

B.E./B.TECH. Degree Examination, January 2021

Semester – V

EE18502 - Power Electronics

(Regulation 2018)

Time: Three hours

Maximum : 80 Marks

Answer **ALL** questions**PART A - (8 X 2 = 16 marks)**

1. Consider an AC voltage source of $12\sin\omega t$ is supplying power to a resistive load of 10Ω through a switch. Assume the switch is ideal and initially off and its control works in such a way that it toggles every time when the source voltage crosses zero. Calculate the efficiency of the system.
a.)100% b.) 95% c.)90% d.) 85%
2. For a single phase symmetrical converter supplying power to a RL load where $R=30\Omega$ and $L=10H$. If the input voltage is 230V and the firing angle is 40° calculate the distortion factor and THD of input current.
a.)0.88,48.2% b.)0.959,29.55% c.)0.764,36.15% d.)0.697,56.8%
3. For a full bridge inverter with the following load : $R=2\Omega, X_L = 8\Omega$ and $X_C=6\Omega$.
a.)The output voltage lags the current by 45° b.)The output current lags the voltage by 45°
c.) The output current lags the voltage by 90° d.) The output current lags the voltage by more than 90°
4. In the principle of phase control
a.)the load is ON for some cycles and OFF for some cycles
b.)control is achieved by adjusting the firing angle of the devices
c.)control is achieved by adjusting the number of ON-OFF cycles
d.)control cannot be achieved
5. Enhancement type MOSFETs are generally used as switching devices. Why?
6. Comment on the connection of the transformer secondary in case of three phase inverters by stating the reason.
7. A step down chopper has input dc voltage of 220V and $R=10\Omega$ in series with $L= 65mH$. If the load current varies linearly between 11A and 17A, then find the duty cycle α .
8. Depict the schematic of Multistage sequence control of Voltage Controllers.

PART B - (4 X16 = 64 marks)

09. (a) Acquire the dynamic characteristics of the MOSFET by explaining its operation with vertical cross section. **(16)**

(OR)

- (b) (i) Snubber circuit for an SCR should primarily consist of capacitor only. But in practice a resistor is used in series with the capacitor. Why? Justify. **(8)**
- (ii) Compare and contrast SCR and MOSFET. **(8)**

10. (a) A boost regulator has an input voltage of $V_s = 5V$. The average output voltage $V_a = 15V$ and the average load current $I_a = 0.5A$. The switching frequency is $25kHz$. If $L = 150\mu H$ and $C = 220\mu F$, determine a.) the duty cycle b.) the peak current of Inductor I_2 c.) the ripple current of inductor ΔI d.) the ripple voltage of filter capacitor ΔV_c e.) the critical values of L and C . (16)

(OR)

- (b) A two pulse single phase bridge converter is connected to RLE load. Source voltage is $230V$, $50Hz$. Average load current of $10A$ is continuous over the working range. For $R = 0.4\Omega$ and $L = 2mH$ compute. (16)

(i) Firing angle delay for $E = 120V$.(ii) Firing angle delay for $E = -120V$.

Indicate which source is delivering power to load in parts (i) and (ii).

11. (a) The single phase half-bridge inverter has a resistive load of $R = 2.4\Omega$ and the dc input voltage is $V_s = 48V$. Determine a.) the rms output voltage at the fundamental frequency V_{o1} b.) the output power P_o c.) the average and peak currents of each transistor d.) the peak reverse blocking voltage V_{BR} of each transistor e.) the THD f.) the DF g.) the HF and DF of the LOH. (16)

(OR)

- (b) Obtain the line and phase voltages of the three phase circuit with D.C input in which each switch conducts for a half cycle with star connected R load. (16)

12. (a) (i) Describe the operation of single phase AC voltage controller with the help of voltage and current waveform. Also derive the expression for average value of the output voltage. (8)
- (ii) A $1-\phi$ sinusoidal AC voltage controller has input voltage $230V$, $50Hz$ and a load of $R = 15\Omega$. For 6 cycles ON and 4 cycles OFF determine. i) rms output voltage ii) input PF iii) average & rms thyristor currents. (8)

(OR)

- (b) (i) By using 18 thyristors depict 3ϕ to 3ϕ cycloconverter and explain its operation. (8)
- (ii) Show that the fundamental RMS value of per phase output voltage of low frequency m pulse cycloconverter is given by (8)
- $$E_{or} = E_{ph} \left(\frac{m}{\pi} \right) \sin\left(\frac{\pi}{m} \right).$$