1.For 3-Q semi converter, firing angle is 60°. Free-wheeling diode conduct for

A. 30°
B. 60°
C. 90°
D. None

Answer ||| D

Solution |||

$$\begin{cases} it\alpha \leq 60° \rightarrow Thyristorconductionperiod = 120° \\ F \qquad\qquad Dconductionperiod = 0° \end{cases}$$

2.Which of the following NOT a mode of operation of SCR.

A. Forward blocking mode
B. Forward conduction mode
C. Reverse blocking mode
D. Reverse conduction mode.

Answer ||| D

Solution |||

A SCR is conducts only when anode is at higher potential than cathode. Hence it cannot be operate in reverse conduction mode.

3.For a 3-ϕ inverter having balanced 3-ϕ load with 180° conduction mode, supply voltage is 440 V. All switches are considered to be ideal, then output rms voltage (line voltage) _____ volts.

A. 440
B. $\frac{440}{\sqrt{2}}$
C. $440\sqrt{\frac{3}{2}}$
D. $440\sqrt{\frac{2}{3}}$

Answer ||| D

Solution |||

For a 3-ϕ inverter with 3-ϕ balanced load having 180° conduction mode,

$$V_{0rms}, \text{line} = V_s\sqrt{\frac{2}{3}}$$

$$= 440\sqrt{\frac{2}{3}}$$

4.Which of the following devices does NOT requires a continuous base drive?

A. MOSFET
B. IGBT
C. BJT
D. SCR

Answer ||| D

Solution |||

⇒ MOSFET requires continuous base voltage to remain in ON state

⇒ BJT requires continuous base current to remains ON state

⇒ IGBT also requires continuous base voltage to remain in on state

⇒ But in SCR gate pulse is required only for turn on process, once SCR turned on, it remains on until anode current become less than holding current.

5.The resistance of a thermistor

A. Increases with the increase of temperature
B. Decreases with the increase of temperature
C. Remains constant with the increase of temperature
D. Remains constant with the decrease of temperature

Answer ||| B

Solution ||| The resistance of a thermistor decreases with the increase of temperature. All resistors vary with temperature, but thermistors are constructed of semiconductor material with a resistivity that is especially sensitive to temperature. However, unlike most other resistive devices, the resistance of a thermistordecreases with increasing temperature.

6.Choose the current option from the statements given below

S1: In string of series connected SCR with addition of SCR in series reliability of the string increases.

S2: In string of series connected SCR with addition of SCR in series efficiency of the string increases.

A. S1 only
B. S2 only
C. Both S1 and S2
D. Neither S1 nor S2

Answer ||| A

Solution |||

Efficiency $\eta = \frac{\text{Total string voltage}}{(\text{One SCR voltage}) \times (\text{Total units})}$

With addition of SCR in series, total units will increase and efficiency will be reduced

So, S2 is incorrect.

Since D.F = 1 – η

So D.F will increase with addition of SCR in series → i.e. Reliability will be increased.

So S1 is correct

7.Use of a reverse conducting thyristor in place of antiparallel combination of thyristor and feedback diode in an inverter:

A. Effectively minimizes the peak commutating current
B. Decreases the operating frequency of operation
C. Minimizes the effects of load inductance on the commutation performance
D. Causes deterioration in the commutation performance

Answer ||| D

Solution ||| Use of a reverse conducting thyristor in place of antiparallel combination of thyristor and feedback diode in an inverter causes deterioration in the commutation performance

8.In a step-down chopper circuit, the 7th harmonic component of output voltage needs to be eliminated completely. What will be the Ton time for the desired result if the Total time period is 540μsec?

A. 57.14 µsec
B. 67.14 µsec
C. 77.14 µsec
D. None of the Above

Answer ||| C

Solution |||

For harmonic Elimination is case of step-down chopper : $\delta = \frac{1}{n}$

Where,

δ = duty cycle

n = harmonic

Here we are telling about 7th harmonic, So n = 7

$\delta = \frac{1}{7}$

$\frac{T_{on}}{T} = \frac{1}{7}$

$T_{on} = \frac{T}{7} = \frac{540}{7}$

= 77.14µsec

9.A 1-ϕ full bridge inverter, employing transistors, is fed from 220V dc source. The THD and distortion factor respectively are

A. 48.9% and 0.6
B. 48.43% and 0.9
C. 48.9% and 0.9
D. 48.43% and 0.6

Answer ||| B

Solution |||

For 1-ϕ full bridge inverter

RMS value of output voltage,

$V_{0rms} = V_S = 220V$

Now, rms value of fundamental component of output voltage,

$$V_{01} = \frac{4V_S}{\sqrt{2}\pi} = \frac{4 \times 220}{\sqrt{2}\pi}$$
$$V_{01} = 198.07\,V$$

Distortion factor is

$$D.F. - \frac{V_{01}}{V_{0rms}} = \frac{198.07}{220} = 0.9$$

Total harmonic distortion is

$$THD = \sqrt{\left(\frac{1}{DF}\right)^2 - 1} = \sqrt{\left(\frac{1}{0.9}\right)^2 - 1} = 0.4843$$

THD = 48.43%

10.Which device provides protection against power outages, voltage regulation during undervoltage and over voltage?

A. Uninterruptible power supply
B. Cycloconverter
C. Unijunction oscillator
D. SMPS

Answer ||| A

Solution |||

UPS provides protection against power outages as well as voltage regulation during undervoltage and overvoltage conditions.

For Supplying critical loads such as computers medical equipment's etc, it is necessary to use UPS.

11.A single phase full bridge inverter controls the power in a resistive load by uniform multiple pulse modulation. The frequency of triangular carrier wave is 1kHz and inverter reference wave frequency is 125Hz. If the total pulse width is 120°, find the width of each pulse?

A. 45°
B. 55°
C. 30°

D. 40°

Answer ||| C

Solution |||

For uniform multiple pulse modulation

No. of pulses/ half cycle , $N = \frac{f_c}{2f_r} = \frac{1000}{2 \times 125} = 4$

Total pulse width = 2d

Width of each pulse = $\frac{2d}{N}$

Width of each pulse = $\frac{120}{4} = 30°$

12.Match the following regarding their property.

Device		Property	
(1)	MOSFET	(i)	Majority carrier devices
(2)	Schottky diode	(ii)	Negative Temperature coefficient (NTC)
(3)	BJT		
(4)	Power diode		

A. (1) – (i), (2) – (i), (3) – (ii), (4) – (ii)
B. (1) – (i), (2) – (ii), (3) – (i), (4) – (ii)
C. (1) – (ii), (2) – (ii), (3) – (i), (4) – (i)
D. (1) – (ii), (2) – (i), (3) – (ii), (4) – (i)

Answer ||| A

Solution |||

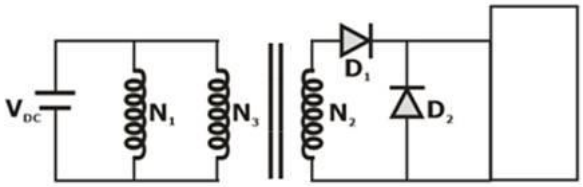
Majority carrier devices		Minority carrier devices	
(1)	MOSFET, Schottky diode	(i)	Power diode, SCR/GTO, BJT
(2)	PTC	(ii)	NTC
(3)	Fast devices	(iii)	Slow devices

13.A switch mode power supply is designed along with a demagnetizing winding with maximum duty ratio of 0.8. What is the turns duty ratio of demagnetizing winding with primary winding at maximum duty ratio ?

A. 2
B. 4
C. 0.25
D. 0.5

Answer ||| B

Solution |||



Maximum duty cycle, $\propto_{max} = \frac{N_1}{N_1 + N_3}$

$$0.8 = \frac{N_1}{N_1 + N_3}$$

$0.8\ N_3 = 0.2\ N_1$

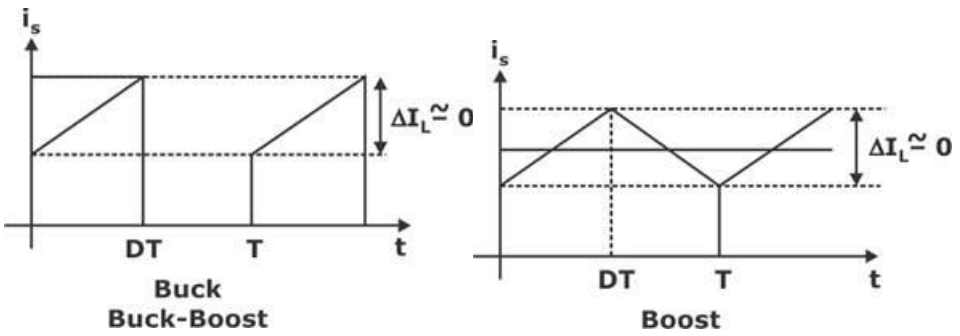
$$\frac{N_1}{N_3} = \frac{N_P}{N_D} = 4$$

14.Which of the following is FASLE?

A. BUCK converter needs external source filter to reduce harmonic component.
B. BUCK-Boost converter needs external source filter.
C. BOOST converter doesn't need any additional filter.
D. BOOST converter needs external source filter.

Answer ||| D

Solution |||



From the above is waveforms $i_s = 0$ from DT to T in Buck and Buck-Boost converters that means it is highly discontinuous due to presence of switch at the source side, this discontinuous nature of i_s contains more harmonic component in order to minimize this external source filter is required in Buck and Buck-Boost converters whereas in Boost converter by selecting inductance value in such a way that it is possible to maintain is to be approximately constant and hence additional filter is not required.

15.A step down chopper operates from a D.C. voltage source V_s = 400 V and feeds a DC motor armature with a back emf E_b = 300 V. From the oscilloscope traces it is found that the current rises for a time t_r = 10 m sec and falls to zero over time t_r = 5 m sec and remains zero for a time of t_o = 6 m sec in every chopping cycle. Then, average DC voltage across the freewheeling diode will be

A. 276 V
B. 257 V
C. 262 V
D. 300 V

Answer ||| A

Solution ||| Average DC voltage across the free – wheeling diode (V_{fd}) =

$$V_{fd} = \frac{V_s t_r + E_b t_o}{t_r + t_f + t_o}$$

$$V_{fd} = \frac{400\times10 + 300\times6}{10 + 5 + 6}$$

$$V_{fd} = 276.19\,V$$

16.For a 3-phase inverter if input DC voltage is 300 V, find output phase voltage, if it is working in 180° conduction mode.

A. 300 V
B. 100 V

C. $200\sqrt{2}V$
D. $100\sqrt{2}V$

Answer ||| D

Solution |||

$$(V_0)_{Ph} = \frac{\sqrt{2}}{3} V_{DC}$$

V_{DC} = 300 V

$$(V_0)_{Ph} = \frac{\sqrt{2}}{3} \times 300$$

$$= 100\sqrt{2}$$

17.In a resonance pulse inverter:

A. DC output voltage variation is wide
B. The frequency is low
C. The output voltage is never sinusoidal
D. DC saturation of transformer core is minimized

Answer ||| A

Solution ||| Resonant inverters are electrical inverters based on resonant current oscillation. In series resonant inverters the resonating components and switching device are placed in series with the load to form an under damped circuit. The current through the switching devices fall to zero due to the natural characteristics of the circuit. If the switching element is a thyristor, it is said to be self- commutated. DC output voltage variation is wide in a resonance pulse inverter.

18.For a 6-pulse converter, what is the ratio of minimum source current harmonic and minimum output voltage harmonic number?

A. 1: 1
B. 3: 5
C. 5: 6
D. 3: 2

Answer ||| C

Solution |||

For n-pulse converter,

Source current has nk ± 1 harmonics.

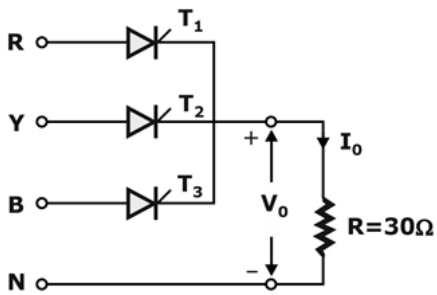
Output voltage has nk harmonics.

For 6 pulse → current harmonics= 5, 7, 11, 13……

Voltage harmonics = 6, 12, 18…….

So, ratio = 5: 6.

19.A 3-ϕ half wave connected rectifier circuit is shown in figure. It is operated from 3-ϕ star connected, supply transformer with a line to line ac supply voltage of 400 volts rms, at 50 Hz. The thyristors are triggered at a delay angle of α = 30°. Assume continuous ripple free current. The average output current is _____A .



A. 7.79 A
B. 12.86 A
C. 5.24 A
D. 15.12 A

Answer ||| A

Solution |||

For 3-ϕ half wave controlled rectifier,

the average output voltage for continuous ripple free output current is,

$$V_{0(avg)} = \frac{3\sqrt{3}\,V_m}{2\pi}\cos\alpha \quad ...(1)$$

Here V_m is peak value of supply phase voltage

We have

$$V_{line(rms)} = 400V;\ \therefore\ V_{ph(rms)} = \frac{400}{\sqrt{3}}$$

$\therefore\ V_{ph(rms)} = 230.94\ V$

$\therefore\ V_m = \sqrt{2}\ V_{ph}\ (rms)$

$= \sqrt{2} \times 230.94$

$\boxed{V_m = 326.6\ V}$

∴ From equation (1)

$$V_{0(avg)} = \frac{3\sqrt{3} \times 326.6}{2\pi} \cos 30^\circ$$

$\boxed{V_{0(avg)} = 233.91\ V}$

Average output current,

$$I_{0(avg)} = \frac{V_{0(avg)}}{R} = \frac{233.91}{30}$$

$\boxed{I_{0(avg)} = 7.79\ A}$

20.Surge current rating of single cycle for SCR is 100 A, then half (1/2) cycle surge current rating will be:

A. 70.71 A
B. 50 A
C. 100 A
D. 141.42 A

Answer ||| D

Solution |||

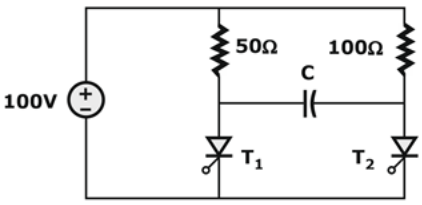
As we known:

$(\text{Surge Current rating})_{1/n} = \sqrt{n} \times (\text{Surge Current rating})_1$

$(I)_{1/2} = \sqrt{2} \times (I)_1 = \sqrt{2} \times 100$

=141.42 A

21.For Class-C commutator shown below, peak value of current from Thyristor T_2 is _____ Amp.



A. 2.5
B. 3.5
C. 4.5
D. 5

Answer ||| D

Solution |||

$$I_{T_2\,max} = V_s\left(\frac{2}{R_1}+\frac{1}{R_2}\right)$$

$$=100\left(\frac{2}{50}+\frac{1}{100}\right)$$

$$=5\text{ A}$$

22.Which of the following statement is correct.

A. SCRs are subjected to peak inverse of $2V_m$ in mid-point converter and V_m in bridge converter.
B. SCRs are subjected to peak inverse of V_m in mid-point converter and $2V_m$ in bridge converter.
C. SCRs are subjected to peak inverse of V_m in mid-point converter and V_m in bridge converter.
D. SCRs are subjected to peak inverse of $2V_m$ in mid-point converter and $2V_m$ in bridge converter.

Answer ||| A

Solution |||

In Bridge converter,

PIV of SCR = V_m

In mid-point converter,

PIV of SCR = $2V_m$

23.For a single phase asymmetrical semi-converter, firing angle is increased from 30° to 45°. Its output voltage will

A. Decrease
B. Increase
C. May increase or decrease
D. cannot be determined

Answer ||| A

Solution |||

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

$$\frac{V_{0_2}}{V_{0_1}} = \frac{1+\cos 45^\circ}{1+\cos 30^\circ}$$

So,

$$V_{o_2} = \frac{1+\frac{1}{\sqrt{2}}}{1+\frac{\sqrt{3}}{2}} V_{0_1}$$

$$= \frac{\frac{1+\sqrt{2}}{\sqrt{2}}}{\frac{2+\sqrt{3}}{2}} V_{0_1}$$

$$= \frac{1+\sqrt{2}}{\sqrt{2}} \times \frac{2}{2+\sqrt{3}} = \left(\frac{1+\sqrt{2}}{2+\sqrt{3}}\right) \sqrt{2}\, V_{0_1}$$

So,

$$V_{0_2} = \frac{2+\sqrt{2}}{2+\sqrt{3}} V_{0_1}$$

So $V_{0_2} < V_{0_1}$

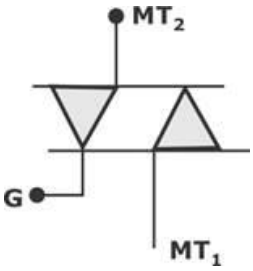
24.Triac can conduct with

A. positive voltage at gate only.
B. Negative voltage at gate only.
C. Either positive or negative voltage at gate.
D. Conduct without gate signal.

Answer ||| C

Solution |||

<u>Triac</u>



1.3 terminal bidirectional switch.

2.Can conduct with either positive or negative voltage at gate.

3.It is equivalent to two thyristors connected back-to-back with their gate terminals tied up.

25.A single phase inverter has a square wave output voltage. What is the percentage of fifth harmonic component in relation to fundamental component present in the output voltage?

A. 40%
B. 30%
C. 20%
D. 10%

Answer ||| C

Solution ||| n^{th} harmonic output voltage for single phase inverter is given by –

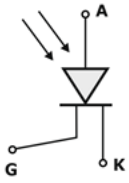
$$V_{on} = \frac{2V_s}{n\pi} \sin n\omega t$$

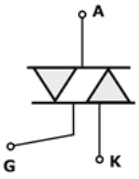
For fundamental component, n = 1
For fifth harmonic component, n = 5

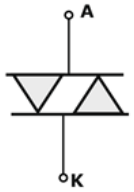
$$\frac{V_{o5}}{V_{01}} = \frac{1}{5} = 0.2$$

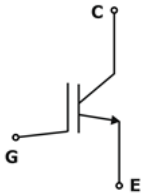
In % $\frac{V_{o5}}{V_{01}} = 20\%$

26.IGBT is shown by which of the following figures

A. 

B. 

C. 

D. 

Answer ||| D

Solution |||

(A) → Light activated thyristor

(B) → TRIAC

(C) → DIAC

(D) → IGBT

27.In a single phase inverter using single pulse modulation for control of output voltage, Harmonics of the order ‘n’ can be eliminated by making the pulse width equal to

A. 4 π/n
B. 2 π/n
C. π/n
D. π/2n

Answer ||| B

Solution |||

$$van = \frac{4vs}{n\pi}\sin(nd)\sin(nwt)$$

Van = 0

nd = π, 2π

$$d = \frac{\pi}{n}, \frac{2\pi}{n}$$

$$pulse\ width = 2\alpha = \frac{2\pi}{n}$$

28.In a step down chopper, for eliminating third harmonic from the output voltage waveform, the ripple factor should be equal to

A. $\sqrt{3}$
B. $\sqrt{2}$
C. $\sqrt{5}$
D. 1.5

Answer ||| B

Solution |||

For step down chopper to eliminate third harmonics from output voltage waveform duty cycle is

$$D = \frac{1}{n} = \frac{1}{3}$$

where, n = n^{th} harmonic to be eliminated.

Now, we know that

$$V_0 = DV_S \qquad \text{where } V_0 = \text{average voltage}$$

$$V_{0r} = \sqrt{D}\,V_S \qquad V_{0r} = \text{rms voltage}$$

$$\therefore V_0 = \frac{1}{3}V_S \ \&\ V_{0r} = \frac{1}{\sqrt{3}}V_S$$

From factor is

$$FF = \frac{V_{0r}}{V_0} = \frac{\frac{1}{\sqrt{3}}V_S}{\frac{1}{3}V_S}$$

$$\therefore\ FF = \sqrt{3}$$

Ripple factor is given by

$$R.F. = \sqrt{(FF)^2 - 1} = \sqrt{(\sqrt{3})^2 - 1}$$

$= \sqrt{3-1}$

$\therefore$ R.F. $= \sqrt{2}$

29.For an SCR operating at 50 Hz. One cycle surge current rating will be _____ Amp, If half cycle surge current rating is 3000 Amp.

A. 3000
B. 1414.14
C. 1000
D. 2121.3

Answer ||| D

Solution |||

Equating energies involved in one cycle and half cycle surges

$$I_1^2 t_1 = I_2^2 t_2$$

$I_1 = 3000$

$$I_2 = \frac{3000}{\sqrt{2}}$$

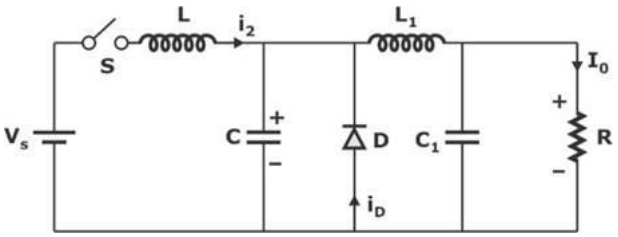
= 2121.3 A

30.In zero current switching resonant converter,

A. Inductor is connected in series with the switch.
B. Inductor is connected in parallel with the switch.
C. Capacitor is connected in series with the switch.
D. Capacitor is connected in parallel with the switch.

Answer ||| A

Solution |||



As you can see in zero current switching resonant converter, inductor is connected in series with switch.

31.For a 1-ϕ full bridge inverter, if

(i) X_L = 6 ohm

(ii) X_C = 4 ohm and

(iii) R = 2 ohm,

Then, each diode conducts for

A. 15°
B. 30°
C. 45°
D. 60°

Answer ||| C

Solution |||

Conduction angle of diode, $\theta = \tan^{-1}\left(\frac{X_L - X_C}{R}\right)$

$$= \tan^{-1}\left(\frac{6-4}{2}\right) = \tan^{-1}(1) = 45°$$

32.For series capacitor committed inverter correct relation for satisfactory operation is

A. $\frac{1}{LC} < \frac{R^2}{L^2}$
B. $\frac{1}{LC} > \frac{R^2}{L^2}$
C. $\frac{1}{LC} < \frac{R^2}{4L^2}$
D. $\frac{1}{LC} > \frac{R^2}{4L^2}$

Answer ||| D

Solution |||

In VSI, obtaining load communication load circuit must be under damped.

i.e., $\xi < w_0$

as $w_0 = \frac{1}{\sqrt{2c}}$

& $\xi = \frac{R}{2L}$

So $\frac{R}{2L} < \frac{1}{\sqrt{LC}}$

or $\frac{R^2}{4L^2} < \frac{1}{LC}$

33.Input voltage v=230 sin(100 π t) volts is given to a converter and the current drawn by the converter is i = 20sin $\left(100\pi t - \frac{\pi}{3}\right)$ +10sin(300 π t+45°)+2sin $\left(700\pi t - \frac{\pi}{3}\right)$ Amps. What is the active power drawn by the converter?

A. 2300 W
B. 1150 W
C. 4324 W
D. 2162 W

Answer ||| B

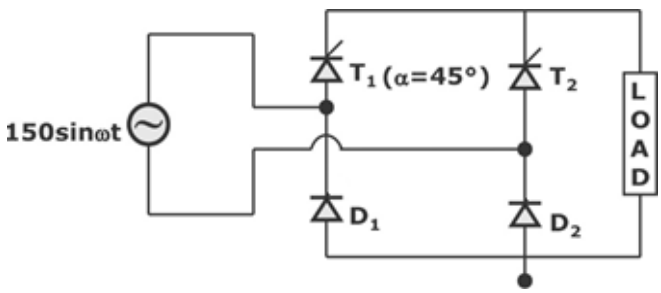
Solution ||| Active power output will be due to fundamental component of current only.

$\therefore P = v_{rms} i_{rms} \cos\phi$

$$P = \frac{230}{\sqrt{2}} \times \frac{20}{\sqrt{2}} \times \cos 60°$$

P = 1150 W

34.Determine the RMS output voltage for the circuit shown below.

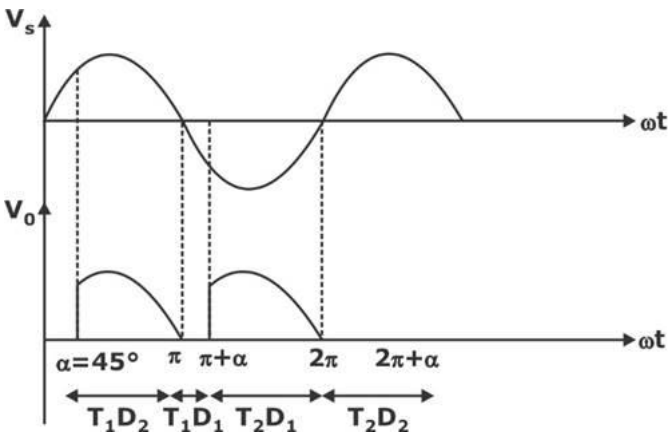


A. 101.1 V
B. 357.2 V
C. 228.5 V
D. 39.8 V

Answer ||| A

Solution |||

Given circuit is a 1 – ϕ half controlled converter or semi-converter.



RMS output voltage, $V_{0(rms)} = \frac{V_m}{\sqrt{2\pi}}\left[(\pi - 2) + \frac{1}{2}\sin 2\alpha\right]^{1/2}$

$$\alpha = 45° = \frac{\pi}{4}$$

$$\Rightarrow \; V_{0(rms)} = \frac{150}{\sqrt{2\pi}}\left[\left(\pi - \frac{\pi}{4}\right) + \frac{1}{2}\sin(2 \times 45)\right]^{1/2}$$

$$= \frac{150}{\sqrt{2\pi}}\left[\frac{3\pi}{4} + \frac{1}{2}\right]^{1/2}$$

= 101.1 V

35.A three phase AC to DC diode bridge rectifier is supplied from a three phase, 300 V supply. The rectifier supplies a purely resistive load. The average DC current across load when the resistance is 4 Ω.

A. 405.14 A
B. 101.28 A
C. 202.46 A
D. 300.50 A

Answer ||| B

Solution ||| The DC output voltage of 3-phase bridge rectifier will be,

$$V_0 = \frac{3V_m}{\pi} = \frac{3 \times 300\sqrt{2}}{\pi} = 405.14 \text{ V}$$

$$I_{0_{arg}} = \frac{V_0}{R} = \frac{405.14}{4}$$

$$I_{0_{arg}} = 101.28 \text{ A}$$

36.A freewheeling diode in phase-controlled rectifiers

A. enables inverter operation
B. is responsible for additional reactive power
C. improves the line power factor
D. is responsible for additional harmonics

Answer ||| C

Solution ||| Function of Freewheeling diode
• It improves input as well as system power factor.
• The load voltage polarity does not change
• It will make the load current to be continuous for a short duration of time that depends on rating of the inductor in the load circuit

37.Due to low internal generation in GTO, the GTO has

A. Lower latching current
B. Lower holding current
C. Lower latching and holding current
D. Higher latching and holding current

Answer ||| D

Solution ||| GTO has higher latching and holding currents

38.A three phase full bridge converter is connected to a supply of voltage 230V per phase and 50 Hz frequency. The source inductance is 4 mH. The load current on dc side is constant at 20A . If the load consists of a dc source of internal emf 400 V with internal resistance of 1Ω, the overlap angle is

A. 7.12°
B. 4.17°
C. 8.22°
D. 9.68°

Answer ||| C

Solution |||

For 3-ϕ full bridge converter with RE load converter output voltage $V_0 = E + I_0R$

$V_0 = 400 + 20 \times 1$

$V_0 = 420$ V

Now, output voltage with overlap

$$V_0 = \frac{3V_{ml}}{\pi}\cos\alpha - \frac{3\omega Ls}{\pi}I_0$$

$$\Rightarrow 420 = \frac{3\times 230\sqrt{6}}{\pi}\cos\alpha - \frac{3(2\pi\times 50)4}{\pi\times 1000}\times 20$$

$$\left[\begin{array}{c} V_{line(rms)} = V_{ph}\times\sqrt{3} = 230\sqrt{3} \\ V_{ml} = 230\sqrt{3}\times\sqrt{2} \\ = 230\sqrt{6} \end{array}\right]$$

By solving the above equation, we get

$\cos\alpha = 0.8253$

$\therefore \alpha = 34.38°$

Now,

$$\cos(\alpha+\mu) = -\frac{2\omega L_S I_0}{V_{ml}} + \cos\alpha$$

$$\cos(\alpha+\mu) = -\frac{2(2\pi\times 50)4\times 20}{230\sqrt{6}\times 1000} + \cos(34.38°)$$

$\cos(\alpha + \mu) = 0.736$

$\alpha + \mu = 42.6°$

$\therefore \mu = 42.6° - 34.38°$

$\mu = 8.22°$

overlap angle = 8.22°

39.In a single-phase DC to AC inverter, using single phase modulation for control of output voltage, harmonics of order n can be eliminated by making the pulse width β.

A. $\frac{4\pi}{n}$

B. $\frac{2\pi}{n}$

C. $\frac{\pi}{n}$

D. $\frac{\pi}{2n}$

Answer ||| B

Solution |||

For single pulse modulation, output voltage of single DC to AC inverter will be:

$$V_0 = \sum_{n=1,3,5...}^{\infty} \frac{4Vs}{n\pi} \sin\frac{n\pi}{2} \sin nd \sin(n\omega t)$$

To eliminate n^{th} harmonic

nd = ϖ

d = $\frac{\pi}{n}$

But pulse width is 2d,

Hence, pulse width to eliminate n^{th} harmonic = $\frac{2\pi}{n}$

40.In a single-phase inverter with RLC load, self-commutation of thyristor will be possible only if:

A. $\frac{1}{LC} = \left(\frac{R}{2L}\right)^2$

B. $\frac{1}{LC} < \left(\frac{R}{2L}\right)^2$

C. $\frac{1}{LC} > \left(\frac{R}{2L}\right)^2$

D. Irrespective of the values of R, L and C

Answer ||| C

Solution |||

For self-commutation of thyristor in RLC load, the current response must be under damped

Condition for under damped:

$$\left(\frac{R}{2L}\right)^2 < \frac{1}{LC}.$$

41.In a single pulse width modulation technique, when the conduction angle of output voltage in DC to AC converter is 120^0, then RMS value of 3rd harmonic component of output voltage will be.

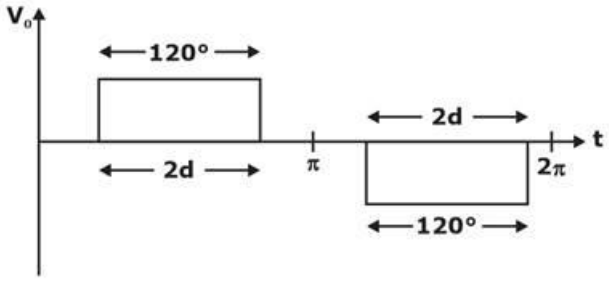
A. 0.78 V
B. 1.10 V
C. 0 V
D. 1.27 V

Answer ||| C

Solution |||

Output voltage will be:

$$V_0 = \sum_{n=1,3,5...}^{\infty} \frac{4V_s}{n\pi} \sin\frac{n\pi}{2} \sin nd \sin(n\omega t)$$



$d = \frac{120°}{2} = 60°$

For 3rd harmonic, n = 3.

$$V_{0_3} = \sum_{n=1,3,5...}^{\infty} \frac{4V_s}{3\pi} \sin\frac{3\pi}{2} \sin 3\times 60°$$

$$V_{0_3} = 0 \text{ V}$$

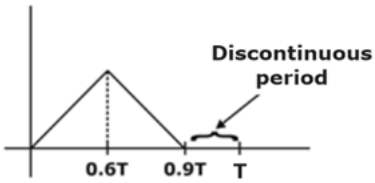
42.For a chopper if T_{ON} = 0.6T, and T_{OFF} = 0.3T. Then chopper will work in which mode.

A. continuous conduction mode
B. Discontinuous conduction mode
C. At Boundary
D. None of these.

Answer ||| B

Solution |||

$T_C = T_{ON} + T_{OFF}$



= 0.6T + 0.3T

= 0.9T

$T_C < T \rightarrow 0.9T < T$

Hence it will work in discontinuous mode

43.Consider the following statements:

A. Both statement (i) and statement (ii) are true, and statement (ii) is the correct explanation of statement (i)

B. Both statement (i) and statement (ii) are true, but statement (ii) is not the correct explanation of statement (i)

C. Statement (i) is true, but statement (ii) is false

D. Statement (i) is false, but statement (ii) is true

Statement (i): The voltage-lift technique is a popular method that is widely applied in electronic circuit design.

Statement (ii): The voltage-lift technique effectively overcomes the effects of parasitic elements.

A. A
B. B
C. C
D. D

Answer ||| A

Solution |||

The voltage-lift technique is a popular method that is widely applied in electronic circuit design because it effectively overcomes the effects of parasitic elements and greatly increases the output voltage. Therefore, dc to dc converters can convert the source voltage into a higher output voltage with high power efficiency, high-power density, and a simple structure.

So, both, statement (i) and statement (ii), are true and statement (ii) is the correct explanation of statement (i).

44.Firing angle range in RC triggering is

A. $0° < \alpha < 60°$
B. $0° < \alpha < 90°$
C. $0° < \alpha < 180°$
D. $0° < \alpha < 45°$

Answer ||| C

Solution |||

RC triggering

The limited range of firing angle in the resistance triggering is overcome in the RC triggering circuit.

The firing angle range is $0° < \alpha < 180°$.

Resistance triggering

It is the simplest triggering method the variable resistance in the circuit is needed to change the firing angle.

The firing angle range is $0° < \alpha < 90°$.

45.For a given SCR junction temperature is 120°C area ambient temperature is 50°C find the thermal resistance if avg power is 35 mw.

A. 2000 °C/w
B. 1000 °C/w
C. 4000 °C/w
D. 5000 °C/w

Answer ||| A

Solution |||

$$\theta_{JA} = \frac{T_J - T_A}{P_{avg}}$$

$$= \frac{120 - 50}{35m}$$

$$= \frac{70}{35m}$$

= 2000 °C/w

46.Which of the following rectifiers have more size practically?

A. Half wave rectifier
B. Full wave rectifier
C. Both half and full wave rectifier wave equal size
D. Depending upon the application there could be different sizes available

Answer ||| A

Solution |||

Transformer utilization factor,

TUF of HWR < TUF of FWR

Since size of transformer $\propto \frac{1}{TUF}$

So, size of transformer in HWR > size of transformer in FWR

So, size of HWR is more than FWR.

47.For an SCR string, consider

(i) Current rating of whole string = 540

(ii) Current rating of one SCR = 60

(iii) Number of SCR in string = 11

So string efficiency is _____%. (nearly)

A. 62
B. 52
C. 72
D. 82

Answer ||| D

Solution |||

$$\eta = \frac{\text{curren rating of whole string}}{\text{current rating of one SCR} \times \text{Number of SCR}} \times 100\%$$

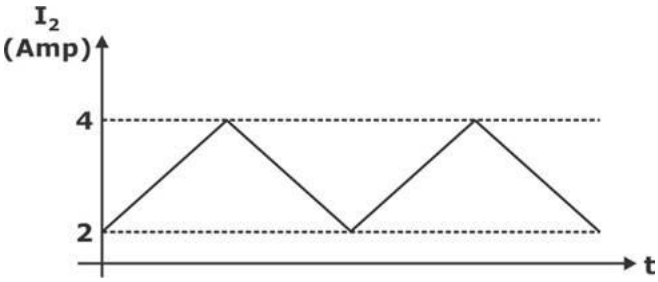
$$= \frac{540}{60 \times 11} \times 100\%$$

$$= \frac{540}{660} \times 100\%$$

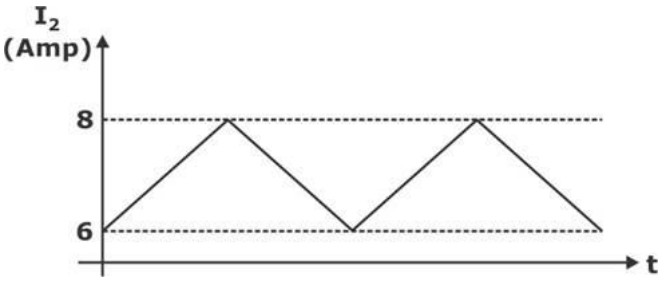
= 81.8%

48.For a chopper, consider two inductor currents.

For inductor L_1 →



For inductor L_2 →



Then

A. $L_1 > L_2$
B. $L_1 < L_2$
C. $L_1 = 2L_2$
D. $L_1 = L_2$

Answer ||| D

Solution |||

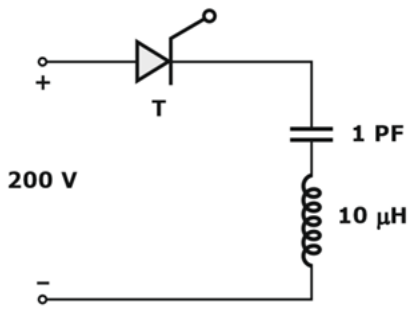
Since $\Delta I_4 = 4 – 2 = 2A$

And $\Delta I_2 = 8 – 6 = 2A$

So $\Delta I_{L1} = \Delta I_{L2}$

So $L_1 = L_2$

49.For the circuit shown in figure the capacitor voltage after SCR gets self-commutated is



A. 100 V
B. 200 V
C. 400 V
D. 300 V

Answer ||| C

Solution |||

Load current $i(t) = V_S\sqrt{\frac{C}{L}}\sin\omega_0 t$

$\Rightarrow V_C(t) = \frac{1}{C}\int i(t)\,dt = V_S(1 - \cos\omega_0 t)$

⇒ The thyristor is self – Commutated at

⇒ $\omega_0 t = \pi$

⇒ $V_C = 2V_S$, at $\omega_0 t = \pi$

⇒ $V_C = 2 \times 200 = 400$ V

50.For Boost DC – DC converter output voltage is 15V (Avg) and input voltage is 5V. Duty cycle is

A. 2/3
B. 3/2
C. 1/3
D. None

Answer ||| A

Solution |||

$V_0 = 15V$

$V_5 = 5V$

$V_0 = \frac{V_5}{1-\alpha}$

$$15 = \frac{5}{1-\alpha} \Rightarrow \boxed{\alpha = \frac{2}{3}}$$

51.The circulating current in the dual converter

A. allows smooth reversal of load current.
B. slows the speed response.
C. Both A and B
D. Neither A nor B

Answer ||| A

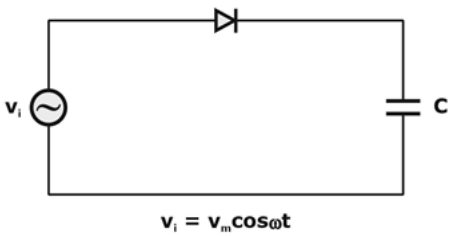
Solution |||

Dual converter Properties

Allows smooth reversal of load current.

Improves speed of response.

52.In the given diode circuit diode will conducts for



A. 90°
B. 180°
C. 360°
D. 0°

Answer ||| D

Solution |||

For a cosine function capacitor will charge instantly at starting of positive half cycle hence diode will conductor for 0°.

Mathematical proof,

$$I = C\frac{dVi}{dt} = C\frac{d}{dt}(V_m \cos\omega t)$$

For diode off, I = 0

$0 = -CV_m\omega \sin \omega t$

$\omega t = 0°$

53.In SCR, if the reverse voltage is increased above critical breakdown level then, avalanche occurs at junction.

A. J1 only
B. J2 and J3

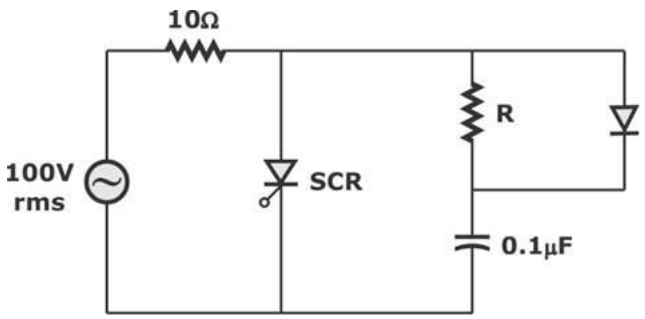
C. J1 and J3
D. J3 only

Answer ||| C

Solution |||

In SCR, if the reverse voltage is increased above critical breakdown level then, avalanche occurs at junction at J1 and J3.

54.SCR withstand dv/dt value for the given snubber circuit is____ V/µs.



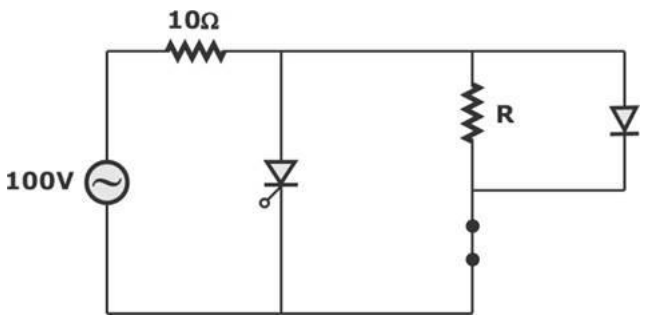
A. $100\sqrt{2}$
B. $\frac{100}{\sqrt{2}}$
C. $50\sqrt{2}$
D. $\frac{50}{\sqrt{2}}$

Answer ||| A

Solution |||

At t = 0^+ → Capacitor = short circuit

So, circuit will look like



So $i = \frac{100\sqrt{2}}{10} = C\frac{dV}{dt}$

$\frac{dV}{dt} = \frac{10\sqrt{2}}{0.1\ \mu F} = 100\sqrt{2}$ V/μ sec

55.Which of the following is slowest

A. MOSFET
B. IGBT
C. Power BJT
D. SCR

Answer ||| D

Solution |||

Decreasing order of speed is

MOSFET < IBGT < Power BJTT < SCR

56.For a 3-ϕ fully controlled bridge converter, if firing angle is 30°, then its input power factor is

A. 0.827 lag
B. 0.866 lag
C. 0.707 lag
D. 1

Answer ||| A

Solution |||

For a 3-ϕ fully controlled bridge converter,

Input power factor = $IPF = \frac{3}{\pi}\cos\alpha$

$= \frac{3}{\pi}\cos 30° = 0.827$

57.The turn-off time of a thyristor is 30 μs at 50 °C. What is its turn-off time at 100 °C?

A. 15 μs
B. 30 μs
C. 60 μs
D. 120 μs

Answer ||| C

Solution ||| Turn off time of thyristor increases with temperature but not linearly.
So turn off time of thyristor is more than 30 μs, but it is not 4 times at 100°C
So 60 μs is more suitable turn off time at 100°C.

58.For a single phase full wave rectifier with RL load, if firing angle is α and a freewheeling diode connected across load. For a constant current load freewheeling diode will conductor for

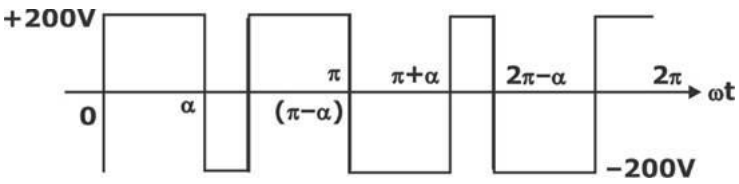
A. π/2
B. π/4
C. π – α
D. α

Answer ||| D

Solution |||

Freewheeling diode is used to eliminate negative spikes from output voltage so for a constant load current it will conducts for α° for every 180°.

59.For an inverter, complete output voltage is shown



RMS value of the fundamental component on output voltage is_____ volts.

Provided ∝ = 75°, cos 75° = 0.26 and sin 75° = 0.96.

A. 46
B. 66
C. 86
D. 106

Answer ||| C

Solution |||

RMS value of fundamental component of voltage = $\frac{4V_{dc}}{\pi\sqrt{2}}(1-2\cos\alpha)$

$= \frac{2\sqrt{2}}{\pi} V_{DC}(1-2\cos\alpha)$

= 0.9 × 200 × (1 – 2 × 0.26)

= 86.4V ≈ 86V

60.A reverse conducting thyristor (RCT) normally replaces

A. A pair of antiparallel thyristors in a circuit.
B. A combination of a thyristor and an antiparallel diode in a circuit.
C. A thyristor in situation where it is not required to have reversed blocking capability at all.
D. Converter grade thyristor.

Answer ||| B

Solution |||

RCT may be considered as a thyristor with a built in antiparallel diode.

61.The use of multiphase rectifier in place of single-phase rectifier provides

A. Increased output voltage and increase harmonics
B. Increased output voltage and reduced harmonics
C. Decreased output voltage and reduced harmonics
D. None of the above

Answer ||| B

Solution |||

Multiphase rectifier has following advantages over the single-phase rectifier

- Better power factor
- Less ripple content in output current
- It doesn't require any additional filter

- It delivers large amount of power
- Higher efficiency

62.A delta connected load R Ω per phase is fed from source voltage V_s through a 3-phase bridge VSI in 120° mode. Let P_1 be the total load power in this mode. Another star connected load of R Ω per phase is fed from source voltage V_s through 3 phase bridge VSI in 180° mode. Let P_2 be the power output across the head then the ratio of $\frac{P_1}{P_2}$ is

A. 2.20
B. 2.30
C. 2.25
D. 2.15

Answer ||| C

Solution |||

120° mode: converting delta load into star equivalent so $R_y = \frac{R_D}{3} = \frac{R}{3}$

Output phase voltage (RMS) $= \sqrt{\frac{2}{3}}\frac{V_s}{2}$

Total power $P_1 = \frac{3\left(\sqrt{\frac{2}{3}}\frac{V_s}{2}\right)^2}{\frac{R}{3}} = \frac{3V_s^2}{2R}$

180° Mode:

Output line voltage $= \sqrt{\frac{2}{3}}V_s$

Phase voltage $= \frac{V_L}{\sqrt{3}} = \frac{\sqrt{2}V_s}{3}$

Total load power $P_2 = \frac{3(V_p)^2}{R} = \frac{3\left(\frac{\sqrt{2}V_s}{3}\right)^2}{R} = \frac{2V_s^2}{3R}$

So, $$\frac{P_1}{P_2} = \frac{\frac{3}{2R}V_s^2}{\frac{2V_s^2}{3R}} = \frac{9}{4} = 2.25$$

Hence option C is correct.

63.In a three phase half controlled rectifier with constant current load and freewheeling diode, what is the fraction of cycle the diode conducts? Consider firing angle (α) of thyristors greater than $60^{0.}$

A. $(\alpha - \pi/3)2\pi$
B. $(\alpha + \pi/3)2\pi$
C. $(\alpha - \pi/3)\times 3/2\pi$
D. $(\alpha + \pi/3)\times 3/2\pi$

Answer ||| C

Solution ||| for α >60 °

Diode conduction cycle is the period of time for which diode will conduct = $\left(\alpha - \frac{\pi}{3}\right)\times\frac{3}{2\pi}$

64.A forward voltage can be applied to an SCR after its

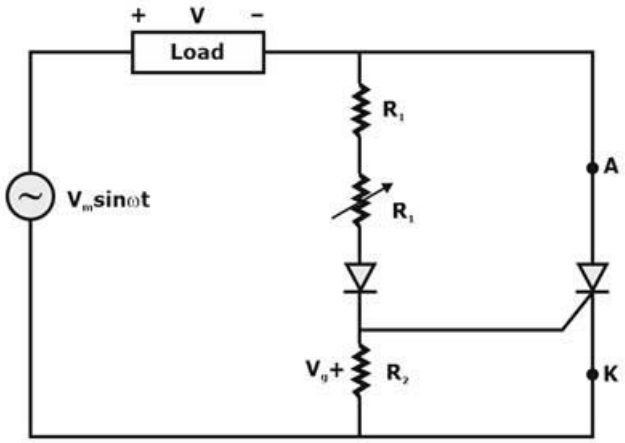
A. Anode current reduces to zero
B. Gate recovery time
C. Reverse recovery time
D. Anode voltage reduces to zero

Answer ||| B

Solution |||

Gate recovery time applied before forward voltage.

65.For the firing circuit shown in α figure the firing angle range of SCR is



A. 0° to 90°
B. 0° to 180°
C. 90° to 180°
D. 90° to 270°

Answer ||| A

Solution |||

Resistance R is stabilizing resistance

By varying resistance R, firing angle α can be varied

When R = 0, V_g is maximum

$$V_{g_{max}} = \frac{V_m}{R_1 + R_2}.R_2$$

$$V_g = \frac{V_s}{R_1 + R_2 + R}.R_2$$

Let firing gate voltage is V_{gt}

$V_{gt} = V_g$ (for certain value of R)

$$V_{gt} = \frac{V_m \sin \omega t}{R_1 + R_2 + R}.R_2 < V_{gmax} (\text{at } \omega t = \frac{\pi}{2})$$

Here $\omega_t = \alpha$ (firing angle)

66.The power supplies which are used extensively in industrial applications are required to meet:
1) Isolation between the source and the load.
2) High conversion efficiency.

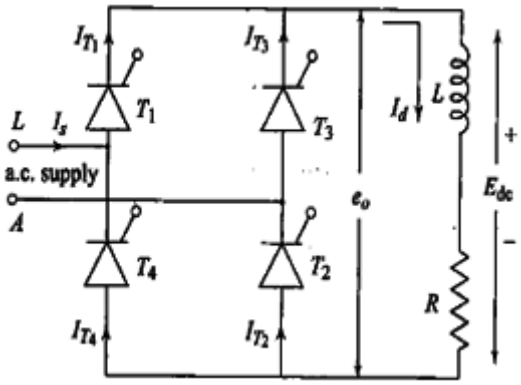
3) Low power density for reduction of size and weight.
4) Controlled direction of power flow.
Which of the above specification are correct?

A. 1, 2 and 3 only
B. 1, 3 and 4 only
C. 1, 2 and 4 only
D. 2, 3 and 4 only

Answer ||| C

Solution ||| • Isolation between the source and the load.
• High conversion efficiency.
• Controlled direction of power flow.

67.The purpose of Inductance in Fully controlled single phase bridge as shown is to:



A. increase the current
B. produce large firing angles
C. lower the ripple
D. all of these

Answer ||| C

Solution ||| In a fully controlled single phase bridge circuit with R-L, inductance L is used in circuit to reduce the ripple. A large value of L will result in a continuous steady current in the load. A small value of L will produce a discontinuous load current for large firing angles.

68.Regulated power supply used is

A. Mobile charger
B. Measurement device
C. Computer

D. All the above

Answer ||| D

Solution |||

Regulated power supply must be required in almost all electronic components.

69.For step down chopper, input and output voltages are 100 V and 50 V respectively. Then its duty ratio is

A. 0.2
B. 0.3
C. 0.4
D. 0.5

Answer ||| D

Solution |||

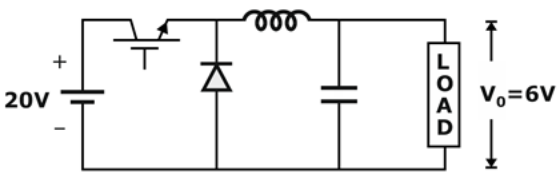
For step down chopper

$V_0 = \alpha V_s$

Since, $V_0 = 50$ V and $V_s = 100$ V

So, $\alpha = \frac{50}{100} = 0.5$

70.In the circuit shown below. If load R = 300Ω, switching frequency is 25 kHz and peak to peak ripple current of inductor is limited to 0.8A, then the filter inductance L is



A. 1.5 mH
B. 0.21 mH
C. 0.44 mH
D. 1.32 mH

Answer ||| B

Solution |||

The given circuit is a buck converter

For buck converter,

$$V_0 = \alpha V_S \Rightarrow \alpha = \frac{V_0}{V_S} = \frac{6}{20}$$

$$\Rightarrow \boxed{\alpha = 0.3}$$

$$\begin{bmatrix} \alpha \rightarrow \text{duty ratio} \\ v_0 \rightarrow \text{output voltage} \\ V_S \rightarrow \text{input voltage} \end{bmatrix}$$

The peak to peak ripple current is

$$\Delta I_L = \frac{V_S}{L}\alpha(1-\alpha)T$$

$$\therefore L = \frac{V_S}{\Delta I_L}\alpha(1-\alpha)T$$

$$\left[T = \frac{1}{f} = \frac{1}{25\,\text{kHz}} = 0.04\ \text{msec}\right]$$

$$\therefore L = \frac{20}{0.8}0.3(1-0.3)(0.04\times 10^{-3})$$

$$\therefore L = 2.1\times 10^{-4} \quad = \boxed{0.21\text{mH}}$$

71.Reverse recovery current of a power diode for a given forward current

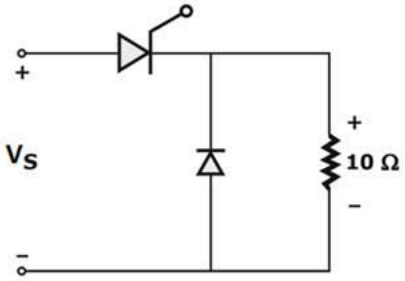
A. Increases with the rate of decrease of the forward current.
B. Increases with the rate of increase of the forward current.
C. Decreases with the rate of decrease of the forward current.
D. Decreases with the rate of increase of the forward current.

Answer ||| A

Solution |||

For a given forward current, Reverse recovery current of a power diode Increases with the rate of decrease of the forward current.

72.The effective input resistance of circuit shown in figure is, if duty ratio is 0.5



A. 50 Ω
B. 60 Ω
C. 40 Ω
D. 80 Ω

Answer ||| C

Solution |||

Effective input resistance of chopper circuit $= \dfrac{\text{DC source Voltage}}{\text{Average source current}}$

⇒ Average source current = Average thyristor current = $DI_0 = \dfrac{D^2V_S}{R}$

$$\Rightarrow R_{in} = \frac{V_S}{\dfrac{D^2V_S}{R_S}} = \left(\frac{R}{D^2}\right) = \frac{10}{(0.5)^2} = 40$$

73.Which of the following is the advantage of single pulse modulation technique?

A. We can control the voltage of inverter within the inverter itself.
B. We can eliminate dominant harmonics by choosing suitable pulse width.
C. Both A and B
D. None of the above.

Answer ||| C

Solution |||

Single modulation helps in controlling the voltage of inverter within inverter itself and is used to eliminate dominant harmonics.

74.An SCR has half cycle surge current rating of 3000A. Its one cycle surge current rating will be.

A. 1500 A

B. 3000 $\sqrt{2}$ A

C. $\frac{3000}{\sqrt{2}} A$

D. 750 $\sqrt{2}$A

Answer ||| C

Solution |||

Energy in half cycle = Energy in one cycle

$$(3000)^2 \times \frac{1}{2f} = I^2 \times \frac{1}{f}$$

$$I = \frac{3000}{\sqrt{2}} A$$

75.A single phase semi converter is fed from 400 V, 50 Hz. If the firing angle is 60° then displacement power factor?

A. 0.524
B. 0.866
C. 0.346
D. 0.158

Answer ||| B

Solution |||

Given,

⇒ 400 V, 50 Hz, α = 60°

We know that displacement Power Factor $= \cos\left(\frac{\alpha}{2}\right) = \cos\left(\frac{60}{2}\right)$

Displacement PF = 0.866

76.A 1-ϕ full converter is supplied from a 200V, 50 Hz supply and has a load of R = 20Ω and L = 15 mH. The holding current of thyristors is I_H = 600 mA and the delay time is 1 μ sec. The converter is operated with a delay angle of α = 45°. The minimum value of gate pulse width will be

A. 51 μ sec
B. 32 μ sec
C. 39 μ sec
D. 46 μ sec

Answer ||| D

Solution |||

The rate of rise of anode current di/dt at the instant of triggering is

$$\frac{di}{dt} = \frac{V_m \sin\alpha}{L} = \frac{200\sqrt{2} \times \sin(45°)}{15 \times 10^{-3}}$$

$$\therefore \frac{di}{dt} = 13333.33 A/s$$

Let t_1 is time required for the anode current to rise to the level of holding current

$$\therefore t_1 \times \frac{di}{dt} = I_H$$

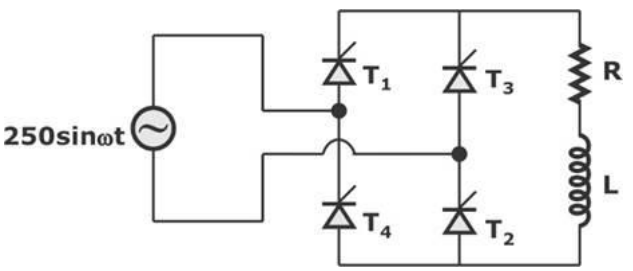
$$\Rightarrow t_1 = \frac{600 \times 10^{-3}}{13333.33} = 4.5 \times 10^{-5} = 45 \times 10^{-6}$$

$$\therefore t_1 = 45\ \mu sec$$

The minimum width of gate pulse is

$$t_g = t_1 + t_d = 45 + 1$$
$$t_g = 46 \mu sec \qquad (\because t_d \rightarrow \text{delay time})$$

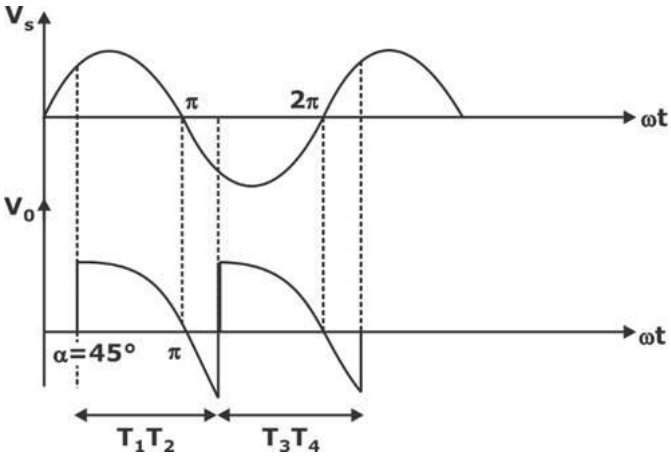
77.For the 1 – ϕ fully controlled rectifier shown below, thyristors T_1 and T_2 are triggered at 45°. Determine the active power output if load current is constant (10 A).



A. 1536.8 W
B. –1729.6 W
C. 1288.2 W
D. 1125.4 W

Answer ||| D

Solution |||



Average output voltage, $V_0 = \frac{2V_m}{\pi} cos\ \alpha$

Load current (I_0) = constant = 10A

⇒ Active power output = ρ = V_0 I_0

$$P = \left(\frac{2V_m}{\pi} cos\ \alpha\right) I_0$$

$$= \left[\frac{2 \times 250}{\pi}\ cos\ 45°\right] \times 10$$

$$\Rightarrow \quad P = 1125.4\ W$$

78.In a single phase DC to AC inverter, using SPWM for control of output voltage, 5th order harmonic voltage can be eliminated by making the pulse width (β) equal to

A. 72°
B. 36°
C. 30°
D. 45°

Answer ||| A

Solution |||

The output voltage of inverter $= \sum_{n=1,3,5}^{\infty} \frac{4V_S}{n\pi} \sin\frac{n\pi}{2} \sin(nd) \sin n\omega t$

⇒ For eliminating n^{th} harmonics

⇒ nd = π or $d = \frac{\pi}{n}$

⇒ Pulse width $(\beta) = 2d = \frac{2\pi}{n}$

⇒ For eliminating of 5th harmonics

⇒ Pule width $(\beta) = \left(\frac{2\pi}{5}\right) = 72^\circ$

79.SCRs with a rating of 1000V and 200A are available to be used in a string to handle 6kV and 1kA. The number of series and parallel units respectively required, if the derating factor is 0.2 is

A. 7 and 6
B. 7 and 8
C. 8 and 7
D. 8 and 6

Answer ||| C

Solution |||

Derating factor = 1 – string efficiency

$0.2 = 1 - \eta_s$

$$\eta_s = \frac{Actual\ voltage\ rating\ of\ whole\ string}{N_s \times Indivisual\ voltage\ rating}$$

$$N_s = \frac{6 \times 10^3}{0.8 \times 1000}$$

$$= 7.5 \cong 8$$

$$\eta_s = \frac{Actual\ current\ rating\ of\ whole\ string}{N_P \times Indivisual\ current\ rating}$$

$$N_P = \frac{1 \times 10^3}{\eta_s \times 200}$$

$$= \frac{1000}{200 \times 0.8}$$

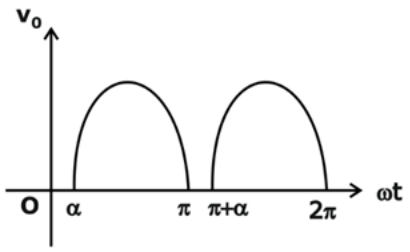
$$= 6.25 \cong 7$$

80.If α is firing angle of 2-pulse bridge converter having freewheeling diode width of diode current pulse is

A. α
B. 2α
C. π + α
D. π + 2α

Answer ||| B

Solution |||



So conducing time of FD = α + α

= (2 α)

81.In a 3-phase semi converter, for firing angle less than or equal to 60°, free-wheeling diode conducts for

A. 30°
B. 60°
C. 90°
D. 0°

Answer ||| D

Solution |||

For firing angle less than 60°, freewheeling diode does not come into operation.

82.For a 3-phase voltage source inverter working in a 180° conduction mode, 3000 W of power is delivered to a resistive load of 10Ω/phase.

The switch current rating (RMS) is _____ Amp.

A. 1
B. $\frac{1}{\sqrt{2}}$
C. 10
D. $\frac{10}{\sqrt{2}}$

Answer ||| D

Solution |||

$P_0 = 3I_{ph}^2 R_L = 3000$

$\Rightarrow \quad 3I_{ph}^2 \times 10 = 3000$

$\Rightarrow \quad I_{ph} = 10$

So $I_{SW\ (RMS)} = \frac{I_{ph}}{\sqrt{2}} = \left(\frac{10}{\sqrt{2}}\right)$

83.If the value of latching current of SCR is 100 A. Then which of the following could be the value of holding current.

A. 120 A
B. 150 A
C. 200 A
D. 80 A

Answer ||| D

Solution |||

The value of holding current of SCR is always lesser than the latching current.

From the given options, only option D has the lower value than 100 A.

Hence, option D is correct.

84.In a 3-phase semi converter, for firing angle less than or equal to 60°, free-wheeling diode conducts for

A. 30°
B. 60°
C. 90°
D. 0°

Answer ||| D

Solution |||

For firing angle less than 60°, freewheeling diode does not come into operation.

85.During parallel operation of SCRs, current distribution is made uniform by?

1) Mounting SCRs on same heat sink.

2) Connecting a small resistor in series with each SCR.

3) Connecting magnetically coupled inductors in series with SCRs.

The correct statements are:

A. 1 and 2
B. 2 and 3
C. 1 and 3
D. 1, 2 and 3

Answer ||| D

Solution |||

During parallel operating of SCRs it should be ensured that operating of SCRs, it should be ensured that they operate at same temperature. This is achieved by mounting the SCRs on same heat sink and making their arrangement symmetric.

→ A suitable small resistance is also added in series with each thyristor to ensure uniform current sharing.

→ Magnetically coupled indicators in series with SCRs will induce voltage of opposite polarity to make equal current sharing.

86.Peak inverse voltage across FD for voltage commutator circuit having supply voltage 230 V is _____V.

A. 230V
B. 115V
C. 460V
D. None of the above

Answer ||| C

Solution |||

For voltage commutator circuit

voltage across FD = $2V_s$

= 2 × 230

= 460V

87.Consider the following statements regarding:

1) The range of control angle ∝ varies from 0 to 150° in tie control connection.

2) Tie control connection is suitable for motor control.

3) The neutral wave controller is not used for motor control.

Which of the above statements is /are correct?

A. 1 and 2
B. 2 and 3
C. 1 and 3
D. 1, 2 and 3

Answer ||| C

Solution |||

Tie control or star connection of voltage controller have maximum output at ∝= 150° or 5π/6

Also, it is not suitable for motor control. Neutral point controller or delta controller is not used for motor control.

88.A large d.c. motor is required to control the speed of blower from a 3-phase a.c. source. What is the most suitable a.c. to d.c. converter?

A. 3-phasee fully controlled bridge converter
B. 3-phasee fully controlled bridge converter with free wheeling diode
C. 3-phasee half- controlled bridge converter
D. A pair of 3-phase converters in sequence control

Answer ||| C

Solution ||| For only motoring half controlled bridge converter is most suitable as it will have improved power factor operation.

89.Match the following methods of protection of thyristor.

(i) Over current protection	(a) Provide heat sink in SCR.
(ii) Over voltage protection	(b) snubber circuit is provided across SCR
(iii) Thermal protection	(c) Varistor are connected across SCR
(iv) High dv/dt protection	(d) Fuse connected in series with SCR

A. (i)-(a), (ii)-(c), (iii)-(d), (iv)-(b)
B. (i)-(d), (ii)-(c), (iii)-(a), (iv)-(b)
C. (i)-(b), (ii)-(d), (iii)-(a), (iv)-(c)
D. (i)-(b), (ii)-(a), (iii)-(d), (iv)-(c)

Answer ||| B

Solution |||

(i) Overcurrent protection: Fuse or circuit breaker connected in series with SCR to limit over-current.

(ii) Overvoltage protection: Varistor are connected across SCR.

(iii) Thermal protection: Provide heat sink in SCR.

(iv) High dv/dt protection: Snubber circuit is provided across SCR.

90.The reverse recovery time of a diode is t_{rr} = 8μs and rate of fall of diode current $\frac{di}{dt} = 10\ A/\mu s$, then charge stored during reverse recovery time is

A. 240μC
B. 320μC
C. 640μC

D. 340μC

Answer ||| B

Solution |||

Given that t_{rr} = 8μs

$$\frac{di}{dt} = 10\,A/\mu s$$

⇒ Peak reverse current $(I_{RR}) = trr\frac{di}{dt} = 10 \times 8 = 80A$

⇒ Charge stored $= \frac{1}{2} \times I_{RR} \times t_{rr} = \frac{1}{2} \times 80 \times 8 \times 10^{-6}$

⇒ Charge stored = 320μC

91.The value of steady state snubber capacitor voltage for a fly Back converter having

(i) Primary to secondary turn ratio = 15:1

(ii) Constant input voltage = 200 V

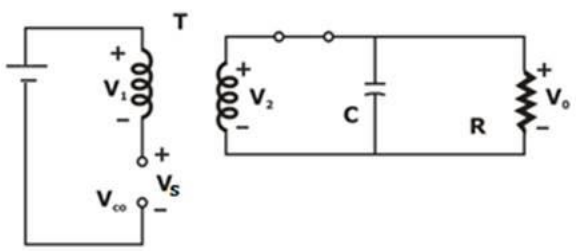
(iii) Constant output voltage =18 V

will be ___volts

A. > 270 V
B. 200 V < v < 270 V
C. < 18 V
D. None of the above

Answer ||| A

Solution |||



For turn off condition shown in figure,

$V_{CO} = V_S + V_I$

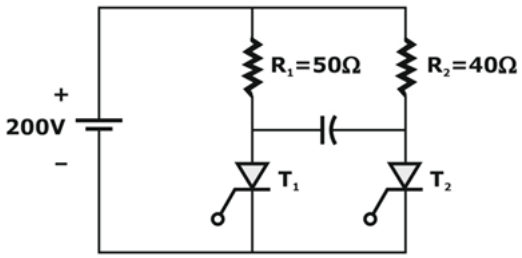
$V_O = 18$ V ; $V_1 = \frac{N_1}{N_2} \times V_1$

$= 15 \times 18 = 270$ V

$V_{CO} = V_S + 270$

> 270 V

92.In the circuit shown below the magnitude of maximum current flowing in thyristor T_1 & T_2 are?



A. 10A, 15A
B. 15A, 10A
C. 14A, 13A
D. 13A, 14A

Answer ||| C

Solution |||

Given that,

$V_S = 200$ V, $R_1 = 50\Omega$, $R_2 = 40\Omega$

⇒ Maximum current through thyristor T_1

$$(I_{T_1})_{max} = \frac{V_S}{R_1} + \frac{2V_S}{R_2}$$

$$= \frac{200}{50} + \frac{2 \times 200}{40}$$

$$= 4 + 10 = 14A$$

⇒ maximum current through thyristor T_2

$$(I_{T_2})_{max} = \frac{V_S}{R_2} + \frac{2V_S}{R_1} = \frac{200}{40} + \frac{2 \times 200}{50} = 5 + 8 = 13A$$

93.In a 3 phase semiconductor, firing angle = 120° and extinction angle = 110°. Each SCR and freewheeling diode conducts respectively for

A. 60°, 50°
B. 30°, 50°
C. 60°, 10°
D. 30°, 40°

Answer ||| A

Solution ||| For a 3 phase semi converter
SCR conducts for (π – α) period
Where α is the firing angle
∴ SCR conduction = π – 120 °
= 60 °

And freewheeling diode conducts for $\left(\beta - \frac{\pi}{3}\right)$ period
Where β is extinction angle

Freewheeling diode conduction = $\beta - \frac{\pi}{3}$
= 110 ° – 60 °
= 50 °

94.In cyclo converter, which of following is true?

A. Both frequency and voltage can be controlled
B. Only frequency is controlled
C. Only voltage is controlled
D. None of the above

Answer ||| A

Solution |||

Cyclo converters

Convert input power at one frequency to output power at different frequency.

95.For 1-ϕ, half bridge inverter consider

i) input voltage = 48V(DC)

ii) load = 2.4 Ω

At fundamental frequency rms output voltage is _____v.

A. $\frac{\sqrt{2}\times 48}{\pi}$
B. $\frac{48}{\pi}$
C. $\frac{48}{\pi}$
D. None

Answer ||| A

Solution |||

V_S = 48 v

R_L = 2.4 Ω

$$V_0 = \frac{2V_S}{\pi} sin\,\omega\, tatfundamentalfreq.$$

$$RMSvalue = \frac{2 \times 48}{\pi \times \sqrt{2}}$$

$= \frac{\sqrt{2}\times 48}{\pi}$

96.The RMS current rating of SCR in single phase diode full converter is 333 A. Then average current rating will be:

A. 333 A
B. 369.63 A
C. 300 A
D. 100 A

Answer ||| C

Solution |||

As we known

$$(I_{avg})_{rating} = \frac{(I_{RMS})_{rating}}{FF}$$

$$FF = \frac{V_{0_{RMS}}}{V_{0_{arg}}}$$

for full converter

$$V_{RMS} = \frac{V_m}{\sqrt{2}}$$

$$V_{Avg} = \frac{2V_m}{\pi}.$$

$$FF = \frac{\frac{V_m}{\sqrt{2}}}{\frac{V_m}{\pi}} = 1.11$$

$(I_{avg})_{rating} = \frac{333}{1.11} = 300$ A.

97.A rectifier will work in inversion mode while charging a battery, then firing angle ∝ must be.

A. ∝ = 90°
B. ∝ < 90°
C. ∝ > 90°
D. ∝ = 180°

Answer ||| C

Solution |||

If α > 90° power output will be negative for a constant current load because output voltage is negative hence net power will flow from DC load to AC load. Then the rectifier will work as a inverter.

98.If a boost converter operates with a duty ratio D = 1 then output voltage is

A. Infinity
B. Input voltage
C. Zero
D. Two times the voltage

Answer ||| C

Solution ||| Output of boost converter is –

$$V_o = \frac{V_{in}}{1-D}$$

Mathematically, it should be infinite but theoretically:
At D =1, As D=1 ,inductor will keep charging and inductor will not feed load.
so, output voltage is zero (0).
If D=1 capacitor continues to discharge finally voltage across capacitor reached to Zero and hence output voltage

99.In a power circuit of 5KV, 6 thyristors each of rating 900 V are connected in series. What is the percentage series dreading factor?

A. 92.59 %
B. 7.4 %
C. 50 %
D. 6 %

Answer ||| B

Solution |||

Efficiency= $\frac{\text{Total Voltage}}{\text{Number of thyristors} \times \text{Rating of each thyristor}}$

$= \frac{5000}{6 \times 900}$ = 0.9259

% Derating Factor = (1·n) × 100

= (1 – 0.9259) × 100

= 7.4 %

100.In a step-down chopper with supply voltage of 100 V and duty ratio of 0.4. The load indicator is 0.5 mH and switching frequency of 20 kHz. the value of load resistance at the point of discontinuous operation will be:

A. 33.34 Ω
B. 66.67 Ω
C. 20.00 Ω
D. 40.00 Ω

Answer ||| A

Solution |||

At the point of discontinuous operation,

$$I_0 = \frac{\Delta I_L}{2}$$

$$\frac{\alpha V_s}{R} = \frac{\alpha(1-\alpha)V_s}{2fL}$$

$$R_{crt} = \frac{2fL}{1-\alpha} = \frac{2 \times 20 \times 10^3 \times 0.5 \times 10^{-3}}{1-0.4}$$

R_{crt} = 33.34 Ω