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Question Paper Code : 11252

M.E./M.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

First Semester

Power Electronics and Drives

PX 4151 – ANALYSIS OF POWER CONVERTERS

(Common to : M.E. Power Systems Engineering)

(Regulations – 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is effect of source impedance on the performance on the converter?
2. Mention two advantages of GTO over SCR.
3. Mention some of the applications of commutated rectifiers.
4. Derive the expression for the output voltage of half wavecontrolled rectifier with R load.
5. What is space vector modulation?
6. What are the two main types of inverters and Distinguish between them explicitly?
7. Give an expression for the RMS output voltage of single phase full wave ac voltage controller with RL load.
8. Mention some of the applications of three phase inverters.
9. Explain briefly pulse width modulation (PWM).
10. Draw the circuit diagram of diode clamped multilevel inverter.

PART B — (5 × 13 = 65 marks)

11. (a) Explain single phase full wave rectifier operation on continuous and discontinuous modes with neat sketch. (13)

Or

(b) A 1phase fully controlled bridge rectifier is operated with a resistive load R=10Ω, the input voltage to the bridge is 230 V. Calculate the following

(i) Average load voltage (3)

(ii) RMS load voltage (3)

(iii) Form factor and ripple factor (4)

(iv) Average load current. (3)

12. (a) Draw and explain operation of three phase fully controlled bridge rectifiers. (13)

Or

(b) Three phase fully controlled converter is connected to a supply voltage of 230 volt per phase and frequency is 50Hz. The source inductance is 4mH. The load current on dc side is constant at 20 A. If the load consists of a dc source voltage of 400V an internal resistance of 1ohm, compute the following:

(i) Firing angle (7)

(ii) Overlap angle (6)

13. (a) A single phase bridge inverter is fed from 230V dc. In output voltage wave only fundamental component is considered. Determine rms current rating of an SCR and a diode of bridge for the following types of load. Consider Resistance R = 2 Ω and X_L = 2 Ω. (13)

Or

(b) Explain the voltage control of single phase inverters using various PWM techniques. (13)

14. (a) (i) Compare the 180° and 120° conduction modes of operation of a three-phase inverter. (6)

(ii) Explain the space vector PWM technique as applicable to 3-phase inverter control with neat schematic diagrams. (7)

Or

(b) Draw the circuit and explain the 180° operation of a 3 phase bridge inverter with R load. (13)

15. (a) Explain current control mode of a PWM scheme with neat circuit diagram. (13)

Or

(b) Explain the design of variable structure controller for the source current shaping of PWM rectifiers. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A three phase fully controlled bridge converter with 415V supply, 0.04Ω resistance per phase and 0.25Ω reactance per phase is operating in the inverting mode at a firing angle of 35°. Calculate the mean generator voltage when the current is level at 80A. The thyristor voltage drop is 1.5 V? (15)

Or

(b) Compare and explain the types of MultiLevel Inverters and also list the applications Multilevel inverter. (15)

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