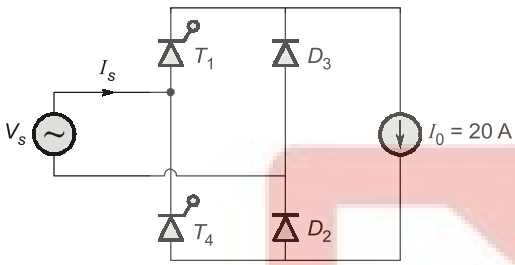
ELECTRICAL ENGINEERING

Power Electronics

Multiple Select Questions : Workbook Sheet

Q.1 Consider the bridge rectifier shown below. If RMS value of source current is 10 A, then which of the following is/are correct?



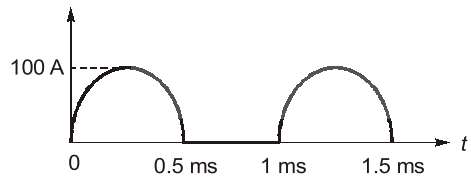
(a) Firing angle for the thyristors is $\frac{3\pi}{4}$.

(b) RMS value of thyristor current is 7.07 A

(c) Average current of each diode is 10 A.

(d) RMS value of each diode is 10 A.

Q.2 A thyristor is used in an application carrying half sinusoidal current of period of 1 msec and a peak of 100 A as shown in figure. The thyristor may modeled during conduction to have a constant voltage drop of 1.1 V and a dynamic resistance of 8 mΩ. Then which of the following is/are correct?



(a) Average current through thyristor is $\frac{100}{\pi}$ A

(b) rms current through thyristor is $\frac{100}{\sqrt{2}}$ A

(c) Conduction losses are 55 W.

(d) rms current though thyristor is 50 A.

Q.3 A single phase asymmetrical semiconverter feeds an *RL* load with $R = 10\ \Omega$ and large *L* so that load current is ripple free. The source voltage to the bridge is 200 V, 50 Hz. For a firing angle of 30°, which of the following is/are correct?

(a) Average output voltage is 168 V.

(b) Average output current is 1.68 A.

(c) rms current through diode is 12.83 A.

(d) Average current through diode is 8.4 A.

Q.4 An ideal chopper operating at a frequency of 500 Hz, supplies a load having resistance of 3 Ω and inductance of 9 mH from a 60 V battery. The switch on/off ratio is 4/1, then which of the following is/are correct?

(a) Duty ratio of chopper is 0.8

(b) Duty ratio of chopper is 0.6

(c) Average output voltage is 36 V

(d) Average output voltage is 48 V

Q.5 A 1-ϕ diode rectifier is feeding a capacitor load. The supply is 230 V, 50 Hz and capacitor is 1 μF. Then which of the following is/are correct?

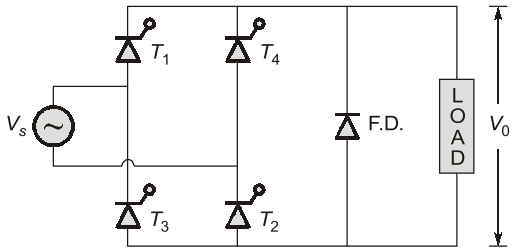
(a) The conduction time of diode is 90°.

(b) The conduction time of diode is 180°.

(c) The final voltage across capacitor is 230 V.

(d) The final voltage across capacitor is $230\sqrt{2}$.

Q.6 A single phase full bridge converter with a freewheeling diode feeds an inductive load. The load resistance is 15.53 Ω and it has a large inductance providing constant and ripple free d.c. current. Input to converter is from an ideal 230 V, 50 Hz. Single phase source, for a firing delay angle of 60°.



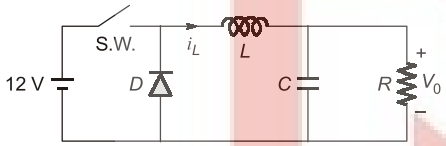
(a) average output current is 10 A

(b) average current through free wheeling diode is 3.33 A

(c) average output current is 20 A

(d) average current through free wheeling diode is 5 A.

Q.7 A buck converter is shown in the figure. The switch is operating at 25 kHz.



For an average output voltage of 5 V, which of the following is/are correct?

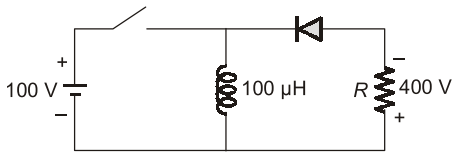
(a) For $\Delta V_0 = 20$ mV and $\Delta i_L = 0.8$ A, the value of capacitance is 200 μF

(b) For $\Delta V_0 = 10$ mV and $\Delta i_L = 0.8$ A, the value of capacitance is 400 μF

(c) For $\Delta V_0 = 20$ mV and $\Delta i_L = 0.8$ A, the value of capacitance is 100 μF

(d) For $\Delta V_0 = 10$ mV and $\Delta i_L = 0.8$ A, the value of capacitance is 200 μF

Q.8 In the following circuit the ideal switch S is operated at 10 kHz then the circuit is operated in steady state at the boundary of the continuous and discontinuous then which of the following is/are correct?



(a) The duty ratio of the converter is 0.8

(b) The duty ratio of the converter is 0.6

(c) Critical resistance of the converter is 40 Ω

(d) Critical resistance of the converter is 25 Ω

Q.9 A thyristor string is formed by series and parallel connection of thyristors. The voltage and current ratings of the string are 11 kV, 4 kA respectively. The thyristor to be employed has voltage and current ratings of 1.7 kV, 1 kA. The string efficiency is 90 for both series and parallel combination. If the maximum blocking current is 15 mA and maximum charge storage ΔQ_{max} is 24 μC. Then which one of the following is/are correct?

(a) Number of thyristors in series must be 7.

(b) Number of thyristors in series must be 8.

(c) The capacitance of equalizer circuit is 64.6 μF

(d) The capacitance of equalizer circuit is 46.6 μF

Q.10 A single SCR is inserted in between voltage source 200 sin 314 t and a resistive load of 10 Ω. If the gate trigger voltage lags the A.C. supply voltage by 120°, then which of the following is/are correct?

(a) The average load current is $\frac{15}{\pi}$ A

(b) The average load voltage is $\frac{150}{\pi}$ V

(c) The average load current is $\frac{5}{\pi}$ A

(d) The average load voltage is $\frac{50}{\pi}$ V

Q.11 In a dc - dc step down converter, if D, f, V_s, L and R are duty ratio, switching frequency, source average voltage, inductance and load resistance respectively, then

(a) The average output voltage is $D \cdot V_s$

(b) Critical inductance is $\frac{(1-D)R}{2f}$.

(c) Peak to peak ripple current of inductor is $\frac{V_S(1-D)D}{fL}$

(d) Average source current is $\frac{D^2V_S}{R}$

Q.12 A 3-ϕ, thyristor controlled rectifier is feeding a purely resistive load on the DC side. AC side is connected to a balanced 3-ϕ supply. Then which of the following is/are correct?

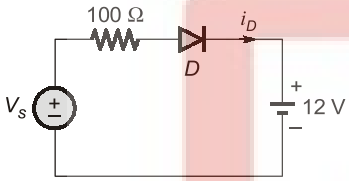
(a) The maximum firing angle for 12-pulse converter is 105°.

(b) The maximum firing angle for 6-pulse converter is 120°.

(c) The maximum firing angle for 3-pulse converter is 150°.

(d) The maximum firing angle for 2-pulse converter is 150°.

Q.13 For the diode circuit shown in figure below if V_S is a sinusoid with 24 V peak amplitude, then



(a) The maximum reverse bias voltage that appears across the diode is 36 V.

(b) The fraction of period during which the diode conduction each cycle is $\frac{T}{4}$.

(c) The maximum reverse bias voltage that appears across the diode is 24 V.

(d) The fraction of period during which the diode conducts in each cycle is $\frac{T}{3}$.

Q.14 A single phase auto sequential commutated CSI is fed from 220 V dc source. The load is $R = 12\ \Omega$ from a 240 V dc source. If the inverter output frequency is 60 Hz, thyristor turnoff time 15 μs and factor of safety 2, then (neglect all losses and assume a maximum current change of 0.4 in one cycle). Which of the following is/are correct?

(a) The source inductance is 5 H.

(b) The commutating capacitor is 2 μF.

(c) The source inductance is 10 H.

(d) The commutating capacitance is 3.6 μF.

Q.15 A 3-ϕ, three pulse converter fed from 3-phase, 400 V, 50 Hz supply has a load $R = 2\ \Omega$ per phase, $E = 230$ V and large inductance so that load current is 25 A level. If source has an inductance value of 2 mH. Then which of the following is/are correct?

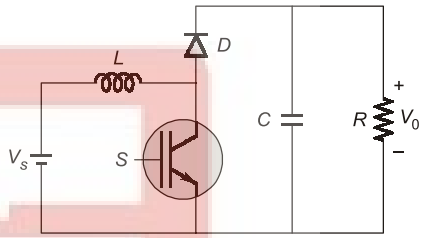
(a) firing angle = 129.7°

(b) overlap angle = 4.27°

(c) firing angle = 133.4°

(d) overlap angle = 6.52°

Q.16 A converter shown in the figure below is operating with $V_{in} = 5$ V, $V_0 = 12$ V and $P_0 = 11$ W. It is operating in dc steady state with $f_s = 200$ kHz and $\Delta I_L = 2$ A, then which of the following is/are correct?



(a) Duty ratio = 0.5333

(b) Inductance, $L = 7.29$ μH

(c) Inductance, $L = 7.72$ μH

(d) Duty ratio = 0.5833

Q.17 Which of the following is/are correct about Buck boost converter?

(a) at duty ratio 60%, the converter acts as buck converter.

(b) at duty ratio 40%, the converter acts as boost converter.

(c) at duty ratio 60%, the converter acts as boost converter.

(d) at duty ratio 40%, the converter acts as buck converter.

Q.18 Which of the following is/are correct about buck converter?

(a) when the switch is on, the inductor absorbs energy.

(b) when the switch is off, the inductor delivers energy.

(c) when the switch is on, the inductor delivers energy.

(d) when the switch is off, the inductor absorbs energy.

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