KUMARAGURU college of technology
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Register Number:……..….

M.E DEGREE EXAMINATIONS: JAN 2015

(Regulation 2014)

First Semester

POWER ELECTRONICS AND DRIVES

P14PET104**:** Analysis of Inverters

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. **Match the following** [K_3]

i) High frequency SMPS	A)IGCT
ii) Medium voltage drives	B) MOSFET
iii) HVDC applications	C) SCR
iv) Modern drives with integrated gate drives	D) IGBT

a) A,B,C,D b) B,D,C,A

c) A,B,D,C d) B,A,C,D

2. What is the effect of blanking time on output voltage in PWM inverter? [K_2]

a) Distortion in instantaneous voltage at current zero crossing b) Low order space harmonics in output voltage

c) Distortion in instantaneous voltage at voltage zero crossing d) High order time harmonics in output voltage

3. In single phase PWM inverter 5^{th} harmonic can be eliminated if pulse width is ____^{0} [K_3]

a) 30 b) 36

c) 72 d) 108

4. The CSI inverter which is meant to work with induction load, is feeding pure resistive load. What happens to output frequency? [K_3]

a) Zero b) constant

c) increases d) decreases

5. A constant current source inverter supplies 10 A to load resistance of 1Ω with Vdc =100V. When load resistance is changed to 10Ω , then the load current [K_3]

a) Remains same at 10A and the load voltage alone changes
b) Remains same at 10A and the load voltage at 100V
c) Changes to 1A from 10A and the load voltage changes remains at 100V
d) Changes to 1A from 10A and the load voltage changes to 80V

6. In current source inverter to maintain constant DC in source side _____ is connected [K_1]

a) Inductance in series with DC supply
b) Capacitance in parallel with DC supply
c) Inductance in parallel with DC supply
d) Capacitance in series with DC supply

7. The total output voltage generated in a cascaded 11 level inverter is 500V. The maximum voltage stress on individual active devices when conducting in H bridge is [K_2]

a) 500V
b) 100V
c) 1000V
d) 800V

8. Which of the following is true for a Multilevel inverter? [K_3]

i) Voltage stress is divided by individual H bridge cells.
ii) Current stress is divided by individual H bridge cells.
iii) The increase in number of levels increases the harmonics.
iv) Well suited for high power applications

a) i) ii) and iv)
b) i) iii) and iv)
c) i) and iv)
d) ii) iii) and iv)

9. A series inverter has 4kHz frequency and capacitance as 0.5μF.The value of inductance is ____ [K_3]

a) 3.16mH
b) 7.32mH
c) 1.58mH
d) 0.5mH

10. Which of the following inverters have self commutation? [K_1]

a) Series inverter
b) McMurray inverter
c) McMurray Bedford inverter
d) Multilevel inverter

PART B (10 x 2 = 20 Marks)

11. A single - phase full bridge inverter employs multiple PWM with 5 pulses per half cycle. The width of each pulse is 10 degrees. If the DC input voltage is 230 V, calculate the RMS value of output voltage. [K_3]

12. A single phase full bridge inverter is connected to RL load. Draw the output load voltage and load current. [K_3]

13. What happens to triplen harmonics in a three phase inverter? Justify with suitable example. [K_1]

14. What is the reason for having dead band in three phase inverter? [K_2]

15. Why CSI fed inverter is not suitable for pure resistive load? Illustrate the answer [K_3]

16. Is feedback diode required for CSI with inductive load? Justify the answer. [K_3]

17. Suggest suitable multilevel inverter to i) interface multiple PV cell into the grid ii) Reactive power compensation [K_3]

18. How many clamping capacitor and main switching devices are involved to generate a 5 level waveform in a capacitor commutated inverter? [K_2]

19. What is the advantage of using bidirectional switches in resonant inverter? [K_1]

20. What is the purpose of employing Zero voltage and zero current switching? [K_2]

PART C (10 x 5 = 50 Marks)

21. A single phase full bridge inverter is connected to DC sources of V_{DC}. Resolve its output voltage into fourier series. [K_2]

22. A single phase bridge inverter has a resistive load R=2.4 Ω and the DC input voltage of 48 V. Determine a) RMS output voltage at fundamental frequency. b)RMS output current c) Output power [K_3]

23. Draw the space vector for a three phase bridge inverter showing the reference and adjacent voltage vectors .Tabulate the summary of switching states [K_2]

24. A three phase Inverter is employed in an application in which the devices takes more time turn off and have faster turn on time. Which mode of operation is preferred 120 or 180 degree? [K_3]

Illustrate the answer by marking the portion in a phase waveform

25. Distinguish VSI and CSI based on the loads and operating characteristics. [K_2]

26. Draw the circuit, output voltage and current waveforms of autosequential commutated CSI with inductive load. [K_1]

27. How is Multilevel inverter used for reactive power compensator and controlling the flow of power between two systems? [K_2]

28. Compare and contrast the different configurations of multilevel inverter based on the device count ,operating principle and applications [K_2]

29. Discuss the working of series resonant inverter with mutually coupled inductor. [K_2]

30. Explain the principle of operation of resonant DC link inverter with relevant circuit. [K_1]

PART D (2 x 10 = 20 Marks)

31. Discuss the principle of working of a three phase voltage source inverter. Draw phase and line voltage waveforms on the assumption that each thyristor conducts for 120° and the resistive load is star connected. Derive expressions for rms value of line voltage in fourier analysis. [K_2]

32. Explain the operation of five-level cascaded multilevel inverter with suitable waveform. Draw the switching table and discuss the modes of operation.
Calculate the number of main switching devices and DC sources required to generate 13 level waveform. [K_3]

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