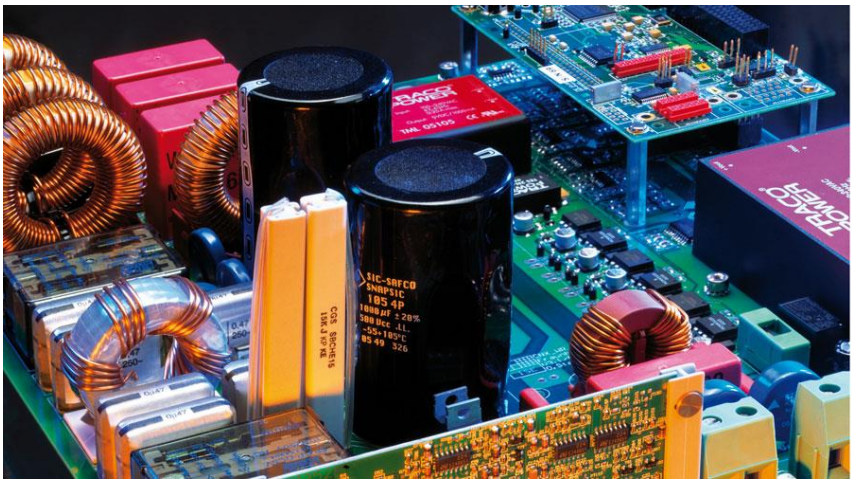
DEPARTMENT OF ELECTRICAL ENGINEERING

QUESTION BANK ON

POWER ELECTRONICS

(5th Semester)



POWER ELECTRONICS MCQ COMPLETE

1. Which of the following devices does not belong to the transistor family?
a) IGBT
b) MOSFET
c) GTO
d) BJT
View Answer
Answer: c
Explanation: GTO is gate turn off transistor, it belongs to the Thyristor family. All the other devices belong to the transistor family.

2. A power transistor is a
a) three layer, three junction device
b) three layer, two junction device
c) two layer, one junction device
d) four layer, three junction device
View Answer
Answer: b
Explanation: It has three layers p-n-p or n-p-n forming two p-n junctions.

3. In a power transistor,_____is the controlled parameter.
a) V_{BE}
b) V_{CE}
c) I_B
d) I_C
View Answer
Answer: d
Explanation: The collector current is the controlled parameter.

4. A power transistor is a_____device.
a) two terminal, bipolar, voltage controlled
b) two terminal, unipolar, current controlled
c) three terminal, unipolar, voltage controlled

d) three terminal, bipolar, current controlled
View Answer
Answer: d
Explanation: Power transistor is simply many BJT's connected in series parallel on a single silicon chip for power applications. It is a three terminal, bipolar, current controlled device.

5. In a power transistor,_____is the controlling parameter.
a) V_{BE}
b) V_{CE}
c) I_B
d) I_C
View Answer
Answer: c
Explanation: The base current controls the collector current. Hence, the base current Ib is the controlling parameter.

6. In a power transistor, the I_B vs V_{BE} curve is
a) a parabolic curve
b) an exponentially decaying curve
c) resembling the diode curve
d) a straight line Y = I_B
View Answer
Answer: c
Explanation: The B-E junction of a BJT resembles a p-n junction diode, hence the curve.

7. For a power transistor, if the base current I_B is increased keeping V_{CE} constant, then
a) I_C increases
b) I_C decreases
c) I_C remains constant
d) none of the mentioned
View Answer
Answer: a
Explanation: Ic is directly proportional to Ic.

8. The forward current gain α is given by
a) I_C/I_B
b) I_C/I_E
c) I_E/I_C
d) I_E/I_B
View Answer
9. The value of β is given by the expression
a) I_C/I_B
b) I_C/I_E

c) I_E/I_C
d) I_E/I_B
View Answer
Answer: a
Explanation: Collector current by the base current is beta, its value is in the range 50 to 300.

10. A power BJT is used as a power control switch by biasing it in the cut off region (off state) or in the saturation region (on state). In the on state
a) both the base-emitter & base-collector junctions are forward biased
b) the base-emitter junction is reverse biased, and the base collector junction is forward biased
c) the base-emitter junction is forward biased, and the base collector junction is reversed biased
d) both the base-collector & the base-emitter junctions are reversed biased
View Answer
Answer: a
Explanation: When base-emitter & base-collector junctions are forward biased only than both the p-n junctions are forward biased and the device is on.

1. For a power transistor, if the forward current gain $\alpha = 0.97$, then $\beta = ?$
a) 0.03
b) 2.03
c) 49.24
d) 32.33
View Answer
Answer: d
Explanation: Use the relation $\alpha = \beta/(\beta+1)$.

2. The power electronics devices have a very high efficiency because
a) cooling is very efficient
b) the devices traverse active region at high speed & stays at the two states, on and off
c) the devices never operate in active region
d) the devices always operate in the active region
View Answer
Answer: b
Explanation: They are efficient due to their higher transition speeds.

3. For a power transistor, which of the following relations is true?
a) Ie>Ic>Ib
b) Ib>Ic>Ie
c) Ic>Ie>Ib
d) Ie=Ib
View Answer

Answer: a
Explanation: Practically speaking Ie = Ib+Ic. Ie is the highest as it is the sum of the collector and base currents. The base current is the smallest.

4. High frequency operation of any device is limited by the
a) forward voltage rating
b) switching losses
c) thermal conductivity
d) heat Sink arrangements
View Answer
Answer: b
Explanation: Lower the switching losses higher the frequency of operation of the device.

5. The instantaneous power loss during the delay time of a transistor is given by
a) Ic Vce
b) Ib Vbe
c) Ic Vbe
d) Ib Vce
View Answer
Answer: a
Explanation: During the delay time only the collector current flows & base to emitter voltage is zero.

6. For a power transistor, the average power loss during the delay time can be given by the equation
a) Ic * Vc
b) $1/T * \int^{Td} (Ic\ Vce)\ dt$
c) Ic * dVc/dt * T
d) $1/T * \int^{(Td\ *Tr)} (Ic\ Vc)\ dt$
View Answer
Answer: b
Explanation: During the delay time only, the collector current flows & base to emitter voltage is zero. Hence the average power can be found, simply by integrating it over the total delay time & dividing by the base time period.

7. A 1mv of i/p gives an output of 1V, the voltage gain as such would be
a) 0.001
b) 0.0001
c) 1000
d) 100
View Answer
Answer: c
Explanation: 1V/1mv = 1000.

8. Which of the following relations is true for a BJT?
a) Ic ≈ Ie
b) Ib ≈ Ic
c) Ie ≈ Ib
d) Ib ≈ Ie ≈ Ic
View Answer
Answer: a
Explanation: The collector & emitter current differ only by the base current, which is very very small.

9. Choose the correct statement
a) A transistor will remain on as long the the base current is applied
b) A transistor remains on after a high to low pulse is applied at the base
c) A transistor will remain on as long the the collector current is applied
d) A transistor remains on after a high to low pulse is applied at the collector
View Answer
Answer: a
Explanation: Unlike the thyristor devices, all the transistor family devices remain in the conducting state as long as the firing pulses are applied. This is a very important property of the transistor devices.

10. Let's say that a transistor is operating at the middle of the load line, then a decrease in the current gain would
a) move the Q point up
b) move the Q point down
c) result in to & fro motion of the Q point
d) not change the Q point
View Answer
Answer: b
Explanation:The current gain would decreases the collector current, shifting the Q point below.

1. The MOSFET combines the areas of_____& _____
a) field effect & MOS technology
b) semiconductor & TTL
c) mos technology & CMOS technology
d) none of the mentioned
View Answer
Answer: a
Explanation: It is an enhancement of the FET devices (field effect) using MOS technology.

2. Which of the following terminals does not belong to the MOSFET?
a) Drain

b) Gate
c) Base
d) Source
View Answer
Answer: c
Explanation: MOSFET is a three terminal device D, G & S.

3. Choose the correct statement
a) MOSFET is a uncontrolled device
b) MOSFET is a voltage controlled device
c) MOSFET is a current controlled device
d) MOSFET is a temperature controlled device
View Answer
Answer: b
Explanation: It is a voltage controlled device.

4. Choose the correct statement(s)
i) The gate circuit impedance of MOSFET is higher than that of a BJT
ii) The gate circuit impedance of MOSFET is lower than that of a BJT
iii) The MOSFET has higher switching losses than that of a BJT
iv) The MOSFET has lower switching losses than that of a BJT
a) Both i & ii
b) Both ii & iv
c) Both i & iv
d) Only ii
View Answer
Answer: c
Explanation: MOSFET requires gate signals with lower amplitude as compared to BJTs & has lower switching losses.

5. Choose the correct statement
a) MOSFET is a unipolar, voltage controlled, two terminal device
b) MOSFET is a bipolar, current controlled, three terminal device
c) MOSFET is a unipolar, voltage controlled, three terminal device
d) MOSFET is a bipolar, current controlled, two terminal device
View Answer
Answer: c
Explanation: MOSFET is a three terminal device, Gate, source & drain. It is voltage controlled unlike the BJT & only electron current flows.

6. The arrow on the symbol of MOSFET indicates
a) that it is a N-channel MOSFET
b) the direction of electrons
c) the direction of conventional current flow

d) that it is a P-channel MOSFET
View Answer
Answer: b
Explanation: The arrow is to indicate the direction of electrons (opposite to the direction of conventional current flow).

7. The controlling parameter in MOSFET is
a) Vds
b) Ig
c) Vgs
d) Is
View Answer
Answer: b
Explanation: The gate to source voltage is the controlling parameter in a MOSFET.

8. In the internal structure of a MOSFET, a parasitic BJT exists between the
a) source & gate terminals
b) source & drain terminals
c) drain & gate terminals
d) there is no parasitic BJT in MOSFET
View Answer
Answer: b
Explanation: Examine the internal structure of a MOSFET, notice the n-p-n structure between the drain & source. A p-channel MOSFET will have a p-n-p structure.

9. In the transfer characteristics of a MOSFET, the threshold voltage is the measure of the
a) minimum voltage to induce a n-channel/p-channel for conduction
b) minimum voltage till which temperature is constant
c) minimum voltage to turn off the device
d) none of the above mentioned is true
View Answer
Answer: a
Explanation: It is the minimum voltage to induce a n-channel/p-channel which will allow the device to conduct electrically through its length.

10.The output characteristics of a MOSFET, is a plot of
a) Id as a function of Vgs with Vds as a parameter
b) Id as a function of Vds with Vgs as a parameter
c) Ig as a function of Vgs with Vds as a parameter
d) Ig as a function of Vds with Vgs as a parameter
View Answer
Answer: b
Explanation: It is Id vs Vds which are plotted for different values of Vgs (gate to source voltage).

1. In the output characteristics of a MOSFET with low values of Vds, the value of the on-state resistance is
a) Vds/Ig
b) Vds/Id
c) 0
d) ∞
View Answer
Answer: b
Explanation: The o/p characteristics Is a plot of Id verses Vds, which for low values of Vds is almost constant. Hence, the on-state resistance is constant & the slop is its constant value.

2. At turn-on the initial delay or turn on delay is the time required for the
a) input inductance to charge to the threshold value
b) input capacitance to charge to the threshold value
c) input inductance to discharge to the threshold value
d) input capacitance to discharge to the threshold value
View Answer
Answer: b
Explanation: It is the time required for the input capacitance to charge to the threshold value, which depends on the device configuration. The device can start conducting only after this time.

3. Choose the correct statement
a) MOSFET suffers from secondary breakdown problems
b) MOSFET has lower switching losses as compared to other devices
c) MOSFET has high value of on-state resistance as compared to other devices
d) All of the mentioned
View Answer
Answer: b
Explanation: MOSFET has lower switching losses due to its unipolar nature & less turn off time. All of the other statements are false.

4. Which among the following devices is the most suited for high frequency applications?
a) BJT
b) IGBT
c) MOSFET
d) SCR
View Answer
Answer: c
Explanation: MOSFET has the least switching losses among the rest of the devices.

5. Choose the correct statement
a) MOSFET has a positive temperature co-efficient

b) MOSFET has a high gate circuit impedance
c) MOSFET is a voltage controlled device
d) All of the mentioned
View Answer
Answer: d
Explanation: MOSFETs are voltage controlled devices. They have high gate circuit impedance and are PTC devices.

6. Consider an ideal MOSFET. If Vgs = 0V, then Id = ?
a) Zero
b) Maximum
c) Id(on)
d) Idd
View Answer
Answer: a
Explanation: Gate current = 0 so device is off (ideally).

7. For a MOSFET Vgs=3V, Idss=5A, and Id=2A. Find the pinch of voltage Vp
a) 4.08
b) 8.16
c) 16.32
d) 0V
View Answer
Answer: b
Explanation: Use Id = Idd x $[1-Vgs/Vp]^2$.

8. How does the MOSFET differ from the JFET?
a) JFET has a p-n junction
b) They are both the same
c) JFET is small in size
d) MOSFET has a base terminal
View Answer
Answer: a
Explanation: None.

9. The basic advantage of the CMOS technology is that
a) It is easily available
b) It has small size
c) It has lower power consumption
d) It has better switching capabilities
View Answer
Answer: c
Explanation: Complementary MOS consumes very less power as compared to all the earlier devices.

10. The N-channel MOSFET is considered better than the P-channel MOSFET due to its
a) low noise levels
b) TTL compatibility
c) lower input impedance
d) faster operation
View Answer
Answer: d
Explanation: The N-channel are faster than the P-channel type.

1. IGBT possess
a) low input impedance
b) high input impedance
c) high on-state resistance
d) second breakdown problems
View Answer
Answer: b
Explanation: Like MOSFET IGBT possess high input impedance.

2. IGBT & BJT both posses ____
a) low on-state power losses
b) high on-state power losses
c) low switching losses
d) high input impedance
View Answer
Answer: a
Explanation: Low on state power loss is one of the best parameters of both BJT & the IGBT.

3. The three terminals of the IGBT are
a) base, emitter & collector
b) gate, source & drain
c) gate, emitter & collector
d) base, source & drain
View Answer
Answer: c
Explanation: IGBT is a three terminal device. It has a gate, a emitter & a collector.

4. In IGBT, the p^+ layer connected to the collector terminal is called as the
a) drift layer
b) injection layer
c) body layer
d) collector Layer
View Answer

Answer: b
Explanation: It is called as a injection layer, because it injects holes into the n^- layer.

5. The controlling parameter in IGBT is the
a) I_G
b) V_{GE}
c) I_C
d) V_{CE}
View Answer
Answer: b
Explanation: The controlling parameter is the gate to emitter voltage, as the device is a voltage controlled device.

6. In IGBT, the n^- layer above the p^+ layer is called as the
a) drift layer
b) injection layer
c) body layer
d) collector Layer
View Answer
Answer: a
Explanation: It is called as the drift layer because its thickness determines the voltage blocking capabilities of the device.

7. The voltage blocking capability of the IGBT is determined by the
a) injection layer
b) body layer
c) metal used for the contacts
d) drift layer
View Answer
Answer: d
Explanation: The drift layer which is a n^- layer determines the voltage blocking capabilities.

8. The controlled parameter in IGBT is the
a) I_G
b) V_{GE}
c) I_C
d) V_{CE}
View Answer
Answer: c
Explanation: The controlling parameter is the gate to collector current.

9. The structure of the IGBT is a
a) P-N-P structure connected by a MOS gate
b) N-N-P-P structure connected by a MOS gate

c) P-N-P-N structure connected by a MOS gate
d) N-P-N-P structure connected by a MOS gate
View Answer
Answer: c
Explanation: The IGBT is a semiconductor device with four alternating layers (P-N-P-N) that are controlled by a metal-oxide-semiconductor (MOS) gate structure without regenerative action.

10. The major drawback of the first generation IGBTs was that, they had
a) latch-up problems
b) noise & secondary breakdown problems
c) sluggish operation
d) latch-up & secondary breakdown problems
View Answer
Answer: d
Explanation: The earlier IGBT's had latch-up problems (device cannot turn off even after the gate signal is removed), and secondary breakdown problems (in which a localized hotspot in the device goes into thermal runaway and burns the device out at high currents).

1. When latch-up occurs in an IGBT
a) Ig is no longer controllable
b) Ic is no longer controllable
c) the device turns off
d) Ic increases to a very high value
View Answer
Answer: b
Explanation: After latch-up the collector emitter current is no longer in control of the gate terminal.

2. A latched up IGBT can be turned off by
a) forced commutation of current
b) forced commutation of voltage
c) use of a snubber circuit
d) none of the mentioned
View Answer
Answer: a
Explanation: Forced commutation of current is the only way to turn off a latched up IGBT.

3. The static V-I curve of an IGBT is plotted with
a) Vce as the parameter
b) Ic as the parameter
c) Vge as the parameter

d) Ig as the parameter
View Answer
Answer: c
Explanation: V-I curves are plotted for Ic vs Vce with the controlling parameter (Vge) as a parameter.

4. Latch-up occurs in an IGBT when
a) Vce reaches a certain value
b) Ic reaches a certain value
c) Ig reaches a certain value
d) the device temperature reaches a certain value
View Answer
Answer: b
Explanation: Latch up occurs when the current through the device (Ic) collector current increases beyond a certain value.

5. In an IGBT, during the turn-on time
a) Vge decreases
b) Ic decreases
c) Vce decreases
d) none of the mentioned
View Answer
Answer: c
Explanation: Vce decreases from 0.9 to 0.1 of the initial value whereas others increase.

6. Choose the correct statement
a) IGBTs have higher switching losses as compared to BJTs
b) IGBTs have secondary breakdown problems
c) IGBTs have lower gate drive requirements
d) IGBTs are current controlled devices
View Answer
Answer: c
Explanation: Due to its high gate impedance, IGBTs require less gate drive current.

7. The approximate equivalent circuit of an IGBT consists of
a) a BJT & a MOSFET
b) a MOSFET & a MCT
c) two BJTs
d) two MOSFETs
View Answer
Answer: a
Explanation: Gate of the MOSFET forms the gate terminal of the IGBT, the source of MOSFET is connected to the base of the BJT and drain to the collector.

8. An IGBT is also know as
a) MOIGT (Metal oxide insulated gate transistor)
b) COMFET (Conductively modulated FET)
c) GEMFET (Grain modulated FET)
d) all of the mentioned
View Answer
Answer: d
Explanation: All of the above mentioned are alternate names of IGBTs.

9. The body of an IGBT consists of a
a) p-layer
b) n-layer
c) p-n layer
d) metal
View Answer
Answer: a
Explanation: IGBT has a p-n-p structure with fingers of n^+ layers into the p layer. The p layer has the largest cross section and forms the body of the IGBT.

10. At present, the state-of-the-art semiconductor devices are begin manufactured using
a) Semiconducting Diamond
b) Gallium-Arsenide
c) Germanium
d) Silicon-Carbide
View Answer
Answer: d
Explanation: All of the above mentioned can be used but Si-Ca has certain advantages over the other materials.

1. For a transistor, the safe operating area (SOA) is a plot of
a) Ib versus Vce
b) Ib versus Ic
c) Ic versus Vce
d) Ic versus time
View Answer
Answer: c
Explanation: For reliable operation the collector current & voltage must remain within the SOA curves.

2. The forward safe operating area (FSOA) pertains to the operation when
a) the device is fired at a 50% Duty cycle
b) the device is forward-biased
c) the device is operated on AC

d) the device is operated on DC
View Answer
Answer: b
Explanation: The FSOA is for forward biased operations. The FSOA is plotted for AC as well as DC for different duty cycles. Hence, option (b) is the most appropriate choice.

3. The SOAs are plotted always on a_____scale
a) time
b) frequency
c) logarithmic
d) polynomial
View Answer
Answer: c
Explanation: The scale is always logarithmic, irrespective of the type of device.

4. As the FSOA increases, the pulse width
a) decreases
b) increases
c) remains constant
d) vanishes
View Answer
Answer: b
Explanation: On reduced pulse width values, the devices can operated on higher voltages & currents.

5. The SOAs provided by the manufacturers are for
a) single pulse operation & a particular temperature
b) multi pulse operation & all the temperature
c) all the conditions
d) a particular duty cycle operation
View Answer
Answer: a
Explanation: The manufacturer specifies the SOAs only for single pulse DC operation & a particular temperature (usually 20Degree Centigrade Scale). For actual operations, The SOA's have to be modified using the thermal impedance charts.

6. A device is operating at Ic = 4A & Vce = 50V. For the device to operate at Ic = 20A (Without damaging),
a) voltage should be increased
b) voltage should be reduced
c) voltage can be kept constant
d) current has to increased further
View Answer

Answer: b
Explanation: For safe operation, the values should be within the limits. P = V.I – with increase in one of the values, another value should decrease.

7. For a BJT, find the maximum power dissipation when the device is safely operated at Vce = 90V and Ic = 0.5A
a) 40 Watts
b) 35 Watts
c) 45 Watts
d) 30 Watts
View Answer
Answer: c
Explanation: P=90*0.5=45Watts.

8. The SOA for a MOSFET is plotted for
a) Id versus Vds
b) Ig versus Id
c) Ig versus Vds
d) Id versus Vgs
View Answer
Answer: a
Explanation: It is a plot of drain current vs drain to source voltage.

9. The SOA for an IGBT is plotted for
a) Ic versus Vge
b) Ig versus Ic
c) Ig versus Vce
d) Ic versus Vce
View Answer
Answer: d
Explanation: It is a plot of collector current vs collector to emitter voltage.

10. For MOSFET's SOA, as the pulse width goes on increasing, the maximum voltage rating_____& current rating _____
a) is constant, increases
b) increases, decreases
c) decreases, is constant
d) constant, decreases
View Answer
Answer: c
Explanation: Refer MOSFET's SOA

1. A thyristor (SCR) is a
a) P-N-P device
b) N-P-N device

c) P-N-P-N device
d) P-N device
View Answer
Answer: c
Explanation: An SCR (silicon controlled rectifier) is a four layer p-n-p-n type device.

2. Which terminal does not belong to the SCR?
a) Anode
b) Gate
c) Base
d) Cathode
View Answer
Answer: c
Explanation: The SCR is having three terminals viz. anode, cathode and the gate.

3. An SCR is a
a) four layer, four junction device
b) four layer, three junction device
c) four layer, two junction device
d) three layer, single junction device
View Answer
Answer: b
Explanation: SCR is a four layer p-n-p-n device which forms three p-n junctions.

4. Choose the false statement.
a) SCR is a bidirectional device
b) SCR is a controlled device
c) In SCR the gate is the controlling terminal
d) SCR are used for high-power applications
View Answer
Answer: a
Explanation: It is a unidirectional device, current only flows from anode to cathode.

5. In the SCR structure the gate terminal is located
a) near the anode terminal
b) near the cathode terminal
c) in between the anode & cathode terminal
d) none of the mentioned
View Answer
Answer: b
Explanation: The gate is located near the cathode, because it allows fast turning on of the device when the gate signal is applied by forward basing the second junction.

6. The static V-I curve for the SCR is plotted for
a) Ia (anode current) vs Ig (gate current), Va (anode – cathode voltage) as a parameter

b) Ia vs Va with Ig as a parameter
c) Va vs Ig with Ia as a parameter
d) Ig vs Vg with Ia as a parameter
View Answer
Answer: b
Explanation: The curve is plotted for Ia vs Va for different values of gate current Ig.

7. If the cathode of an SCR is made positive with respect to the anode & no gate current is applied then
a) all the junctions are reversed biased
b) all the junctions are forward biased
c) only the middle junction is forward biased
d) only the middle junction is reversed biased
View Answer
Answer: c
Explanation: The device is in the reverse blocking state (3rd quadrant) & only the middle junction is forward biased whereas other two are reversed biased.

8. For an SCR in the reverse blocking mode, (practically)
a) leakage current does not flow
b) leakage current flows from anode to cathode
c) leakage current flows from cathode to anode
d) leakage current flows from gate to anode
View Answer
Answer: c
Explanation: In the reverse blocking mode, the gate current is zero & a reverse voltage is applied at the cathode-anode.

9. With the anode positive with respect to the cathode & the gate circuit open, the SCR is said to be in the
a) reverse blocking mode
b) reverse conduction mode
c) forward blocking mode
d) forward conduction mode
View Answer
Answer: c
Explanation: The SCR is in the forward blocking mode with its top and bottom junctions forward biased and the middle junction reversed biased.

10. For an SCR in the forward blocking mode (practically)
a) leakage current does not flow
b) leakage current flows from anode to cathode
c) leakage current flows from cathode to anode

d) leakage current flows from gate to anode
View Answer
Answer: b
Explanation: In the forward blocking mode, the gate current is zero & only the middle J2 junction is reversed biased.

1. The forward break over voltage is the
a) anode-cathode voltage at which conduction starts with gate signal applied
b) anode-cathode voltage at which conduction starts with no gate signal applied
c) gate voltage at which conduction starts with no anode-cathode voltage
d) gate voltage at which conduction starts with anode-cathode voltage applied
View Answer
Answer: b
Explanation: It is the forward voltage at which the middle junction breaks down without any gate signal and pushes the device into the conducting state.

2. For a forward conducting SCR device, as the forward anode to cathode voltage is increased
a) the device turns on at higher values of gate current
b) the device turns on at lower values of gate current
c) the forward impedance of the device goes on increasing
d) the forward impedance of the device goes on decreasing
View Answer
Answer: b
Explanation: Higher the value of anode-cathode forward voltage, lower the gate requirements of the device. Also, the forward resistance of the device is always constant as long as the junction temperature is constant.

3. A thyristor can be bought from the forward conduction mode to forward blocking mode by
a) the dv/dt triggering method
b) applying a negative gate signal
c) applying a positive gate signal
d) applying a reverse voltage across anode-cathode terminals
View Answer
Answer: d
Explanation: a) & c) are used to turn on the device, b) will damage the SCR.

4. Usually the forward voltage triggering method is not used to turn-on the SCR because
a) it increases losses
b) it causes noise production
c) it may damage the junction & destroy the device
d) relatively it’s an inefficient method
View Answer

Answer: c
Explanation: In forward voltage triggering the middle junction breaks down without any gate signal and pushes the device into the conducting state. This method can permanently damage the J2 junction and make the device useless.

5. Among the following, the most suitable method to turn on the SCR device is the
a) gate triggering method
b) dv/dt triggering method
c) forward voltage triggering method
d) temperature triggering method
View Answer
Answer: a
Explanation: d) & b) are unreliable methods, c) can permanently damage the SCR
Gate triggering is simple, reliable & most efficient.

6. The forward break over voltage is maximum when
a) Gate current = ∞
b) Gate current = 0
c) Gate current = -∞
d) It is independent of gate current
View Answer
Answer: b
Explanation: Higher the value of anode-cathode forward voltage, lower the gate requirements of the device.

7. For the SCR to remain in the ON (conducting) state
a) gate signal is continuously required
b) no continuous gate signal is required
c) no forward anode-cathode voltage is required
d) negative gate signal is continuously required
View Answer
Answer: b
Explanation: Unlike the transistor devices, once the SCR is turned on by the gate terminal, the gate terminal losses its control over the device.

8. The value of anode current required to maintain the conduction of an SCR even though the gate signal is removed is called as the
a) holding current
b) latching current
c) switching current
d) peak anode current
View Answer
Answer: b
Explanation: It is the minimum anode current value required to maintain the conduction

of an SCR even though the gate signal is removed. It is a very important parameter when employing an SCR in any circuit.

9. In the reverse blocking mode the middle junction (J_2) has the characteristics of that of a
a) transistor
b) capacitor
c) inductor
d) none of the mentioned
View Answer
Answer: b
Explanation: It is like a capacitor, as the dv/dt voltage triggering turns on the device. The charging current is given by,
$I_C = C_j dV_a/dt$.

10. _____are semiconductor thyristor devices which can be turned-on by light of appropriate wavelengths.
a) LGTOs
b) LASERs
c) MASERs
d) LASCRs
View Answer
Answer: d
Explanation: LASCR stands for light activated SCRs, which can be turned on in made to conduct by firing appropriate light pulses at its gate region.

Question Bank

UNIT – I
POWER SEMI-CONDUCTOR DEVICES

1. What is meant by thyristor converter system?
2. What is the difference between power diode and signal level diode?
3. Define reverse recovery time in diodes.
4. Define safe operating area.
5. What are the different methods to turn on the thyristor?
6. Define latching and holding current.
7. List the advantages of GTO over SCR?
8. Distinguish between SCR, TRIAC and GTO.
9. What is snubber circuit?
10. What is the drawback of SCR over BJT?
11. What is DIAC and how it differs from SCR?
12. Draw the symbol of TRIAC, GTO, MOSFET and IGBT.
13. Compare MOSFET and BJT.
14. Why IGBT is very popular now a day?
15. IGBT and MOSFET is voltage controlled device why?
16. Why MOSFETs are preferred for high frequency applications?
17. List the important features of IGBT.
18. Define circuit turn-off time
19. Why circuit turn-off time should be greater than the thyristor turn-off time?
20. What is the basis for selection of power semiconductor device for a particular application?

PART- B

1. i. Enumerate the importance of series and parallel operation of an SCR with relevant sketches.
   ii .Discuss the various methods of turning on of SCR.
   iii. Explain the two transistor analogy of SCR.
   iv. Explain about the dV/dt and di/dt protection in an SCR.
2. Draw the symbol and structure of TRIAC. Explain all the four triggering modes of operation with neat sketch.
3. i. Explain the construction, operation and switching characteristics of SCR.
   ii. Explain the construction, operation and switching characteristics of BJT.
   iii. Explain about the secondary breakdown in BJT.
4. i. Explain the construction, operation and switching characteristics of MOSFET.
   ii. Explain the construction, operation and switching characteristics of IGBT.

UNIT – II
PHASE CONTROLLED CONVERTER
PART A

1. What is meant by phase controlled rectifier?
2. Mention some of the applications of controlled rectifiers.
3. Classify controlled rectifiers.
4. Define delay or firing angle.
5. Define extinction angle.
6. Differentiate between line and forced commutation.
7. What is commutation angle or overlap angle?
8. What is the function of freewheeling diode in controlled rectifiers?
9. List the advantages of freewheeling diodes.

10. What is the inversion mode of rectifiers?
11. Why the power factor of semi converter is greater than full converter?
12. What is meant by input power factor in controlled rectifier?
13. What are the advantages of six pulse converter?
14. Distinguish between two and four quadrant converters.
15. What are ac voltage controllers and give few applications?
16. List the merits and demerits of ac voltage controllers.
17. List the strategies available for control of ac voltage controllers.
18. Distinguish between ON-OFF and integral cycle control.
19. What are the two types of ac voltage controllers? Which one of these is preferred, why?
20. What is meant by full wave or bidirectional ac voltage controller?

PART- B

1. Explain the principle of operation and derive the expressions for average output voltage and RMS output voltage of the following,
   a. Single-phase half controlled rectifier feeding R load
   b. Single-phase full controlled rectifier feeding RL load
   c. Single-phase two quadrant and two pulse converter operating on rectification and Inversion modes.
2. Explain the operation of three-phase half and full converter rectifier feeding RL load. With the aid of neat waveforms and also derive the expression for average output voltage.
3. Explain the effect of source impedance on the performance of converters.
4. Explain the operation of Single-phase ac voltage controller having only thyristors feeding resistive load by on-off and phase control. Derive the expression for rms value of output voltage in both cases.
5. Explain the principle of operation of Single-phase ac voltage controllers with necessary circuit and waveforms.

UNIT III
DC TO DC CONVERTER

PART- A

1. What is chopper and list its applications?
2. What are the advantages of dc chopper?
3. Define duty cycle.
4. What are the two types of control strategies used in choppers?
5. What is meant by frequency modulation control in dc chopper?
6. What is meant by pulse width modulation control in dc chopper?
7. What are the types of TRC?
8. What is current limit control?
9. Differentiate between step-up and step-down chopper.
10. What is continuous current operation?
11. Draw the circuit diagram of Buck-Boost chopper.
12. Why voltage commutated chopper is extensively used?
13. What are four quadrant choppers?
14. What is meant by Cycloconverters? List its types.
15. What are the applications of Cycloconverters?

PART- B

1. Explain the operation of step-up and step down choppers. Also derive the expressions for the output voltage.
2. With the aid of power circuit explain the Class A to Class E copper configurations.
3. Derive an expression for duty ratio of buck boost converter.

4. With relevant sketches explain the operation of a voltage, current and load commutated chopper.
5. Explain the operation of the following,
   a. Single phase to single phase bridge type Cycloconverters
   b. Three phase to single phase Cycloconverters.

UNIT IV
INVERTERS
PART- A

1. What are inverters, list its applications.
2. How inverters are classified based on the commutation circuitry?
3. How the output frequency is varied in an inverter?
4. Why diodes should be connected in anti parallel with the thyristors in inverter circuits?
5. Why thyristors are not preferred for inverters?
6. What is inverter gain?
7. Mention the methods available for the output voltage control of inverters.
8. What is meant by PWM control?
9. List the different types of PWM techniques.
10. What are the advantages of PWM techniques in inverters?
11. Compare VSI and CSI.
12. What are the applications of CSI?
13. What are the drawbacks of the presence of harmonics in inverters?
14. What are the methods of reduction of harmonic content?

PART- B

1. Explain the operation of single-phase half bridge inverter with aid of relevant waveforms and derive the instantaneous output voltage.
2. Explain the operation of single-phase full bridge inverter with aid of relevant waveforms and derive the instantaneous output voltage.
3. i. Explain the principle of operation of current source inverter.
   ii. Explain the principle of operation of auto sequential 1Ø current sourceinverter?
4. i. Explain three-phase 180^0 degree conduction mode of inverter.
   ii. Explain three-phase 120^0 degree conduction mode of inverter.
5. What is the need for controlling the output voltage of inverters and state the different methods of voltage control of single phase inverters. Describe the single phase sinusoidal PWM control with relevant waveforms.
6. Write short notes on, Harmonic reduction.

UNIT V AC TO AC CONVERTERS

1. What is the difference betweenON-OFF control and phase control?
2. What is the advantage of ON-OFF control?
3. What is the disadvantage ofON-OFF control?
4. What is the duty cycle in ON-OFF control method?
5. What is meant by unidirectional or half-wave ac voltage controller?
6. What are the disadvantages of unidirectional or half-wave ac voltage controller?
7. What is meant by bidirectional or half-wave ac voltage controller?
8. What is the control range of firing angle in ac voltage controller with RL load?
9. What type of gating signal is used in single phase ac voltage controller with RL load?
10. What are the disadvantages of continuous gating signal?
11. What is meant by high frequency carrier gating?
12. What is meant by sequence control ofac voltage regulators?

13. What are the advantages ofsequence control of ac voltage regulators?
14. What is meant by cyclo-converter?
15. What are the two types of cyclo-converters?
16. What is meant by step-up cyclo-converters?
17. What is meantby step-down cyclo-converters?
18. What are the applications of cyclo-converter?
19. What is meant by positive converter groupin a cyclo converter?
20. What is meant by negative converter group in a cyclo converter?

PART-B

1. Draw the circuit diagramof 1_capacitor commutated currentsource inverter and explain its operation with equivalent circuits for different modes and necessary waveforms.
2. Explain the operation of multistage controlof AC voltagecontrollers withneat diagram.
3. Explain the operation of 1_ ACvoltage controller with RL load.
4. Explain the operation of sequence control of AC voltagecontroller..

5 Explain the operation of 1_ sinusoidal AC voltagecontroller..