

**POWER  
ELECTRONICS**  
TWO MARK QUESTIONS &  
ANSWERS  
Class : V SEM  
EEE

**UNIT – II – PHASE CONTROLLED CONVERTERS**

1. **What is meant by phase controlled rectifier?**  
It converts fixed ac voltage into variable dc voltage.
2. **Mention some of the applications of controlled rectifier.**
  - f. Steel rolling mills, printing press, textile mills and paper mills employing dc motor drives.
  - g. DC traction
  - h. Electro chemical and electro-metallurgical process
  - i. Portable hand tool drives
  - j. Magnet power supplies
  - k. HVDC
3. **What is the function of freewheeling diodes in controlled rectifier?**  
It serves two process.
  - l. It prevents the output voltage from becoming negative.
  - m. The load current is transferred from the main thyristors to the freewheeling diode, thereby allowing all of its thyristors to regain their blocking states.
4. **What are the advantages of freewheeling diodes in a controlled rectifier?**
  - n. Input power factor is improved.
  - o. Load current waveform is improved and thus the load performance is better.
5. **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 thyristor is fired.
6. **What are the advantages of single phase bridge converter over single phase mid-point converter?**
  - p. SCRs are subjected to a peak-inverse voltage of  $2V_m$  in a fully controlled bridge rectifier. Hence for same voltage and current ratings of SCRs, power handled by mid-point configuration is about
  - q. 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.
7. **What is commutation angle or overlap angle?**  
The commutation period when outgoing and incoming thyristors are conducting is known as overlap period. The angular period, when both devices share conduction is known as the commutation angle or overlap angle.

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

- r. UJT firing circuit.
- s. The cosine wave crossing pulse timing control.
- t. Digital firing schemes.

**9. Give an expression for average voltage of single-phase semiconverters.**

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

**10. 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.

$PF = (V_1 I_1 \cos \phi_1) / (V_{rms} I_{rms})$  where  $V_1$  = phase voltage,  $I_1$  = fundamental component of the supply current,  $\phi_1$  = input displacement angle,  $I_{rms}$  = supply rms current.

**11. What are the advantages of six-pulse converter?**

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

**12. What does ac voltage controller mean?**

It is device, which converts fixed alternating voltage into a variable voltage without change in frequency.

**13. What are the applications of ac voltage controllers?**

- w. Domestic and industrial heating
- x. Lighting control
- y. Speed control of single phase and three phase ac motors
- z. Transformer tap changing

**14. What are the advantages of ac voltage controllers?**

- aa. High efficiency
- bb. Flexibility in control
- cc. Less maintenance

**15. 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.

**16. What are the two methods of control in ac voltage controllers?**

- dd. ON-OFF control
- ee. Phase control

**17. 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.

**18. 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.

**19. 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.

**20. 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.

**21. 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.

**22. What are the disadvantages of unidirectional or half-wave ac voltage controller?**

- ff. 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
- gg. .7% and 100%.
- hh. The input current and output voltage are asymmetrical and contain a dc component. If there is an input transformer, saturation problem will occur
- ii. It is only used for low power resistive load.

**23. What is meant by bidirectional or half-wave ac voltage controller?**

Here the power flow is controlled during both cycles of the input voltage

**24. What is the control range of firing angle in ac voltage controller with RL load?**

The control range is  $\alpha < \alpha < 180^\circ$ , where  $\alpha =$  load power factor angle

**25. 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.

**26. What are the disadvantages of continuous gating signal?**

- jj. More heating of the SCR gate.
- kk. Increases the size of pulse transformer.

**27. What is meant by high frequency carrier gating?**

Thyristor is turned on by using a train of pulses from  $\alpha$  to  $\beta$ . This type of signal is called as high frequency carrier gating.

**28. Define Displacement Factor.**

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

**29. Define voltage ripple factor.**

It is defined as the ratio of the net harmonic content of the output voltage to the average output voltage.

**30. What is mean by uncontrolled rectifier?**

The uncontrolled rectifier uses only diodes and it converts fixed ac voltage into fixed dc voltage.

**31. How to classify rectifier circuits.**

- (i) Uncontrolled rectifier
- (ii) Controlled rectifier

**32. What is mean by full converter?**

A fully controlled converter uses thyristors only and there is a wider control over the level of dc output voltage. It is also known as two quadrant converter.

**33. What are the performance factors of line commutated converters?**

Input displacement angle, input power factor, DC voltage ratio, Input harmonic factor, Voltage & current ripple factor.

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

- i) Mid point converter
- ii) Bridge Converter

**35. What is meant by 2 pulse converter?**

Two pulse converter is defined as two triggering pulses or two sets of triggering pulses are to be generated during every cycle of the supply to trigger the various SCRs.

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

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

**37. What is meant by inversion mode?**

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

**38. What are the different types of controlled rectifier?**

According to input supply – Single phase controlled rectifier & Three phase controlled rectifier

According to Quadrant operation – semiconverter , full converter, dual converter

According to no. pulses / cycle – one pulse, two pulse, three pulse , Six pulse & twelve pulse converter.

**39. What are the difference between half controlled & fully controlled bridge rectifier?**Half Controlled Bridge Rectifier

1. Power circuit consists of mixture of diodes & SCRs
2. It is one quadrant Converter
3. The Dc output voltage has limited control level.
4. Input power factor is more.

Full Controlled Bridge Rectifier

1. Power circuit consists of SCRs only
2. It is 2 quadrant Converter
3. The Dc output voltage has wider control level.
4. Input power factor is less.

**40. What is meant continuous current operation of thyristor converter?**

When a free wheeling diode is connected across the output, load current continuous flow through the load. Whenever the load voltage tends to go to negative, free wheeling diode starts conduct. As a result load current is transferred from SCR to freewheeling diode. This is called continuous current operation of thyristor converter.

**41. 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.

**42. 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.

**16 MARK QUESTIONS:**

1. Describe the working of single-phase fully controlled bridge converter in the rectifying mode and inversion mode. Also sketch the following waveforms for delay angle  $\alpha$  load voltage, load current and thyristor voltage. **NOV03.**
2. Explain the operation of 3phase, 6pulse bridge converter with resistive load. Draw the output voltage, voltage across T1 and current waveform of T2 for  $\alpha = 0$ . list the firing sequence of SCR. **NOV03.**
3. Explain the method of phase control with relevant sketches derive an expression for r.m.s. Output voltage. **NOV97.**
4. Explain the operation of dual converter with a neat circuit diagram. **NOV97.**
5. Draw the circuit diagram of single-phase full wave fully controlled rectifier with inductive load. Explain the operation of circuit relevant sketches. Explain the operation of freewheeling diode on the performance of this circuit. **NOV97.**
6. Explain the operation of a fully controlled thyristor bridge converter. Also, derive expressions for the average load voltage and input power factor. **APR98.**
7. With a neat diagram and output waveforms explain the operation of 3-phase, 6pulse converter. Derive expression for the d.c output voltage. When the source impedance effect is neglected and load is resistive. **APR98.**
8. Draw the power circuit diagram of a six pulse, two-quadrant converter circuit. Explain the operation of the circuit with necessary waveforms. **APR97.**
9. Explain the inverting operating and conditions for inversion of a fully controlled converter with relevant circuit diagram and waveforms. **APR99.**
10. Explain the clearly the effects of load inductance and source inductance on the performance of controlled rectifiers. **APR2000.**