



EEE III Year/ V Sem

EE8552 Power Electronics Question Bank

Unit-I

Part -A

1. List the different methods to turn on the SCR

The SCR can be made to conduct or switched from blocking (non-conducting or OFF) state to Conduction (ON) State by any one of the following methods.

- a) Forward Voltage Triggering
- b) Temperature Triggering
- c) dv/dt Triggering
- d) Light Triggering
- e) Gate Triggering

2. Define: threshold voltage of power MOSFET

Minimum gate to source voltage required to turn on the MOSFET below which the device could be in off state

3. Define Holding current and Latching current in SCR

Holding current

Holding current is the minimum anode current to maintain the thyristor in the 'on' state.

Latching current

Latching current is the minimum anode current required to maintain the thyristor in the on State immediately after a thyristor has been turned on and gate signal has been removed

4. What are the advantages of GTO over SCR?

GTO can be turned off using negative gate signal of sufficient amplitude.

This eliminates the necessity of bulky and costlier commutation circuit which is required for turning OFF an SCR

5. Differentiate holding current from latching current

S.No	Holding Current	Latching Current
1	Holding current is associated with turn-off process	Latching current is associated with turn-on process
2	Holding current is less than latching current	Latching current is 2 to 3 times of holding current
3	The thyristor can be turned- off or the thyristor can be returned to forward blocking state only if the forward current falls below a level current called the holding 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

6. What do you mean by second breakdown in power BJT?

In a power transistor under certain conditions the current concentrates in a small spot of the base-emitter junction. This causes local heating, resulting in a small hotspot and leads to the breakdown of BJT.

7. What is a snubber circuit?

Snubber circuit is used to prevent failure due to dv/dt .

Snubber uses a small resistor (R) in series with a small capacitor (C). This combination can be used to suppress the rapid rise in voltage across a thyristor.

Part-B

1. Draw the two-transistor model of SCR and derive an expression for anode current
2. Explain the construction, static and switching characteristics of SCR
3. Explain the construction, static and switching characteristics of MOSFET
4. Explain the construction, static and switching characteristics of IGBT
5. Explain in detail about different commutation methods of SCR
6. Discuss about any one driver circuit for SCR, MOSFET and IGBT
7. Discuss about any one snubber circuit for SCR, MOSFET



Unit-II

Part-A

1. What are the effects of source inductance?

The source inductance causes the outgoing and incoming SCRs to conduct together. When the source inductor increases, the overlap angle increases and as a consequence the average output voltage decrease.

2. What are the functions of freewheeling diode and its advantages?

It prevents the output voltage from becoming negative

It transfers the load current from main thyristors to freewheeling diode, thereby allowing all of its thyristors to regain their blocking states

3. What is overlap angle?

When both incoming and outgoing thyristors conduct simultaneously causing short circuit of dc load. The period is referred to as overlap and angle corresponding to it is known as overlap angle.

4. What is meant by Phase control?

SCR can be turned on at any angle, with respect to the applied voltage. By controlling the firing angle, the converter output voltage are controlled. This is called as the phase control.

5. What is meant by delay angle or firing angle

The delay angle is defined as the angle between the zero crossing of the input voltage and the instant the thyristor is fired

Part – B

- 1. Explain the effect of source inductance in the performance of the single phase fully controlled converter**
- 2. Explain the operation of a single-phase full converter with RLE load using relevant waveforms. Obtain the expression for its average output voltage and RMS value of output voltage**
- 3. Explain the operation of a dual converter with the aid of relevant waveforms. Obtain the expression of its instantaneous circulating current**
- 4. Explain the operation of 3 phase fully controlled bridge rectifier with necessary waveforms**



5. Discuss the operation of a 3 phase semi converter with 'R' load and also draw the output voltage waveform for 30 and 90
6. Explain the working of single phase fully converter for 'RL' load discontinuous mode of operation with neat sketch and waveforms.

Unit-III

Part – A

1. Define duty cycle in dc chopper

Duty cycle is defined as the ratio of on time of the chopper to the total time of the chopper

$$\alpha = \frac{T_{on}}{T}$$

$$\alpha = \frac{T_{on}}{T_{on} + T_{off}}$$

2. Name the two types of control strategies available for dc choppers

- (1) Time-ratio control (TRC), and
- (2) Current limit control

3. What is meant by time ratio control (TRC) and mention its types?

The TRC control, the value of $\frac{T_{on}}{T}$ is varied. This can be done in two ways.

- (1) Constant Frequency System
- (2) Variable Frequency System

4. What is meant by current limit control of a chopper

The chopper is switched on and off so that the load current is maintained between two limits.

When current exceeds upper limit, the chopper is switched OFF

During OFF period load current free wheels through FW Diode

When current reaches lower limit, the chopper is turned ON



5. What is a resonant converter?

Resonant converters consist at least one tank circuit as sub circuit with one inductor (L) and one capacitor (C).

The tank circuit forces zero voltage or zero current during switching conditions and eliminate switching stresses

6. What is meant by ZVS and ZCS?

Zero-Voltage Switching (ZVS): The switches turn on and off at zero voltage this is called as ZVS

Zero- Current Switching (ZCS): The switches turn on and off at zero current this is called as ZCS

7. What is meant by FM control in dc chopper and state its disadvantages

In this method, the chopping frequency f (or chopping period T) is varied and either

- (1) T_{on} is kept constant
- (2) T_{off} is kept constant

This method is called Frequency modulation scheme (FM)

Disadvantages

- (1) Filter design difficult
- (2) Cause EMI interference due to harmonics

Part – B

1. Explain the working of buck converter with neat waveform and also derive the expression of peak to peak voltage across the capacitor.
2. Explain the working of boost converter with neat waveform and also derive the expression of peak to peak voltage across the capacitor.
3. Explain the working of buck-boost converter with neat waveform and also derive the expression of peak to peak voltage across the capacitor.
4. The buck regulator has an input range of $V_s = 12\text{ V}$. The regulated average output voltage is $V_s = 5\text{ V}$ at $R=500\Omega$ and the peak to peak output ripple voltage is 20 mV . The switching frequency is 25 kHz if the peak to peak ripple current of inductor is limited to 0.8 A determine

- (1) The duty cycle, K
- (2) The filter inductance, L
- (3) The filter capacitance, C and The critical value of L and C

Unit-IV

Part – A

1. Define modulation index and what is its use?

Modulation index is the ratio of peak magnitudes of the modulating waveform and the carrier waveform $M = \frac{V_m}{V_c}$

Modulation index used for control the output of the inverter

2. What are the applications of CSI

- i) It can be used for the speed control of ac, specially induction, motors subject to variation in load torque.
- ii) used in induction heating application

3. What are harmonics

Harmonics are voltages and/or currents present in the output at some multiple of the fundamental frequency

4. Differentiate VSI and CSI

S.No	VSI	CSI
1	Input voltage is maintained constant	Input current is maintained constant
2	Output voltage does not depend on the load	Output current does not depend on the load
3	It requires feedback diodes	It does not requires feedback diode
4	Commutation circuit is complex	Commutation circuit is simple

5. What is meant by space vector modulation

Space vector modulation (SVM) is an algorithm for the control of pulse width (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

6. What are the purpose of feedback diodes in inverters?

For RL loads, load current will not be in phase with output voltage hence diodes connected in antiparallel with thyristors will allow the current to flow allow the main thyristor are turned off.



Part – B

- 1. Explain the principle of working of three phase VSI in 120 conduction mode with a star connected load**
- 2. With the neat sketch and output waveform, discuss the operation of three phase inverter operating in 180 mode with a star connected load**
- 3. Explain the principle of space vector PWM applied to three phase VSI using the space vector diagram**

Unit-V

Part – A

- 1. What is meant by ac voltage controller? And its applications**

The AC voltage controller converts fixed alternating voltage into a variable ac output voltage without change in supply frequency

Applications

- Domestic and Industrial heating
- Lighting control
- Speed control of single phase and three phase ac motors\
- Transformer tap changing
- e.

- 2. What is a Cycloconverter?**

Cycloconverter converts input power at one frequency to output power at a different frequency with one stage conversion. Cycloconverter is also known as frequency changer.

- 3. What is a matrix converter?**

Matrix converter is capable of direct conversion from AC to AC by using bidirectional fully controlled switches

- 4. What are two methods of control in AC voltage controllers?**

- ON-OFF control
- Phase control

- 5. What is the difference between on-off control and phase control?**

ON-OFF control

Thyristors are employed as switches to connect the load circuit to the source for few cycles 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 cycle of input voltage

6. What is integral cycle control?

Thyristors are employed as switches to connect the load circuit to the source for few cycles and disconnect it for another few cycles. **(ON-OFF control)**

7. What are the types of cycloconverter?

- i) Step down cycloconverter
- ii) Step up cycloconverter

Part – B

- 1. Explain the operation of single-phase full wave A.C Voltage regulator with help of voltage and current waveform**
- 2. Explain the working of three phase to single phase cycloconverter with neat circuit diagram and necessary waveforms**
- 3. Explain the operation of single phase to single phase cycloconverter**
- 4. Explain the operation of Three phase to Three phase cycloconverter**

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