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MANIPAL INSTITUTE OF TECHNOLOGY Manipal University



SEVENTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION NOV/DEC 2015 SUBJECT: POWER ELECTRONICS (ECE - 403)

Instructions to candidates	
• Answer ANY FIVE full questions.	

- Missing data may be suitably assumed.
- 1A. With necessary circuit diagram and waveforms, obtain the expressions for V_o, maximum output voltage ripple and minimum inductance value required for continuous conduction in a Boost converter.
- 1B. With circuit diagram and waveforms explain the working of single phase dual converter.
- 1C. For half controlled single phase rectifier with RL load draw the output waveform for $\alpha=90^{\circ}$ along with the trigger pulses for the SCRs.

(5+3+2)

2A. For a 3-phase 6-pulse fully controlled converter in Figure 2(a), plot the output voltage, voltage across T_1 for $\alpha=30^{\circ}$. Also, obtain the expression for average output voltage.



Figure 2(a)

Figure 2(b)

- 2B. Analyze the circuit shown in Figure 2(b), for the given switching sequence. Determine and plot the inductance and source current over a time period T.
- 2C. Explain the basic structure and V-I characteristics of power diode.

(5+3+2)

- 3A. With the help of circuit diagram, and waveforms, derive the expressions for average and RMS voltage of fully controlled bridge rectifier with RL load.
- 3B. Explain the Thyristor turn-off characteristics for both ac and dc sources
- 3C. Design a UJT firing circuit. The parameters of UJT are $V_s = 32$ volts, $\eta = 0.51$, $I_p=10\mu A$, $V_v=3.5V$, $I_v = 10mA$. The frequency of oscillation is f = 60Hz and the width of the triggering pulse $t_g = 50\mu s$ assume $V_D=0.5V$ and $C = 0.5\mu F$.

(5+3+2)

- 4A. Draw the circuit diagram of three-phase bridge inverter. Plot (i) phase to phase (V_{ab}) (ii) phase to neutral (V_{an}, V_{bn}) voltage waveforms in a 3- ϕ inverter with 120° conduction angle. (Note: Just plot waveforms without considering star or delta connected load)
- Plot the PWM waveform with bipolar switching scheme. 4B.
- 4C. (i) ----- batteries are commonly used for the UPS applications. (ii) State True or False: In normal mode of operation of UPS, the power to the inverter is supplied by the battery.

(5+3+2)

- 5A. List different types of power conditioners and mention its significance. What are the two factors that decide the effect of power line disturbances on the sensitive equipment?
- Draw the circuit diagram of double ended forward DC-DC converter and derive the expression for 5B. output voltage.
- Identify the converter circuit shown in Figure (5c). What is the voltage v_x when both the switches are 5C. open?



Figure 5(c)

Figure 6(a)

(5+3+2)

For the push-pull dc-dc converter shown in Figure 6(a) derive the expression for 6A.

- (i) Output voltage
- (ii) The maximum and minimum current in L_x
- (iii)Output voltage ripple

Determine the values of the above parameters if, $V_s = 60V$, $R = 10\Omega$, $L_x = 0.4$ mH, $C = 10\mu$ F, f =20kHz, $N_p/N_s = 3$, D = 0.4.

What is the drawback of this converter?

- With the help of neat circuit diagram and waveforms explain the working of zero voltage switching 6B. resonant converter.
- 6C. Draw a full bridge inverter using IGBTs. Explain its working.

(5+3+2)