that step downs its DC input voltage. The value of average output DC voltage of this chopper is less than that of its fixed DC input source voltage.

21. What are the advantages in operating choppers at high frequency?
The operation at a high frequency improves motor performance by reducing current ripple and eliminating discontinuous conduction.

22. How is chopper efficiency calculated?
For a duty cycle of 0.4, the power taken by the chopper is 2097 Watts. Find the chopper efficiency. Take the voltage drop across the chopper switch as 2 V. $\eta = Po/Pi = 99.14$ %.

23. Do transistors use AC or DC?

Transistors are DC components. This means that the output will also be a DC voltage. But if we amplify an AC voltage, then we probably want to get an AC voltage at the output as well.

24. What are the types of choppers?
Types of Chopper Circuits
Type A Chopper or First–Quadrant Chopper.
Type B Chopper or Second-Quadrant Chopper.
Type -C chopper or Two-quadrant type-A Chopper.
Type D Chopper or Two-Quadrant Type –B Chopper.
Type –E chopper or the Fourth-Quadrant Chopper.

25.How can we convert AC to DC?
The most common way to convert alternating current into direct current is to use one or more diodes, those handy electronic components that allow current to pass in one direction but not the other. Although a rectifier converts alternating current to direct current, the resulting direct current isn't a steady voltage.

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.
2. Explain the control strategies of chopper.
3. Explain the working of buck converter with neat waveform and also derive the expression of peak to peak voltage across the capacitor.
4. With neat sketch and output waveforms explain the working of a boost converter.
5. Discuss L Type and M type zero current switching resonant converter.
6. Draw the power circuit diagram of a buck-boost regulator and explain its operation with equivalen circuit for different modes and waveforms.
7. 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 (ii)Power delivered to load.
8. Explain in detail the different modes of operation of current commutated chopper with relevant circuit diagram.
9. Draw and explain the block schematic of SMPS and mention its advantages over linear power supply.
10. 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.

UNIT IV INVERTERS

PART-A

1.What is meant by inverter?
A device that converts dc power into ac power at desired output voltage and frequency is called an inverter.

2.What are the applications of an inverter?
a. Adjustable speed drives
b. Induction heating
c. Stand-by aircraft power supplies
d. UPS
e. HVDC transmission

3.What are the main classification of inverter?

a. Voltage Source Inverter
b. Current Source Inverter

4. Why thyristors are not preferred for inverters?
Thyristors require extra commutation circuits for turn off which results in increased complexity of the circuit. For these reasons thyristors are not preferred for inverters.

5. How output frequency is varied in case of a thyristor?
The output frequency is varied by varying the turn off time of the thyristors in the inverter circuit, i.e. the delay angle of the thyristors is varied.

6.Give two advantages of CSI.
a. CSI does not require any feedback diodes.
b. Commutation circuit is simple as it involves only thyristors.

7. What is the main drawback of a single phase half bridge inverter?
It requires a 3-wire dc supply.

8. Why diodes should be connected in antiparallel with the thyristors in inverter circuits?
For RL loads, load current will not be in phase with load voltage and the diodes connected in anti parallel will allow the current to flow when the main thyristors are turned off. These diodes are called feedback diodes.

9.What types of inverters require feedback diodes?
VSI with RL load.

10.What is meant a series inverter?

An inverter in which the commutating elements are connected in series with the load is called a series inverter.

11.What is the condition to be satisfied in the selection of L and C in a series inverter?

$R2 < 4L$

12.What is meant a parallel inverter?
An inverter in which the commutating elements are connected in parallel with the load is called a parallel inverter.

13.What are the applications of a series inverter?
The thyristorised series inverter produces an approximately sinusoidal waveform at a high output frequency, ranging from 200 Hz to 100kHz. It is commonly used for fixed output applications such as
a. Ultrasonic generator.
b. Induction heating.
c. Sonar Transmitter
d. Fluorescent lighting.

14.How is the inverter circuit classified based on commutation circuitry?

a. Line commutated inverters.
b. Load commutated inverters.
c. Self commutated inverters.
d. Forced commutated inverters.

15.What is meant by McMurray inverter?
It is an impulse commutated inverter which relies on LC circuit and an auxiliary thyristor for commutation in the load circuit.

16.What are the applications of a CSI?
a. Induction heating
b. Lagging VAR compensation
c. Speed control of ac motors
d. Synchronous motor starting.

17.What is meant by PWM control?
In this method, a fixed dc input voltage is given to the inverter and a controlled ac output voltage is obtained by adjusting the on and off periods of the inverter components. This is the most popular method of controlling the output voltage and this method is termed as PWM control
.

18. What are the advantages of PWM control?
a. The output voltage can be obtained without any additional components.
b. Lower order harmonics can be eliminated or minimized along with its output voltage control. As the higher order harmonics can be filtered easily, the filtering requirements are minimized.

19. What are the disadvantages of the harmonics present in the inverter system?
a. Harmonic currents will lead to excessive heating in the induction motors. This will reduce the load carrying capacity of the motor.
b. If the control and the regulating circuits are not properly shielded, harmonics from power ride can affect their operation and malfunctioning can result.
c. Harmonic currents cause losses in the ac system and can even some time produce resonance in the system. Under resonant conditions, the instrumentation and metering can be affected.
d. On critical loads, torque pulsation produced by the harmonic current can be useful.

20. What are the methods of reduction of harmonic content?
a. Transformer connections
b. Sinusoidal PWM
c. Multiple commutation in each cycle
d. Stepped wave inverters

21.Compare CSI and VSI.

CSI	VSI
1. Input voltage is maintained Constant	Input current is constant but adjustable
2. The output voltage does not depend	The output current the does not on load depend on the load
3. It requires feedback diodes	It does not requires feedback diodes
4. Commutation circuit is complicated	Commutation circuit is simple

22.What are the disadvantages of PWM control?

SCRs are expensive as they must possess low turn-on and turn-off times.

23. What is space vector modulation technique?

ace vector modulation (SVM) is an algorithm for the control of pulse width **modulation** (**PWM**). It is used for the creation of alternating current (AC) waveforms; most commonly to drive 3 phase AC powered motors at varying speeds from DC using multiple class-D amplifiers.

24. What is meant by induction heating?

Induction heating is the process of heating an electrically conducting object (usually a metal) by electromagnetic induction, through heat generated in the object by eddy currents. ... The rapidly alternating magnetic field penetrates the object, generating electric currents inside the conductor, called eddy currents.

25. What are the types of PWM techniques?

The different PWM techniques are Single pulse width modulation, Multiple pulse width modulation, Phase displacement control, Sinusoidal pulse width modulation, Harmonic Injection modulation, Space Vector pulse width modulation, Hysteresis (Delta) pulse width modulation, Selective Harmonic Elimination and Current.

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.
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.
3. State the different methods of voltage control inverters. Describe about PWM control in inverter.
4. Describe in detail, the various types of PWM methods available for voltage control employed in an inverter.
5. Explain the SPWM and modified SPWM techniques for inverter switching.
6. Demonstrate the working of a single phase full bridge inverter supplying R, RL loads with relevant circuit and waveforms.
7. Write in detail about voltage and harmonic control with neat diagram.
8. Discuss the circuit diagram of current source inverter and explain its operation with relevant waveforms
9. Explain in detail the different types of harmonic control of inverters
10. i) Explain Multiple PWM. (ii) Explain Sinusoidal PWM.

UNIT V AC TO AC CONVERTERS

PART-A

1. What does ac voltage controller mean?
It is device which converts fixed alternating voltage into a variable voltage without change in frequency.

2.What are the applications of ac voltage controllers?
a. Domestic and industrial heating
b. Lighting control
c. Speed control of single phase and three phase ac motors
d. Transformer tap changing

3.What are the advantages of ac voltage controllers?
a. High efficiency
b. Flexibility in control
c. Less maintenance

4. What are the disadvantages of ac voltage controllers?
The main draw back is the introduction of harmonics in the supply current and the load voltage waveforms particularly at low output voltages
.

5.What are the two methods of control in ac voltage controllers?
a. ON-OFF control
b. Phase control

6.What is the difference between ON-OFF control and phase control?
ON-OFF control: In this method, the thyristors are employed as switches to connect the load circuit to the source for a few cycles of the load voltage and disconnect it for another few cycles. Phase control: In this method, thyristor switches connect the load to the ac source for a portion of each half cycle of input voltage.

7. What is the advantage of ON-OFF control?
Due to zero-voltage and zero current switching of thyristors, the harmonics generated by the switching action are reduced.

8.What is the disadvantage of ON-OFF control?
This type of control is applicable in systems that have high mechanical inertia and high thermal time constant.

9. What is the duty cycle in ON-OFF control method?
Duty cycle K = n/ (n + m), where n = no. of ON cycles, m = no. of OFF cycles.

10.What is meant by unidirectional or half-wave ac voltage controller?
Here the power flow is controlled only during the positive half-cycle of the input voltage.

11. What are the disadvantages of unidirectional or half-wave ac voltage controller?
a. Due to the presence of diode on the circuit, the control range is limited and the effective RMS output voltage can be varied between 70.7% and 100%.
b. The input current and output voltage are asymmetrical and contain a dc component. If there is an input transformer, saturation problem will occur
c. It is only used for low power resistive load.

12.What is meant by bidirectional or half-wave ac voltage controller?
Here the power flow is controlled during both cycles of the input voltage.

13.What type of gating signal is used in single phase ac voltage controller with RL load?
High frequency carrier gating signal is used for single phase ac voltage controller with RL load.

14.What are the disadvantages of continuous gating signal?
a. More heating of the SCR gate.
b. Increases the size of pulse transformer.

15.What is meant by high frequency carrier gating?
Thyristor is turned on by using a train of pulses from a to p. This type of signal is called as high frequency carrier gating.

16.What is meant by sequence control of ac voltage regulators?
It means that the stages of voltage controllers in parallel triggered in a proper sequence one after the other so as to obtain a variable output with low harmonic content.

17. What are the advantages of sequence control of ac voltage regulators?
a. System power factor is improved.
b. Harmonics are reduced in the source current and the load voltage.

18. What is meant by cyclo-converter?
It converts input power at one frequency to output power at another frequency with one-stage conversion. Cycloconverter is also known as frequency changer.

19. What are the two types of cyclo-converters?
a. Step-up cyclo-converters
b. Step-down cyclo-converters

20. What is meant by step-up cyclo-converters?
In these converters, the output frequency is less than the supply frequency.

21. What is meant by step-down cyclo-converters?
In these converters, the output frequency is more than the supply frequency.

22.What are the applications of cyclo-converter?

a. Induction heating
b. Speed control of high power ac drives
c. Static VAR generation
d. Power supply in aircraft or ship boards

23.What is meant by positive converter group in a cyclo converter?

The part of the cycloconverter circuit that permits the flow of current during Positive half cycle of output current is called positive converter group.

24. What is meant by negative converter group in a cyclo converter?

The part of the cyclo converter circuit that permits the flow of current during negative half cycle of output current is called negative converter group.

25. How does a power factor controller work?

Capacitors contained in most power factor correction equipment draw current that leads the voltage, thus producing a leading power factor. If capacitors are connected to a circuit that operates at a nominally lagging power factor, the extent that the circuit lags is reduced proportionately.

PART-B

1. Describe with circuit diagram and waveform principle of phase control of single phase controller with RL load and obtain expression for voltage and power factor
2. Describe the operation of two stage sequence control of Ac voltage controller
3. Decribe the operating principle of single phase to single phase cycloconverter with continuous and discontinuous load current with circuit and waveform
4. Discuss the operation of three phase to three phase cycloconverter with neat diagram and waveforms
5. (i) What is the importance of power factor control in a converter?Explain it in details.
(ii) Write a short note on Matrix converter.
6. 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
7. 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 (ii)Input p.f
(iii)Average and rms thyristor currents.
8. What is meant by Multistage sequence control? Explain it with relevant circuit diagram.
9. Explain with circuit diagram and waveform principle of operation of three phase AC voltage controller with neat diagram.
10. Design a single phase to single phase step down cycloconverter with centre –tapped transformer configuration and also explain the operation with output current and voltage waveforms.