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Question Paper Code	12409
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M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

First Semester

M.E. - Power Electronics and Drives

20PPEPC104 - ANALYSIS AND DESIGN OF INVERTERS

(Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

- | | <i>Marks,
K-Level, CO</i> |
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| 1. List the Techniques employed for the reduction of harmonics from the output voltage of an inverter. | <i>2,K1,CO1</i> |
| 2. Define commutation. How they are generally classified? | <i>2,K1,CO1</i> |
| 3. What is the purpose of connecting diode in antiparallel with thyristors in inverter? | <i>2, K1,CO2</i> |
| 4. Define modulation index of PWM. | <i>2, K1,CO2</i> |
| 5. Differentiate between VSI and CSI. | <i>2, K2,CO3</i> |
| 6. List the applications of multilevel inverter. | <i>2, K1,CO4</i> |
| 7. What are the features of cascaded inverter? | <i>2, K1,CO4</i> |
| 8. Why a PWM inverter is superior to square wave inverters? | <i>2, K2,CO3</i> |
| 9. What are the methods of voltage control of resonant inverters? | <i>2, K1,CO5</i> |
| 10. What is UPS? Name the various configurations of UPS. | <i>2,K1,CO5</i> |

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) Discuss the operation of full bridge single phase inverter with R-L load and derive the expression for fundamental component of output voltage. *13,K2,CO1*
- OR**
- b) Analyze and explain the modified McMurry Half-bridge Inverter with appropriate voltage and current waveforms and drive suitable expressions for commutating components L and C. *13,K3,CO1*
12. a) With a neat circuit diagram and waveforms explain the working of 180-degree conduction mode operation of three phase inverter with star connection load. *13,K2,CO2*
- OR**
- b) Describe the space vector modulation techniques used to control the output voltage of the three-phase inverter. *13,K2,CO2*

13. a) Draw and explain the operation of single-phase capacitor commutated CSI with resistive load and also draw related voltage and current waveforms. *13,K2,CO3*

OR

- b) Draw the circuit diagram of single phase auto sequential commutated current source inverter and explain its operation with equivalent circuits for different modes and necessary waveforms. *13,K2,CO3*

14. a) With neat sketch explain the principle of operation of diode clamped multi-level inverter. *13,K2,CO4*

OR

- b) Discuss the operation of DC-link capacitor voltage balancing with suitable waveforms. *13,K2,CO4*

15. a) With neat sketch, explain the principle of operation of parallel resonant inverter. *13,K2,CO5*

OR

- b) Describe the operation of Class E resonant inverter with neat waveforms. *13,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) Discuss in detail the different PWM techniques used for single phase multilevel inverters. *15,K2,CO4*

OR

- b) In a single-phase series inverter, the operating frequency is 50 kHz and the thyristor turn-off time $t_q = 10\mu\text{s}$. Circuit parameter are: $R = 3\Omega$, $L = 60\mu\text{H}$, $C = 7.5\mu\text{F}$ and $V_S = 220\text{ V dc}$. Calculate (a) the circuit turn-off time and (b) maximum possible operating frequency, assuming a factor of safety = 1.5. *15,K3,CO5*