PEPS21 - Advanced Power Electronics

P. Pages : 2

Time : Three Hours

2982

GUG/S/19/11021

Max. Marks : 70

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Notes : 1. All questions carry equal marks.
2. Attempt **any five** questions.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.
6. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
7. Use of non-programmable electronic calculator is permitted.

1. a) Explain Boost DC-DC converter with 'R' Load.   **7**
Derive output voltage equation for given duty ratio = k and input DC voltage = Vs.

   b) Draw following characteristics.   **7**
     i) Transfer characteristics of power MOSFET.
     ii) V-I characteristics of Thyristor.
     iii) V-I characteristics of I.G.B.T.

2. a) i) What is the function of driver circuit of power MOSFET.   **4**

     ii) What is function of driver circuit of IGBT.   **3**

   b) Explain the principle of operation of forward, Push-Pull, Half Bridge converters.   **7**

3. a) Explain a suitable DC to DC converter to give isolated DC high voltage output from a lower voltage DC source.   **7**

   b) A Buck DC-DC converter has voltage supply = 2000V DC. Load parameters are $R = 0.3\,\Omega$, L = 1mH, Chopper on time = $1300\,\mu$ sec and off time = $1000\,\mu$ sec. Find   **7**
     i) Average load voltage.   ii) Average load current.
     iii) RMS load current.   iv) Ripple factor.

4. a) Explain four quadrant operation of DC-DC converter showing power circuit & switches operating in first & second quadrant. Show modes of operation also.   **7**

   b) A boost DC-DC convertor has input voltage 200V DC, where as the output required 600V DC. If the off time of the convector 1 & $100\,\mu$ sec. Calculate on time and duty ratio "K".   **7**

5. a) Explain how to obtain PWM pulses to control a dc-dc convertor. Name 3 various techniques & explain anyone using waveforms & circuit Diagram.   **7**

   b) Draw power circuits of half bridge series resonant convertor with isolated output. Explain load current & capacitor voltage waveforms.   **7**

6. a) Explain series resonant 1 phase full bridge Inverter with power circuits & wave forms for load current; Capacitor voltage. **7**

b) Explain quasi-resonant zero current switched DC-DC-Buck convertor with modes of operation & waveforms. **7**

7. a) Find the output frequency of series resonant invertor having L = 10 mH, C = 0.14 μF, $R_L = 0.4k\Omega$, $t_{off} = 0.2$ m sec. **5**

b) Draw power circuit of 3pn invertor using IGBTs & star connected 3pn load. Show wave form & switching sequence. **9**

8. Explain in brief :- **14**

i) Switching losses.

ii) Block diagram of on-line UPS.

iii) Soft switching.

iv) Total harmonic distortion.

v) Block diagram of off-line UPS.

vi) Advantages of ferrite core transformer.

vii) Advantages of high frequency switching.

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