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Total Pages : 05

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May 2024

B.Tech. (EL) (Fourth Semester)

Power Electronics (ELPC-403)

Time : 3 Hours] [*Maximum Marks : 75*

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) Define the terms rise time and spread time for a thyristor. **1.5**

(b) Differentiate between voltage source inverter and current source inverter. **1.5**

(c) Distinguish between the line commutation and forced commutation. **1.5**

(d) Which type of chopper configuration is used for Regenerative braking ? **1.5**

(e) Enumerate various disadvantages of Frequency modulation control over PWM control. **1.5**

(f) Which type of AC to DC converter can work in both first and second quadrant ? **1.5**

(g) What are the line commutated inverters ? **1.5**

(h) What is Snubber circuit ? Why is it used ? **1.5**

(i) Why diodes are connected in anti-parallel with semiconductor switches in inverter circuit ? **1.5**

(j) Which type of semiconductor switch is used for high frequency operation ? **1.5**

Part B

2. (a) Describe various modes of operation of thyristor in detail and draw the V-I characteristics. **7.5**

(b) Explain the Current commutation technique of thyristor using appropriate waveforms. **7.5**

3. (a) Explain the operation of a Single phase Full wave thyristor rectifier with RL load. Derive the average and rms values of output voltage. **7.5**

(b) The voltage across secondary winding of a single phase transformer is 200 V, 50 Hz and the transformer deliver power to resistive load of R = 2 ohms through a single phase half wave controlled rectifier. If the firing angle of thyristor is 90 deg, calculate : **7.5**

(i) Average DC output voltage

(ii) Average DC output current

(iii) rms output voltage

(iv) rms output current

(v) Form factor

(vi) Rectification efficiency

(vii) Transformer utilization factor.

4. Describe the working of a three-phase inverter in 180 degree conduction scheme. Mention the switching scheme and draw the equivalent circuit for different steps. Also draw the line voltages and phase voltages. **15**

5. (a) Perform the steady state time domain analysis of a Buck converter and derive the expression for maximum and minimum value of load currents. 7.5

(b) A Buck converter has input voltage of 220 V, and a resistive load of 10 ohms. When thyristor is used as a switch, the voltage across the thyristor switch is 2 V during on condition. If the duty cycle is 0.8, switching frequency is 1 kHz, determine : **7.5**

(i) Average output voltage

(ii) Average output current

(iii) rms output voltage

(iv) rms output current

(v) Average thyristor current

(vi) Efficiency of converter.

6. (a) Explain the operation of a Boost converter using suitable circuit diagram and waveforms. Derive the equation for output voltage in terms of duty cycle and source voltage. **7.5**

(b) A Boost converter has an input voltage of 200 V and output voltage of 400 V. If the conduction time of the switch is 150 micro sec, what is the pulse width of output voltage ? If the pulse width becomes one-fourth for constant frequency operation ? compute the new average values of output voltage. **7.5**

7. (a) Explain the working of a Full Bridge inverter along with the circuit diagram and waveforms. Write the Fourier series expression for the output voltage. **7.5**

(b) Discuss the Unipolar Sinusoidal PWM technique of a single phase Half Bridge Inverter using appropriate waveforms. **7.5**