Reg. No. | | | | | | | | | | | | |

Question Paper Code : 13934

M.E. DEGREE EXAMINATION, JANUARY 2015.

First Semester

Power Electronics and Drives

PX 7103 — ANALYSIS AND DESIGN OF INVERTERS

(Common to M.E. Power Systems Engineering)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define commutation.
2. List the various PWM technique used in single phase inverters.
3. What is the limiting factor for the operating frequency of an inverter?
4. Write the different methods for control of output voltage in inverters.
5. Compare VSI and CSI.
6. What are the applications of load commutated inverter?
7. How selective harmonic elimination is achieved in multilevel inverters?
8. Mention the applications of multilevel inverters.
9. What is the value of fundamental input voltage under quasi square wave control?
10. How the output voltage is controlled in a series resonant inverters?

PART B — (5 × 16 = 80 marks)

11. (a) Explain the voltage control of single phase inverters using PWM technique with the help of waveforms. (16)

Or

(b) (i) What are the techniques for harmonic reductions? (8)

(ii) A single phase full bridge inverter delivers power to a RLC load $R=2\Omega$ and $X_L=10\Omega$. The bridge operates with a periodicity of 0.2 ms. Calculate the value of C so that load commutation is achieved for the thyristors. Turn–off time for thyristors is 15 μs. Factor of safety is 2. Assume the load current to contain only the fundamental component. (8)

12. (a) Discuss the principle of working of a three phase VSI. Draw phase and line voltage waveforms on the assumption that each thyristor conducts for 180° and the resistive load is delta connected. Derive expressions for RMS value of line voltage, phase voltage and fundamental phase voltage. (16)

Or

(b) With necessary diagram describe the space vector modulation techniques used to control the output voltage of three phase inverter. (16)

13. (a) In a single phase ASCI with inductive load SCRs T_3 and T_4 are conducting a constant current = 15 A. If T_1 and T_2 are turned ON at t = 0 to force commutate T_3, T_4, find the time required for the load current to fall zero. Load L = 12 μH and commutating capacitance, C = 5 μF. Find also the total communication interval and the circuit turn-off time for each of the SCRs. (16)

Or

(b) Explain the single phase auto sequential commutated CSI with relevant mode diagrams and waveforms. (16)

14. (a) Draw and explain the operation of a three-level diode clamped multilevel inverter. Write the inverter relationship for R-phase. Derive the expressions for

(i) Transistor voltage,

(ii) Freewheeling diode current,

(iii) Capacitor junction current and

(iv) Clamping diode current. (16)

Or

(b) A single phase diode inverter has m = 5. Find the peak voltage and current ratings of diodes and switching devices if $V_{dc}=10\,KV$ and $i_0=50\sin(\theta-\pi/3)$. (16)

15. (a) Describe the operation of resonant DC link inverters with zero voltage switching. Draw necessary waveforms. (16)

Or

(b) Explain the operation of class E Resonant inverter with wave forms. (16)
