

III B.Tech I Semester Regular Examinations, November 2006

POWER ELECTRONICS

(Electrical & Electronic Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

\*\*\*\*\*

1. (a) Explain the transfer and output characteristics of MOSFETs.  
(b) Why does the concept of saturation differ in BJTs and Power MOSFETs.  
(c) What are the differences between enhancement type MOSFETs and depletion type MOSFETs. [6+6+4]
2. Explain the operation of a single phase half wave converter for R-load with neat circuit diagram and necessary waveforms. Also derive the output average voltage and current for  $\alpha = 30^\circ$ . [12+4]
3. A three phase, half wave converter is supplying a load with a continuous constant current of 40A over a firing angle from  $0^\circ$  to  $75^\circ$ . What will be the power dissipated by the load at these limiting values of firing angle? The supply voltage is 415V (line). [8+8]
4. Two SCRs are connected back-to-back have a load resistance of 400 ohms and a supply of 110V ac. If firing angle is  $60^\circ$ , find  
(a) the rms output voltage  
(b) average power. [10+6]
5. For a single phase mid-point cyclo-converter, explain the operation of the circuit when fed to R-load with the help of neat circuit diagram and relevant output waveforms for  $\alpha = 30^\circ$  and  $\alpha = 120^\circ$  for  $f_0 = 1/4$  fs. [4+8+4]
6. An ideal chopper operating at a chopping period of 2ms supplies a load of 4 ohms having an induction of 8 mH from a 80V battery. Assuming the load is shunted by a perfect commutating diode, and battery to be loss less, compute load current waveforms for  $T_{on} / T_{off}$  values of 1/1, 4/1. [8+8]
7. Draw and explain the simple SCR series inverter circuit employing class A type commutation. With the help of important waveforms. State the limitations of this inverter. [8+4+4]
8. The single phase full bridge auxiliary commutated inverter has a load of  $R = 5$  ohms,  $L = 10$ mH and  $C = 25\mu$ F. The input dc voltage is  $V_s = 220$ V and inverter frequency is  $f_0 = 60$ Hz,  $t_q = 18\mu$ s. Determine the optimum values of commutation components  $C_m$  and  $L_m$ . [16]

\*\*\*\*\*

**III B.Tech I Semester Regular Examinations, November 2006**

**POWER ELECTRONICS**

**(Electrical & Electronic Engineering)**

**Time: 3 hours**

**Max Marks: 80**

**Answer any FIVE Questions  
All Questions carry equal marks**

\*\*\*\*\*

1. Explain the V-I Characteristics of Thyristors with elaborating the following :
  - (a) Latching current
  - (b) holding current
  - (c) on-state and off-state condition
  - (d) turn-on and turn-off times
  - (e) finger voltage [6+10]
2. Single phase dual converter is operated from 230V, 50Hz supply and the load resistance 10 ohms. The circulating inductance is  $L_C = 40\text{mH}$ , firing angles are  $\alpha_1 = 60^\circ$  and  $\alpha_2 = 120^\circ$ . Calculate the peak circulating current, peak currents of converter 1 and converter 2. Also compute the load current. [8+4+4]
3. A three phase, fully controlled bridge converter is supplying dc load of 400V, 60A from a three phase 50Hz, 660V (line) supply. If the thyristors have a voltage drop of 1.2V when conducting, then neglecting overlap, compute
  - (a) firing angle of thyristor
  - (b) RMS value of thyristor currents
  - (c) mean power loss in thyristors [6+5+5]
4. A single phase full wave ac voltage controller has a resistance load of
  - (a) 10 ohms and
  - (b) 5 ohms.The input ac voltage is 230V, 50Hz. For a delay angle of  $90^\circ$ , determine the rms load voltage, rms load current, rms thyristor current and input power factor for above two loads. [8+8]
5. Explain the operation of single phase bridge type cyclo converter when fed from 230V, 50Hz source and controlling power to resistive load with the help of neat circuit diagram and output voltage and current waveforms for  $\alpha = 45^\circ$  and  $\alpha = 160^\circ$  for  $f_0 = 1/5 \text{ fs}$ . [4+6+6]
6. A load commutated chopper, fed from a 230V dc source has a constant load current of 50A. For a duty cycle of 0.4 and a chopping frequency of 2 KHz, Calculate
  - (a) the value of commutating capacitance

- (b) average output voltage
  - (c) circuit turn-off time for one SCR pair
  - (d) total commutation interval [4+4+4+4]
7. Draw and explain the simple SCR series inverter circuit employing class A type commutation. With the help of important waveforms. State the limitations of this inverter. [8+4+4]
8. (a) What are the different pulse width modulation techniques used for inverters.  
(b) Which of the schemes gives better quality of voltage and current. [10+6]

\*\*\*\*\*

**III B.Tech I Semester Regular Examinations, November 2006****POWER ELECTRONICS****(Electrical & Electronic Engineering)****Time: 3 hours****Max Marks: 80****Answer any FIVE Questions****All Questions carry equal marks**

\*\*\*\*\*

1. The voltage and current ratings of a particular circuit are 3.3KV and 750 amps. SCRs with rating of 800V and 175 amps are available. The recommended minimum derating factor is 15%. Calculate min. series and parallel units required. Also calculate the values of resistance and capacitance to be used in the static and dynamic equalizing circuits if the max. forward blocking current for the SCRs is 25mA and  $\Delta Q_{max}$  is  $50\mu C$ . Where  $\Delta Q_{max}$  is max. charge stored in thyristor. [16]
2. Explain the operation of a single phase half wave converter for R-load with neat circuit diagram and necessary waveforms. Also derive the output average voltage and current for  $\alpha = 30^\circ$ . [12+4]
3. A three phase, fully controlled bridge converter is supplying dc load of 400V, 60A from a three phase 50Hz, 660V (line) supply. If the thyristors have a voltage drop of 1.2V when conducting, then neglecting overlap, compute
  - (a) firing angle of thyristor
  - (b) RMS value of thyristor currents
  - (c) mean power loss in thyristors [6+5+5]
4. Derive the output rms voltage, output rms current and source power factor for a single phase ac voltage controller fed to R-L load. [6+4+6]
5. Explain the operation of single phase midpoint cyclo converter with R-L load for continuous conduction with relevant circuit diagram and necessary output waveforms for  $f_0 = 1/3$  fs. [4+6+6]
6. Explain the operation of DC Morgan's Chopper for resistive load with neat circuit diagram and output voltage and current waveforms. [4+7+5]
7. Draw and explain the simple SCR series inverter circuit employing class A type commutation. With the help of important waveforms. State the limitations of this inverter. [8+4+4]
8. A single PWM inverter feeds an RL load with  $R = 10$  ohms, and  $L = 20$ mH. If the  $V_s = 120$  V, find out the total harmonic distortion in the load current. The width of each pulse is  $120^\circ$  and the output frequency is 50Hz. [16]

\*\*\*\*\*

III B.Tech I Semester Regular Examinations, November 2006

POWER ELECTRONICS

(Electrical & Electronic Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

\*\*\*\*\*

1. (a) Explain the necessity of series and parallel connection of SCRs.  
(b) What is String efficiency in series and parallel connections.  
(c) What are the problems arising in series and parallel connections. [4+4+8]
2. Derive the expressions for the following performance factors of single phase fully controlled bridge converter  
(a) input displacement factor  
(b) input power factor  
(c) voltage ripple factor  
(d) active power input  
(e) Reactive power input [5+3+2+3+3]
3. Explain the operation of three phase half-wave controlled converter with resistive load, and inductive load. Sketch the associated waveforms. [8+8]
4. Two SCRs are connected back-to-back have a load resistance of 400 ohms and a supply of 110V ac. If firing angle is  $60^\circ$ , find  
(a) the rms output voltage  
(b) average power. [10+6]
5. Discuss the working of a single phase mid point cyclo converter with R-L loads and for discontinuous operation with neat circuit diagram and output rms voltage and current waveforms for  $f_0=1/3$  fs. [4+7+5]
6. (a) A step-up chopper with a pulse width of  $150 \mu s$  operating on 220V, dc supply. Compute the load voltage if the blocking period of the device is  $40 \mu s$ .  
(b) What is the necessity of step-up chopper where do you use. [10+6]
7. Draw and explain the simple SCR series inverter circuit employing class A type commutation. With the help of important waveforms. State the limitations of this inverter. [8+4+4]
8. The single phase modified Me Murray full-bridge inverter is fed by dc source of 300V. The d.c. source voltage may fluctuate by  $\pm 15\%$ . The current during commutation may vary from 20 to 100A. Obtain the value of commutating components, if the thyristor turn-off time is  $20 \mu s$ . Also compute the value of R. [16]

\*\*\*\*\*