R07

Set No: 1

Code No: V3112

III B.Tech. I Semester Supplementary Examinations, April/May - 2013
POWER ELECTRONICS
(Electrical and Electronics Engineering)

Time: 3 Hours   **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) What are the types of BJTs and what are the three regions of operation for BJTs?
    b) Explain the static characteristics of SCRs.

2. a) Draw the two-transistor analogy of a SCR and explain its latching operation.
    b) What is line commutation and Forced Commutation? Explain with examples.

3. Draw the power circuit for a single-phase half controlled converter and explain its operation with relevant waveforms. Derive the average voltage expression assuming continuous current operation.

4. a) Explain how a 1-phase full wave bridge converter can be constructed using i)a Single SCR (ii) two SCRs and (iii) four SCRs.
    b) A 1-phase bridge rectifier using four SCRs feeds power to RLE load with R=10 ohms, L=100mH,and E=100V.The ac source voltage is 230v at 50Hz.Assuming continuous conduction, calculate the average value of load current, given the firing delay is equal to 45^0.

5. A 3-phase fully controlled bridge converter is supplied from 400v,50Hz, three phase mains and operates at a firing angle 45^0. IF the current on load side is constant at 8A and the load voltage is 320V,calculate the source inductance and overlap angle. Derive the relevant formula.

6. a) Explain the working of a 1-phase ac voltage controller supplying R-loads with relevant waveforms.
    b) A 1-phase ac voltage controller is connected to a resistive load of 10Ω.The input ac voltage is 230V at 50Hz.Estimate the rms load voltage, rms load current, power input and load power factor for a delay angle of 90^0.

7. a) Discuss the working of JONES chopper with a neat circuit diagram and waveforms.
    b) A dc chopper has an input voltage of 230V and an output voltage of 150V.It is operating at frequency of 1KHz.Find the ON time and OFF time of the chopper.

8. a) Explain the operation of basic Series inverter with relevant waveforms.
    b) A 1-phase bridge inverter is connected to resistive load of 5ohm.The dc input voltage is 24V and the frequency of the output voltage is 400Hz.Draw the waveforms of the output voltage and output current and estimate the rms value of the output voltage.

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Set No: 2

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Time: 3 Hours　　　　　　　　　　　　　　　　　　　　　　　　　　**Max Marks: 80**

Answer any FIVE Questions
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1. a) What are the output characteristics of IGBTs and what are the differences between MOSFETs and BJTs?
   b) Explain the basic theory of operation of SCR.

2. a) Discuss the need for static equalizing circuits and dynamic equalizing circuits for series operation of SCRs.
   b) In a particular application, SCR with voltage and current ratings of 4kV and 800A is required. However, SCR with voltage rating of 800V and current rating of 200A are available. Assuming a de-rating factor of 20%, estimate the number of SCRs to be connected in series and parallel.

3. a) What is a free-wheeling diode? How does it work? and what are its functions in converter circuits?
   b)A single phase half controlled thyristor converter is connected to a load consisting of a 5ohm resistance,1H inductance, and 10V emf. Compute the average load voltage and average load current assuming continuous current operation for a triggering angle of $45^{0.}$Estimate the input power factor if the load current can be assumed to be constant. The supply voltage is 230V and 50Hz.

4. a) List the factors on which commutation overlap angle depends in fully controlled converters.
   b) A 1-phase full wave bridge converter is connected to a20 ohm resistance load. Estimate the average load current, and rms load current for a triggering angle of 30^{0} ,if the supply voltage is 230V at 50Hz.Also find average and rms values of thyristor currents.

5. a) Draw the power circuit diagram of a Dual converter and explain its operation.
   b) A 3-phase six pulse fully controlled converter is connected to a 3-phase ac supply of 400v and 50Hz and operates with firing angle of $\alpha=\pi/4$.The load current is maintained constant at 10A and the load voltage is 360V.Calculate the load resistance, source inductance and overlap angle.

6. a) Describe the principle of working of a 1-phase to 1-phase bridge type step down cycloconverter feeding an RL load.
   b) A 1-phase full wave ac voltage controller has a resistive load of 5Ω.The input ac voltage is 230V at 50Hz.For a delay angel of 120^{0},determine the rms load voltage, rms load current, and rms thyristor current.

7. a) What is time ratio control and explain current limit control of DC chopper.
   b) A dc chopper is connected to an inductive load with a resistance of 5Ω and an input voltage of 300v.The on time and off time of the chopper are 20ms and 10ms respectively. Estimate the duty ratio, chopping frequency, average load voltage and average load current.

8. Draw the circuit diagram of 1-phase Mc-Murray bridge inverter and explain its operation when supplying RL load. Explain how the output voltage and frequency are controlled.

R07

Set No: 3

Code No: V3112

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Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. a) Explain the v-I characteristic of thyristors? Explain the need and necessity of dv/dt and di/dt protection in thyristors.
   b) Explain the various turn-off methods of SCRs.

2. a) Discuss clearly the series and parallel operation of SCRs.
   b) A 100A SCR is to be used in parallel with SCR of 150A rating. The ON state voltage drops of the two SCRs are 2.1V and 1.75V respectively. Calculate the series resistance that should be connected with each SCR if the two SCRs have to share the total current 250A in proportion to their ratings.

3. a) Explain the operation of a single phase half controlled thyristor converter with inductive load.
   b)A thyristor is connected in series with a resistance of 100 ohm and an ac supply of 230v at 50Hz.Compute the average current and power delivered if the thyristor is triggered at 45^0in every positive half-cycle.

4. Explain the operation of a fully controlled bridge converter as a rectifier as well as line commutated inverter. Draw the necessary waveforms. Also derive the expression for the average load voltage of such a converter.

5. a) Obtain an expression for the average output voltage of a 3-phase fully controlled bridge converter in terms of a line to neutral voltage and firing angle.
   b) A 3-phase half controlled bridge converter is feeding a resistive load of 50 ohms. The supply voltage is 400V at 50Hz.For a trigger angle of 45^0,estimate the average load voltage and average load current.

6. What is a cycloconverter? Describe the working of a basic 1-phase cycloconverter with neat circuit diagram and relevant waveforms and the limitations if any on its working.

7. a) Explain the operation of step down chopper with RL load.
   b) A step up chopper has input voltage of 220V and output voltage of 660V.If the off time of the chopper is 100μs, compute the pulse width of the output voltage. In case the pulse width is reduced by 50%. Find the new output voltage.

8. a) Explain the working a series inverter and discuss the draw backs if any.
   b) Explain at least two forced commutation circuits used for bridge inverter.

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| R07 | | Set No: 4 |

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Time: 3 Hours **Max Marks: 80**

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1. a) Explain the characteristics of Power MOSFET and compare with BJT.
   b) Explain various turn-on methods of SCRs.

2. a) Discuss the various voltage and current ratings of SCRs and IGBTs, give typical values.
   b) If Vg-Ig characteristic of a SCR are assumed to be a straight line passing through the origin with a gradient of $3x10^3$.Calculate the required gate-source resistance ,given that Vs=10v and allowable Pg=0.012W.

3. a) What are the advantages and disadvantages of Phase-angle control?
   b) Explain the operation of a Line commutated converter, which can function as rectifier and also as an inverter with a neat circuit diagram and waveforms.

4. a) A 1-phase fully controlled bridge converter is feeding a highly inductive load. A freewheeling diode is present across the output. Derive an expression for the output dc voltage.
   b) A 1-phase fully controlled thyristor bridge converter is connected to a highly inductive load with a resistance of 2ohm and an emf. The supply voltage is 230V,50Hz. If the average load is to be at 10A at trigger angle of 120^0, what should be the emf on the load side.

5. a) What is the relationship between the firing angles of two converters forming the dual converter? and what are the two modes of operation of a dual converter?
   b) A 3-phase fully controlled thyristor bridge is connected to highly inductive load with a resistance of 60 ohm. Determine the average load voltage, average load current, and input power factor for trigger angle of 30^0.The input supply voltage is 400V, 3-phase.Assume the load current is ripple free.

6. a) Discuss the methods of voltage control employed in ac voltage controllers.
   b) Discuss the working of ac voltage controller using TRIAC and draw the relevant waveforms.

7. a) Draw the circuit diagram and explain the operation of 1-phase ac chopper connected to resistive load.
   b) A 400V dc source supplies RLE load through a chopper. For the duty cycle of chopper, α=0.25, find the chopping frequency to limit the amplitude of load current excursion to 10A.Take load L-0.5H and R=0.

8. a) List the commonly used PWM techniques for voltage and waveform control of inverters and explain any one method in detail.
   b) Explain the working of a Basic parallel Capacitor inverter bridge inverter.

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