

Code.No: 07A50204

R07

SET-1

III B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010

POWER ELECTRONICS
(COMMON TO EEE, E.CONT.E)

Time: 3hours

Max.Marks:80

Answer any FIVE questions
All questions carry equal marks

- 1.a) Describe the different modes of operation of a thyristor with the help of schematic diagram, static V-I characteristics.
- b) Explain why holding current is less than latching current. [8+8]
- 2.a) Explain the following thermal ratings of SCRs
 - i) Junction temperature
 - ii) Transient thermal resistance
- b) What are dv/dt and di/dt ratings of SCRs? What happens if there ratings are exceeded? Explain. [8+8]
3. A resistance load of 10Ω is connected through a single phase half wave SCR circuit on 220V, 50 Hz supply. Calculate power delivered to the load for a firing angle of 75° . Find also the value of input power factor. [16]
4. Derive the expression for the following performance factors of a single phase fully controlled bridge converter. i) input displacement factor ii) input power factor iii) d.c. voltage ratio iv) input harmonic factor and v) voltage ripple factor. [16]
- 5.a) Explain the operation of a three phase fully controlled bridge converter with inductive load. Draw the voltage and current waveforms for $\alpha = 70^\circ$. List the firing sequence of SCRs.
- b) Derive the expression for average load voltage. [8+8]
6. A single phase load of resistance 12Ω in series with an Inductance of 24 mH is fed from a 230V(rms), 50Hz supply by a pair of inverse parallel thyristors. Find mean power in the load at firing angles of i) 0° ii) 60° and iii) 135° . Ignore source inductance and device voltage drops. [16]
7. Explain the operation of an Oscillation d.c. chopper circuit and its commutation process with the help of neat circuit diagram and necessary waveforms. [16]
8. Explain the operation of a single phase bridge inverter for RL loads with the help of neat circuit diagram and necessary waveforms. [16]

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Time: 3hours**Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

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1. Describe the various modes of operation of Power MOSFET with the help of its Circuit diagram and static V-I characteristics and transfer characteristics. Explain how Power MOSFET can be turned-on and turned-off. [16]
2. Explain the operation of series connected SCRs with the help of neat circuit diagram and derive the static and dynamic equalizing parameters. [16]
3. Explain the operation of single phase half wave converter using single thyristor for RL load and free wheeling diode, with the help of neat circuit diagram and waveform. Explain the main features of wheeling diode and its advantages. [16]
4. A single phase fully controlled bridge converter is supplied with 230 V, 50 Hz source. The load consists of $R = 20\Omega$ and a large inductance so as to reach the load current constant. For a delay angle of 60° , determine i) average output voltage ii) average output current iii) average values of SCR current and iv) input power factor. [16]
5. A three phase half wave converter is supplying a load with a continuous constant current of 50 A over a firing angle from 0° to 60° . What will be the power dissipated by the load at these limiting values of firing angle. The supply voltage is 415 V(line). [16]
6. Describe the principle of working of a single phase bridge type cyclo-converter for both continuous and discontinuous conduction with the help of neat circuit diagram and waveforms. [16]
7. A simple d.c. chopper is operating at a frequency of 2 kHz from a 110 V d.c. source to supply a load resistance of 10Ω . The load time constant is 6 ms. If the average load voltage is 57.6V, Find the period of the chopper, the average load current and the magnitude of the ripple current. [16]
8. Discuss the operation of Mc Murray inverter with the help of circuit diagram and necessary waveforms. [16]

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POWER ELECTRONICS
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Time: 3hours

Max.Marks:80

Answer any FIVE questions
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1. What are the different methods for turning-off an SCR. Explain all methods in detail with the help of waveforms and circuit diagrams. [16]
2. An SCR is to be gated by using a relaxation oscillator which has a UJT with the characteristics, $\eta = 0.7$, $I_p = 0.7 \text{ mA}$, $V_p = 16.5 \text{ V}$, normal leakage current with emitter open = 37 mA , $V_v = 1.0 \text{ V}$, $I_v = 6 \text{ mA}$ and $R_{b1b2} = 5.5 \Omega$. The firing frequency as 1000 Hz . If $C = 0.1 \mu\text{f}$. Calculate the values of R , R_1 and R_2 . [16]
3. A single phase half controlled bridge converter is operated from a 230 V , 50 Hz supply and load is resistance of $R = 10 \Omega$. If the average output voltage is 35% of the maximum possible average output voltage. Calculate i) delay angle ii) rms and average output currents and iii) average and rms thyristor currents. [16]
4. Derive expressions for following for a single phase full wave mid-point converter for RL load
i) average load voltage ii) average load current and iii) rms load voltage. [16]
5. Explain the operation of three phase half wave converter with resistance load and inductive load with circuit diagram. Sketch the associated waveforms also. [16]
6. For a single phase AC voltage controller feeding resistance load, draw waveforms of supply voltage, gating signals, output voltage, source and output current and voltage across SCRs. Describe its working with reference to the waveforms drawn, with neat circuit diagram. [16]
7. Explain the operation of d.c. jones chopper with its commutation procedure by sketching circuit diagram and necessary waveforms. [16]
8. Discuss various voltage control techniques for single phase bridge inverter with the help of signal waveforms for each of the technique. [16]

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Time: 3hours

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Answer any FIVE questions
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- 1.a) Define the i) Forward break over voltage ii) Latching current iii) Finger voltage iv) SCR turn-off time.
- b) Compare the SCR with power BJT and mention the salient points. [8+8]
2. The SCRs are used in a string to withstand a d.c. voltage of 12KV. The maximum leakage current and recovery charge difference of SCRs is 10 mA and 50 μ C respectively. The values of R for steady state equalizing circuit is 40 K Ω and value of C of dynamic equalizing circuit is 0.2 μ f. Find the steady state and transient voltage derating factor. [16]
3. Explain the operation of single phase half wave converter using single thyristor for RL load and free wheeling diode, with the help of neat circuit diagram and waveform. Explain the main features of free wheeling diode and its advantages. [16]
4. Describe the operation of a single phase two-pulse mid-point converter for RL loads with relevant voltage and current waveforms. Discuss how each SCR is subjected to a reverse voltage equal to double the supply voltage, in case of turns ratio from primary to each secondary is unity. [16]
5. A three phase fully controlled bridge converter is connected to three phase 415 V (line), 50 Hz supply and is operating in inverting mode at a firing angle of 30°. If a.c. supply has resistance and inductance per phase of 0.09 Ω and 1 mH respectively. Find i) d.c. source voltage and ii) overlap angle. [16]
6. Discuss the operation of a single phase AC voltage controller with resistance and inductive load, when α is less than or equal to load phase angle ϕ . Hence show that for α less than ϕ , output voltage of the a.c. regulator can not be regulated. [16]
7. Discuss the working of a Morgan's chopper circuit and its commutation procedure with the help of neat circuit diagram. [16]
8. Explain the operation of Mc Murray-Bedford inverter with the help of neat circuit diagram and necessary waveforms including its commutation process. [16]

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