Power Electronics and Drives

1) The latching current of SCR is 18 mA.Its holding current will be
a) 6 mA b) 18 mA c) 54 mA d) 12 mA
= Answer (a) 6 mA
Latching current = 3 × Holding current
∴ Holding current = $\frac{18}{3}$
= 6 mA

2) A positive voltage is applied to the gate of a reverse biased SCR.
a) This injects more electrons into junction J_1
b) This increases reverse leakage current into anode
b) Hesting of junction is unaffected
d) Failure of junctions occurs due to thermal run away
= Answer (b) This increases reverse leakage current into anode

3) When the SCR cunducts,the forward voltage drop
a) is 0.7 V
b) is 1 to 1.5 V
c) increases slightly with load current
d) remains constant with load current
= Answer (c) increases slightly with load current

4) The maximum $\frac{dI}{dt}$ in a SCR is
a) directly proportional to V_m of supply voltage
b) inversely proportional to V_m of supply voltage
c) inversely proportional to L in the circuit
d) directly proportional to L in the circuit
= Answer (a) directly proportional to V_m of supply voltage

5) In a conventional reverse blocking thyristor
a) external layers are lightly doped and internal layers are heavily doped
b) external layers are heavily doped and internal layers are lightly doped
c) the p layers are heavily doped and the n layers are lightly doped
d) the p layers are lightly doped and the n layers are heavily doped
= Answer (d) the p layers are lightly doped and the n layers are heavily doped

6) In order to obtain static voltage equalization in series connected SCRs,connections are made of
a) one resistor across the string
b) resistors of different values across each SCR
c) resistors of the same value across each SCR
d) one resistor in series with the string
= Answer (c) resistors of the same value across each SCR

7) When a thyristor is negatively biased
a) all the three junctions are negatively biased
b) outer junctions are positively biased and the inner junction is negatively biased

c) outer junctions are negatively biased and the inner junction is positively biased
d) the junction near the anode is negatively biased and the one near the cathode is positively biased
= Answer (c) outer junctions are negatively biased and the inner junction is positively biased

8) MOS controlled thyristors have the following :
1. Low forward voltage drop during conduction
2. Fast turn-on and turn-off time
3. Low switching losses
4. High reverse voltage blocking capability
5. Low gate input impedance
Of these statements
a) 1,2 and 3 are correct
b) 3,4 and 5 are correct
c) 2,3 and 4 are correct
d) 1,3 and 5 are correct
= Answer (a) 1,2 and 3 are correct

9) Which semiconductor power device out of the following is not a current triggered device ?
a) Thyristor b) GTO c) Triac d) MOSFET
= Answer (d) MOSFET

10) The frequency of ripple in the output voltage of a three-phase half controlled bridge rectifier depends on the
a) firing angle b) lead inductance
c) load resistance d) supply frequency
= Answer (d) supply frequency

11) It is required to drive a DC shunt motor at different speeds in both the directions (forward and reverse) and also to brake it in both the directions.Which one of the following would you use?
a) A half-controlled thyristor bridge
b) A full-controlled thyristor bridge
c) A dual converter
d) A diode bridge
= Answer (c) A dual converter

12) A fully controlled three-phase converter has to supply an output voltage 270 V.The minimum secondary line voltage of the input transformer is
a) 490 V b) 280 V c) 350 V d) None of these
= Answer (a) 490 V

$V_{mean} = \frac{\sqrt{3}}{\pi} V_{line}$

$\therefore V_{line} = \frac{270 \times \pi}{\sqrt{3}}$

= 490 v

13) A single-phase half wave controlled rectifier has 400 sin 314t as the input voltage and R as the load.For the firing angle of 60^0 for the SCR,the average output voltage is
a) $\frac{400}{\pi}$ b) $\frac{300}{\pi}$ c) $\frac{240}{\pi}$ d) $\frac{200}{\pi}$

= Answer (b) $\frac{300}{\pi}$

$V_0 = \frac{V_m}{2\pi}(1 + \cos\alpha)$

$= \frac{400}{2\pi}(1 + \cos 60^0)$

$= \frac{300}{\pi}$

14) If a three-phase,half-wave rectifier,if per phase input voltage is 200 V,then the average output voltage is

a) 233.91 V b) 116.95 V c) 202.56 V d) 101.28 V

= Answer (a) 233.91 V

$V_0 = \frac{3\sqrt{2}V_{ph}}{\pi}$

$= \frac{3\sqrt{2}\times 200}{\pi}$

= 233.91 V

15) A three-phase converter feeds a pure resistance load at a firing angle of $\alpha = 60^0$.The average value of current flowing in the load is 10 A.If a very large inductance is connected in the load circuit,then the

a) average value of current will remain as 10 A

b) average value of current will become greater than 10 A

c) average value of current will become less than 10 A

d) trend of variation of current cannot be predicted unless the exact value of the inductance connected is known

= Answer (a) average value of current will remain as 10 A

16) A single-phase diode bridge rectifier supplies a highly inductive load.The load current can be assumed to be ripple free.The AC supply side current waveform will be

a) sinusoidal b) constant DC c) square d) triangular

= Answer (c) square

17) In a three-phase controlled bridge rectifier with an increase of overlap angle,the output DC voltage

a) decreases

b) increases

c) does not change

d) depends upon load inductance

= Answer (a) decreases

18) AC to DC circulating current dual converters are operated with the following relationship between their triggering angle (α_1 and α_2)

a) $\alpha_1 + \alpha_2 = 180^0$ b) $\alpha_1 + \alpha_2 = 360^0$

c) $\alpha_1 - \alpha_2 = 180^0$ d) $\alpha_1 + \alpha_2 = 90^0$

= Answer (a) $\alpha_1 + \alpha_2 = 180^0$

19) In a dual converter,the circulating current

a) allows smooth reversal of load current but increases the response time

b) does not allow smooth reversal of load current but reduces the response time

c) allows smooth reversal of load current with improved speed of response

d) flows only if there is no interconnecting inductor

= Answer (c) allows smooth reversal of load current with improved speed of response

20) Resonant converters are basically used to
a) generate large peaky voltage
b) reduce the switching losses
c) eliminate harmonics
d) convert a squarewave into a sinewave
= Answer (b) reduce the switching losses

21) A three-phase,fully controlled,converter is feeding power into a DC load at a constant current of 150 A.The rms current through each thyristor of the converter is
a) 50 A b) 100 A c) $\frac{150\sqrt{2}}{\sqrt{3}}$ A d) $\frac{150}{\sqrt{3}}$ A
= Answer (d) $\frac{150}{\sqrt{3}}$ A

22) A chopper operating at a fixed frequency is feeding on RL load.As the duty ratio of the chopper is increased from 25% to 75%,the ripple in the load current
a) remains constant
b) decreases,reaches a minimum at 50% duty ratio and then increases
c) increases,reaches a maximum at 50% duty ratio and then decreases
d) keeps on increasing as the duty ratio is increased
= Answer (a) remains constant

23) In a thyristor DC chopper,which type of commutation results in best performance?
a) Voltage commutation b) Current commutation
c) Load commutation d) Supply commutation
= Answer (c) Load commutation

24) Chopper control for DC motor provides variation in
a) input voltage b) frequency
c) Both (a) and(b) d) None of these
= Answer (a) input voltage

25) A step-up chopper has V_s as the source voltage and α as the duty cycle.The output voltage for this chopper is given by
a) $V_s(1 + \alpha)$ b) $V_s/(1 - \alpha)$ c) $V_s(1 - \alpha)$ d) $V_s/(1 + \alpha)$
= Answerb (b) $V_s/(1 - \alpha)$

26) In DC chopper,if T is the chopping period,then the output voltage can be controlled by PWM by varying
a) T keeping T_{On} constant b) T_{On} kepping T constant
c) T keeping T_{Off} constant d) T_{Off} keeping T constant
= Answer (b) T_{On} kepping T constant

27) For type A chopper,V_s is the source voltage,R is the load resistance and α is the duty cycle.Average output voltage of this chopper is
a) αV_s b) $(1 - \alpha)\ V_s$ c) V_s/α d) $V_s/(1 - \alpha)$
= Answer (a) αV_s

28) In DC chopper,the waveform for input voltage
a) is continuous and output voltage is discontinuous
b) is discontinuous and output voltage is continuous
c) as well as output voltage both are continuous
d) as well as output voltage both are discontinuous
= Answer (a) is continuous and output voltage is discontinuous

29) In DC choppers,if T_{On} is the On period and f is the chopping frequency,then output voltage in terms of the input voltage V_i is given by
a) $V_s T_{On}$/f b) V_sf/T_{On} c) V_s/(f/T_{On}) d) V_sfT_{On}
= Answer (a) $V_s T_{On}$/f

30) In DC choppers,the waveform for input and output voltages are respectively
a) discontinuous and continuous b) continuous and discontinuous
c) both continuous d) both discontinuous
= Answer (b) continuous and discontinuous

31) The efficiency of a chopper can be expected in the range
a) 50 to 55% b) 65 to 72% c) 82 to 87% d) 92 to 99%
= Answer (d) 92 to 99%

32) The feedback diodes in a DC to AC thyristor inverter
a) freewheel the load current
b) provide reverse bias effectively to the thyristor for turn-off
c) improve the switching properties of the inverter
d) improve the harmonic distortion to the inverter output current
= Answer (a) freewheel the load current

33) A single-phase inverter has square wave output voltage.What is the percentage of the fifth harmonic component in relation to the fundamental component?
a) 40% b) 30% c) 20% d) 10%
= Answer (c) 20%

34) When a line commutated converter operates in the inverter mode,it
a) draws both real and reactive power from the AC supply
b) delivers both real and reactive power to the AC supply
c) delivers real power to the AC supply
d) draws reactive power from the AC supply
= Answer (c) delivers real power to the AC supply

35) In a three-phase voltage source inverter operating in square wave mode,the output line voltage is free from
a) 3rd harmonic b) 7th harmonic
c) 11th harmonic d) 13th harmonic
= Answer (a) 3rd harmonic

36) Which one of the following statements are correct in connection with inverters?
1) Both voltage source inverter and current source inverter require feedback diodes

2) The current source inverter requires feedback diodes
3) GTOs can be used only in the current source inverter
4) The voltage source inverter requires feedback diodes
a) Only 1 b) 2 and 3 c) 3 and 4 d) Only 4
= Answer (c) 3 and 4

37) The commutation method, in an inverter is
a) line commutation b) forced commutation
c) Either (a) or (b) d) None of these
= Answer (c) Either (a) or (b)

38) In a series inverter supplying a load resistor R,the commutating elements L and C should be such that
a) $R^2 = \frac{4L}{C}$ b) $R^2 < \frac{4L}{C}$ c) $R^2 > \frac{4L}{C}$ d) $R^2 < \frac{2L}{C}$
= Answer (b) $R^2 < \frac{4L}{C}$

39) The thermal resistance between the body of a power semiconductor device and the ambient is expressed as
a) voltage across the device divided by current through the device
b) average power dissipated in the device divided by the square of the rms current in device
c) average power dissipated in the device divided by the temperature difference from body to ambient
d) temperature difference from body to ambient divided by average power dissipated in the device
= Answer (d) temperature difference from body to ambient divided by average power dissipated in the device

40) A switched mode power supply operating at 20 kHz to 100 kHz range uses as the main switching element
a) thyristor b) MOSFET c) triac d) UJT
= Answer (b) MOSFET

41) Which semiconductor power device out of the following is not a current triggered device?
a) Thyristor b) GTO c) Triac d) MOSFET
= Answer (d) MOSFET

42) The uncontrolled electronic switch employed in power electronic converter is
a) thyristor b) bipolar junction c) diode d) MOSFET
= Answer (a) thyristor

43) The MOSFET switch in its On state may be considered equivalent to
a) resistor b) inductor c) capacitor d) battery
= Answer (c) capacitor

44) As the temperature is increased,the voltage across a diode carrying a constant current
a) increases
b) decreases
c) remains constant
d) may increase or decrease depending upon the doping levels in the junction

= Answer (b) decreases

45) A bipolar junction Transistor (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,for the BJT
a) both the base emitter and base collector junction are reverse 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 reverse biased
d) both the base emitter and base collector junctions are forward biased
= Answer (d) both the base emitter and base collector junctions are forward biased

46) The conduction loss versus device current characteristic of a power MOSFET is best approximated by a/an
a) parabola
b) straight line
c) rectangular hyperbola
d) exponentially decaying function
= Answer (a) parabola

47) Six MOSFETs connected in a ridge configuration (having no other power device) must be operated as a voltage source inverter (VSI).This statement is
a) true,because being majority carrier device,MOSFETs are voltage driven
b) true,because MOSFETs have inherently antiparallel diodes
c) false,because it can be operated both as Current Source Inverter (CSI) or a VSI
d) false,because MOSFETs can be operated as excellent constant current sources in the statement region
= Answer (d) false,because MOSFETs can be operated as excellent constant current sources in the statement region

48) A triac can be triggered by a gate pulse of …….. polarity.
a) negative
b) positive
c) neither negative nor positive
d) either positive or negative
= Answer (d) either positive or negative

49) Turn-on time of SCR can be reduced by using a
a) rectangular pulse of high amplitude and narrow width
b) rectangular pulse of low amplitude and wide width
c) triangular pulse
d) trapezoidal pulse
= Answer (a) rectangular pulse of high amplitude and narrow width

50) The triac can be used only in
a) inverter
b) rectifier
c) multiquadrant chopper
d) cycloconverter
= Answer (c) multiquadrant chopper

51) Which of the following does not cause permanent damage of an SCR?
a) High current
b) High rate of rise current
c) High temperature rise
d) High rate of rise of voltage
= Answer (c) High temperature rise

52) If a diode is connected in antiparallel with a thyristor,then
a) Both turn-off power loss and turn-off time decrease
b) Turn-off power loss decreases but turn-off time increases
c) Turn-off power loss increases but turn-off time decreases
d) None of the above
= Answer (b) Turn-off power loss decreases but turn-off time increases

53) The main reason for connecting a pulse transformer at the output stage of a thyristor triggering circuit is to
a) amplifying the power of the triggering pulse
b) provide electrical isolation
c) reduce the turn-on time of the thyristor
d) avoid spurious triggering of the thyristor due to noise
= Answer (b) provide electrical isolation

54) An SCR is considered to be semi-controlled device because
a) it can be turned-off but not On with a gate pulse
b) it conducts only during one half-cycle of an alternating current wave
c) it can be turned-on but not Off with a gate pulse
d) it can be turned-on only during one half-cycle of an alternating voltage wave
= Answer (c) it can be turned-on but not Off with a gate pulse

55) A single-phase diode bridge rectifier supplies a highly inductive load.The load current can be assumed to be ripple free.The AC supply side current waveform will be
a) sinusoidal b) constant DC c) square d) triangular
= Answer (c) square

56) When a line commutated converter operates in the inverter mode
a) it draws both real and reactive powers from the AC supply
b) it delivers both real and reactive power to the AC supply
c) it delivers real power to the AC supply
d) it draws reactive power from the AC supply
= Answer (c) it delivers real power to the AC supply

57) Thyristor circuit that directly convert polyphase AC voltage from one frequency to another frequency are called
a) SCR b) cycloconverter c) inverter d) converter
= Answer (b) cycloconverter

58) In a three-phase controlled bridge rectifier with an increase of overlap angle,the output DC voltage
a) decreases

b) increases
c) does not change
d) depends upon load inductance
= Answer (a) decreases

59) In a dual converter,the circulating current
a) allows smooth reversal of load current but increases the response time
b) does not allow smooth reversal of load current but reduces the response time
c) allows smooth reversal of load current with improve speed of response
d) flows only if there is no interconnecting inductor
= Answer (c) allows smooth reversal of load current with improve speed of response

60) A PWM switching scheme is used with a three phase inverter to
a) reduce the total harmonic distortion with modest filtering
b) minimize the load on the DC side
c) increase the life of batteries
d) reduce low order harmonics and increase high order harmonics
= Answer (d) reduce low order harmonics and increase high order harmonics

61) Triangular PWM ontrol,when applied to a three-phase,BJT based voltage source inverter,introduces
a) low order harmonic voltages on the DC side
b) very high order harmonic voltages on the DC side
c) low order harmonic voltages on the AC side
d) very high order harmonic voltage on the AC side
= Answer (d) very high order harmonic voltage on the AC side

62) A thyristorised,three-phase,fully controlled converter feeds a DC load that draws a constant current.Then,he input AC line current to the converter ha a/an
a) rms value equal to the DC load current
b) average alue equal to the DC load current
c) peak value equal to the DC load current
d) fundamental frequency component whose rms value is equal to the DC load current
= Answer (c) peak value equal to the DC load current

63) The output voltage waveform of a three-phase square wave inverter contains
a) only even harmonic
b) both odd and even harmonics
c) only odd harmonics with no triplen
d) only triplen harmonics
= Answer (c) only odd harmonics with no triplen

64) A single-phase ull wave half ontrolled bridge converter feed in inductive load.The two SCRs in the converter are connected to a common DC bus.The converter has to have a freewheeling diode
a) because the converter inherently does not provide for freewheeling
b) because the converter does not provide for freewheeling for high values of triggering angles
c) or else the freewheeling action of the converter will cause shorting of the AC supply
d) or else if a gate pulse to one of the SCRs is missed,it will subsequently cause a high load current in the other SCR

= Answer (b) because the converter does not provide for freewheeling for high values of triggering angles

65) In a thyristor DC chopper,which type of commutation results in best performance?
a) voltage commutation b) current commutation
c) load commutation d) supply commutation
= Answer (a) voltage commutation

66) In case of an armature controlled separately excited DC motor drive with close-loop control,an inner current,loop is useful because it
a) limits the speed of the motor to a safe value
b) helps in improving the drive energy effiency
c) limits the peak current of the motor to the permissible value
d) reduces the steady state speed error
= Answer (a) limits the speed of the motor to a safe value