SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
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QUESTION BANK (DESCRIPTIVE)

Subject with Code: ADVANCED POWER ELECTRONICS

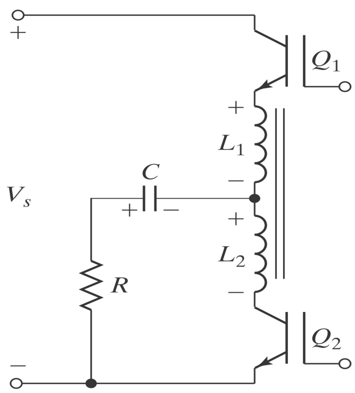
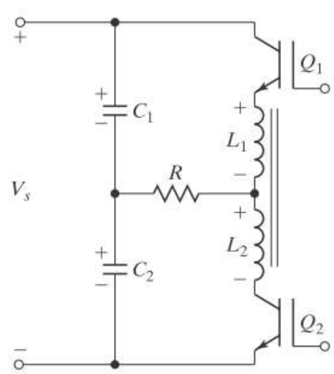
Course & Branch: **M.TECH. IN POWER ELECTRONICS**

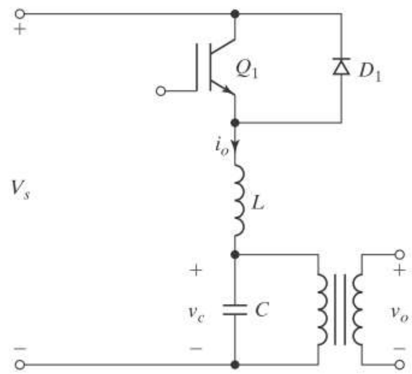
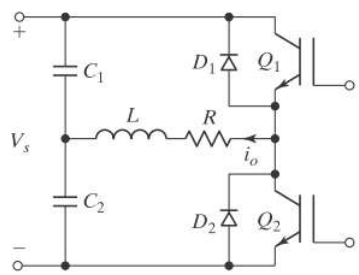
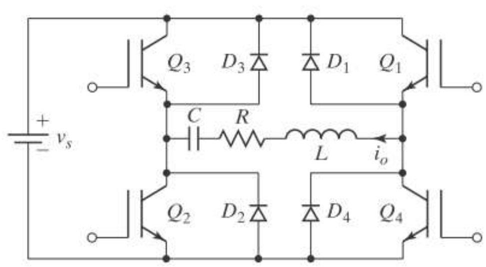
Year &Sem: I-M.Tech & II Sem **Regulation:** R25

UNIT –I
HIGH-POWER SEMICONDUCTOR DEVICES

1	a	Explain the different types of power diodes briefly.	**[L2][CO1]**	**[4M]**
	b	Explain the diode reverse recovery characteristics in detail.	**[L2][CO1]**	**[6M]**
2	a	Explain the construction and working of Power MOSFET.	**[L2][CO1]**	**[5M]**
	b	Explain the characteristics of Power MOSFET.	**[L2][CO1]**	**[5M]**
3	a	Explain the construction and working of Insulated Gate Bipolar Transistor (IGBT).	**[L3][CO1]**	**[5M]**
	b	Explain the characteristics of Insulated Gate Bipolar Transistor (IGBT).	**[L3][CO1]**	**[5M]**
4		Explain the Switching Characteristics during Turn-on and Turn-off of Silicon-Controlled Rectifier (SCR)	**[L3][CO1]**	**[10M]**
5	a	Explain the characteristics of Gate Turn Off (GTO) Thyristor.	**[L3][CO1]**	**[6M]**
	b	Compare Gate Turn Off (GTO) Thyristor and Silicon-Controlled Rectifier (SCR).	**[L4][CO1]**	**[4M]**
6	a	Explain the characteristics of Gate Commutated Thyristor (GCT).	**[L4][CO1]**	**[5M]**
	b	Compare Silicon-Controlled Rectifier (SCR), Gate Turn Off (GTO) Thyristor and Gate Commutated Thyristor (GCT).	**[L3][CO2]**	**[5M]**
7		Explain the two-transistor model of Silicon-Controlled Rectifier.	**[L3][CO2]**	**[10M]**
8		Explain the operation of series connected Silicon-Controlled Rectifier.	**[L2][CO2]**	**[10M]**
9		What are the main Causes of Voltage Unbalance. Explain the voltage Equalization for GCTs.	**[L2][CO2]**	**[10M]**
10	a	A string of four series-connected thyristors is provided with static and dynamic equalizing circuits. This string has to withstand an off-state voltage of 10 kV. The static equalizing resistance is 25000 Ω and the dynamic equalizing circuit has $R_c = 40\ \Omega$and $C = 0.08\ \mu F$. The leakage currents for four thyristors are 21 mA, 25 mA, 18 mA and 16 mA respectively. Determine voltage across each SCR in the off-state and the discharge current of each capacitor at the time of turn-on.	**[L2][CO2]**	**[5M]**
	b	Explain the voltage Equalization for IGBTs.	**[L2][CO2]**	**[5M]**

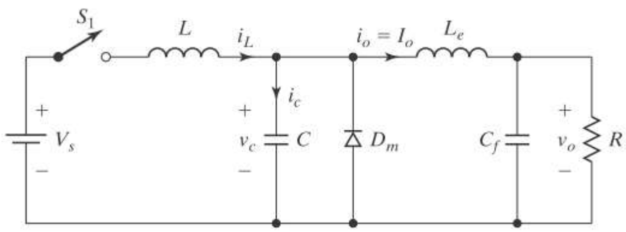
UNIT –II
RESONANT PULSE INVERTERS

1	Explain in detail various modes of operation of Series resonant Inverters with unidirectional Switches.	**[L3][CO3]**	**[10M]**
2	The series resonant inverter in Figure 7.2 has $L_1 = L_2 = L = 50\ \mu H$, $C = 6\ \mu F$, and $R = 2\ \Omega$. The dc input voltage is Vs = 220 V and the frequency of output voltage is fo = 7 kHz. The turn-off time of transistors is toff = 10 μs. Determine (a) the available (or circuit) turn-off time toff′, (b) the maximum permissible frequency fmax, (c) the peak-to-peak capacitor voltage Vpp, and (d) the peak load current. (e) Sketch the instantaneous load current io(t), capacitor voltage vc(t), and dc supply current is(t). Calculate (f) the rms load current Io; (g) the output power Po; (h) the average supply current Is; and (i) the average, peak, and rms transistor currents.  	**[L3][CO3]**	**[10M]**
3	The half-bridge resonant inverter in Figure below, is operated at an output frequency, fo = 7 kHz. If $C_1 = C_2 = C = 3\ \mu F$, $L_1 = L_2 = L = 50\ \mu H$, $R = 2\ \Omega$, and Vs = 220 V, determine (a) the peak supply current I_{ps}, (b) the average transistor current I_A, and (c) the rms transistor current I_R.  	**[L4][CO3]**	**[10M]**
4	Explain with necessary waveforms, the operation of a series resonant Inverters with Bidirectional Switches	**[L3][CO3]**	**[10M]**
5	The resonant inverter in Figure below has C = 2 μF, L = 20 μH, R = ∞, and Vs = 220 V. The switching time of the transistor is tsw = 12 μs. The output frequency is fo = 20 kHz. Determine (a) the peak supply current Ip, (b) the average device current IA, (c) the rms device current IR, (d) the peak-to-peak capacitor voltage Vpp, (e) the maximum permissible output frequency fmax, and (f) the average supply current Is.	**[L2][CO3]**	**[10M]**

			
6	The half-bridge resonant inverter in Figure 7.8a is operated at a frequency of fo = 3.5 kHz. If $C_1 = C_2 = C = 3$ μF, $L_1 = L_2 = L = 50$ μH, R = 2 Ω, and Vs = 220 V, determine (a) the peak supply current Ip, (b) the average device current IA, (c) the rms device current IR, (d) the rms load current Io, and (e) the average supply current Is.  (a) Circuit	**[L2][CO3]**	**[10M]**
7	The full-bridge resonant inverter in Figure below is operated at a frequency, fo = 3.5 kHz. If C = 6 μF, L = 50 μH, R = 2 Ω, and Vs = 220 V, determine (a) the peak supply current Ip, (b) the average device current IA, (c) the rms device current IR, (d) the rms load current Io, and (e) the average supply current Is.  (a) Circuit	**[L2][CO3]**	**[10M]**
8	Explain the frequency response of series resonant inverter for series loaded inverter.	**[L4][CO3]**	**[10M]**
9	Explain the operation of parallel resonant inverter.	**[L2][CO3]**	**[10M]**
10	Explain the various modes of operation of Class-E resonant inverter	**[L3][CO3]**	**[10M]**

UNIT –III
RESONANT CONVERTERS

1	a	Explain various switch configurations for Zero current switching resonant converters.	**[L2][CO4]**	**[5M]**
	b	The ZCS resonant converter of Figure below delivers a maximum power of $P_L = 400$ mWat $V_o = 4$ V. The supply voltage is $V_s = 12$ V. The maximum operating frequency is $f_{\max} = 50$ kHz. Determine the values of	**[L2][CO4]**	**[5M]**

		L and C. Assume that the intervals t_1 and t_3 are very small, and $x = 1.5$.  		
2	Explain the various modes of operation of L-type Zero current switching resonant Converter		**[L3][CO4]**	**[10M]**
3	Explain the various modes of operation of M-type Zero current switching resonant Converter		**[L3][CO4]**	**[10M]**
4	Explain the various modes of operation of Zero voltage switching resonant Converter		**[L3][CO4]**	**[10M]**
5	a	Explain the comparison between Zero current switching and Zero voltage switching resonant converters.	**[L4][CO4]**	**[5M]**
	b	What is the principle of zero-current-switching (ZCS) resonant converters?	**[L4][CO4]**	**[5M]**
6	Explain the various modes of operation of Two quadrant ZVS resonant converters		**[L2][CO4]**	**[10M]**
7	Explain single phase Resonant dc link inverters with necessary waveforms.		**[L3][CO4]**	**[10M]**
8	Explain three phase Resonant dc link inverters with necessary waveforms.		**[L2][CO4]**	**[10M]**
9	What are the advantages and limitations of Zero current switching converters?		**[L2][CO6]**	**[10M]**
10	What are the advantages and limitations of Zero voltage switching converters?		**[L2][CO6]**	**[10M]**

UNIT –IV
MODULATION TECHNIQUES

1	Explain sinusoidal pulse width modulation scheme with necessary wave form	**[L2][CO5]**	**[10M]**
2	Discuss the concepts of harmonic content in two level inverter waveform and over modulation.	**[L3][CO5]**	**[10M]**
3	Explain the concept of space vectors and switching states of space vector modulation.	**[L3][CO5]**	**[10M]**
4	Explain Dwell time calculation in space vector modulation.	**[L2][CO5]**	**[10M]**
5	Explain the concept of modulation index in space vector modulation.	**[L3][CO5]**	**[10M]**
6	Explain the concept of switching sequence in space vector modulation.	**[L3][CO5]**	**[10M]**
7	Explain how to eliminate even order harmonics using modified space vector modulation.	**[L2][CO6]**	**[10M]**
8	Explain Bipolar Pulse-Width Modulation in Single-phase H-bridge inverter.	**[L2][CO6]**	**[10M]**
9	Explain Unipolar Pulse-Width Modulation in Single-phase H-bridge inverter.	**[L2][CO5]**	**[10M]**
10	Explain the concept of Discontinuous Space Vector Modulation.	**[L4][CO5]**	**[10M]**

UNIT –V
MULTILEVEL INVERTERS

1	Explain the working principle of Cascaded H-Bridge (CHB) multilevel inverter with equal DC voltage sources.	**[L2][CO6]**	**[10M]**
2	Discuss Cascaded H-Bridge multilevel inverter with unequal DC voltage sources.	**[L2][CO6]**	**[10M]**

3	Explain Phase-Shifted Multicarrier Modulation for multilevel inverters.	**[L3][CO6]**	**[10M]**
4	Explain level-Shifted Multicarrier Modulation for multilevel inverters.	**[L2][CO6]**	**[10M]**
5	Explain Staircase Modulation in Cascaded H-Bridge (CHB) multilevel inverter	**[L2][CO6]**	**[10M]**
6	Explain the commutation of switching devices in the three level NPC inverter.	**[L2][CO6]**	**[10M]**
7	Explain space vector modulation (SVM) scheme for the three-level NPC inverter with dwell time calculations.	**[L2][CO6]**	**[10M]**
8	Explain the Effect of Switching States on Neutral-Point Voltage Deviation in three-level NPC inverter	**[L2][CO6]**	**[10M]**
9	Explain the Switching Sequence with Minimal Neutral-Point Voltage Deviation in three-level NPC inverter.	**[L2][CO6]**	**[10M]**
10	Explain the concept of Even-Order Harmonic Elimination in three-level NPC inverter.	**[L2][CO6]**	**[10M]**

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