Code No: R31024

R10

Set No: 1

III B.Tech. I Semester Regular Examinations, November/December - 2012
POWER ELECTRONICS
(Electrical and Electronics Engineering)

Time: 3 Hours   **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Explain the switching characteristics of power MOSFETs.
   (b) Compare the features of Power MOSFETs with BJTs.

2. (a) Explain principle of operation of SCR with the help of two transistor analogy.
   (b) SCRs with rating of 1000V and 200A are available to be used in a string to handle 6kV and 1 kA. Calculate the number of series and parallel units required in case de-rating factor is (i) 0.1 and (ii) 0.2.

3. (a) Explain the principle of operation of single phase half controlled bridge rectifier with RL load. Draw the relevant wave forms and derive output voltage and current.
   (b) A single phase transformer, with secondary voltage of 230V, 50Hz, delivers power to load R=10Ω through a half-wave controlled rectifier circuit. For a firing angle delay of 60^0, determine (i) the rectifier efficiency (ii) form factor (iii) voltage ripple factor (iv) transformer utilization factor and (v) PIV of thyristor.

4. (a) Explain the principle of operation of single phase, two pulse mid-point converter with relevant voltage and current waveforms.
   (b) Discuss A single phase full converter bridge is connected to RLE load. The source voltage is 230V, 50 Hz. The average load current of 10A is constant over the working range. For R=0.4Ω and L=2mH, Compute
   (i) Firing angle delay for E=120V
   (ii) Firing angle delay for E=-120V
   Indicate which source is delivering power to load in parts of (i) and (ii).

5. (a) Explain the effect of source inductance on the performance of a three-phase fully controlled bridge converter. Draw the relevant wave forms.
   (b) A three-phase half-wave controlled rectifier has a supply of 200V/phase. Determine the average load voltage for firing angle of 0^0, 30^0 and 60^0 assuming a thyristor volt drop of 1.5V and continuous load current.

6. (a) Explain the operation of TRIAC with various modes of operation.
   (b) A single phase full-wave ac voltage controller feeds a load of R=20Ω with an input voltage of 230V, 50Hz. Firing angle for both the thyristors is 45^0. Calculate
   (i) rms value of output voltage
   (ii) Load power and input pf
   (iii) Average and rms current of thyristors.

7. (a) Explain the principle of operation of step-up chopper and also derive output voltage.
   (b) A chopper circuit is operating on TRC principle at a frequency of 2kHz on a 220V d.c. supply. If the load voltage is 170V, compute the conduction and blocking period of a thyristor in each cycle.

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8. (a) Explain the principle of operation of three phase series inverter.
   (b) In a single-phase series inverter, the operating frequency is 50kHz and the thyristor turn-off time t_q=10µs. Circuit parameter are: R=3Ω, L=60µH, C=7.5µF and V_s=220V dc. Determine (i) the circuit turn-off time and (ii) maximum possible operating frequency, assuming a factor of safety = 1.5.

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Set No: 2

III B.Tech. I Semester Regular Examinations, November/December - 2012
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(Electrical and Electronics Engineering)

Time: 3 Hours　　　　　　　　　　　　　　　　　　　　　　　　**Max Marks: 75**

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1. (a) Describe different modes of operation of thyristor with the help of its static　v-i characteristics.
    (b) Explain dynamic characteristics of a thyristor with neat sketches.

2. (a) Explain the basic requirements for the successful firing of thyristor in detail.
    (b) A string of four series connected thyristors is provided with static and dynamic equalizing circuits. This string has to withstand an off-state voltage of 10kV. The static equalizing resistance is 25kΩ and the dynamic equalizing circuit has $R_c=40Ω$ and C=0.08µF. The leakage currents for four thyristors are 21mA, 25mA, 18mA and 16mA respectively. Determine voltage across each SCR in the off-state and the discharge current of each capacitor at the time of turn-on.

3. (a) Explain the effect of freewheeling diode in rectifier circuits.
    (b) A single phase semi-converter delivers power to RLE load with R=5 ohms, L=20mH and E=50V. The ac source voltage is 230V, 50Hz. For continuous conduction, find the average value of output current for a firing angle delay of 45deg.

4. (a) Explain the principle of operation of single phase two pulse mid-point converter with RL load using relevant voltage and current waveforms.
    (b) A single phase fully-controlled bridge circuit is used for obtaining a regulated dc output voltage. The RMS value of the ac input voltage is 230V, and the firing angle is maintained at $\pi/3$, so that the load current is 4A. Calculate
    (i) The dc output voltage
    (ii) Active and reactive power input.

5. (a) Explain the operation of three-phase half-wave controlled converter with RL load and also sketch the associated waveforms.
    (b) Three- phase fully-controlled bridge converter to a supply voltage of 230V per phase and frequency of 50Hz. The source inductance is 3mH. The load current on d.c. side is constant at 15A. If the load consists of a d.c. source voltage of 400V having an internal resistance of 1Ω, compute the following:
    (i) Firing angle. (ii) Overlap angle.

6. (a) Derive an expression for amplitude of fundamental component of load or source current for single-phase a.c. voltage regulator.
    (b) In a standard A single-phase bridge-type cycloconverter has input voltage of 230V, 50Hz and load of R=10Ω. Output frequency is one-third of input frequency. For a firing angle delay of 30^0, Calculate (i) rms value of output voltage (ii) rms current of each converter (iii) rms current of each thyristor (iv) input power factor.

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7. (a) Explain principle of operation Buck converter with neat sketches.
   (b) A step up chopper has input voltage of 220V and output voltage of 660V. If the conducting time of thyristor chopper is 100µs, Determine the pulse width of output voltage. In case output voltage pulse width is halved for constant frequency operation, find the average value of new output voltage.

8. (a) Explain principle of operation of single phase series inverter with neat sketches.
   (b) Inductance L=6mH, Capacitance C=1.2 µF, Load resistance R=100Ω and T_{off}=0.2ms. If the load resistance is varied from 40 to 140Ω, find out the range of output frequency.

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Set No: 3

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Time: 3 Hours   **Max Marks: 75**

Answer any FIVE Questions
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1. (a) Describe the turn on and turn off times of a thyristor.
   (b) Explain static characteristics of a thyristor with neat sketches.

2. (a) Derive the values of Static and dynamic equalizing parameters in case of series Connection of SCRs.
   (b) It is required to operate 250A SCR in parallel with 350A SCR with their respective on-state voltage drops of 1.6V and 1.2V. Calculate the value of resistance to be inserted in series with each SCR so that they share the total load of 600A in proportion to their current ratings.

3. (a) Explain the principle of operation of single phase half wave circuit with RL load and freewheeling diode with neat sketches. Derive the expression for load voltage.
   (b) A 230V, 50Hz, one-pulse SCR controlled converter is triggered at a firing angle of 40^0 and the load current extinguishes at an angle of 210^0. Find the circuit turn off time, average output voltage and the average load current for R=5Ω and L=2mH.

4. (a) Explain the principle of operation of single phase Semi-converter with RL load using relevant voltage and current waveforms.
   (b) A single phase full converter is made to deliver a constant load current. For zero degree firing angle, the overlap angle is 15^0. Calculate the overlap angle when firing angle is (i) 30^0 (ii) 45^0 and (iii) 60^0.

5. (a) Explain the operation of three-phase semi converter with RL load with neat sketches.
   (b) A three phase half wave controlled converter is fed from three phase 400V, 50Hz source and is connected to load taking a constant current of 36A. Thyristor has a voltage drop of 1.4V.
   (i) Calculate average value of load voltage for a firing angle of 30^0 and 60^0.
   (ii) Find the average power dissipated in each thyristor.

6. (a) Explain the principle of operation of single phase voltage controller with RL load. Draw necessary waveforms.
   (b) A single phase voltage controller is employed for controlling the power flow from 230V, 50Hz source into a load circuit consisting of R=3Ω and ωL=4Ω. Calculate
   (i) the range of firing angle
   (ii) the maximum value of rms load current
   (iii) the maximum power and power factor
   (iv) the maximum values of average and rms thyristor currents.

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7. (a) Explain principle of operation Buck-Boost converter with neat sketches.
   (b) A step down chopper fed from 220V dc is connected to RL load with R=10Ω and L=150mH. Chopper frequency is 1250Hz and duty cycle is 0.5. Calculate (i) minimum and maximum values of load current (ii) maximum value of ripple current (iii) average and rms values of load current.

8. (a) What are the different pulse width modulation techniques used for inverter?
   (b) Which of the pulse width modulation techniques gives better quality of voltage and current? Explain in detail.

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Time: 3 Hours   **Max Marks: 75**

Answer any FIVE Questions
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1. (a) Explain switching characteristics of an IGBT.
   (b) Explain the gate characteristics of a thyristor with neat sketches.

2. (a) Explain principle of operation of resonant pulse commutation with neat sketches.
   (b) Explain principle of operation of UJT.

3. (a) Describe the performance factors of one pulse converters.
   (b) A single phase half wave converter is operated from 230V, 50Hz source and the load resistance R=12Ω. For a firing angle delay of 30^0, determine
      (i) the rectifier efficiency (ii) form factor (iii) voltage ripple factor
      (iv) transformer utilization factor.

4. (a) Describe the effect of source inductance on the performance of single phase full converters
   (b) A single phase full converter is supplied from 230V, 50Hz source. The load consists of R=10Ω and a large inductance so as to render the load current constant. For a firing angle delay of 30^0, determine
      (i) average output voltage (ii) average output current
      (iii) Average and rms values of thyristor currents.

5. (a) Describe the working of a single-phase dual converter with appropriate waveforms.
   (b) A single phase dual converter is fed from 230V, 50Hz source. The load is R=30Ω and the current limiting reactor has L=0.05H. For $\alpha_1=30^0$, calculate the peak value of circulating current and also the peak currents of both the converters.

6. (a) Describe the basic principle of working of single phase to single phase step down cycloconverter with the help of bridge type configuration.
   (b) A single phase voltage controller has input voltage of 230V, 50 Hz and a load of R=15Ω. For 6 cycles on and 4 cycles off, determine (i) rms output voltage
      (ii) input pf   (iii) average and rms thyristor currents

7. (a) Explain principle of operation of time ratio control and current limit control strategies for chopper circuits.
   (b) Describe the principle of operation of step up chopper. Derive an expression for the output voltage in terms of input voltage and duty cycle.

8. (a) What is pulse width modulation? List the various PWM techniques. How do these differ from each other?
   (b) Discuss Uni polar and Bi–polar Inverters

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