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Question Paper Code : 83297

M.E. DEGREE EXAMINATION, JANUARY 2014.

First Semester

Power Systems Engineering

PX 7103 — ANALYSIS AND DESIGN OF INVERTERS

(Common to M.E. Power Electronics and Drives)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Mention the advantages of using IGBT when compared to Power MOSFET.
2. Why is it necessary to eliminate harmonics from the inverter output?
3. What is the drawback of operating 3-phase inverter in 120° mode?
4. What do you mean by space vector modulation?
5. Compare CSI with VSI.
6. What is the special feature of auto sequentially commutated current source inverter?
7. Why higher levels are not possible with diode clamped multilevel inverter?
8. List some of the applications of multi level inverters.
9. What are resonant inverters?
10. What are the advantages of class E resonant inverter?

PART B — (5 × 16 = 80 marks)

11. (a) With a neat power circuit diagram explain the working of Mc-Murray-Bedford half bridge inverter. Draw the necessary equivalent circuits and all the waveforms related to the circuit.

Or

(b) Discuss in detail the various harmonic elimination methods as applied to single phase inverters.

12. (a) Draw neatly the power circuit diagram of three phase inverter with star connected load. Explain the circuit operation in the 180° mode with necessary equivalent circuits. Mark the ON duration of various switches and draw all the three phase and line output voltages. From the waveform derive the expression for the output phase and Line voltages.

Or

(b) With a neat sketch explain the voltage control of three phase inverters
(i) with SPWM
(ii) with SVM.

13. (a) A single phase auto-sequential commutated inverter is used to deliver power to a load of $R = 12\Omega$ from a 240 V dc source. If the inverter output frequency is 60 Hz, thyristor turn off time 15 μ sec and safety factor 2, and then determine the suitable values for source inductance and the commutating capacitors. Neglect all losses and assume a maximum current change of 0.4 in one cycle. Derive the formula used for determining C.

Or

(b) Write short note on the following:
(i) load commutated inverters
(ii) current pulsations.

14. (a) With a neat power circuit diagram explain the working of three phase cascade type multilevel inverter. Consider three cells for each phase. Discuss in detail on the number of levels at the output and number of components required for the circuit. Draw the appropriate output.

Or

(b) (i) With necessary diagram, explain the working of three phase impedance source inverters.
(ii) Write short note on the three level flying capacitor MLI.

15. (a) A parallel resonant inverter delivers a load power of P_L = 1kW at a peak sinusoidal load voltage of V_p = 170 V and at resonance. The load resistance is $R = 10\Omega$. The resonant frequency is f_0 = 20 kHz. Determine
(i) The dc input current
(ii) The quality factor Q_p if it is required to reduce the load power to 250 W by frequency control so that u = 1.25
(iii) The inductor and
(iv) The capacitor.

Or

(b) With a neat power circuit diagram explain the working of series resonant inverter. Draw the necessary equivalent circuits for various modes and waveforms. Under each mode derive the appropriate capacitor voltage and load current expressions.
