

Reg. No.

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code : 66272

M.E. DEGREE EXAMINATION, DECEMBER 2015/JANUARY 2016

First Semester

Power Electronics and Drives

PX7103 : ANALYSIS AND DESIGN OF INVERTERS

(Common to M.E. Power Systems Engineering)

(Regulations – 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. List the performance parameters of inverters.
2. Give the need for connecting anti parallel diodes with switches.
3. Why should normalized carrier frequency m_f of a three phase inverter be an odd multiple of three ?
4. In a voltage source inverter, the shape of the load current depends on the load parameters. Give reason.
5. What are the advantages of CSI when compared to VSI ?
6. Increasing the size of commutating capacitors in a three phase CSI causes a decrease in the output frequency. Say true or false and justify your answer.
7. What are the features of a multilevel inverter ?
8. Compare diode clamped with flying capacitors multilevel inverter.
9. What are the advantages and limitations of class E resonant inverters ?
10. What is the principle of series resonant inverter ?

Answer ALL Questions

PART – B (5 × 13 = 65 Marks)

11. (a) Explain with the help of necessary waveforms the operation of a single phase full bridge inverter. (13)
OR
(b) Describe briefly and compare the various methods employed for the control of output voltage of inverters. (13)

12. (a) Describe briefly the 180° conduction mode of operation of a three phase inverter with star connected resistive load. (13)

OR

- (b) (i) What is pulse width modulation? List the various Pulse width modulation techniques. How do these differ from each other? (4)
(ii) Explain space vector modulation used in inverters. Write the important features of the same. (9)

13. (a) Draw and explain the operation of a single phase capacitor commutated current source inverters with resistive load. Draw also the related voltage and current waveform. (13)

OR

- (b) Describe a three phase auto sequential CSI with L-back emf load. Also explain the significance of overlap region in a single phase CSI with this load. (13)

14. (a) With circuit diagram and waveform explain the operation of five level flying capacitor multilevel inverter. (13)

OR

- (b) Explain the principle of operation of a single phase multilevel cascaded H-bridge inverter with neat diagrams and waveforms. Also list its features, advantages and disadvantages. (13)

15. (a) Explain the operating principle of parallel resonant inverter. (13)

OR

- (b) Discuss the various modes of operation of a class E resonant inverter with circuit and waveforms. (13)

PART – C (1 × 15 = 15 Marks)

16. (a) (i) The series resonant inverter with coupled inductors has $L_1 = L_2 = 50\mu\text{H}$, $C = 6\mu\text{F}$ and $R = 2\Omega$. The DC input voltage is $V_S = 220\text{V}$ and the frequency of output voltage is $f_0 = 7\text{kHz}$. The turn off time of thyristors is $t_q = 10\mu\text{s}$. Determine (a) the circuit turn off time t_{off} (b) the maximum permissible frequency f_{max} (c) the peak to peak capacitor voltage V_{pp} and the peak load current I_p . (5)

- (ii) Explain the principle of multilevel inverter concept with the help of a single phase bridge type five level diode clamped multilevel inverter. (10)

OR

- (b) (i) A single phase bridge inverter has a resistive load $R = 2.4\Omega$ and the DC input voltage of 48 V. Determine (a) RMS output voltage at fundamental frequency (b) output power (c) I_{av} and I_m of each transistor (d) Distortion Factor (e) Harmonic Factor (f) Lowest order Harmonic (10)

- (ii) What are line commutated inverters? How do they operate? Explain the difference between line commutated and force commutated inverters. (5)