Code : 031609

masterranjeet.com

B.Tech 6th Semester Exam., 2019

POWER ELECTRONICS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **EIGHT** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Answer any *seven* of the following : 2×7=14

(a) Draw the symbols of BJT, MOSFET and SITH.

(b) The reverse recovery time of a diode is $t_{rr} = 3\ \mu s$ and the rate of fall of the diode current is $di/dt = 30\ A/\mu s$. Determine the stored charge Q_{RR} in reverse recovery zone.

(c) What is the softness factor of diodes?

(d) Explain forward-biased safe operating area (FBSOA) of BJT.

(e) Define distortion factor (DF).

(f) A step-up d.c.-d.c. converter has input voltage $V_s = 10$ V, inductance $L = 1$ mH, duty ratio $d = 0{\cdot}5$ and time period $T = 1$ ms. Find the peak-to-peak ripple current in inductor.

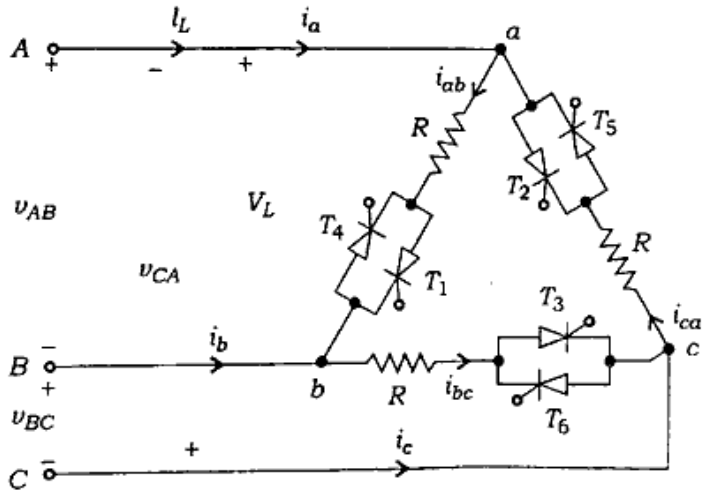
(g) The H-bridge inverter has an *R-L-C* load with $R = 10\ \Omega$, $L = 31{\cdot}5$ mH and $C = 112\ \mu F$. The inverter frequency is $f_o = 60$ Hz and d.c. input voltage is $V_s = 220$ V. Find the output fundamental r.m.s. voltage.

(h) Find the line-to-line r.m.s. voltage of three-phase inverter operating in 180° conduction mode if d.c. input voltage $V_s = 220$ V.

(i) Explain dynamic current sharing in parallel operation of thyristors.

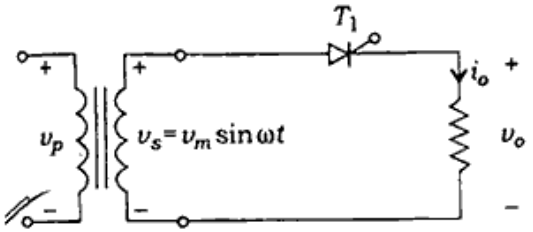
(j) The full converter is connected to a 120 V, 60 Hz supply. The load current $I_a = 8$ A is continuous and its ripple content is negligible. If the delay angle is $\alpha = \pi/3$, calculate power factor.

2. *(a)* The three-phase bidirectional delta-connected controller shown in the figure below has a resistive load of $R = 10$ ohm. The line-to-line voltage is $V_s = 208$ V (r.m.s.), 60 Hz and the delay angle is $\alpha = 2\pi/3$. Determine the r.m.s. output voltage V_o, the input PF and the r.m.s. current of a thyristor I_R :



(b) Explain three-phase full-wave delta-connected controller with various waveforms. 14

3. *(a)* A single-phase half-wave converter shown in the figure below is operated from a 120 V, 60 Hz supply and the resistive load is $R = 10\ \Omega$. If the average output voltage is 50% of the maximum possible output voltage, calculate the delay angle, the r.m.s. and average output currents :



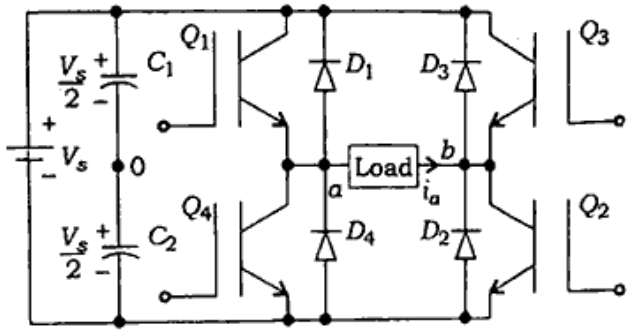
(b) Explain three-phase full converter with *R-L* load with various waveforms. 14

4. *(a)* Explain two-transistor model of a thyristor.

(b) A single-phase half-bridge inverter has resistive load of $R = 5\ \Omega$ and the d.c. input voltage is $V_s = 100$ V. Determine the r.m.s. output voltage at the fundamental frequency V_{01} and the output power P_o. 14

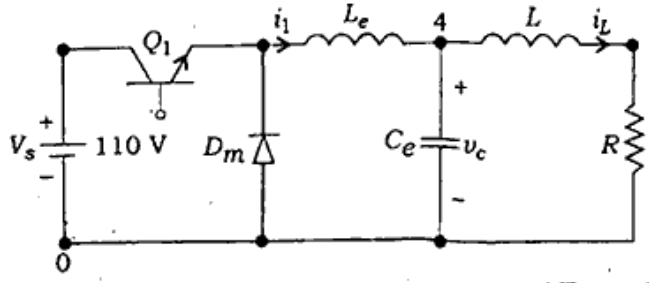
5. *(a)* A single-phase full-bridge inverter is operated at 1 kHz and uses a uniform PWM with four pulses per half-cycle for voltage control. Plot the fundamental component, distortion factor and THD against the modulation index *M*.

(b) The bridge inverter shown in the figure below has an R-L-C load with $R = 10\ \Omega$, $L = 31{\cdot}5$ mH and $C = 112\ \mu$F. The inverter frequency is $f_o = 60$ Hz and d.c. input voltage is $V_s = 220$ V. Calculate the r.m.s. load current at the fundamental frequency I_{o1} and the THD of the load current :



14

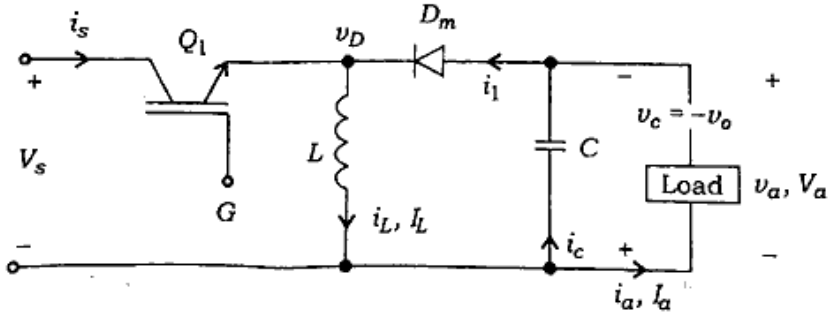
6. (a) The buck converter shown in the figure below has a d.c. input voltage $V_s = 110$ V, average load voltage $V_a = 80$ V and average load current $I_a = 15$ A. The chopping frequency is $f = 10$ kHz. The peak-to-peak ripples are 5% for load voltage, 2·5% for load current and 10% for filter L_e current. Determine the values of L_e, L, C_e :



(b) Write on the steady state analysis of buck converter. 14

7. (a) Explain briefly about Cuk-converter.

(b) The buck-boost regulator shown in the figure below has an input voltage of $V_s = 12$ V. The duty cycle $k = 0{\cdot}25$ and the switching frequency is 25 kHz. The inductance $L = 150\ \mu$H and filter capacitance $C = 220\ \mu$F. T_e average load current $I_a = 1{\cdot}25$ A. Determine the peak- to-peak output voltage ripple ΔV_c and the peak-to-peak ripple current of inductor ΔI :



14

8. Write brief notes on any *two* of the following : 14

(a) DC motor drive

(b) AC motor drive

(c) Modern PE devices

(d) Commutation circuits

* * *